ARTICLE 6.4 MECHANISM

A6.4-MEP011-A02

Draft Methodological tool

Emissions from electricity generation and consumption

Version 02.0

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Supervisory Body of the Article 6.4 mechanism, at its fifteenth meeting, approved its workplan for 2025 for the Methodological Expert Panel (MEP) and requested the MEP to continue working on the revision of CDM methodologies, methodological tools, standards and guidelines, including the "Tool to calculate emission factor for an electricity system" (hereinafter referred as "CDM TOOL07") and the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (hereinafter referred as "CDM TOOL05").

2. Purpose

2. The purpose of this new methodological tool is to provide different options for activity participants to estimate baseline, project and leakage emissions from electricity generation and its consumption under a proposed Article 6.4 activity.

3. Key issues and proposed solutions

3.1. Scope of the tool

3. The proposed methodological tool is developed based on the CDM TOOL05 and CDM TOOL07. The MEP proposes to merge these tools, considering that the determination of the emission factor for the electricity system is a critical component in estimating emissions associated with electricity generation and/or consumption.

4. The proposed methodological tool also broadens the scope of the merged tools. Whereas the CDM TOOL05 was limited to determining emissions from electricity consumption, the proposed methodological tool also includes provisions for determining emissions from electricity generation.

5. The MEP also notes that the core methodological approaches of the CDM TOOL07 were developed under different circumstances and needed to be updated to reflect recent developments. The CDM TOOL07 had been primarily developed for the purpose of determining baseline emissions and did not include conservative approaches for determining project or leakage emissions. The proposed methodological tool amends the scope of the CDM TOOL07 to also include project emissions associated with electricity consumption.

6. For these reasons, the revisions introduce a number of enhancements to the existing CDM tools, including:

   (a) Revisions to align the methodological approaches with the "Standard: Setting the baseline in mechanism methodologies" (A6.4-STAN-METH-004, hereinafter referred to as the "baseline standard"),[1] such as by providing for a systematic consideration of uncertainty;

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

(b) Amendments to allow the emission factor for an electricity system to be also used for determining project and leakage emissions, and not only baseline emissions;

(c) Revisions to reflect the increasing contribution of intermittent renewable power generation (e.g., solar and wind) in many electricity systems;

(d) Revisions to some provisions of the CDM tools to address identified shortcomings, such as issues with data vintage when determining the emission factor based on historical data;

(e) Inclusion of more options for activity participants to select simplified and conservative default values.

7. Table 1 provides a summary of key differences in the applicability conditions between the CDM tools and the proposed methodological tool.

Table 1 Comparison of key applicability conditions between the CDM tools and the proposed methodological tool

CDM Tools		**Proposed methodological tool**
CDM TOOL05	This tool provides procedures to estimate the baseline, project and/or leakage emissions associated with the consumption of electricity, and procedures to monitor the amount of electricity generated by the project power plant	This methodological tool provides different options for activity participants to estimate baseline, project and leakage emissions associated with the generation and consumption of electricity under a proposed Article 6.4 activity. These options aim to provide flexibility to activity participants, while ensuring that the estimation of emission reductions is conservative. This methodological tool also provides approaches and options to determine the respective emission factors for electricity generation and/or consumption in the baseline scenario and/or the project scenario
CDM TOOL07	This tool may be applied to estimate the operating margin (OM) emission factor, the build margin (BM) emission factor and/or the combined margin (CM) emission factor when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g., demand-side energy efficiency projects)	

3.2. General approach

8. The proposed methodological tool provides a stepwise approach to determine emissions from electricity generation and/or consumption, as follows:

(a) Step 1: identify all relevant electricity generation and/or consumption source *s* in relation to the Article 6.4 activity;

(b) Step 2: determine, for each electricity generation or consumption source *s,* whether the electricity is consumed from or fed into an electricity system, or whether it is consumed from or avoids power generation by fossil-fuel fired captive power plant(s);

(c) Step 3: identify the relevant electricity system(s), where applicable;

(d) Step 4: determine whether applying a higher or a lower value for the emissions from electricity generation and/or consumption is more conservative;

(e) Step 5: determine the amount of electricity generation and/or consumption;

(f) Step 6: determine which emission factor is applicable;

(g) Step 7: determine the emission factor of the electricity system, where applicable;

(h) Step 8: determine the emission factor for electricity sourced from captive fossil-fuel fired power plants, where applicable;

(i) Step 9: determine the transmission and distribution losses from the electricity system, where applicable;

(j) Step 10: determine the emissions from electricity generation and/or consumption.

3.2.1. Determination of applicable scenarios

9. This section outlines the concepts of the essential steps and the associated approaches applied in the tool.

10. Step 2 defines the following three scenarios and requires activity participants to identify which of the scenarios applies:

(a) Scenario A: The electricity is consumed from or fed into the electricity system only;

(b) Scenario B: The electricity is consumed from or avoids power generation by fossil-fuel fired captive power plant(s) only; or

(c) Scenario C: A combination of scenarios A and B, i.e., the electricity is consumed from or fed into the electricity system and consumed from or avoids power generation by fossil-fuel fired captive power plant(s).

11. Other potential scenarios, such as power generation by a renewable captive power plant, are not yet applicable under this version of the tool. However, some of the procedures and requirements of this proposed methodological tool already address such scenarios. Some other parts of the tool may need further revision to make the tool applicable to such scenarios. This may be further addressed in future revisions to this tool.

12. Under Scenario A, the emission factor of the project electricity system shall apply. Accordingly, the relevant electricity system shall be identified in Step 3, unless conservative default values are used to determine the emission factor, in which case assessing the boundary of the electricity system is unnecessary.

13. Under Scenario B, the emission factor of the fossil-fuel fired captive power plant shall apply.

14. Under Scenario C, the emission factor may be determined either separately for fossil-fuel fired captive electricity generation and electricity generation in the electricity system, based on the specific configuration of the Article 6.4 activity, or by applying the more conservative value between these two emission factors.

15. Lastly, the proposed tool does not yet include provisions for integrating off-grid power plants in the calculation of the emission factor for the electricity system. The MEP

proposes that this issue be addressed in future revisions to this methodological tool or through bottom-up methodology submissions.

3.2.2. Ensuring conservativeness while providing flexibility

16. To ensure conservativeness in determining emissions associated with electricity generation and consumption, the proposed methodological tool defines two distinct cases:

    (a) Case 1 refers to situations where a higher emission factor is more conservative; and

    (b) Case 2 refers to situations where a lower emission factor is more conservative.

17. Throughout the tool, these two cases are considered and differentiated to ensure that emission factors and baseline, project or leakage emissions are all determined in a conservative manner.

18. To provide flexibility to activity participants, the tool also provides different calculation options and corresponding default values for determining both the quantity of electricity generation or consumption and the emission factor under each case.

3.2.3. Determination of the emission factor of the project electricity system

19. The proposed methodological tool provides options to either calculate the emission factor of the project electricity system or use simplified conservative default values for the emission factor. Different default values are provided in the tool, taking into account the share of the renewable and nuclear energy sources in the project electricity system.

20. Where the emission factor of the electricity system is calculated, a “Combined Margin” (CM) emission factor is determined, in line with CDM TOOL07, as the weighted average of the OM and the BM.

21. The proposed methodological tool draws upon the four methods for determining the OM emission factor in CDM TOOL07: dispatch Data OM, simple OM, simple adjusted OM, and average OM. The proposed tool refines and simplifies the approaches from the CDM, and specifies applicability conditions for each method, noting that TOOL07 was only intended for determining baseline emissions and that intermittent power generation played a smaller role when TOOL07 was developed.

22. Table 2 provides a summary of key differences between the CDM TOOL07 and the proposed methodological tool with regard to the conditions for using the OM method.

Table 2. Comparison of the conditions for using the different OM methods between the CDM TOOL07 and the proposed methodological tool

CDM Tool		**Proposed methodological tool**	
Dispatch data analysis OM	Hourly data from each power plant on power generation and fuel type and fuel consumption is available	Dispatch data OM	In addition to the CDM tool: Power units in the electricity system are dispatched in a certain order

CDM Tool		**Proposed methodological tool**	
Simple OM	Low cost/must run (LCMR) share <50% in recent 5 years; or an average load by LCMR < average lowest annual system load (LASL) over three years	Simple OM	For case 1: no conditions For case 2: one of the following conditions is met: i. The number of hours in a calendar year in which at least one of the following two conditions apply is smaller than 100: ▪ Renewable electricity generation is curtailed because available output exceeds what the electricity system could absorb; or ▪ The electricity system operates solely based on renewable, nuclear, and/or storage power units; or • The share of electricity generation from renewable and nuclear power units in the relevant period t does not exceed 30 per cent
Simple adjusted OM	LCMR share > 50% in recent 5 years, and an average load by LCMR > an average LASL over three years	Simple adjusted OM	This method includes two options: i. Option 1: No conditions ii. Option 2: Only applicable to non-intermittent electricity generation sources and electricity consumption sources not depending on intermittent generation
Average OM	Annual aggregated data from the grid on power generation, fuel type and fuel consumption is available	Average OM	Only applicable to case 2 and to non-intermittent electricity generation sources and electricity consumption sources not depending on intermittent generation

23. The dispatch data OM method is based on hourly dispatch data and is considered the most accurate approach as it estimates the real-time impact of the Article 6.4 activity.

24. For the simple OM method, power units designated as “must-run” in the project electricity system are excluded from the emission factor calculation, assuming that their operation is unlikely to be affected by the Article 6.4 activity. The proposed methodological tool provides criteria for identifying must-run power units and considers most types of renewable power units to be must-run units. This approach leads to a relatively higher calculated emission factor compared to that if all plants were considered, as it focuses on

more carbon-intensive electricity generation sources. Therefore, the tool stipulates that the simple OM method is applicable without conditions for case 1, where using a higher emission factor value represents the conservative approach. For case 2, if a high penetration of renewable energy results in situations where during a material number of hours in which renewable electricity generation is curtailed because available output exceeds what the electricity system could absorb or only renewable power and any nuclear power units serve the electricity system, the electricity associated with the Article 6.4 activity may effectively displace renewable generation. In such instances, the simple OM method is not applicable to case 2 and the simple adjusted OM may be used instead.

25. The simple adjusted OM is a variation of the simple OM method. It requires determining when renewable electricity generation is curtailed because available output exceeds what the electricity system could absorb or when the electricity system operates solely based on renewable, nuclear, and/or storage power units. During these times, the OM emission factor is assumed to be zero. The tool provides two options for calculating the simple adjusted OM emission factor:

    (a) Under Option 1, several data points are required on an hourly basis. This includes electricity generation or consumption data of the Article 6.4 activity, as well as information on whether renewable electricity generation is curtailed because available output exceeds what the electricity system could absorb or the project electricity system is operating solely on renewable, nuclear energy and/or storage power units. This option may always be applied without any conditions, because the hourly information allows reflecting at what times the Article 6.4 activity affects fossil fuel power generation and at which times not;

    (b) Under Option 2, all information is determined on an annual basis. This includes the fraction of time during which renewable electricity generation is curtailed because the available output exceeds what the electricity system could absorb or the electricity system is operating solely on renewable, nuclear energy and/or storage power units. This option is not applicable to Article 6.4 activities that include intermittent electricity generation sources and electricity consumption sources depending on intermittent generation, as defined in the proposed methodological tool. Indeed, since intermittent generation is likely to be concentrated on certain hours, an annual calculation is likely to lead in an overestimation.

26. The average OM emission factor is calculated as the average emission intensity of all power plants operating in the electricity system. This approach includes all renewable and nuclear power generation and thus leads to a relatively low emission factor. It can therefore only be applied under case 2 in which a lower emission factor is more conservative. However, this method may not be conservative for intermittent electricity generation sources and electricity consumption sources depending on intermittent generation, as it is based on annual information. Therefore, this method only applies to non-intermittent electricity generation sources and electricity consumption sources not depending on intermittent generation.

27. The emission factors derived from the simple OM, simple adjusted OM, and average OM methods can be determined either ex ante for a crediting period or be updated ex post during monitoring period. A discount shall be applied where historical data is used, to account for the trend of increasing renewable energy penetration in the electricity system which generally leads to a decrease in the OM emission factor over time.

28. Table 3 provides a summary of key differences with regard to the OM method between the CDM TOOL07 and the proposed methodological tool.

Table 3. Comparison of the methodological approaches to determine the OM emission factor between the CDM TOOL07 and the proposed methodological tool

CDM Tool		**Proposed methodological tool**	
Dispatch data analysis OM	Determined as the generation-weighted average CO_2 emission of power units dispatched at the margin in hour *h* within the electricity system	Dispatch data OM	As under the CDM tool
Simple OM	Determined as the generation-weighted average CO_2 emissions per unit net electricity generation of all generating power plants serving the system, excluding LCMR power plants/units	Simple OM	As under the CDM, with a refined definition of must-run power units
Simple adjusted OM	Determined as a variation of the simple OM by considering the fraction of time when LCMR power units are operating at the margin	Simple adjusted OM	Determined as a variation of the simple OM, with an adjustment for those periods in which renewable electricity generation is curtailed because available output exceeds what the electricity system could absorb or the electricity system operates solely based on renewable, nuclear, and/or storage power units
Average OM	Determined as the average emission rate of all power plants serving the grid	Average OM	As under the CDM

29. The build margin (BM) emission factor is calculated as the weighted average emission intensity of the new power units that have been most recently built within the electricity system. The proposed methodological tool refines the approach from the CDM TOOL07. For the first crediting period, it allows activity participants to choose between two reference periods for identifying these power units: the "concurrent" reference period, which reflects the time when the Article 6.4 is implemented, and a "historical" reference period. Where historical data is used, a discount applies to account for the increasing share of renewables that are built over time in many electricity systems. In that case, the emission factor should also be updated when the necessary data becomes available to use the “concurrent” reference period. Table 4 provides a comparison between the data vintage and updates of the BM emission factor between the CDM TOOL 07 and the proposed methodological tool.

Table 4. Comparison of requirements on data vintage and updates of the BM emission factor between the CDM TOOL07 and the proposed methodological tool

CDM TOOL07	Proposed methodological tool
For the first crediting period: • Ex ante option: based on the most recent information available at the time of CDM-PDD submission to the DOE for validation; • Ex post option: Updated annually based on the information of those units built up to the year of registration of the project activity or, up to the latest year for which information is available. For the second crediting period, based on the most recent information available at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, use the build margin emission factor calculated for the second crediting period	For the first crediting period, update the BM emission factor annually. Further, if the historical period is applied, update the reference period once the necessary data to calculate the emission factor for the "concurrent" reference period becomes available. For the second and third crediting periods, the BM emission factor shall be determined for the concurrent reference period once ex ante and not be updated annually

30. The value for weighting of the OM and BM emission factor in calculating the CM emission factor is higher compared with that in the CDM TOOL07, accounting for the growing trend of renewable energy penetration in electricity systems.

3.2.4. Determination of the emission factor of the fossil-fuel fired captive power plant

31. The proposed methodological tool provides two options for calculating the emission factor: based on the actual emission factor of the fossil-fuel fired captive power plant and based on simplified, conservative default values.

32. The activity participant may calculate the emission factor based on the fossil fuel consumed and the electricity generated by the captive fossil-fuel fired power plant.

3.2.5. Determination of transmission and distribution losses

33. If data is available, the activity participant may determine the transmission and distribution losses based on local data of the project electricity system. In principle, only physical losses shall be considered as transmission and distribution losses, while noting that for some electricity systems there may also be non-physical losses such as electricity pilferage. Such losses shall only be considered if their inclusion leads to a conservative estimate of the emission reductions.

34. Additionally, the proposed methodological tool also provides default values for transmission and distribution losses for both case 1 and case 2, based on the voltage level at which electricity is consumed.

3.2.6. Determination of uncertainty

35. The uncertainty of emissions or emission factors shall be determined following the guidance of Volume 1, Chapter 3 of the 2019 Refinement of the 2006 IPCC Guidelines. For some methods or assumptions, the uncertainty is specified in the tool.

36. For some parameters, the tool provides conservative default values. When these conservative default values are used, no further consideration of uncertainty is required. In other instances, default values provided in the tool represent a mean estimate, with the indication of an uncertainty range. In these cases, the indicated uncertainty shall be considered in the quantification of the overall uncertainty.

4. Consideration of public comments

37. A compilation of the public comments received is provided in the "Information note: Summary of the comments received from stakeholders on the draft mechanism methodological tool "Emissions from electricity generation and/or consumption" from the call for public inputs to annexes of the MEP010".[2] This section summarizes how substantive comments were addressed. Editorial comments or very minor issues are not summarized here.

38. Some proposals were not incorporated in the methodological tool because they are not aligned with the RMPs or relevant standards under the Article 6.4 mechanism, such as the "Standard: Setting the baseline in mechanism methodologies" (A6.4-STAN-METH-004) and the "Standard: Transition of CDM activities to the Article 6.4 mechanism" (A6.4-STAN-AC-001). Such comments include, for example:

    (a) Removing the determination of the uncertainty;

    (b) Requesting a note or guidance for CDM project activities that are seeking transition to the Article 6.4 mechanism on the application of the proposed methodological tool.

4.1. General

39. A comment was received proposing that further guidance be developed for Designated National Authorities (DNAs) to consider impacts of transboundary electricity exchanges for the preparation of BTRs and NDCs, citing examples such as the Southern African and West African Power Pools. The MEP notes that the tool is a technical document intended to calculate emissions from activities under the Article 6.4 mechanism, not covering impacts with regard to the preparation of BTRs or NDCs. At the same time, the MEP recognizes that such regional "power pools" raise particular issues, as the emission reductions may occur in a different country than where the Article 6.4 activity is implemented. Further clarification on these issues may be helpful. Therefore, the MEP will further consider the potential impact of transboundary electricity exchanges on host countries when determining emissions from electricity generation and/or consumption.

40. Comments were received indicating that the methodological tool became complex after the merging of the two CDM tools and recommended including examples and flowcharts to facilitate the understanding of the requirement. The emission factor of electricity system is a critical parameter for determining emissions associated with electricity generation and/or consumption. Also, several common issues have been identified within the approved CDM tools. The merging of the two tools into a single document is intended to comprehensively address all relevant issues and eliminate duplicated requirements across different documents. Flowcharts illustrating the options available for the different scenarios A, B and C were included in the appendix of the methodological tool.

[2] See https://unfccc.int/sites/default/files/resource/A6.4-INFO-MISC-004.pdf.

41. Comments were received proposing that the methodological tool accounts for the impact of electricity market instruments, such as wheeling contracts and environmental attributes (e.g., renewable energy certificates). The MEP acknowledges the ongoing development of electricity markets. The MEP further recognizes that applying such instruments may influence emission calculations for activities under the Article 6.4 mechanism. However, due to limited access to data on electricity market contracts, variations in regional implementation of electricity market instruments, and evolving developments in relevant fora or under relevant regulatory frameworks, the MEP concludes that it is not appropriate to integrate these instruments into the tool at the current stage. The MEP will continue monitoring developments in relevant regulatory frameworks and standard-setting fora, and may address this issue in future revisions of the tool.

42. A comment was received suggesting considering the impact of unconditional nationally determined contributions, long-term low-emissions development strategies and policy-driven strategies. The MEP notes that the effect of these instruments is appropriately reflected the calculation of the emission factor. The OM emission factor shall be updated annually, or adjusted to account for changes in emissions intensity of the electricity system over time.

4.2. Applicability conditions

43. A comment was received proposing to include interim guidance for methodology developers on what could be acceptable conservative approaches for configurations of projects such as captive renewable power plants, hybrid systems combining grid electricity, storage, and behind-the-meter renewable generation, and electricity consumption associated with flexible demand, load shifting, or demand response. The MEP noted that a methodological tool is not the appropriate document to guide the development of mechanism methodologies. The proposed draft methodological tool's scope is to provide the technical requirements to calculate the emission factors of the electricity system under a broad range of circumstances. Any provisions related to specific technologies or circumstances would need to be addressed in proposed mechanism methodologies.

44. A comment requested clarifications on the distinctions on limiting the application of the methodological tool to projects only, noting that the application of the tool may get applied at project and PoA level. The MEP acknowledges the comment and notes that the regulatory documents pertaining to activities implemented at other scales (including large-scale crediting and PoAs) still need to be adopted by the SBM, and these regulations may have different requirements when compared to activities implemented at the project level.

4.3. Definitions

45. A comment recommended refining the definition of concept of must-run power units to improve accuracy, while not compromising conservativeness, by allowing (i) explicit consideration of curtailment rates, (ii) use of residual load or price-based indicators where available and (iii) differentiation between technical must-run and economically dispatched renewables. The MEP acknowledges the comment. The MEP did not revise the definition of must-run power units but considered the implications of curtailment of renewable electricity generation, including price-based indicators, in the calculation of the simple OM and simplified adjusted OM.

4.4. General approach

46. A comment was submitted proposing to merge steps 7 and 8 since they are alternatives to each other. The MEP noted that merging Steps 7 and 8 would result in a very long section with five layers of sub-sections which could make it difficult to follow the document. Furthermore, separating Step 7 and Step 8 may be beneficial for Article 6.4 activities that involve only the electricity system or only captive fossil-fuel fired power plants.

4.5. Step 1: Identify all relevant electricity generation and consumption sources s in relation to the Article 6.4 activity

47. Only comments on editorial changes were proposed.

4.6. Step 2. Determine, for each electricity generation or consumption source s, whether electricity is consumed from or fed into an electricity system, or whether it is consumed from or avoids power generation by captive fossil-fuel fired power plant(s)

48. Comments were submitted proposing clarifications on the identification of Scenarios A, B, and C. The MEP implemented revisions to refine the requirements and provide examples in the relevant paragraphs.

4.7. Step 3: Identify the relevant electricity system(s), if applicable

49. A comment was received recommending including a subsection under Step 3 requiring activity participants to describe the boundary of the project electricity system, to identify the relevant dispatch centres and to assess the transmission constrains as per the guidance contained in the tool. The MEP included a requirement under paragraph 27 for activity participants to describe the electricity system in the PDD, including identifying the relevant dispatch centres.

50. Comments were submitted proposing refinements to the requirements for assessing transmission constraints between dispatch centres. The MEP implemented revisions to clarify these requirements.

4.8. Step 4 – Determine whether applying a higher or a lower value for emissions from electricity generation and/or consumption is more conservative

51. One comment was received proposing to include worked examples to illustrate when to apply case 1 or case 2 with clear decision trees or flowcharts to reduce interpretation risk and validation disputes. The MEP revised the methodological tool accordingly by including (i) a table which provides different examples for the application of case 1 and case 2; (ii) a footnote under section 5.3 to illustrate situations where case 1 and case 2 apply.

52. Comments were submitted proposing to simplify or remove the requirement on identification of case 1 and case 2. The MEP acknowledges the comment and did not implement the proposed change since the redrafted paragraph would not be fully consistent with the requirements of the methodological tool. The differentiation between case 1 and case 2 is needed to ensure that the most appropriate emission factor is applied for different situations that an Article 6.4 project may face during its operation, i.e., a higher emission factor is applied to account for project emissions and a lower emission factor is applied to account for baseline emissions as explained in the footnote.

53. A comment was submitted proposing that the average auxiliary consumption rate of fossil fuel power plants (10%) be used as the threshold to determine whether only case 1 or case 2 should be applied, based on the comparison of the amount of electricity generation and/or consumption between the two cases when the Article 6.4 activity covers both cases. The MEP adopted the threshold of 1%, considering that the emission factors under case 1 and case 2 can have significant variation.

4.9. Step 5: Determine the amount of electricity generation and/or consumption

54. A comment was submitted requesting to confirm that the electricity generation or consumption aggregation period aligns with the emission factor time resolution and justification where conservative zero values are applied under paragraph 39 of the version published for call for public inputs. The alignment between the electricity quantification and the determination of the emission factor is covered in the first paragraph under section 5, and the MEP included this requirement in the monitoring methodology.

4.10. Step 7: Determine the emission factor of the electricity system, where applicable

55. A comment was submitted recommending introducing a tiered approach to determine the emission factor of an electricity system analogous to IPCC Tier methodologies, such as: (i) Tier 1: Standardized or nationally approved grid emission factors, (ii) Tier 2: Simplified OM/BM approaches with safeguards, and (iii) Tier 3: Full dispatch-based approaches where data permit. The MEP acknowledges the comment and did not revise the methodological tool because its nature is to be data intensive to determine an accurate estimation of baseline, project and leakage emissions, while at the same time the methodological tool also provides simplified (and conservative) approaches in case the Article 6.4 project cannot find the required data.

56. A comment was submitted recommending a uniform application of approaches to update OM and BM, i.e., either ex ante or ex post. The MEP acknowledges this comment but did not revise the requirement since OM must be updated ex post under specific circumstances (e.g., when dispatch data analysis is applied) whereas the cohort of power plants used to identify BM shall remain fixed; however, the operational data of these power plants must still be updated ex post.

57. A comment was submitted stating that the simplification provided in paragraph 48 of the version published for call for public inputs is not realistic since no two power plants have the same operational efficiencies, and recommends providing technology specific efficiency ranges as the basis for aggregating several power units into a single power plant. The proposal to aggregate several power plants into a single power plant is already addressed if “any features relevant for the calculation” (including the efficiency) is different between two power plants.

58. A comment was made to paragraphs 56 and 57 of the version published for call for public inputs to: (i) include reference to the CDM methodological tool “TOOL33: Default values for common parameters” to determine the fraction of non-renewable biomass (f_{NRB}) for case 1 where biomass consumed by the power plant *p* is not renewable, and (ii) to use an approach developed by the methodology to establish that any hydrogen consumed by the power plant *p* is green or does not lead to leakages. The MEP acknowledges the comment (i) but did not implement the proposed changes to paragraph 56 since reference is made to a methodological tool approved under the CDM and the MEP is currently working on the development of a methodological tool to determine the project and leakage emissions from biomass (a footnote was added clarifying that the associated tool currently under

development can be applied once it is adopted by the SBM), and (ii) implemented the proposed changes to paragraph 60.

59. A comment was submitted proposing to include a requirement for activity participants to justify the selected OM method, how the applicability conditions under 3 of the version published for call for public inputs are met, and explain the reasons for excluding the other OM methods. The mandatory justification to the application of the selected OM method is however already covered by the methodological tool under the first paragraphs of each relevant section.

60. A comment was submitted proposing to include a mandatory table listing each power unit, its must-run status, applicable criteria under paragraph 62, data sources used, and justification of the must-run classification since this is often implicit. The MEP acknowledges the comment but did not implement the proposed changes since the identification of must-run is highly dependent on the grid. In addition, requirements were provided in section 2.2 of the main part of the document.

61. A comment proposed amending the conditions to apply the dispatch data OM to clarify that it is applicable to electricity systems dispatched in a defined order subject to technical, spatial, temporal and security constraints. The MEP implemented the proposed changes in Table 4 and in section 5.7.1.2.1 of the main part of the document.

62. Comments were received proposing to determine the limit on the share of electricity generation from renewable and nuclear power units in the relevant period *t* (i) every three years or (ii) based on a trend of past 5 years of the global electricity generation increase in RE vs the net increase in electricity generation from all other sources (including coal, gas, fuel oil and nuclear), however the frequency for updating is already covered in the methodological tool.

63. A comment was received requesting to clarify whether the simple OM emission factor (i) requires annual recalculation, (ii) may be applied as a single ex ante value across all calendar years, or (iii) requires separate ex ante values to be calculated for each calendar year at validation. The simple OM requires annual calculation only if the ex post option is selected. In addition the approach may be applied ex ante if such option is selected, and no separate ex ante values to be calculated for each calendar year at validation are required, however, the methodological tool includes an equation to adjust the emission factor to account for the data vintage, as stipulated in section 5.7.1.2.2 of the main part of the document.

64. Comments were submitted asserting inconsistencies between paragraph 85 and the requirements of paragraph 87, between paragraph 89 and the requirements in paragraph 87, and between paragraph 92 and the requirements of paragraph 91(a) of the version published for call for public inputs. The comment seems however to misunderstand option 1 and option 2 with case 1 and case 2.

65. A comment was submitted proposing to place the index *t* with the index *y* in equation 12 of the version published for call for public inputs. The MEP acknowledges the comment and did not implement the changes since the index *t* covers the year *y* and the hour *h*.

66. A comment was submitted recommending specific weights for OM and BM based on whether the grid is in a situation of “surplus” or “deficit” in the absence of the incentive instrument. The MEP acknowledges the comment but did not accept the changes since the proposed weights and description of the scenarios shall be covered by the methodology.

67. A comment was submitted proposing to remove the requirement to exclude solar and wind power plants to the share of electricity generation from renewable sources when identifying the default emission factor of the electricity system to be applied. The MEP acknowledges the comment and did not accept the changes since (i) solar and wind power plants are likely to be designated as must-run and will not be impacted, and (ii) electricity systems with higher ratio of hydropower generation are covered under the higher ratio (i.e., exceeding 67 per cent).

4.11. Step 8: Determine the emission factor for electricity sourced from captive fossil fuel power plant(s), where applicable

68. A comment was submitted asserting that equation 14 of the version published for call for public inputs is not correct since it assumes that the quantity of heat co-generated has the same value as equal amount of heat produced from fuel combustion in a boiler. The MEP acknowledges the comment but did not accept the changes since the proposed equation is a widely applied approach to make the allocation among the heat and electricity generation.

4.12. Step 9: Determine the transmission and distribution losses from the electricity system, where applicable

69. A comment was submitted requesting clearer guidance or default treatment for non-technical losses, especially in countries where they constitute a significant share of total losses. The transmission and distribution losses in the methodological tool accounts for both technical and non-technical losses. In addition, non-technical losses are only considered if they are conservative.

70. A comment was submitted requesting the inclusion of the voltage ranges to classify the voltages as low, medium and high. The MEP acknowledges the comment and implemented the proposed change by adding the voltage classes in Table 5 based on the classification from "IEC 60038:2009 - IEC standard voltages".

71. A comment was submitted requesting to clarify that transmission and distribution (T&D) losses are only to be applied in context of consumption and not generation. The MEP acknowledges the comment and implemented the proposed change in paragraph 122.

4.13. Uncertainty

72. One comment highlighted that some default values and uncertainties are not explicitly linked to national circumstances or official data source and could penalize, rather than safeguard, the calculation of baseline, project and leakage emissions. The MEP noted that, wherever possible, the default values and uncertainties used in the tool are based on empirical data. The MEP acknowledges that in some instances expert judgment was required to estimate uncertainties, noting that expert judgments are also applied in the context of the Intergovernmental Panel on Climate Change (IPCC).

73. One comment recommended providing a clear step-wise procedure on how to apply the IPCC guidance on combining uncertainties to determine one common uncertainty value for each of these OM estimation methods. The MEP noted that the methodological tool requires determining uncertainty following the guidance from the 2019 refinement to the 2006 IPCC guidelines. However, the MEP may consider conducting further work on uncertainty in the future.

4.14. Monitoring methodology

74. A comment was submitted requesting to (i) clarify whether EMS or real-time energy monitoring systems may be accepted as data sources for monitoring electricity generation, consumption, and net delivered electricity in Data / Parameter table 1, Data / Parameter table 2, Data / Parameter table 6 of the version published for call for public inputs, and (ii) specify that such systems may be used provided the readings can be cross verified using calibrated meters and are subject to appropriate QA/QC procedures. The data can be recorded using EMS, however the primary source of the electricity generation or consumption shall be from electricity-meters.

75. A comment was submitted proposing to revise the bracketed options under the "measurement methods and procedures" of the "Data / Parameter table 9. $\eta_{p,t}$ (Average net energy conversion efficiency of power unit *p* in the project electricity system in period *t*)" of the version published for call for public inputs since a more conservative approach would be 30 percent as the default value for Case 1, and 62 percent as the default value for Case 2. The MEP acknowledges the comment and implemented the proposed changes.

5. Impacts

76. The proposed methodological tool provides requirements and procedures for activity participants and methodology proponents to determine the emissions associated with electricity generation and/or consumption.

6. Subsequent work and timelines

77. The default value in the appendix 2 of the tool need to be regularly updated to incorporate data from recent years. Moreover, several other parameter values and provisions should also be updated once more data is available.

78. The tool may also be amended to be applicable to activities implemented at other scales (including large-scale crediting and PoAs).

7. Recommendations to the Supervisory Body

79. The MEP recommends the Supervisory Body to adopt the methodological tool.

80. The MEP further seeks a mandate from the Supervisory Body to annually revise the tool to incorporate the most recent data for the parameters $F_{OM,simple}$, $F_{OM,avg}$ and F_{BM} into the table in appendix 2 of the tool and to update other relevant parameters or provisions when new data becomes available.

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1. Introduction

1.1. Scope

1. This methodological tool provides options for activity participants to estimate baseline, project, and leakage emissions associated with the generation and/or consumption of electricity [1], which are referred to as emissions from electricity generation and/or consumption throughout the tool, under a proposed Article 6.4 activity. These options aim to provide flexibility to activity participants, while ensuring that the estimation of emission reductions is conservative. Some options rely on conservative default factors or conservative simplifications, whereas other options require more data to produce estimates.

2. This methodological tool establishes requirements to determine the parameters provided in Table 1. The tool includes approaches to determine, for each parameter, the mean value (noting that the mean value includes some degree of conservativeness due to the use of conservative default values or conservative assumptions), as well as the upper and the lower bounds of uncertainty for the value at 95 per cent confidence level.

Table 1. Parameters determined

Parameter	SI Unit	Description
$BE_{EG,y}$	t CO_2	Baseline emissions from electricity generation in year *y*
$BE_{EC,y}$	t CO_2	Baseline emissions from electricity consumption in year *y*
$PE_{EG,y}$	t CO_2	Project emissions from electricity generation in year *y*
$PE_{EC,y}$	t CO_2	Project emissions from electricity consumption in year *y*
$LE_{EG,PJ,y}$	t CO_2	Leakage emissions from electricity generation in the project scenario in year *y*
$LE_{EG,BL,y}$	t CO_2	Leakage emissions from electricity generation in the baseline scenario in year *y*
$LE_{EC,PJ,y}$	t CO_2	Leakage emissions from electricity consumption in the project scenario in year *y*
$LE_{EC,BL,y}$	t CO_2	Leakage emissions from electricity consumption in the baseline scenario in year *y*
$EF_{EG/C,BL,s,y}$	t CO_2/MWh	Emission factor for electricity generation or consumption by electricity generation or consumption source *s* in the baseline scenario (case 2) in year *y*
$EF_{EG/C,PJ,s,y}$	t CO_2/MWh	Emission factor for electricity generation or consumption by electricity generation or consumption source *s* in the project scenario (case 1) in year *y*
$EF_{EG/C,BL,s,h}$	t CO_2/MWh	Emission factor for electricity generation or consumption by electricity generation or consumption source *s* in the baseline scenario (case 2) in hour *h*
$EF_{EG/C,PJ,s,h}$	t CO_2/MWh	Emission factor for electricity generation or consumption by electricity generation or consumption source *s* in the project scenario (case 1) in hour *h*

[1] Note that this version of the tool does not include procedures to account for the effects of contracts between actors in electricity markets, such as power purchase agreements between specific entities. The tool may be updated in the future to reflect such contracts based on evolving developments in relevant fora or under relevant regulatory frameworks.

1.2. Entry into force and validity

3. This methodological tool enters into force on DD/MM/YYYY.

4. This methodological tool remains valid for five years, until DD/MM/YYYY, unless an earlier date applies if the methodological tool is revised or withdrawn in accordance with the "Procedure: Development, revision and clarification of methodologies and methodological tools" (A6.4-PROC-METH-001).[2]

2. Definitions

2.1. General terms

5. The following general terms are applied to the methodological tool:

   (a) "Shall" is used to indicate requirements that must be followed;

   (b) "Should" is used to indicate that, among several options, one course of action is recommended as particularly suitable; and

   (c) "May" is used to indicate what is permitted.

2.2. Methodological terms and definitions

6. The following methodological terms and definitions are applied to the methodological tool:

   (a) **Connected electricity system:** An electricity system that is connected by transmission lines to the project electricity system;

   (b) **Dispatch area**: An electricity system or a part of the electricity system controlled by a dispatch centre. An electricity system can be controlled by several dispatch centres that are organized as layered dispatch areas or by a single dispatch centre. An example of a layered dispatch area is one in which regional dispatch centres are required to comply with orders of a higher-level dispatch centre (e.g., a national or transboundary dispatch centre);

   (c) **Dispatch centre:** An entity responsible for maintaining synchronization of the electricity system within its dispatch area. The dispatch centre's responsibilities include scheduling generation and dispatching electricity from power plants to customers and, where applicable, to connected electricity system(s);

   (d) **Electricity consumption source:** The electric equipment (e.g., pumps, electric motors, blowers, etc.) and/or electric appliances that consume electricity from an electricity system and/or from captive power plant(s)/unit(s);

   (e) **Electricity consumption source depending on intermittent generation:** An electricity consumption source where the pattern of electricity consumption from the electricity system or a third party depends on the availability of intermittent electricity supply;[3]

[2] See https://unfccc.int/sites/default/files/resource/A6.4-PROC-METH-001.pdf.

[3] For example, this may apply to a facility that purchases electricity from a specific wind power plant through a dedicated electricity line and therefore draws a high load from the electricity system during periods of low wind power availability.

(f) **Electricity generation source:** The power plant(s)/unit(s) that are connected to an electricity system or operate as captive power plant(s)/unit(s)) in the baseline or in the project scenarios;

(g) **Intermittent electricity generation source:** A renewable energy power plant/unit where the pattern of electricity generation depends on natural, uncontrollable, and variable inputs such as sunlight, wind, tides, or wave action. This typically applies to wind, solar, tidal, and wave power plants, etc.;

(h) **Must-run power plant/unit:** A power plant/unit dispatched independently of the daily or seasonal electricity consumption load and the operation of intermittent electricity generation sources in the electricity system (e.g., because the plant has low marginal electricity generation costs);

(i) **Net electricity generation:** The difference between the total quantity of electricity generated by a power plant/unit and the auxiliary electricity consumption (also known as parasitic load) of the power plant/unit (e.g., for pumps, fans, control systems, etc.).

(j) **Non-intermittent electricity generation source:** An electricity generation source where electricity generation can be ramped up or down by the operators of the power plant, regardless of external conditions such as sunlight, wind, or wave action;

(k) **Power plant/unit:** A facility that generates electric power. Several power units at one site comprise one power plant, whereas a power unit is characterized by the fact that it can operate independently from other power units at the same site. Where several identical power units (i.e., with the same capacity, age and efficiency) are installed at one site, they may be considered as a single power unit;

(l) **Project electricity system:** The spatial extent of the power plants and electricity end-users that are physically connected through transmission and distribution lines with the Article 6.4 activity (e.g., a renewable power plant or the consumers that are either being served with or saving electricity) and that are covered by either a single or a layered dispatch area;

(m) **Top-level dispatch centre:** The dispatch centre that is at the highest level within a layered dispatch area or the single dispatch centre in a situation without a layered dispatch area; and

(n) **Transmission and distribution losses:** The fraction of electrical energy lost during the transmission and distribution of electricity from power plants to end-users.

7. Further definitions from the “Article 6.4 Glossary of Terms”, once adopted by the Supervisory Body, shall also apply to this methodological tool.

3. Applicability

8. This methodological tool may be used by mechanism methodologies related to emission reductions.

9. This methodological tool is applicable to Article 6.4 activities where its use is explicitly referenced in the applicable mechanism methodology.

10. This version of the methodological tool is only applicable to Article 6.4 activities implemented at the project level. The methodological tool may be amended in the future

to also cover activities implemented at other scales (e.g., programmes of activities, policies, sectoral approaches, etc.).

11. This methodological tool may be used to determine baseline, project, and leakage emissions from:

    (a) The generation of electricity that is supplied to an electricity system or to captive consumers, which may or may not be connected to an electricity system; and/or

    (b) The consumption of electricity from an electricity system or from captive fossil fuel power plant(s)/unit(s).

12. This methodological tool also provides approaches and options to determine the respective emission factors for electricity generation and consumption in the baseline scenario and/or the project scenario.

13. This version of the methodological tool is not applicable to Article 6.4 activities where a captive renewable power plant is installed at the site of the Article 6.4 activities:

14. This version of the methodological tool does not include procedures for estimating the following emission sources:

    (a) Upstream emissions associated with electricity generation/consumption; and

    (b) Greenhouse gas (GHG) emissions other than CO_2.

15. This methodological tool is only applicable where mechanism methodologies include a reference to this methodological tool and specify:

    (a) Which sources of baseline, project, and leakage emissions, and from which electricity generation or consumption source *s,* are to be calculated using this methodological tool;[4]

    (b) How the amount of electricity generated or consumed is determined for each relevant electricity generation or consumption source *s*;

    (c) Whether any specific options provided in this methodological tool shall be applied by activity participants;

    (d) Which scenarios (A, B, or C, as specified in section 5.2) apply to each electricity generation or consumption source *s,* or how activity participants shall determine which of these scenarios apply; and

    (e) How the uncertainty of the emission factor, the quantification of the amount of electricity generated or consumed, and the transmission and distribution losses shall be considered in the emission reduction calculation.

16. Where a standardized baseline is developed using this methodological tool, all provisions pertaining to the PDD and/or monitoring report as specified in this tool shall be documented in the submission of the proposed standardized baseline.

17. Where the mechanism methodology referring to this methodological tool specifies approaches that differ from those described in this methodological tool, the requirements contained in the mechanism methodology shall take precedence.

[4] For example, in the case of a landfill gas utilization project, one electricity generation source *s* may be the power generation equipment utilizing the landfill gas, while electricity consumption sources may include equipment used to operate the landfill gas capture system and other auxiliary equipment.

4. Normative and informative references

18. This normative document is indispensable for the application of this methodological tool. The most recent version of this document shall apply: Intergovernmental Panel on Climate Change (2019). 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.[5]

5. Methodological approaches

19. Activity participants shall determine emissions from electricity consumption and/or generation through the steps listed below. A flowchart is included in appendix 1 illustrating the application of these steps for the different scenarios discussed under Step 2.

    (a) **Step 1:** identify all relevant electricity generation and consumption sources *s* in relation to the Article 6.4 activity (see section 5.1);

    (b) **Step 2:** determine, for each electricity generation or consumption source *s*, whether electricity is consumed from or fed into an electricity system, or whether it is consumed from or avoids power generation by fossil-fuel fired captive power plant(s) (see section 5.2);

    (c) **Step 3:** identify the relevant electricity system(s), where applicable (see section 5.3);

    (d) **Step 4:** determine whether applying a higher or a lower value for emissions from electricity generation and/or consumption is more conservative (see section 5.4);

    (e) **Step 5:** determine the amount of electricity generation and/or consumption (see section 5.5);

    (f) **Step 6:** determine which emission factor is applicable (see section 5.6);

    (g) **Step 7:** determine the emission factor of the electricity system, where applicable (see section 5.7);

    (h) **Step 8:** determine the emission factor for electricity sourced from captive fossil-fuel fired power plants, where applicable (see section 5.8);

    (i) **Step 9:** determine the transmission and distribution losses in the electricity system, where applicable (see section 5.9); and

    (j) **Step 10:** determine the emissions from electricity generation and/or consumption (see section 5.10).

5.1. Step 1: Identify all relevant electricity generation and consumption sources *s* in relation to the Article 6.4 activity

20. Activity participants shall identify all electricity generation and consumption sources *s* in relation to the Article 6.4 activity, in accordance with the methodology referring to this methodological tool. This may include electricity generation and consumption sources which may occur in the project scenario and/or in the baseline scenario. It may also include electricity generation and consumption sources classified as leakage sources, where these are considered in accordance with the mechanism methodology referring to this methodological tool. Note that any net "positive leakage" shall not be accounted for, in

[5] See https://www.ipcc-nggip.iges.or.jp/public/2019rf/index.html.

accordance with the provisions of the "Standard: Addressing leakage in mechanism methodologies" (A6.4-STAN-METH-005, hereinafter referred as the "leakage standard").[6]

21. For each identified electricity generation or consumption source *s*, activity participants shall, in the project design document (PDD):

    (a) Assign a unique number to the identified source;

    (b) Describe the electricity generation or consumption source and its location;

    (c) Classify an electricity generation source as either intermittent or non-intermittent, and an electricity consumption source as either depending on or not depending on intermittent electricity supply;

    (d) Specify how electricity generation or consumption is quantified for that source; and

    (e) Specify whether the electricity generation or consumption source occurs in the project scenario, the baseline scenario, or both, including in relation to any leakage sources.

5.2. Step 2: Determine, for each electricity generation or consumption source *s*, whether electricity is consumed from or fed into an electricity system, or whether it is consumed from or avoids power generation by fossil-fuel fired captive power plant(s)

22. Activity participants shall identify, for each electricity generation or consumption source *s* identified in section 5.1, which of the following scenarios applies:

    (a) Scenario A: electricity is consumed from or fed into an electricity system only;

    (b) Scenario B: electricity is consumed from or avoids power generation by fossil-fuel fired captive power plant(s) only; or

    (c) Scenario C: a combination of scenarios A and B, i.e., the electricity is consumed from or fed into an electricity system and is consumed from or avoids power generation by fossil fuel-fired captive power plant(s).

23. **Scenario A** applies where:

    (a) The electricity generation or consumption source is connected only to an electricity system and not to any fossil-fuel fired captive power plant; or

    (b) The electricity generation or consumption source is connected to both an electricity system and fossil-fuel fired captive power plant(s); however, the implementation of the Article 6.4 activity affects only the quantity of electricity consumed from or fed into the electricity system and does not affect the operation of the fossil-fuel fired captive power plant(s). This applies, for example, where:

        (i) At all times during the monitored period, the total electricity demand at the site of the fossil-fuel fired captive power plant(s) is greater than the electricity generation capacity of the fossil-fuel fired captive power plant(s) in both the project scenario and the baseline scenario; or

        (ii) The fossil-fuel fired captive power plant(s) are operated continuously (apart from maintenance) and feed any excess electricity into the electricity system

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

because revenues from feeding electricity into the electricity system exceed the plants' operation costs; or

(iii) The fossil-fuel fired captive power plant(s) are centrally dispatched, and their dispatch is therefore outside the control of the activity participants.

24. **Scenario B** applies where:

(a) The electricity generation or consumption source is connected only to fossil-fuel fired captive power plant(s) and not to an electricity system; or

(b) The implementation of the Article 6.4 activity is clearly demonstrated to affect only the quantity of electricity generated by the fossil-fuel fired captive power plant(s) and does not affect the quantity of electricity consumed from or fed into the electricity system. This applies, for example, where, at all times during the monitored period, the total electricity demand at the site of the fossil-fuel fired captive power plant(s) exceeds the quantity of electricity that can physically be supplied by the electricity system in both the project scenario and the baseline scenario.

25. **Scenario C** applies in all other cases where the electricity generation or consumption source is connected to both an electricity system and fossil-fuel fired captive power plant(s).

26. Activity participants shall document, in the PDD and in monitoring reports, which scenario applies, justify why the scenario applies, and provide relevant evidence. **Scenario C** shall be selected, as a conservative approach, where it is not possible to clearly classify the circumstances as **scenario A** or **scenario B**.

5.3. Step 3: Identify the relevant electricity system(s), where applicable

27. This step is applicable only where:

(a) **Scenario A** or **scenario C** applies; and

(b) **Option A** (calculate the combined margin emission factor of the electricity system), as specified in section 5.7.1 is applied.

28. Activity participants shall delineate the project electricity system and any connected electricity system(s) and shall transparently document the geographical boundary of the project electricity system and any connected electricity system(s) in the PDD. When doing so, activity participants shall also identify the relevant dispatch centres.

29. An electricity system (i.e., the project electricity system or any connected electricity system(s)) shall be delineated as follows:

(a) Where available, use the delineation of electricity systems published by the DNA of the host country or by a group of DNAs covering the host country as well as other countries. Where a delineation is provided by a group of DNAs, the same delineation shall be used by all activity participants applying this methodological tool in those countries; or

(b) Where a delineation by the DNA or by a group of DNAs is not available, determine the delineation of electricity systems as follows:

(i) Identify the dispatch areas covered by the respective dispatch centres;

(ii) Where a dispatch area is controlled by more than one dispatch centre (i.e., a layered dispatch area), the higher-level area shall be considered the top-level dispatch area;[7]

(iii) Assess whether any transmission constraints exist between the top-level dispatch areas identified in subparagraph (ii) above; and

(iv) Identify the relevant electricity system as the area covered by all top-level dispatch centres between which no transmission constraints exist.

30. The assessment of whether transmission constraints exist between two top-level dispatch centres shall be conducted for a period of one calendar year, using the most recent calendar year for which data is available.

31. It shall be determined that no transmission constraints exist if any one of the following criteria is met:

(a) In the case of electricity systems with spot electricity markets, the difference in electricity prices (excluding transmission and distribution costs) between the two top-level dispatch centres is less than five per cent during at least 90 per cent of the hours within the assessment period;

(b) The transmission line(s) between the two top-level dispatch centres are operated at 75 per cent or less of their rated capacity during 90 per cent or more of the hours within the assessment period. This shall be determined as follows:

(i) Determine the maximum load capacity of the transmission line(s) between the two top-level dispatch centres based on official information (e.g., from the system operator). Where more than one transmission line operates between the two top-level dispatch centres, the total load capacity of the transmission line(s) shall apply;

(ii) Determine the operated load of the transmission line(s) between the two top-level dispatch centres in each hour and assess whether they are operated at 75 per cent or less of their rated capacity during that hour;

(iii) Determine whether the cumulative number of hours in which the condition in subparagraph (ii) is met accounts for 90 per cent or more of the hours within the assessment period. If this condition is met, it shall be determined that no transmission constraints exist; otherwise a transmission constraint is deemed to exist;[8] or

(c) The transmission capacity of the transmission line(s) between the two independent dispatch centres exceeds 10 per cent of the installed power generation capacity of the smaller of the two independent dispatch centres.

32. In addition, in cases involving an international interconnection (i.e., transmission lines between different countries), it shall be further confirmed that no legal restrictions on

[7] For example, where regional cross-boundary dispatch centres are required to comply with dispatch orders of a national dispatch centre, the area controlled by the national dispatch centre shall be used to delineate the project electricity system.

[8] For example, if two transmission lines are operated between two independent dispatch centres and each has a maximum load capacity of 100 MW, then count the number of hours during which the total operating capacity of these two lines is lower than 150 MW. If the number of hours during which the total operating capacity is lower than 150 MW exceeds 7884 in a non-leap year and 7902 in a leap year, it shall be considered that no transmission constraints exist between the two independent dispatch centres in that year.

international electricity exchange exist in order to determine that no transmission constraints exist.

33. The assessment of whether transmission constraints exist shall be updated at the renewal of the crediting period.

34. For the purposes of this methodological tool, the reference system is the project electricity system. Accordingly, electricity transfers from connected electricity system(s) to the project electricity system are defined as electricity imports, while electricity transfers from the project electricity system to connected electricity system(s) are defined as electricity exports.

5.4. Step 4: Determine whether applying a higher or a lower value for emissions from electricity generation and/or consumption is more conservative

35. This step serves to determine whether applying a higher or a lower value for emissions from electricity generation and/or consumption represents the more conservative approach. For this purpose, this methodological tool defines two cases:

(a) **Case 1:** situations in which a higher value for emissions from electricity generation and/or consumption is more conservative. This case applies to the determination of the parameters $PE_{EG,y}$, $PE_{EC,y}$, $LE_{EG,PJ,y}$ and $LE_{EC,PJ,y}$ in Table 1 above; and

(b) **Case 2:** situations in which a lower value for emissions from electricity generation or consumption is more conservative. This case applies to the determination of the parameters $BE_{EG,y}$, $BE_{EC,y}$, $LE_{EG,BL,y}$ and $LE_{EC,BL,y}$ in Table 1 above.

36. Activity participants shall determine and justify, for each electricity generation or consumption source *s*, whether **case 1** or **case 2** applies. This determination shall be based on the specific circumstances of the Article 6.4 activity and its corresponding baseline. Table 2 provides examples for instances where case 1 and case 2 applies, including for intermittent and non-intermittent electricity generation sources and for electricity consumption sources depending on, or not depending on, intermittent generation, noting that some instances may apply in very specific circumstances only.

Table 2. Examples of activities where case 1 or case 2 applies

	Case 1	**Case 2**
Non-intermittent electricity generation	An Article 6.4 activity uses electricity from a pre-existing fossil fuel power unit that, prior to the implementation of the Article 6.4 activity, delivered electricity to the electricity system	An Article 6.4 activity installs a biomass power plant that delivers electricity to the electricity system
Intermittent electricity generation	An Article 6.4 activity uses electricity from a pre-existing renewable power unit that, prior to the implementation of the Article 6.4 activity, delivered electricity to the electricity system	An Article 6.4 activity installs a wind power plant that delivers electricity to the electricity system
Electricity consumption not depending on intermittent generation	An Article 6.4 activity involves the flaring of landfill gas consumes electricity for the purpose of collecting the landfill gas and operating the flare	An Article 6.4 activity reduces the electricity consumption of households for lighting purposes through the use of efficient lamps

	Case 1	Case 2
Electricity consumption depending on intermittent generation	An Article 6.4 activity produces hydrogen through electrolysis. It mainly consumes electricity from a specific wind power plant and consumes electricity from the electricity system when the wind power plant is not operating at full load	An Article 6.4 activity reduces the electricity consumption of electric cooking devices that are exclusively used for preparing lunch meals in a country with significant solar generation

37. Where an Article 6.4 activity covers multiple electricity generation or consumption sources *s* for which electricity is consumed from or fed into the same electricity system and/or is consumed from or avoids power generation by the same fossil-fuel fired captive power plant(s), the net total electricity generation and/or consumption from all sources may be netted for each hour covered by the monitoring period. Where **case 1** applies to some hours within a monitoring period and **case 2** applies to the remaining hours of the same monitoring period, activity participants shall apply the corresponding emission factor for the respective hours. Alternatively, activity participants may determine emissions separately for each electricity generation or consumption source *s*, by applying the corresponding emission factor to each source *s*, depending on whether **case 1** or **case 2** and whether **scenario A**, **B,** or **C** applies to the respective source *s*.[9]

38. Where either **case 1** or **case 2** applies to all electricity generation and consumption sources *s* throughout the monitoring period of the Article 6.4 activity, activity participants shall identify the relevant case and apply it consistently in the determination of the emission factor. This approach may also be applied where one of the two cases accounts for less than 1 per cent of the amount of electricity generation and/or consumption compared to the other case.

5.5. Step 5: Determine the amount of electricity generation and/or consumption

39. Activity participants shall specify in the PDD how the amount of electricity generated or consumed shall be determined for each electricity generation or consumption source *s* identified in Step 1. The period for aggregating the amount of electricity generation or consumption shall align with the period used to determine the emission factor, as specified in sections 5.7 and 5.8.

40. The electricity generated or consumed shall either be directly monitored by activity participants, in accordance with the provisions of section 6 below, or be determined using any of the simplified and conservative options provided in paragraphs 41 and 42. These simplified and conservative options may be applied to the entire monitoring period or to any specific interval during which data are missing.

[9] For example, in the case of a grid-connected landfill gas recovery project activity participants may choose between two approaches to determine the applicable case: (1) Activity participants may calculate the hourly net electricity supplied to or consumed from the electricity system. If there is net consumption of electricity from the electricity system during a given hour, case 1 applies. The emission factor for case 1 shall be applied to the net consumption for that hour to calculate $PE_{EC,y}$. If there is a net supply of electricity to the electricity system during a given hour, case 2 applies. The emission factor for case 2 shall be applied to the net generation for that hour to calculate $BE_{EG,y}$. (2) Alternatively, activity participants may calculate the emissions separately for all electricity generation sources (e.g., the landfill gas generator) and for all electricity consumption sources (e.g., auxiliary consumption of the generator, flare, and lighting). The emission factor for case 1 shall be applied exclusively to the total electricity consumption to calculate $PE_{EC,y}$. The emission factor for case 2 shall be applied exclusively to the total electricity generation to calculate $BE_{EG,y}$.

41. Where **case 1** applies, activity participants shall apply the following simplified and conservative options:

    (a) For electricity generation:

        (i) Identify the nominal capacity (in MW) of the respective power plant/unit;

        (ii) Multiply the nominal capacity by the actual operating hours of the power plant or by 8 760 hours/year.

    (b) For electricity consumption:

        (i) Identify the rated power or capacity of the electricity consumption source *s*; and

        (ii) Determine the electricity consumed by the electricity consumption source *s* as the product of (i) the rated power or capacity of the electricity consumption source *s* and (ii) the actual operating hours of the electricity generation or consumption source *s* or 8,760 hours per year.

42. Where **case 2** applies, activity participants shall, as a simplified and conservative approach, apply a value of zero to the electricity generation or consumption of the respective source *s*.

5.6. Step 6. Determine which emission factor is applicable

43. The determination of the emission factor for an electricity generation or consumption source *s* depends on which of the three **scenarios** (**A**, **B**, or **C**) and which of the two cases (**case 1** or **case 2**) apply to that source.

44. Where **scenario A** applies, the emission factor shall be determined as the emission factor of the electricity system to which the Article 6.4 activity is connected, under **case 1** and **case 2**, respectively, applying the procedure set out in section 5.7.

45. Where **scenario B** applies, the emission factor shall be determined as the emission factor of the fossil fuel fired captive power plant(s), under **case 1** and **case 2**, respectively, applying the procedure set out in section 5.8.

46. Where **scenario C** applies, the emission factor shall be determined by:

    (a) Applying the respective emission factor for **scenario A** and **scenario B** separately, where the amount of electricity generated and/or consumed under each scenario is available (i.e., applying the emission factor of the electricity system to the amount identified for scenario A and applying the emission factor of the fossil-fuel fired captive power plant(s) to the amount identified for **scenario B**); or

    (b) Applying a conservative approach, as follows:

        (i) For **case 1**, using the higher value between the emission factor of the electricity system and the emission factor of the fossil fuel fired captive power plant(s); and

        (ii) For **case 2**, using the lower value between the emission factor of the electricity system and the emission factor of the fossil fuel fired captive power plant(s).

5.7. Step 7: Determine the emission factor of the electricity system, where applicable

47. This step is applicable where **step 6** confirms that the emission factor of the electricity system shall be used.

48. Activity participants shall determine the emission factor of the electricity system by choosing one of the following two options and shall document their choice in the PDD:

    (a) **Option A:** calculate the combined margin emission factor of the electricity system, as set out in section 5.7.1; or

    (b) **Option B:** use a conservative default emission factor, as set out in section 5.7.2.

5.7.1. Option A: Calculate the combined margin emission factor of the electricity system

49. The emission factor of the electricity system shall be determined as the "combined margin" (CM) emission factor, which is the result of a weighted average of two emission factors pertaining to the electricity system: the "operating margin" (OM) emission factor and the "build margin" (BM) emission factor. The OM emission factor aims to represent the emissions intensity of existing power units whose electricity generation is affected by the Article 6.4 activity. The BM emission factor aims to represent the average emissions intensity of new power units that would likely be built in the absence of the Article 6.4 activity.

50. For both cases (**case 1** and **case 2**), the emission factor of the electricity system shall be determined based on the following sub-steps:

    (a) Sub-step a: determination of the OM emission factor ($EF_{OM,y}$);

    (b) Sub-step b: determination of the BM emission factor ($EF_{BM,y}$); and

    (c) Sub-step c: determination of the CM emission factor ($EF_{CM,y}$).

5.7.1.1. General requirements applicable to different sub-steps

5.7.1.1.1. Consideration of power plants or units

51. For simplicity, section 5.7 refers only to power units. Whether power units or power plants shall be considered in the calculation depends on the operational roles of the power units at the site of the power plant. Power units shall be considered separately in the calculation where any features relevant for the calculation differ among them, such as fuel type, efficiency, or must-run status (e.g., where a power plant includes a mix of must-run and non-must-run units). Otherwise, several power units may be aggregated into one power plant and considered together in the calculation.

5.7.1.1.2. Treatment of electricity imports and exports

52. Any net electricity imports from a connected electricity system to the project electricity system during the relevant period shall be treated as a power unit *p* supplying electricity to the project electricity system. The must-run status of net electricity imports shall be determined in accordance with para 104, as applicable. The emission factor for the connected electricity system that is exporting electricity to the project electricity system shall be determined for the relevant period (either the calendar year *y* of the crediting

period or the hour *h* within the calendar year *y* of the crediting period) using one of the following options:

(a) Use the combined margin emission factor of the connected electricity system, determined in accordance with this section (section 5.7.1); or

(b) Use the conservative default emission factors set out in section 5.7.2 for the exporting electricity system; or

(c) Where the amount of net electricity imports is smaller than 5 per cent of electricity generation in the project electricity system during the relevant period, one of the following options may be used:

(i) The simple OM emission factor of the exporting electricity system, determined as described in section 5.7.1.2.2, where the conditions for this method, as described in paragraph 74, apply to the exporting electricity system; or

(ii) The simple adjusted OM emission factor of the exporting electricity system, determined as described in section 5.7.1.2.3, where the conditions for this method, as described in paragraph 85, apply to the exporting electricity system.

(iii) The average OM emission factor of the exporting electricity system, determined as described in section 5.7.1.2.4, where the conditions for this method, as described in paragraph 91, apply to the exporting electricity system;

53. Any net electricity exports from the project electricity system to a connected electricity system shall not be accounted for in the application of this methodological tool.

5.7.1.1.3. General requirements for determining CO_2 emission factors of power units

54. This section sets out how activity participants shall determine the CO_2 emission factors of power units *p*. The section applies to the calculation of both the BM and the OM emission factor.

55. The CO_2 emission factor of each power unit *p* ($EF_{EL,p,t}$) shall be determined as follows:

(a) **Option 1:** if, for a power unit *p,* data on fuel consumption and net electricity generation are available, the emission factor shall be determined as follows:

(i) Where the power unit is not a cogeneration unit:

$$EF_{EL,p,t} = \frac{\sum_i FC_{i,p,t} \times NCV_{i,t} \times EF_{CO2,i,t}}{EG_{p,t}} \quad \text{Equation (1)}$$

Where:

$EF_{EL,p,t}$	=	CO_2 emission factor of power unit *p* in period *t* (t CO_2/MWh)
$FC_{i,p,t}$	=	Amount of fuel type *i* consumed by power unit *p* in period *t* (Mass or volume unit)
$NCV_{i,t}$	=	Net calorific value (energy content) of fuel type *i* in period *t* (GJ/mass or volume unit)
$EF_{CO2,i,t}$	=	CO_2 emission factor of fuel type *i* in period *t* (t CO_2/GJ)

$EG_{p,t}$	=	Net quantity of electricity generated and delivered to the electricity system by power unit *p* in period *t* (MWh)
p	=	All relevant power units serving the electricity system in period *t* as per the method used for determining the OM or BM emission factor
i	=	All fuel types combusted in power unit *p* in *period t*
t	=	The relevant period used for determining the emission factor

(ii) Where the power generation unit is a cogeneration unit, by allocating the emissions of the power unit *p* to heat and power by assuming that, in the absence of cogeneration, the heat would be generated in a boiler using the same type(s) of fossil fuel as those used in the power unit:

$$EF_{EL,p,t} = \frac{\left[\sum_i \left(FC_{i,p,t} \times NCV_{i,t}\right) - \frac{HG_{p,t}}{\eta_{boiler}}\right]}{EG_{p,t}} \times \frac{\sum_i FC_{i,p,t} \times NCV_{i,t} \times EF_{CO2,i,t}}{\sum_i FC_{i,p,t} \times NCV_{i,t}}$$

Equation (2)

Where:

$EF_{EL,p,t}$	=	CO_2 emission factor of power unit *p* in period *t* (t CO_2/MWh)
$FC_{i,p,t}$	=	Amount of fuel type *i* consumed by power unit *p* in period *t* (Mass or volume unit)
$NCV_{i,t}$	=	Net calorific value (energy content) of fuel type *i* in period *t* (GJ/mass or volume unit)
$HG_{p,t}$	=	Heat co-generated in power plant *p* in period *t* (GJ)
h_{boiler}	=	Efficiency of the boiler assumed to generate heat in the absence of cogeneration
$EF_{CO2,i,t}$	=	CO_2 emission factor of fuel type *i* in period *t* (t CO_2/GJ)
$EG_{p,t}$	=	Net quantity of electricity generated and delivered to the electricity system by power unit *p* in period *t* (MWh)
p	=	All relevant power units serving the electricity system in period *t* as per the method used for determining the OM or BM emission factor
t	=	The relevant period used for determining the emission factor

(b) **Option 2:** if, for a power unit *p,* only data on the fuel type(s) used is available, the emission factor shall be determined using one of the following two approaches:

(i) Based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,p,t} = \frac{EF_{CO2,p,t} \times 3.6}{\eta_{p,t}}$$

Equation (3)

Where:

$EF_{EL,p,t}$	=	CO_2 emission factor of power unit *p* in period *t* (t CO_2/MWh)
$EF_{CO2,p,t}$	=	Average CO_2 emission factor of the fuel used in power unit *p* in period *t* (t CO_2/GJ)

$\eta_{p,t}$ = Average net energy conversion efficiency of power unit *p* in period *t* (ratio)

p = All relevant power units serving the electricity system in period *t* as per the method used for determining the OM or BM emission factor

t = The relevant period used for determining the emission factor

(ii) As a simple and conservative approach, using the default values in.

Table 3. Default values for the emission factor of power units (t CO_2/MWh)[10]

Fuel type	Case 1	Case 2
Coal	1.3	0.7
Oil	0.9	0.54
Natural gas	0.7	0.3

56. Where biomass or biomass-derived fuels are consumed by a power unit *p*, use, for **case 1**, the higher value within a plausible range of emission factors, assuming that the biomass is not renewable, and use for **case 2** an emission factor of zero.[11]

57. Where hydrogen or hydrogen-derived fuels are consumed by a power unit *p*, use, for **case 1,** the higher value within a plausible range of emission factors, assuming that the hydrogen is produced from fossil fuels without carbon capture and storage, and use, for **case 2** an emission factor of zero, unless other approaches are provided by the mechanism methodology referring to this tool.

58. Where several fuel types are consumed by a power unit *p* and the data required for **option 1** are not available, use the fuel type with the highest emission factor for **case 1** and the fuel type with the lowest emission factor for **case 2**.

5.7.1.2. Sub step a: Determination of the OM emission factor

59. The OM emission factor ($EF_{OM,t}$) shall be determined based on one of the following methods:[12]

(a) **Dispatch data OM**, as described in section 5.7.1.2.1;

(b) **Simple OM**, as described in section 5.7.1.2.2;

(c) **Simple adjusted OM**, as described in section 5.7.1.2.3; or

(d) **Average OM**, as described in section 5.7.1.2.4.

[10] The values in the table were calculated based on the higher and the lower estimates of power plant efficiencies and CO_2 emission factors for the relevant fuel types. The CO_2 emission factors were taken from the 2006 IPCC Guidelines for National Greenhouse Inventories. Power plant efficiencies were collected from various sources, including manufacturer information for the upper end of the efficiency range.

[11] The MEP is currently working on the development of a methodological tool for project and leakage emissions from biomass. This tool may be applied to determine these emissions once it is adopted by the Supervisory Body.

[12] The MEP may consider further methods in the future. In addition, activity participants may also submit proposals for a revision of this tool to include other methods. For example, in some instances an electricity consumption source that depends on intermittent generation may only depend on one form of intermittent generation (e.g. only wind power). The effect of such an instance on the electricity system could be reflected through a more refined method in the future.

60. Table 4 summarizes the applicability conditions for the different methods and specifies the uncertainty deemed to be associated with each method. This uncertainty shall be used when determining the overall uncertainty of the emission factor for the electricity system. For all methods, the data necessary to apply the method must be available.

Table 4. Applicability conditions (other than data availability) and associated uncertainty for different methods to determine the OM emission factor[13]

Method	Applicability conditions	Associated method uncertainty at a 95 percent confidence level (%)
Dispatch data OM	• Power units in the electricity system are dispatched in a defined order subject to technical, spatial, temporal, and security constraints	±5%
Simple OM	• For case 1: no conditions • For case 2: one of the following conditions is met: i. The number of hours in a calendar year in which at least one of the following two conditions apply is smaller than 100: ▪ Renewable electricity generation is curtailed because available output exceeds what the electricity system could absorb; or ▪ The electricity system operates solely based on renewable, nuclear, and/or storage power units; or ii. The share of electricity generation from renewable and nuclear power units in the relevant period *t* does not exceed 30 per cent	±20%
Simple adjusted OM	This method includes two options: • Option 1: no conditions • Option 2: applicable only to non-intermittent electricity generation sources and electricity consumption sources not depending on intermittent generation	±20%
Average OM	• Only applicable to **case 2** and to non-intermittent electricity generation sources and electricity consumption sources not depending on intermittent generation	0%

61. Where activity participants choose the simple OM method or the simple adjusted OM method, they shall determine, for each power unit in the electricity system, whether it is a

[13] The uncertainties in this table are based on expert judgements by the MEP. The uncertainty estimates for the simple OM and simple adjustment OM are informed by a comparison between the dispatch data OM emission factor and the simple OM emission factor for a limited set of data. The MEP aims to gather additional data and may update these values in a future revision of the tool. Under the conditions in which the average OM emission factor may be applied, its use is conservative. Therefore, the value for the uncertainty is set to zero.

must-run power unit. Activity participants shall document the designation for each power unit in the PDD or monitoring report, as applicable, specify the data sources used, and provide an appropriate justification.

62. A power generation unit shall be designated as a must-run power unit if it meets one or more of the following conditions:

    (a) **Fulfilment of non-power generation obligations**: the operation of the power generation unit is determined by obligations not related to electricity production (e.g., the provision of essential heat or steam from a cogeneration power unit);

    (b) **Low marginal electricity generation costs**: the power unit is a hydro, wind, solar, tidal, or geothermal power generation unit, noting that such units usually have low marginal electricity generation costs; or

    (c) **Steady operation and constant load**: the power unit has operated during the most recent three years for more than 7 500 full load hours per year. Full load hours shall be calculated by dividing net electricity generation by the installed capacity.

63. Power units registered as Article 6.4 projects or component projects, or registered under other carbon crediting programs, shall be included in the cohort of power units used to calculate the operating margin under the applicable method.

64. Where activity participants can demonstrate that the simple OM emission factor is consistently higher (for case 1) or consistently lower (for case 2) than the dispatch data OM emission factor for the relevant period, then activity participants may, instead of the uncertainty values for the simple OM or simple adjusted OM method, use the uncertainty value for the dispatch data OM method in Table 4 above for the calculation of the overall uncertainty, given that in these instances the use of simple OM or simple adjusted OM is a conservative method. In other instances, the uncertainties method indicated in Table 4 above shall be used.[14]

5.7.1.2.1. Method (a): Dispatch data OM

65. The dispatch data OM emission factor ($EF_{OM,DD,t}$) shall be determined based on the power units in the electricity system that are actually dispatched at the margin during each hour *h* in which the Article 6.4 activity is displacing electricity in, or consuming electricity from, the electricity system. Accordingly, the dispatch data OM emission factor shall always be determined ex post for the relevant monitoring period.

66. The emission factor may be applied for both **case 1** and **case 2**. It may also be applied to any type of electricity generation or consumption source, including intermittent and non-intermittent electricity generation sources and electricity consumption sources depending on, or not depending on, intermittent generation. However, it shall be applied only where power units in the electricity system are dispatched in a defined order subject to technical, spatial, temporal, and security constraints [15] and data on the dispatch order are available. This usually applies where:

    (a) The electricity system has an established spot market; or

[14] For example, in some instances, data on the dispatch data OM emission factor may be available but the activity participants may not wish to use it since it would require them to account for electricity generation or consumption on an hourly basis.

[15] The order is usually based on increasing marginal costs of electricity generation; however, other considerations may also play a role, such as the availability of water for irrigation purposes in the case of hydro power plants.

(b) Power units are centrally dispatched by a dispatch centre.

67. Activity participants shall document and justify, in the PDD or monitoring report, as applicable, that the conditions in paragraph 66 are fulfilled and shall specify the data sources used to demonstrate this.

68. The dispatch data OM emission factor ($EF_{OM,DD,h}$) shall be calculated for each hour *h* of a period *t* (e.g., the monitoring period), using one of the following approaches:

(a) Based on hourly fuel consumption data, where available, as follows:

$$EF_{OM,DD,h} = \frac{\sum_{i,p} FC_{i,p,h} \times NCV_{i,t} \times EF_{CO2,i,t}}{\sum_{p} EG_{p,h}} \quad \text{Equation (4)}$$

Where:

$EF_{OM,DD,h}$	=	Dispatch data OM emission factor during hour *h* within period *t* (t CO_2/MWh)
$FC_{i,p,h}$	=	Amount of fuel type *i* consumed by power unit *p* in hour *h* (Mass or volume unit)
$NCV_{i,t}$	=	Net calorific value (energy content) of fuel type *i* in period *t* (GJ/mass or volume unit)
$EF_{CO2,i,t}$	=	CO_2 emission factor of fuel type *i* in period *t* (t CO_2/GJ)
$EG_{p,h}$	=	Net electricity generated and delivered by power unit *p* to the electricity system in hour *h* (MWh)
p	=	Power units in the electricity system that operate within the top of the dispatch order in hour *h* (as defined below)
i	=	Fuel types combusted in power unit *p* in period *t*
h	=	Hours in period *t* in which the Article 6.4 activity is displacing electricity in, or consuming electricity from, the electricity system
t	=	Period for which emissions from displacing electricity in, or consuming electricity from, the electricity system are quantified

(b) Based on the net electricity generation of each power unit *p* and a CO_2 emission factor for each power unit *p*, as follows:

$$EF_{OM,DD,h} = \frac{\sum_{p} EG_{p,h} \times EF_{EL,p,t}}{\sum_{p} EG_{p,h}} \quad \text{Equation (5)}$$

Where:

$EF_{OM,DD,h}$	=	Dispatch data OM emission factor during hour *h* within period *t* (t CO_2/MWh)
$EG_{p,h}$	=	Net electricity generated and delivered by power unit *p* to the electricity system in hour *h* (MWh)
$EF_{EL,p,t}$	=	CO_2 emission factor of power unit *p* in period *t* (t CO_2/MWh)
p	=	Power units in the electricity system that operate within the top of the dispatch order in hour *h* (as defined below)
h	=	Hours in period *t* in which the Article 6.4 activity is displacing electricity in, or consuming electricity from, the electricity system

t	=	Period for which emissions from displacing electricity in, or consuming electricity from, the electricity system are quantified

69. The CO_2 emission factor of the power units p ($EF_{EL,p,t}$) shall be determined in accordance with the provisions of section 5.7.1.2.3.

70. To determine the set of power units p, activity participants shall obtain from the relevant dispatch centre:

    (a) The electricity system dispatch order of operation for each power unit in the electricity system, including power units from which electricity is imported; and

    (b) The amount of electricity (MWh) dispatched from all power units connected to the electricity system during each hour h in which the project activity is displacing or consuming electricity.

71. For each hour h, activity participants shall stack electricity generation from each power unit in accordance with the dispatch order. The group of power units p at the margin shall comprise the units accounting for the top ***x*** per cent of the total electricity dispatched during hour *h;* i.e., the power units dispatched last within the dispatch order.

72. The value of **x** shall be equal to the greater of:

    (a) 10 per cent, where, if 10 per cent falls on part of the generation of a power unit, the generation of that power unit is fully included in the calculation; or

    (b) The quantity of electricity displaced or consumed by the Article 6.4 activity during hour *h,* divided by the total electricity generation by all power units in the electricity system during that hour.

5.7.1.2.2. Method (b): Simple OM

73. The simple OM emission factor ($EF_{OM,simple,y}$) shall be determined as the generation-weighted average CO_2 emission factor per unit of net electricity generation from all power units serving the electricity system that are not designated as must-run power units.

74. The simple OM emission factor shall be applied only where the necessary data are available. It may be applied to any type of electricity generation or consumption source, including intermittent and non-intermittent electricity generation sources and electricity consumption sources depending on, or not depending on, intermittent generation. In addition, the conditions below apply for **case 1** and **case 2**:

    (a) For **case 1**, no further conditions apply; and

    (b) For **case 2**, the simple OM shall be applied only if one of the following conditions is met:

        (i) The number of hours in a calendar year in which at least one of the following two conditions apply is smaller than 100:

            a. renewable electricity generation is curtailed because available output exceeds what the electricity system could absorb[16]; or

[16] Such curtailment may occur, for example, due to interventions by the operator of the electricity system to ensure a safe operation of the system or due to renewable electricity producers limiting generation in response to market signals, such as negative electricity prices. In some countries, data on hours with negative electricity prices is available and may be used as a proxy for the hours in which renewable electricity generation is curtailed.

b. the electricity system operates solely based on renewable, nuclear, and/or storage power units; or

(ii) The share of electricity generation from renewable and nuclear power units in the relevant period *t* does not exceed 30 per cent.[17]

75. Activity participants shall document and justify, with appropriate evidence, in the PDD or monitoring report, as applicable, that the conditions in paragraph 74 above are fulfilled.[18]

76. The simple OM emission factor shall be determined for each calendar year of the crediting period. Activity participants shall use one of the following two options to determine the simple OM emission factor and shall apply the selected option throughout the crediting period:

(a) **Ex ante option:** Activity participants shall calculate the emission factor based on historical data available at the time of submission of the PDD to the DOE for validation. A three-year generation-weighted average emission factor shall be used. The emission factor shall then be adjusted during monitoring for each calendar year *y* of the crediting period to account for the vintage of data; however, the data underlying the calculation of the emission factor shall not be updated; or

(b) **Ex post option:** the emission factor shall be updated ex post during monitoring for each calendar year *y* of the crediting period. Activity participants shall specify in the PDD whether the emission factor is determined based on data from the calendar year *y* of the crediting period or based on data from a historical calendar year *v*. Where a historical year *v* is chosen, activity participants shall apply a fixed time difference between year *y* and year *v* throughout the crediting period, shall specify this time difference in the PDD, and shall not change it during the crediting period.[19] The time difference shall be as recent as possible, taking into account when the necessary data usually become available.[20]

77. The simple OM shall be calculated using one of the following two approaches:

(a) **Approach A**: based on the net electricity generation of each power unit not designated as must-run power unit and a CO_2 emission factor for that power unit; or

(b) **Approach B**: based on the total net electricity generation of all power units serving the electricity system that are not designated as must-run power units and the fuel types and total fuel consumption of these power units. **Approach B** shall only be used if:

(i) The necessary data for **approach A** is not available; and

[17] The value of 30% was derived from an analysis of the share of renewable electricity generation and the number of hours in which electricity prices were negative or close to zero for several countries. It was found that with a share of renewable electricity generation of up to 30%, the number of hours with negative or close to zero electricity prices are commonly less than 100 in a calendar year.

[18] For instance, this may include power generation curves or operational statistics for the project electricity system released by regulatory agencies or system operators.

[19] For example, the emission factor for 2025 may be calculated based on data from 2023, the emission factor for 2026 based on data from 2024, and so on.

[20] For example, if the annual data required to calculate the emission factor for year y are usually available only more than six months after the end of year *y*, the historical year *v* may correspond to year *y*-1. If the data are usually available only 18 months after the end of year *y*, the historical year *v* may correspond to year *y*-2.

(ii) Only nuclear and renewable power generation units are designated as must-run power units, and the quantity of electricity supplied to the electricity system by these power units is known.

78. Under **approach A**, the simple OM emission factor shall be calculated based on the net electricity generation of each power unit not designated as must-run power unit and an emission factor for that power unit as follows:

$$EF_{OM,simple,t} = \frac{\sum_p EG_{p,t} \times EF_{EL,p,t}}{\sum_p EG_{p,t}} \quad \text{Equation (6)}$$

Where:

$EF_{OM,simple,t}$	=	Simple OM CO_2 emission factor in period *t* (t CO_2/MWh)
$EG_{p,t}$	=	Net quantity of electricity generated and delivered to the electricity system by power unit *p* in period *t* (MWh)
$EF_{EL,p,t}$	=	CO_2 emission factor of power unit *p* in period *t* (t CO_2/MWh)
p	=	Power units not designated as must-run power units delivering electricity to the electricity system in period *t*
t	=	Relevant period: under the ex ante option the most recent three historical calendar years for which data are available at the time of submission of the PDD to the DOE for validation; under the ex post option, the calendar year y of the crediting period or the historical year v

79. The CO_2 emission factor of the power units *p* ($EF_{EL,p,t}$) shall be determined in accordance with the provisions of section 5.7.1.1.3.

80. Under approach B, the simple OM emission factor shall be calculated based on the total net electricity generation of all power units serving the electricity system that are not designated as must-run power units and the fuel types and total fuel consumption of these power units, as follows:

$$EF_{OM,simple,t} = \frac{\sum_i FC_{i,t} \times NCV_{i,t} \times EF_{CO2,i,t}}{EG_t} \quad \text{Equation (7)}$$

Where:

$EF_{OM,simple,t}$	=	Simple OM CO_2 emission factor in period *t* (t CO_2/MWh)
$FC_{i,t}$	=	Amount of fuel type *i* consumed by power units that are not designated as must-run power units in period *t* (mass or volume unit)
$NCV_{i,t}$	=	Net calorific value (energy content) of fuel type *i* in period *t* (GJ/mass or volume unit)
$EF_{CO2,i,t}$	=	CO_2 emission factor of fuel type *i* in period *t* (t CO_2/GJ)
EG_t	=	Net electricity generated and delivered to the electricity system by all power units serving the electricity system that are not designated as must-run power units in period *t* (MWh)
i	=	All fuel types combusted in power units serving the electricity system that are not designated as must-run power units in period *t*

t	=	Relevant period: under the ex ante option the most recent three historical calendar years for which data are available at the time of submission of the PDD to the DOE for validation; under the ex post option, the calendar year y of the crediting period or the historical year v

81. Where data from the calendar year *y* of the crediting period are used, the emission factor from equation (6) and equation (7) shall be used as the emission factor for the respective calendar year y (i.e., $EF_{OM,simple,y} = EF_{OM,simple,t}$).

82. Where data from a calendar year prior to calendar year *y* of the crediting period are used (i.e., under the ex ante option or where a historical year *v* is used under the ex post option), the simple OM emission factor derived from historical data shall be adjusted to account for data vintage, noting that, in many electricity systems, the average emissions intensity of existing power units declines over time due to an increasing share of renewable energy power units, the use of more efficient power units, and the use of less GHG-intensive fuels, as follows:

$$EF_{OM,simple,y} = EF_{OM,simple,t} \times \left[1 - F_{OM,simple} \times (y - t)\right] \quad \text{Equation (8)}$$

Where:

$EF_{OM,simple,y}$	=	Simple OM CO_2 emission factor in year *y* (t CO_2/MWh)
$EF_{OM,simple,t}$	=	Simple OM CO_2 emission factor in period *t* (t CO_2/MWh)
$F_{OM,simple}$	=	Factor accounting for the likely annual decrease of the simple OM emission factor over time
y	=	Calendar year of the crediting period for which emission reductions are determined
t	=	Period for which the simple OM emission factor is calculated: under the ex post option, the historical year *v*; under the ex ante option, the central calendar year of the three-year period used to calculate the emission factor

83. For **case 1**, a value of zero shall be applied to the parameter $F_{OM,simple}$, as a simplified and reasonably conservative approach. For **case 2**, activity participants shall use either the global value or the respective country-specific value provided in appendix 2.

5.7.1.2.3. Method (c): Simple adjusted OM

84. The simple adjusted OM emission factor ($EF_{OM,adj,t}$) is a variation of the simple OM, with an adjustment for periods in which either (i) renewable electricity generation is curtailed because available output exceeded what the electricity system could absorb or (ii) the electricity system operates solely based on renewable, nuclear, and/or storage power units.

85. The simple adjusted OM emission factor shall be applied only where the necessary data are available. It may be applied to both **case 1** and **case 2** and to any type of electricity generation or consumption source, including intermittent and non-intermittent electricity generation sources and electricity consumption sources depending on, or not depending on, intermittent generation.

86. This methodological tool provides two options for calculating the simple adjusted OM emission factor:

(a) **Option 1:** based on (i) hourly data on the electricity generation or consumption from all sources *s*, (ii) hourly data indicating whether renewable electricity generation is curtailed because available output exceeded what the electricity system could absorb, (iii) hourly indicating whether the electricity system operates solely based on renewable, nuclear, and/or storage power units, and (iv) annual data used to calculate the simple OM emission factor; or

(b) **Option 2:** based on annual data on electricity generation or consumption from all sources *s* and aggregated information on the number of hours in which the renewable electricity generation is curtailed because available output exceeded what the electricity system could absorb and/or the electricity system operates solely based on renewable, nuclear, and/or storage power units.

87. **Option 1** may be applied in all situations. **Option 2** shall be applied only to non-intermittent electricity generation sources or electricity consumption sources not depending on intermittent generation. Furthermore, **option 1** shall be determined using the ex post option, as described for the simple OM emission factor in section 5.7.1.2.2. **Option 2** may be determined using either the ex ante option or the ex post option, as described for the simple OM emission factor in section 5.7.1.2.2.

88. Under both options, the simple adjusted OM emission factor shall be determined by applying an adjustment to the simple OM emission factor, as follows:

(a) **Option 1:** an emission factor of zero shall be applied for each hour *h* in which either (i) renewable electricity generation in the electricity system is curtailed because available output exceeded what the electricity system could absorb or (ii) the electricity system operates solely based on renewable, nuclear, and/or storage power units. In all other hours *h*, the annual simple OM emission factor shall be applied. This is expressed through the term S_h, which shall be equal to zero for hours in which either renewable electricity generation is curtailed because available output exceeded what the electricity system could absorb or the electricity system operates solely based on renewable, nuclear, and/or storage power units and equal to one for all other hours:

$$EF_{OM,adj,h} = S_h \times EF_{OM,simple,y} \quad \text{Equation (9)}$$

(b) **Option 2:** the simple adjusted OM emission factor shall be determined for calendar year *y* by adjusting for the fraction of time in which renewable electricity generation is curtailed because available output exceeded what the electricity system could absorb and/or the electricity system operates solely based on renewable, nuclear, and/or storage power units, as follows:

$$EF_{OM,adj,y} = (1 - \lambda_y) \times EF_{OM,simple,y} \quad \text{Equation (10)}$$

Where:

$EF_{OM,adj,y}$ = Simple adjusted OM CO_2 emission factor in year *y* (t CO_2/MWh)

S_h	=	Binary parameter indicating whether during hour *h* renewable electricity generation in the electricity system is curtailed because available output exceeded what the electricity system could absorb and/or the electricity system operates solely based on renewable, nuclear, and/or storage power units (S_h = 0 in this case; otherwise S_h = 1)
$EF_{OM,simple,y}$	=	Simple OM CO_2 emission factor in year *y* (t CO_2/MWh)
λ_y	=	Fraction of time in year *y* during which renewable electricity generation in the electricity system is curtailed because available output exceeded what the electricity system could absorb and/or the electricity system or the electricity system operates solely based on renewable, nuclear, and/or storage power units
y	=	Calendar year of the crediting period for which emission reductions are determined

89. For the purpose of determining whether the electricity system operates solely based on renewable, nuclear, and/or storage power units, the parameters S_h and λ_y shall be determined differently depending on which case applies, as follows:[21]

    (a) Where **case 1** applies, this shall refer to the fraction of time during which only the following types of power units operate: hydro, solar, wind, tidal, wave, geothermal nuclear, and hydro or battery storage power units; and

    (b) Where **case 2** applies, this shall refer to the fraction of time during which only the following types of power units operate: hydro, solar, wind, tidal, wave, geothermal, nuclear, biomass or biomass-derived fuels, hydrogen or hydrogen-derived fuels, and any type of storage power units.

5.7.1.2.4. Method (d): Average OM

90. The average OM emission factor ($EF_{OM,av,y}$) shall be determined as the generation-weighted average CO_2 emission factor per unit of net electricity generation from all power units in the electricity system.

91. The average OM method shall be applied only where the necessary data are available. Moreover, it shall be applied only:

    (a) To non-intermittent electricity generation sources and electricity consumption sources not depending on intermittent generation; and

    (b) Where **case 2** applies.

92. The average OM emission factor ($EF_{OM,av,y}$) shall be calculated as the generation-weighted average emission factor of all power units serving the electricity system, using the same approaches as for the simple OM emission factor, but also including power units designated as must-run in all equations. The emission factor shall be determined for each calendar year *y* of the crediting period. As for the simple OM emission factor, either the ex ante option or the ex post option may be used, and **approach B** shall be used only

[21] This differentiation is preliminary. Further work may be undertaken on this matter, pending the development of other methodological tools under the Article 6.4 mechanism. Biomass may originate from renewable or non-renewable resources. As a conservative and simplified approach, in this version of the methodological tool biomass is considered non-renewable under **case 1** and renewable under **case 2**. Similarly, the emissions impact of power generation based on hydrogen depends on how the hydrogen is produced. As a conservative and simplified approach, hydrogen is treated as a fuel associated with emissions under **case 1** and as a zero-emission fuel under **case 2.**

where the necessary data for **approach A** are not available. To account for data vintage, the respective value for $F_{OM,avg}$ in appendix 2 shall be used instead of the value of $F_{OM,simple}$. The relevant provisions in section 5.7.1.2.2 shall apply.

5.7.1.3. Sub-step b: Determination of the BM emission factor ($EF_{BM,y}$)

93. The BM emission factor ($EF_{BM,y}$) shall be determined based on the generation-weighted average emissions intensity of new power units that started supplying electricity to the electricity system during a reference period. Where the necessary data are available, the reference period shall reflect the period in which the Article 6.4 activity starts operation (hereinafter referred to as the "**concurrent reference period**"). Where the relevant data are not available at the time of calculating the BM emission factor, a "**historical reference period**" may be used. In the case of a historical reference period, the average emissions intensity of new power units shall be adjusted to account for data vintage, noting that, in many electricity systems, the average emissions intensity of new power units declines over time due to an increasing share of renewable energy power units, the use of more efficient power units, and the use of less GHG-intensive fuels.

94. Activity participants shall include the following power units *p* in the calculation of the BM emission factor:

    (a) Where **case 1** applies and the electricity generation source is intermittent, or the electricity consumption source depends on intermittent generation, include only non-intermittent electricity generation sources; or

    (b) In all other situations, include all power units.

95. Activity participants shall determine the reference period for calculating the BM emission factor as follows:

    (a) Determine the calendar year in which the Article 6.4 activity started operation, hereinafter referred to as year *x*;

    (b) Determine the most recent calendar year for which data are available on new power units that started supplying electricity to the electricity system, hereinafter referred to as year *z*;

    (c) Determine an initial three-year reference period, either as a concurrent or historical reference period, as follows:

        (i) **Concurrent reference period**: where $z \geq x+1$, determine the initial reference period as the three-year period covering the calendar year before, during, and after the start of operation of the Article 6.4 activity (i.e., the period covering the calendar years x-1, x and x+1); or

        (ii) **Historical reference period**: where $z < x+1$, determine the initial reference period as the most recent three-year period for which data are available (i.e., the period covering the calendar years z-2, z-1 and z);

    (d) Identify the total installed capacity of all power units in the electricity system (MW) at the end of the initial reference period, hereinafter referred to as $P_{EL,total}$;

    (e) Identify all power units *p* that started supplying electricity to the electricity system during the initial reference period and determine their total installed capacity (MW), hereinafter referred to as $P_{EL,refperiod}$; and

    (f) Where at least five power units have been identified under sub-paragraph (e) above and $P_{EL,refperiod} \geq 0.05 \times P_{EL,total}$, use the initial three-year period determined

under sub-paragraph (c) as the reference period. Otherwise, determine a five-year reference period, either as a concurrent or historical reference period, as follows:

(g) **Concurrent reference period**: where $z \geq x+2$, determine the reference period as the five-year period covering the two calendar years before the start of operation of the Article 6.4 activity, the calendar year during start of operation of the Article 6.4 activity, and the two calendar years after the start of operation of the Article 6.4 activity (i.e., calendar years x-2, x-1, x, x+1, and x+2); or

(h) **Historical reference period**: where $z < x+2$, determine the reference period as the most recent five-year period for which data are available (i.e., the calendar years z-4, z-3, z-2, z-1, and z).

96. Activity participants shall determine the BM emission factor as the generation-weighted average emission factor (t CO_2/MWh) of all power units p during the period t, calculated as follows:

(a) **For a concurrent reference period**:

$$EF_{BM,y} = \frac{\sum_p EG_{p,t} \times EF_{EL,p,t}}{\sum_p EG_{p,t}} \quad \text{Equation (11)}$$

(b) **For a historical reference period**:

$$EF_{BM,y} = \frac{\sum_p EG_{p,t} \times EF_{EL,p,t}}{\sum_p EG_{p,t}} \times [1 - F_{BM} \times (x - r)] \quad \text{Equation (12)}$$

Where:

$EF_{BM,y}$	=	BM CO_2 emission factor in year y (t CO_2/MWh)
$EG_{p,t}$	=	Net quantity of electricity generated and delivered to the electricity system by power unit p in period t (MWh)
$EF_{EL,p,t}$	=	CO_2 emission factor of power unit p in period t (t CO_2/MWh)
p	=	Power units included in the BM
y	=	Calendar year of the crediting period for which emission reductions are determined
t	=	Period from the start of the reference period up to the most recent calendar year for which electricity generation data are available[22]
F_{BM}	=	Factor accounting for the likely annual decrease of the BM emission factor over time
x	=	Calendar year in which the Article 6.4 activity starts operation

[22] For example, the reference period may start on 1 January 2022. If a project determines the emission factor for the year 2029, the most recent available data may be available for 2027. In this case, period t corresponds to the six-year period from 1 January 2022 to 31 December 2027. If a power unit p included in the BM calculation started operation on 1 July 2023, the electricity generation data for that power units shall cover the period from 1 July 2023 until 31 December 2027. If another power unit p included in the calculation started operation on 15 November 2024, the electricity generation data for that power unit shall cover the period from 15 November 2024 until 31 December 2027.

r	=	Central year within the historical reference period (i.e., *z*-1 for a three-year historical reference period and *z*-3 for a five-year historical reference period)
z	=	Most recent calendar year for which data are available on new power units that started supplying electricity to the electricity system

97. For **case 1**, a value of zero shall be applied to the parameter F_{BM}, as a simplified and reasonably conservative approach. For **case 2**, activity participants shall use either the global value or the respective country-specific value provided in appendix 2.

98. Power units registered as Article 6.4 projects or component projects, or registered under other carbon crediting programs, shall be included in the calculation of the BM emission factor. However, capacity additions resulting from retrofits of existing power units shall be excluded.

99. For the first crediting period, the BM emission factor shall be updated for each calendar year as follows:

    (a) Where data to determine the BM emission factor for a concurrent reference period are not yet available, the BM emission factor shall be updated for each calendar year using the same historical reference period and the same set of power units *p*, but updating data on electricity generation and emission factors of the power units *p* by extending the period *t* to the most recent calendar year for which data are available; and

    (b) Once data become available to determine the BM emission factor for a concurrent reference period, the BM emission factor shall be updated using the concurrent reference period and a new set of power units *p*. In subsequent calendar years, the BM emission factor shall be updated for each calendar year of the crediting period using the same concurrent reference period and same set of power units *p*, while extending period *t* to the most recent calendar year for which data are available.

100. For the second and third crediting periods, the BM emission factor shall be determined once ex ante and shall not be updated for each calendar year of the crediting period. It shall be determined for the concurrent reference period and the set of power units *p* identified for that period, in accordance with the provisions in paragraph 95, using data on electricity generation from the power units *p* covering the period from the start of the concurrent reference period up to the most recent calendar year for which data are available at the time of renewal of the crediting period.

101. The CO_2 emission factor of the power units *p* ($EF_{EL,p,t}$) shall be determined in accordance with the provisions in section 5.7.1.1.3.

102. For the purpose of quantifying the uncertainty of the BM emission factor, the uncertainty associated with the BM method, in particular the assumption that the Article 6.4 activity would displace the construction of the same type and composition of power units as those included in the BM, shall be assumed to be ±10 per cent of the calculated BM emission factor.

5.7.1.4. Sub step c: Determination of the CM emission factor ($EF_{CM,y}$ or $EF_{CM,h}$)

103. The CM emission factor shall be calculated as follows:

$$EF_{CM,t} = EF_{OM,t} \times w_{OM} + EF_{BM,t} \times w_{BM}$$

Equation (13)

Where:

$EF_{CM,t}$	=	CM CO_2 emission factor in period *t* (t CO_2/MWh)
$EF_{OM,t}$	=	OM CO_2 emission factor in period *t* (t CO_2/MWh)
$EF_{BM,t}$	=	BM CO_2 emission factor in period *t* (t CO_2/MWh)
w_{OM}	=	Weighting factor of the OM emissions factor (unitless)
w_{BM}	=	Weighting factor of the BM emissions factor (unitless)
t	=	Period for which the emission factor of the electricity system is determined (either the calendar year *y* of the crediting period or the hour *h* within the calendar year *y* of the crediting period)[23]

104. The default values in Table 5 shall be used for w_{OM} and w_{BM}, unless the mechanism methodology referring to this methodological tool specifies other values.[24] Activity participants shall use the more conservative approach, which results in a higher emission factor for case 1 and a lower emission factor for case 2, between (i) using the lower value for w_{OM} combined with the upper value for w_{BM} or (ii) using the upper value for the w_{OM} combined with the lower value for w_{BM}, such that the sum of w_{OM} and w_{BM} is equal to one.

Table 5. Default values for w_{OM} and w_{BM}[25]

Type of electricity generation or consumption source	w_{OM}		w_{BM}	
	Lower value	**Upper value**	**Lower value**	**Upper value**
• Intermittent electricity generation sources • Electricity consumption sources depending on intermittent generation	0.25	0.75	0.25	0.75
• Non-intermittent electricity generation sources • Electricity consumption sources not depending on intermittent generation	0.125	0.375	0.625	0.875

105. The values for w_{OM} and w_{BM} shall be fixed for the duration of a crediting period.

5.7.2. Option B: Use a conservative default emission factor

106. Where **case 1** applies and the electricity generation source is not intermittent, or the electricity consumption source does not depend on intermittent generation, activity participants shall apply one of the following default emission factors and justify the choice in the PDD or monitoring report, as applicable:

[23] Note that the BM emission factor is always calculated for a calendar year *y* of the crediting period. Where the OM emission factor is determined on an hourly basis, the annual value of the BM emission factor may be applied to each hour *h*.

[24] Mechanism methodologies may, for example, specify more narrow ranges of the values for specific technologies or circumstances, such as different ranges for different types of renewable power generation technologies (e.g. wind power, solar PV, wind power, reflecting their likely) or different circumstances (e.g. availability of solar radiation or the share of renewable electricity generation).

[25] These values are based on an expert judgment by the MEP which is informed by an assessment of the 'capacity value' of different types of power units based on the literature. The 'capacity value' reflects contribution a generation resource makes to grid reliability. It is here assumed that non-intermittent power units have a higher capacity value and therefore affect the BM emission factor more strongly.

(a) **0.44 t CO_2e/MWh** if there is high confidence that the share of electricity generation from renewable (excluding solar and wind) and nuclear energy in the electricity system exceeds 67 per cent in the period for which the emission factor is determined;[26] or

(b) Otherwise **0.87 t CO_2e/MWh** if there is high confidence that the share of electricity generation from renewable (excluding solar and wind) and nuclear energy in the electricity system exceeds 33 per cent in the period for which the emission factor is determined;[27] or

(c) Otherwise **1.3 t CO_2e/MWh**.[28]

107. Where **case 1** applies and the electricity generation source is intermittent, or the electricity consumption source depends on intermittent generation, activity participants shall apply a default value of **1.3 t CO_2e/MWh**.[29]

108. Where **case 2** applies, activity participants shall apply one of the following default emission factors and justify the choice in the PDD or monitoring report, as applicable:

(a) **0.2 t CO_2e/MWh** if there is high confidence that the share of electricity generation from renewable energy (including solar and wind) and nuclear energy in the electricity system is less than 33 per cent in the period for which the emission factor is determined;[30] or

(b) Otherwise **0.1 t CO_2e/MWh** if there is high confidence that the share of electricity generation from renewable energy (including solar and wind) and nuclear energy in the electricity systems is less than 67 per cent in the period for which the emission factor is determined;[31] or

(c) Otherwise **0.03 t CO_2e/MWh**.[32]

109. For determining the emission factor applied under **case 1**, the data used to identify the share of electricity generation from renewable energy (excluding solar and wind) and

[26] Calculated as 1.3 t CO_2/MWh x 1/3.

[27] Calculated as 1.3 t CO_2/MWh x 2/3.

[28] This value represents a conservative (i.e. higher end) value for the emission intensity of coal power generation (see Table 3).

[29] Where case 1 applies and the electricity generation source is intermittent, or the electricity consumption source depends on intermittent generation, the default values in paragraph 106 are not necessarily conservative. This is illustrated through the following example: an electricity system consists of 40% hydro power, 10% wind power, and 50% coal power generation. A hydrogen production plant mainly uses electricity from a dedicated wind power plant and complements this by electricity generation from the electricity system when wind power is not available. In this configuration it is likely that the electricity consumed mostly stems from coal power generation. However, the applicable emission factor of 0.87 t CO2e/MWh is calculated based on the assumption that at least one third of the electricity consumed is from renewable or nuclear power plants and may not be conservative if all electricity is consumed from coal power plants. Therefore, a conservative value of 1.3 t CO2e/MWh is used in this case under Option B.

[30] Calculated as 0.3 t CO_2/MWh x 2/3. The value of 0.3 t CO_2/MWh represents a conservative (i.e. lower end) value for the CO_2 emissions intensity of a natural gas power plant (see Table 3).

[31] Calculated as 0.3 t CO_2/MWh x 1/3.

[32] This value is based on upstream emissions from solar PV power plants as reported in *Life Cycle Greenhouse Gas Emissions from Concentrating Solar Power,* published by the National Renewable Energy Laboratory (NREL).

nuclear energy in the electricity system may be determined either ex ante, based on the average data from the most recent three years at the time of submission, or ex post for period *t* for which the emission factor is determined. For **case 2**, the share of renewable and nuclear energy (including solar and wind) in the electricity system shall be determined ex post for period *t* for which the emission factor is determined.

110. Under **option B**, uncertainty associated with the emission factor is already addressed through the use of these conservative values and does not need to be considered in calculating the combined uncertainty in section 5.7.2.

5.8. Step 8: Determine the emission factor for electricity sourced from captive fossil fuel power plant(s), where applicable

111. This step is applicable if **step 6** confirms that the emission factor for electricity sourced from captive fossil fuel power plant(s) shall be used.

112. Activity participants shall determine the emission factor for electricity sourced from captive fossil fuel power plant(s) by choosing one of the following two options and shall document their choice in the PDD:

(a) **Option A**: calculate the actual emission factor of the fossil fuel fired captive power plant(s), as set out in section 5.8.1; or

(b) **Option B**: use a conservative default emission factor, as set out in section 5.8.2.

5.8.1. Option A: Calculate the actual emission factor of the fossil fuel fired captive power plant(s)

113. The emission factor for electricity generation shall be determined based on the CO2 emissions from fuel combustion and the electricity generation of the fossil-fuel fired captive power plant(s) identified in **step 2**. In the case of plants that co-generate heat and power (cogeneration plants), activity participants may:

(a) Ignore, as a conservative assumption, the heat generation for activities under **case 1**; or

(b) Allocate the emissions of the fossil fuel fired captive power plant to heat and power by assuming that, in the absence of cogeneration, the heat would be generated in a boiler using the same type(s) of fossil fuel as those used in the captive power plant(s). This option requires determining the quantity of heat generated by the captive power plant(s).

114. Where none of the fossil-fuel fired captive power plants is a cogeneration plant, or where heat generation is ignored in accordance with the conditions outlined in paragraph 108, the emission factor of the captive power plant(s) shall be calculated as follows:

$$EF_{BE/PE/LE,p,t} = \frac{\sum_i FC_{i,p,t} \times NCV_{i,t} \times EF_{CO2,i,t}}{EG_{p,t}} \quad \text{Equation (14)}$$

Where:

$EF_{BE/PE/LE,p,t}$ = Emission factor of captive power plant *p* in the period *t* (t CO_2e/MWh)

$FC_{i,p,t}$ = Quantity of fossil fuel type *i* fired in captive power plant *p* in period *t* (mass or volume unit)

$NCV_{i,t}$ = Average net calorific value of fossil fuel type *i* used in period *t* (GJ/mass or volume unit)

$EF_{CO2,i,t}$	=	Average CO_2 emission factor of fossil fuel type *i* used in period *t* (t CO_2e/GJ)
$EG_{p,t}$	=	Quantity of electricity generated in captive power plant *p* in period *t* (MWh)
p	=	Fossil fuel fired captive power plants identified in step 2
t	=	Period for which the emission factor for electricity generation is determined (see paragraph 116)

115. In other cases, the CO_2 emission factor for electricity generation shall be calculated by allocating fuel consumption between electricity and heat generation, as follows:

$$EF_{BE/PE/LE,p,t} = \frac{\left[\sum_i \left(FC_{i,p,t} \times NCV_{i,t}\right) - \frac{HG_{p,t}}{\eta_{boiler}}\right] \times EF_{CO2,p,t}}{EG_{p,t}} \quad \text{Equation (15)}$$

Where:

$EF_{BE/PE/LE,y}$	=	Emission factor of captive power plant *p* in period *t* (t CO_2e/MWh)
$FC_{i,p,t}$	=	Quantity of fossil fuel type *i* fired in captive power plant *p* in the period *t* (mass or volume unit)
$NCV_{i,t}$	=	Average net calorific value of fossil fuel type *i* used in period *t* (GJ/mass or volume unit)
$HG_{p,t}$	=	Quantity of heat co-generated by captive power plant *p* in the period *t* (GJ)
η_{boiler}	=	Efficiency of the boiler assumed to generate heat in the absence of cogeneration
$EF_{CO2,p,t}$	=	Average CO_2 emission factor of fossil fuels fired in captive power plant *p* in period *t* (t CO_2/GJ)
$EG_{p,t}$	=	Quantity of electricity generated by captive power plant *p* in period *t* (MWh)
p	=	Fossil fuel fired captive power plants identified in step 2
t	=	Period for which the emission factor for electricity generation is determined (see paragraph 116)

116. The period *t* shall correspond to:

(a) The monitored period (e.g., the year *y*) for:

(i) Determining project and leakage emissions of electricity consumption source *s*; or

(ii) Determining baseline emissions where existing or new captive power plant(s) are operated at the site of the electricity generation or consumption source *s* during the monitored period; or

(b) The most recent three historical years prior to the implementation of the Article 6.4 activity for determining baseline emissions where no captive power plant is operated at the site of the electricity generation or consumption source *s* during the monitored period.

117. The average CO_2 emission factor of the fossil fuels fired in fossil-fuel fired captive power plant *p* ($EF_{CO2,p,t}$) shall be determined as follows:

(a) Where a fossil-fuel fired captive power plant has used only a single fuel type since the start of operation (except for a small amount of start-up fuel), use the CO_2 emission factor of that fuel type (i.e., $EF_{CO2,p,t} = EF_{CO2,i}$); or

(b) Where a fossil-fuel fired captive power plant has used multiple fuel types since the start of operation, apply one of the following options:

(i) For **case 1**, use the fuel type with the highest CO_2 emission factor ($EF_{CO2,i,t}$) among the fuel types from the start of the project activity to the end of the monitored period in question;

(ii) For **case 2**, use the fuel type with the lowest CO_2 emission factor ($EF_{CO2,i,t}$) among the fuel types from the start of the Article 6.4 activity to the end of the monitored period in question, or where the fossil-fuel fired captive power plant would only operate in the baseline scenario, use the fuel type with the lowest CO_2 emission factor among the fuel types used in the most recent three years prior to the implementation of the Article 6.4 activity; or

(iii) Calculate an average CO_2 emission factor for period *t*, provided that the decision on the fuel mix is outside the control of the activity participants (e.g., for leakage electricity consumers, or where the fuel mix is fixed by regulation or determined by a centralized dispatch authority), as follows:

$$EF_{CO2,p,t} = \frac{\sum_i FC_{i,p,t} \times NCV_{i,t} \times EF_{CO2,i,t}}{\sum_i FC_{p,i,t} \times NCV_{i,t}} \quad \text{Equation (16)}$$

Where:

$EF_{CO2,p,t}$	=	Average CO_2 emission factor of the fossil fuels fired in captive power plant *p* in period *t* (t CO_2/GJ)
$FC_{i,p,t}$	=	Quantity of fossil fuel type *i* fired in captive power plant *p* in period *t* (mass or volume unit)
$NCV_{i,t}$	=	Average net calorific value of fossil fuel type *i* used in period *t* (GJ/mass or volume unit)
$EF_{CO2,i,t}$	=	CO_2 emission factor of fossil fuel type *i* used in period *t* (t CO_2/GJ)
i	=	Fossil fuel types fired in captive power plant *p* in period *t*
p	=	Fossil fuel fired captive power plants identified in step 2
t	=	Period for which the emission factor for electricity generation is determined (see paragraph 116 above)

(iv) Calculate the average CO_2 emission factor, in accordance with **equation (14)**, for (a) the most recent three years prior to the implementation of the activity and (b) the monitored period in question, and activity participants shall use the higher value for case 1 and lower value for case 2.

118. The selected approach shall be documented in the PDD and shall not be changed during the crediting period.

119. Under **option A**, uncertainty associated with the emission factor shall be addressed in accordance with the requirements in section 5.11.

5.8.2. Option B: Use a conservative default emission factor

120. The default values provided in **table 2** in section 5.7.1.1.3 shall be applied for each specified type of fossil fuel-based power plant. Where multiple fossil fuel types are consumed, or where the fuel type cannot be determined, the higher emission factor shall be used for **case 1** and the lower emission factor shall be used for **case 2**.

121. Under **option B**, uncertainty associated with the emission factor does is already addressed through the use of these conservative values and does not need to be considered in calculating the combined uncertainty in section 5.7.1.4.

5.9. Step 9. Determine the transmission and distribution losses from the electricity system, where applicable

122. This step is only applicable where **scenario A** or **scenario C** applies and where electricity is consumed from the project electricity system in the Article 6.4 activity scenario and/or the baseline scenario. This step is **not applicable** where electricity is supplied to the project electricity system in the Article 6.4 activity scenario and/or baseline scenario.

123. Activity participants shall determine transmission and distribution losses from the electricity system using one of the following two options:

(a) **Option 1**: determine the transmission and distribution losses for the specific circumstances of the Article 6.4 activity, taking into account the relevant parameters such as the geographical region and the voltage level at which electricity is consumed from the electricity system, based on transmission and distribution loss data from sources such as electricity wholesale or retail companies. This option may be applied either (i) ex post for the calendar year for which emission reductions are determined, or (ii) ex ante for the crediting period, using average transmission and distribution losses from the most recent three years for which data are available at the time of submission of the PDD to the DOE for validation. The following conditions apply:

(i) For **case 1**, the data used may include or exclude losses from electricity pilferage. Accordingly, data may be used even if no information is available on whether losses from electricity pilferage are included; and

(ii) For **case 2**, the data shall include physical losses only and shall exclude any losses from electricity pilferage; or

(b) **Option 2**: apply the appropriate default value from Table 6 for transmission and distribution losses, based on the voltage level at which electricity is consumed and depending on whether **case 1** or **case 2** applies.

Table 6. Default transmission and distribution losses by voltage level and case

Voltage level at which electricity is delivered to the electricity consumption source *s*	Voltage range (kV)[33]	Case 1	Case 2
High and extra high voltage (HV)	≥ 35	7%	2%
Medium voltage (MV)	< 35 and > 1	11%	4%
Low and extra low voltage (LV)	≤ 1	16%	8%

[33] Source: IEC 60038:2009 - IEC standard voltages.

5.10. Step 10. Determine the emissions from electricity generation and/or consumption

124. Baseline, project and/or leakage emissions from generation and/or consumption shall be calculated based on the quantity of electricity generation and/or consumption, the applicable emission factor for electricity generation or consumption, and, where relevant, a factor to account for transmission and distribution losses, as follows:

(a) **Annual determination:** where electricity generation and/or consumption and emission factors are determined on an annual basis for each calendar year *y* of the crediting period, emissions shall be calculated as follows:

$$BE_{EG,y} = \sum_{s} EG_{s,y} \times EF_{EG,BL,s,y}$$ Equation (17)

$$BE_{EC,y} = \sum_{s} EC_{s,y} \times EF_{EC,BL,s,y} \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (18)

$$PE_{EG,y} = \sum_{s} EG_{s,y} \times EF_{EG,PJ,s,y}$$ Equation (19)

$$PE_{EC,y} = \sum_{s} EC_{s,y} \times EF_{EC,PJ,s,y} \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (20)

$$LE_{EG,BL,y} = \sum_{s} EG_{s,y} \times EF_{EG,BL,s,y}$$ Equation (21)

$$LE_{EC,BL,y} = \sum_{s} EC_{s,y} \times EF_{EC,PJ,s,y} \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (22)

$$LE_{EG,PJ,y} = \sum_{s} EG_{s,y} \times EF_{EG,PJ,s,y}$$ Equation (23)

$$LE_{EC,PJ,y} = \sum_{s} EC_{s,y} \times EF_{EC,PJ,s,y} \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (24)

Where:

$BE_{EG,y}$ = Baseline emissions from electricity generation in year *y* (t CO_2)

$BE_{EC,y}$ = Baseline emissions from electricity consumption in year *y* (t CO_2)

$PE_{EG,y}$ = Project emissions from electricity generation in year *y* (t CO_2)

$PE_{EC,y}$ = Project emissions from electricity consumption in year *y* (t CO_2)

$LE_{EG,BL,y}$	=	Leakage emissions from electricity generation in the baseline scenario in year *y* (t CO_2)
$LE_{EC,BL,y}$	=	Leakage emissions from electricity consumption in the baseline scenario in year *y* (t CO_2)
$LE_{EG,PJ,y}$	=	Leakage emissions from electricity generation in the project scenario in year *y* (t CO_2)
$LE_{EC,PJ,y}$	=	Leakage emissions from electricity consumption in the project scenario in year *y* (t CO_2)
$EG_{s,y}$	=	Electricity generation by the electricity generation source *s* in year *y* (MWh)
$EC_{s,y}$	=	Electricity consumption by the electricity consumption source *s* in year *y* (MWh)
$EF_{EG,BL,s,y}$	=	Emission factor for electricity generation by electricity generation source *s* in the baseline scenario in (case 2) year *y* (t CO_2/MWh)
$EF_{EC,BL,s,y}$	=	Emission factor for electricity consumption by electricity consumption source *s* in the baseline scenario in (case 2) year *y* (t CO_2/MWh)
$EF_{EG,PJ,s,y}$	=	Emission factor for electricity generation by electricity generation source *s* in the project scenario in (case 1) year *y* (t CO_2/MWh)
$EF_{EC,PJ,s,y}$	=	Emission factor for electricity consumption by electricity consumption source *s* in the project scenario in (case 1) year *y* (t CO_2/MWh)
$F_{TDL,s,y}$	=	Factor to account for transmission and distribution losses applicable to electricity generation or consumption source *s* in year *y*
s	=	Relevant electricity generation or consumption sources

(b) **Hourly determination:** where electricity generation and/or consumption and emission factors are determined on an hourly basis for each hour *h* of the calendar year *y* of the crediting period, emissions shall be calculated as follows:

$$BE_{EG,y} = \sum_{s} \sum_{h=1}^{8,760} EG_{s,h} \times EF_{EG,BL,s,h}$$ Equation (25)

$$BE_{EC,y} = \sum_{s} \left(\sum_{h=1}^{8,760} EC_{s,h} \times EF_{EC,BL,s,h} \right) \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (26)

$$PE_{EG,y} = \sum_{s} \sum_{h=1}^{8,760} EG_{s,h} \times EF_{EG,PJ,s,h}$$ Equation (27)

$$PE_{EC,y} = \sum_{s} \left(\sum_{h=1}^{8,760} EC_{s,h} \times EF_{EC,PJ,s,h} \right) \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (28)

$$LE_{EG,BL,y} = \sum_{s} \sum_{h=1}^{8,760} EG_{s,h} \times EF_{EG,BL,s,h}$$ Equation (29)

$$LE_{EC,BL,y} = \sum_{s} \left(\sum_{h=1}^{8,760} EC_{s,h} \times EF_{EC,PJ,s,h} \right) \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (30)

$$LE_{EG,PJ,y} = \sum_{s} \sum_{h=1}^{8,760} EG_{s,h} \times EF_{EG,PJ,s,h}$$ Equation (31)

$$LE_{EC,PJ,y} = \sum_{s} \left(\sum_{h=1}^{8,760} EC_{s,h} \times EF_{EC,PJ,s,h} \right) \times \frac{1}{1 - F_{TDL,s,y}}$$ Equation (32)

Where:

$BE_{EG,y}$	=	Baseline emissions from electricity generation in year *y* (t CO_2)
$BE_{EC,y}$	=	Baseline emissions from electricity consumption in year *y* (t CO_2)
$PE_{EG,y}$	=	Project emissions from electricity generation in year *y* (t CO_2)
$PE_{EC,y}$	=	Project emissions from electricity consumption in year *y* (t CO_2)
$LE_{EG,BL,y}$	=	Leakage emissions from electricity generation in the baseline scenario in year *y* (t CO_2)
$LE_{EC,BL,y}$	=	Leakage emissions from electricity consumption in the baseline scenario in year *y* (t CO_2)
$LE_{EG,PJ,y}$	=	Leakage emissions from electricity generation in the baseline scenario in year *y* (t CO_2)
$LE_{EC,PJ,y}$	=	Leakage emissions from electricity consumption in the baseline scenario in year *y* (t CO_2)
$EG_{s,h}$	=	Electricity generated by the electricity generation source *s* in hour *h* (MWh)
$EC_{s,h}$	=	Electricity consumed by the electricity consumption source *s* in hour *h* (MWh)
$EF_{EG,BL,s,h}$	=	Emission factor for electricity generated by the electricity generation source *s* in the baseline scenario in hour *h* (t CO_2/MWh)
$EF_{EC,BL,s,h}$	=	Emission factor for electricity consumed by the electricity consumption source *s* in the baseline scenario in hour *h* (t CO_2/MWh)
$EF_{EG,PJ,s,h}$	=	Emission factor for electricity generated by the electricity generation source s in the project scenario in hour *h* (t CO_2/MWh)
$EF_{EC,PJ,s,h}$	=	Emission factor for electricity consumed by the electricity consumption source s in the project scenario in hour *h* (t CO_2/MWh)
$F_{TDL,s,y}$	=	Factor accounting for transmission and distribution losses applicable to sources s in hour *h*
s	=	Relevant electricity generation or consumption sources

h	=	All hours within the calendar year *y*
y	=	Calendar year of the crediting period for which emission reductions are determined

5.11. Uncertainty determination

125. Activity participants shall determine the uncertainty of the emissions or emission factors from electricity generation and/or consumption, unless otherwise specified by the mechanism methodology referring to this tool. The determined uncertainty shall then be used in the calculations, as specified by the mechanism methodology.

126. The uncertainty shall be determined by considering the uncertainty associated with the methods, assumptions, data, and measurements used, following the guidance of Volume 1, Chapter 3 of the 2019 Refinement of the 2006 IPCC Guidelines. The uncertainty shall be expressed as the standard error of the mean and incorporated into the uncertainty calculations as specified by the mechanism methodology. For both **case 1** and **case 2**, the upper and the lower bound of the uncertainty at a 95 per cent confidence interval shall be specified.

127. Specifically, the following sources of uncertainty shall be considered in the quantification of uncertainty:

(a) **Uncertainty of input data**, including the uncertainty associated with measurements or default values (unless the default values explicitly represent conservative default values) used in the calculations. Such data include:

(i) Data related to power units in the electricity system and/or fossil-fuel fired captive power plants, such as the amount of fuel consumed, net calorific values, emission factors of fuels, electricity generation, and conversion efficiency of power plants;

(ii) Data used to determine transmission and distribution losses, such as total electricity generation and consumption within the electricity system; and

(iii) Measurements of electricity generation and/or consumption by equipment operated under the Article 6.4 activity or in the baseline scenario; and

(b) **Uncertainty associated with methods and assumptions,** including the weighting of the OM and BM in determining the CM emission factor, as specified in this methodological tool. This includes uncertainties associated with the specific methods chosen to determine the OM and BM emission factors (dispatch data OM, simple OM, simple adjusted OM, average OM and BM), as well as the uncertainty associated with the weighting used to combine them into a single CM emission factor, as detailed in the 5.7.1.2, 5.7.1.3 and 5.7.1.4 (sub-step c).

128. When applying conservative default values provided in this tool (i.e., values that are explicitly specified as conservative and for which no uncertainty range is indicated, including conservative default values based on IPCC data that are set at the upper or lower bound of the uncertainty range at a 95 per cent confidence interval), no further uncertainty analysis for these specific values is required. Accordingly, these values shall not be considered to contribute to uncertainty in the quantification of overall emission reductions.

6. Monitoring methodology

129. Some parameters listed in this section shall either be monitored continuously during the crediting period or calculated only once for the crediting period, depending on the data vintage selected. This shall be done in accordance with the methodological approaches set out in **section 5**, and with the guidance on **measurement and updating frequency** and **additional comments** provided **in this section**, including the relevant data/parameter tables, as applicable.

130. The calculation of the OM and BM emission factors shall be documented electronically in a spreadsheet that shall be attached to the PDD and, where applicable, to monitoring reports. All data shall be presented in a manner that enables reproduction of the calculation of the OM and BM emission factors. This shall include all data used to calculate the emission factors, including:

(a) The following information for each power plant or power unit:

(i) Information to clearly identify the plant;

(ii) The date of commissioning;

(iii) Installed capacity (MW);

(iv) Fuel type(s) used;

(v) The quantity of net electricity generation in the relevant year(s);

(vi) Where applicable, the fuel consumption of each fuel type in the relevant period(s); and

(vii) Where the simple OM or simple adjusted OM is applied, an indication of whether the plant or unit is designated as must-run plant;

(b) Net calorific values used;

(c) CO_2 emission factors used;

(d) Plant efficiencies used;

(e) Identification of the power plants or units included in the BM and OM during the relevant period(s);

(f) Where the simple OM or simple adjusted OM is applied, the hours during which renewable electricity generation in the electricity system is curtailed because available output exceeded what the electricity system could absorb and/or the project electricity system operates solely based on renewable, nuclear, and/or storage power units, as applicable; and

(g) Where the dispatch data OM is applied, for each hour *h* in which the Article 6.4 activity displaces electricity in, or consumes electricity from, the electricity system:

(i) The dispatch order of all power plants connected to the electricity system;

(ii) The total electricity generation of the electricity system;

(iii) The quantity of electricity displaced or consumed by the Article 6.4 activity; and

(iv) Identification of the power plants operating at the margin and, for each such plant, information on electricity generation and, where hourly fuel

consumption data are available, the types and quantities of fuels consumed during that hour.

131. The period for aggregating the amount of electricity generation or consumption shall align with the period used to determine the emission factor.

Data / Parameter table 1.

Data/parameter	$EG_{s,y}$; $EG_{s,h}$	
Description	$EG_{s,y}$: Electricity generated by the electricity generation source *s* in year *y* $EG_{s,h}$: Electricity generated by the electricity generation source *s* in hour *h*	
Data unit	$EG_{s,y}$: MWh in year *y* $EG_{s,h}$: MWh in hour *h*	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	$EG_{s,y}$: Continuous measurement and at least monthly recording $EG_{s,h}$: Continuous measurement and at least hourly recording	
Measurement methods and procedures	Direct measurement or calculation based on measurements from more than one electricity meter	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	Electricity-meter(s)
	Accuracy class	If electricity-meters are regulated: in accordance with the specifications of the meter supplier and/or with the requirements set by the operators of the electricity system or national requirements. If electricity meters are not regulated: at least accuracy class 0.5, or in accordance with the specifications of the meter supplier or national requirements
	Calibration requirements	If electricity meters are regulated: in accordance with national standards or requirements set by the meter supplier or by the operators of the electricity system, including the frequency of calibration. If electricity meters are not regulated: every three years or in accordance with national standards or requirements set by the meter supplier, including the frequency of calibration
	Location	Scenario A and C: electricity system interface, where applicable, Scenario B and C: entrance to the electricity consuming facility, where applicable
QA/QC procedures	In cases where electricity meters are regulated (e.g., the electricity is supplied by the electricity system – scenario A), the electricity meter shall be subject to regular maintenance and testing in accordance with the stipulation of the meter supplier and/or with the requirements set by the operators of the electricity system or national requirements. In cases where electricity meters are not regulated (e.g., electricity is supplied by fossil-fuel fired captive power plants – scenario B), the electricity meter shall be subject to regular maintenance and testing in	

	accordance with the stipulation of the meter supplier or national requirements. The electricity generation (gross or net) shall be cross-checked with records of electricity sale (e.g., sales receipts)
Treatment of uncertainties	Uncertainties are determined based on the measuring instruments
Additional comment	If the electricity is exported to the electricity system using a one-way electricity meter, $EG_{s,y}$ and $EG_{s,h}$ are calculated as the difference between (a) the quantity of electricity supplied by the project plant/unit to the electricity system and (b) the quantity of electricity consumed by the project plant/unit from the electricity system

Data / Parameter table 2.

Data/parameter	$\boldsymbol{EC_{s,y}}$; $\boldsymbol{EC_{s,h}}$	
Description	$\boldsymbol{EC_{s,y}}$**:** Electricity consumed by the electricity consumption source *s* in year *y* $\boldsymbol{EC_{s,h}}$**:** Electricity consumed by the electricity consumption source *s* in hour *h*	
Data unit	$\boldsymbol{EC_{s,y}}$**:** MWh in year *y* $\boldsymbol{EC_{s,h}}$**:** MWh in hour *h*	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	$\boldsymbol{EC_{s,y}}$**:** Continuous measurement and at least monthly recording $\boldsymbol{EC_{s,h}}$**:** Continuous measurement and at least hourly recording	
Measurement methods and procedures	Direct measurement or calculation based on measurements from more than one electricity meter	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	Electricity-meter(s)
	Accuracy class	If electricity meters are regulated: in accordance with the specifications of the meter supplier and/or with the requirements set by the operators of the electricity system or national requirements. If electricity meters are not regulated: at least accuracy class 0.5, or in accordance with the specifications of the meter supplier or national requirements
	Calibration requirements	If electricity meters are regulated: in accordance with national standards or requirements set by the meter supplier or by the operators of the electricity system, including the frequency of calibration. If electricity meters are not regulated: every three years or in accordance with national standards or requirements set by the meter supplier, including the frequency of calibration
	Location	Scenario A and C: electricity system interface, where applicable, Scenario B and C: entrance to the electricity consuming facility, where applicable

QA/QC procedures	In cases where electricity meters are regulated (e.g., the electricity is supplied by the electricity system – scenario A), the electricity meter shall be subject to regular maintenance and testing in accordance with the stipulation of the meter supplier and/or with the requirements set by the operators of the electricity system or national requirements. In cases where electricity meters are not regulated (e.g., the electricity is supplied by fossil-fuel fired captive power plants – scenario B), the electricity meter shall be subject to regular maintenance and testing in accordance with the specifications of the meter supplier or national requirements. The electricity consumption shall be cross-checked with records of electricity purchased (e.g., purchase receipts)
Treatment of uncertainties	Uncertainties are determined based on the measuring instruments
Additional comment	-

Data / Parameter table 3.

Data/parameter	$FC_{i,p,t}$; $FC_{i,p,h}$	
Description	$FC_{i,p,t}$: Amount of fuel type *i* consumed by power unit *p* in period *t* $FC_{i,p,h}$: Amount of fuel type *i* consumed by power unit *p* in hour *h*	
Data unit	$FC_{i,p,t}$: Mass or volume unit at reference conditions[34] in period *t* $FC_{i,p,h}$: Mass or volume unit at reference conditions[34] in hour *h*	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	$FC_{i,p,t}$: Continuous measurement and at least monthly recording $FC_{i,p,h}$: Continuous measurement and at least hourly recording	
Measurement methods and procedures	Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: the ruler gauge must be part of the daily tank, be calibrated at least once a year, and have a control logbook for recording the measurements (on a daily basis or per shift). Accessories such as transducers, sonar, and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and subject to reasonable maintenance. In the case of using daily tanks with pre-heaters for heavy oil, calibration shall be performed with the system at typical operational conditions	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	Mass or volume meters, ruler gauge (that is part of daily tanks), transducers, sonar and piezoelectronic devices
	Accuracy class	N/A
	Calibration requirements	Ruler gauge: at least once a year.

[34] Conditions defined as 0ºC (273.15 K, 32ºF) and 1 atm (101.325 kN/m2, 101.325 kPa, 14.69 psia, 29.92 in Hg, 760 torr).

		Transducers, sonar and piezoelectronic devices: calibrated with the ruler gauge and subject to reasonable maintenance
	Location	N/A
QA/QC procedures	The consistency of metered fuel consumption quantities should be cross-checked annually using an energy balance on purchased quantities and stock changes. Where purchased fuel invoices can be identified specifically for the Article 6.4 activity, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from financial records	
Treatment of uncertainties	Uncertainties are determined based on the measuring instruments	
Additional comment	Article 6.4 activities that face data gaps due to meter failure or other unforeseen reasons may estimate the quantity of fuel using one of the following options, provided that the gap period does not exceed 30 consecutive days within six consecutive months: The purchased fuel or energy invoices/bills, where the purchased fuel can be identified specifically for the Article 6.4 activity. For Article 6.4 activities under scenario A or scenario C, this parameter needs to be updated at the renewal of the crediting period if activity participants choose to determine the OM or BM ex ante	

Data / Parameter table 4.

Data/parameter	$NCV_{i,t}$	
Description	Net calorific value of the fuel type *i* in period *t*	
Data unit	GJ/mass unit or GJ/volume unit	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	Option 1: At each fuel delivery; Option 2: At each fuel delivery; Option 3: Annually; Option 4: Update based on future revisions of the IPCC Guidelines	
Measurement methods and procedures	Option 1: Values provided by the fuel supplier (preferred source), in line with national or international fuel standards; Option 2: Measurements by activity participants undertaken in line with national or international fuel standards (if supplier-provided values provided are not available); Option 3: Regional or national default values (if supplier-provided values are not available and only for liquid fuels). Values shall be reviewed annually; Option 4: Upper bound for case 1 and lower bound for case 2, at a 95 per cent confidence interval, from IPCC default values provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2019 Refinement to the 2006 IPCC Guidelines on National GHG Inventories (if supplier-provided values are not available). Update based on future revisions of the IPCC Guidelines	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	N/A

	Accuracy class	N/A
	Calibration requirements	N/A
	Location	N/A
QA/QC procedures	The laboratories in option 1 or option 2 shall have ISO17025 accreditation or shall justify compliance with equivalent quality standards	
Treatment of uncertainties	Verify whether the values under options 1, 2 and 3 fall within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2019 Refinement to the 2006 IPCC Guidelines. If the values fall outside of this range, collect additional information from the testing laboratory to justify the outcome or conduct additional measurements.	
Additional comment	For Article 6.4 activities under scenario A or scenario C, this parameter shall be updated in accordance with the provisions in section 05.7.1.2 at the renewal of the crediting period if activity participants choose to determine the OM emission factor ex ante	

Data / Parameter table 5.

Data/parameter	$EF_{CO2,i,t}$	
Description	CO_2 emission factor of fuel type *i* in period *t*	
Data unit	t CO_2/GJ	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	Option 1: At each fuel delivery; Option 2: At each fuel delivery; Option 3: Annually; Option 4: Updated based on future revisions of the IPCC Guidelines	
Measurement methods and procedures	Option 1: Values provided by the fuel supplier (preferred source), in line with national or international fuel standards; Option 2: Measurements by activity participants undertaken in line with national or international fuel standards (if supplier-provided values are not available); Option 3: Regional or national default values (if supplier-provided values are not available and only for liquid fuels). Values shall be reviewed annually; Option 4: Upper bound for case 1 and lower bound for case 2, at a 95 per cent confidence interval, from IPCC default values provided in the 2019 Refinement to the 2006 IPCC Guidelines on National GHG Inventories (if supplier-provided values are not available). Update based on future revisions of the IPCC Guidelines	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	N/A
	Accuracy class	N/A
	Calibration requirements	N/A
	Location	N/A

QA/QC procedures	Laboratories in Options 1 and 2 shall have ISO17025 accreditation, or justify compliance with equivalent quality standards
Treatment of uncertainties	Verify whether the values under options 1, 2, and 3 fall within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2019 Refinement to the 2006 IPCC Guidelines. If the values fall outside of this range, collect additional information from the testing laboratory to justify the outcome or conduct additional measurements
Additional comment	For option 1, if the fuel supplier provides both the NCV and CO_2 emission factor on the invoice and these values are based on measurements for the specific fuel delivered, the provided CO_2 emission factor shall be used. If another source is used for the CO_2 emission factor, or no CO_2 emission factor is provided, Options 2, 3, or 4 shall be used. For Article 6.4 activities under scenario A or scenario C, this parameter shall be updated in accordance with the provisions in section 05.7.1.2 at the renewal of the crediting period if activity participants choose to determine the OM emission factor ex ante

Data / Parameter table 6.

Data/parameter	$\boldsymbol{EG_{p,t}}$; $\boldsymbol{EG_{p,h}}$	
Description	$\boldsymbol{EG_{p,t}}$**:** Net quantity of electricity generated and delivered to the electricity system by power plant *p* in period *t* or, where applicable, the quantity of electricity generated by fossil-fuel fired captive power plant *p* in period *t.* $\boldsymbol{EG_{p,h}}$**:** Net quantity of electricity generated and delivered to the electricity system by power plant *p* in hour *h* or, where applicable, the quantity of electricity generated in fossil-fuel fired captive power plant *p* in hour *h*	
Data unit	$\boldsymbol{EG_{p,t}}$**:** MWh in period *t* $\boldsymbol{EG_{p,h}}$**:** MWh in hour *h*	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	$\boldsymbol{EG_{p,t}}$**:** Continuous measurement and at least monthly recording $\boldsymbol{EG_{p,h}}$**:** Continuous measurement and at least hourly recording	
Measurement methods and procedures	Direct measurement or calculation based on measurements from more than one electricity meter	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	Electricity-meter(s)
	Accuracy class	At least accuracy class 0.5, or in accordance with the specifications of the meter supplier or national requirements
	Calibration requirements	Every three years or in accordance with national standards or requirements set by the meter supplier, including the required calibration frequency
	Location	Entrance of the captive consumer, where applicable
QA/QC procedures	The electricity meter shall be subject to regular maintenance and testing in accordance with the stipulation of the meter supplier or national requirements.	

	The electricity generation (gross or net) shall be cross-checked with records of electricity sale (e.g., sales receipts)
Treatment of uncertainty	Uncertainties are determined based on the measuring instruments
Additional comment	For Article 6.4 activities under scenario A or scenario C, this parameter shall be updated in accordance with the provisions in section 05.7.1.2 at the renewal of the crediting period if activity participants choose to determine the OM emission factor ex ante

Data / Parameter table 7.

Data/parameter	$HG_{p,t}$	
Description	Quantity of heat co-generated by fossil-fuel fired captive power plant *p* in the period *t*	
Data unit	GJ in period *t*	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	Continuous measurement, aggregated at least annually	
Measurement methods and procedures	Determined as the difference between the enthalpy of the steam or hot water generated and the enthalpy of the feedwater and any condensate return. The respective enthalpies shall be determined based on the mass (or volume) flows, the temperatures, and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	N/A
	Accuracy class	N/A
	Calibration requirements	N/A
	Location	N/A
QA/QC procedures	Cross-check measurement results with records for sold heat and other relevant energy measurements, where applicable	
Treatment of uncertainty	Uncertainties are determined based on the measuring instruments	
Additional comment	-	

Data / Parameter table 8.

Data/parameter	η_{boiler}
Description	Efficiency of the boiler in which heat is assumed to be generated in the absence of a fossil-fuel fired captive cogeneration plant
Data unit	%
Equations referred	
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions

Measurement and updating frequency	If option 1 below is chosen: once at the start of the Article 6.4 activity. If option 2 below is chosen: not applicable	
Measurement methods and procedures	Option 1: Measurement of the efficiency where a heat-only boiler is installed and operated at the site of the fossil-fuel fired captive power plant(s), using relevant national or international standards; or Option 2: Assume a default value of 100 per cent for case 1 and 60 per cent for case 2	
Entity/person responsible for the measurement	If option 1 is chosen: activity participants. If option 2 is chosen: not applicable	
Measuring instrument(s)	*Type of instrument*	N/A
	Accuracy class	N/A
	Calibration requirements	N/A
	Location	N/A
QA/QC procedures	-	
Treatment of uncertainty	If option 1 is chosen: Uncertainties shall be determined based on the measuring instruments. If option 2 is chosen: Not applicable	
Additional comment	-	

Data / Parameter table 9.

Data/parameter	$\eta_{p,t}$	
Description	Average net energy conversion efficiency of power unit *p* in the project electricity system in period *t*	
Data unit	%	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	Once for the crediting period	
Measurement methods and procedures	Option 1: Documented manufacturer's specifications provided that the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or Option 2: For power plants connected to the electricity system: data from the utility, the dispatch centre, or official records, provided that such data can be deemed reliable; or Option 3: Use the following default values:	
Entity/person responsible for the measurement	Activity participants	
Measuring instrument(s)	*Type of instrument*	N/A

Fuel type	Case 1	Case 2
Coal	30%	45%
Oil	30%	50%
Natural gas	30%	65%

	Accuracy class	N/A
	Calibration requirements	N/A
	Location	N/A
QA/QC procedures	N/A	
Treatment of uncertainties	N/A	
Additional comment	-	

Data / Parameter table 10.

Data/parameter	$F_{TDL,s,y}$	
Description	Factor to account for transmission and distribution losses applicable to the electricity generation or consumption source *s* in year *y*	
Data unit	%	
Equations referred		
Purpose of data	☒ Baseline emissions ☒ Project emissions ☒ Leakage emissions	
Measurement and updating frequency	If option 1 below is chosen: once at the start of the Article 6.4 activity or updated annually. If option 2 below is chosen: not applicable	
Measurement methods and procedures	Option 1: Data sourced from electricity wholesale or retail companies, including data on transmission and distribution losses for different voltage levels; Option 2: Default values provided in the methodological tool	
Entity/person responsible for the measurement	If option 1 is chosen: Electricity wholesale or retail companies. If option 2 is chosen: N/A	
Measuring instrument(s)	*Type of instrument*	N/A
	Accuracy class	N/A
	Calibration requirements	N/A
	Location	N/A
QA/QC procedures	-	
Treatment of uncertainty	If option 1 is chosen: Uncertainty values, where available, as provided by the electricity wholesale or retail companies; If option 2 is chosen: not applicable	
Additional comment	If option 1 is chosen: for case 1, the data used may include or exclude losses from electricity pilferage; for case 2, the data shall only be used if it includes only physical losses and excludes any losses from electricity pilferage	

Appendix 1. Flowcharts illustrating the application of the methodological steps to scenarios A, B and C

Figure 1. Flowchart to calculate the emissions from electricity consumption and/or generation for energy sources falling under Scenario A

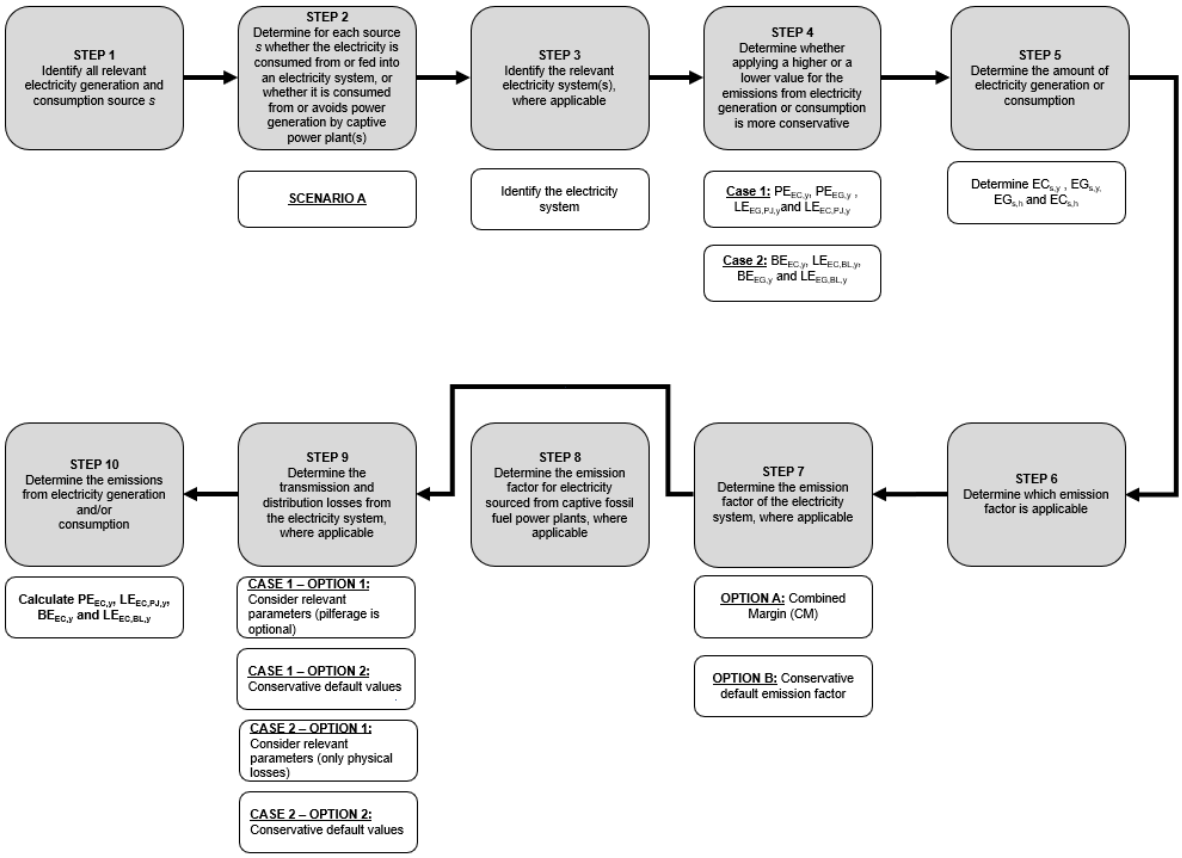


Figure 2. Flowchart to calculate the emissions from electricity consumption and/or generation for energy sources falling under Scenario B

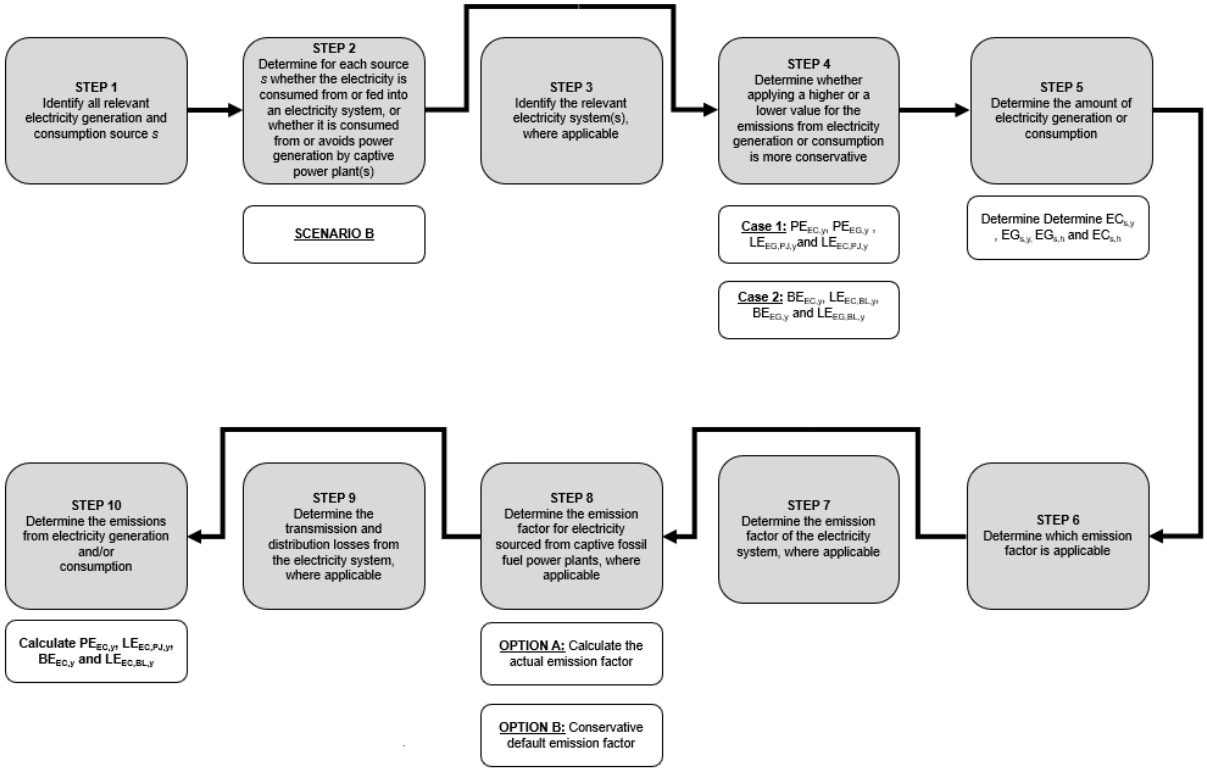
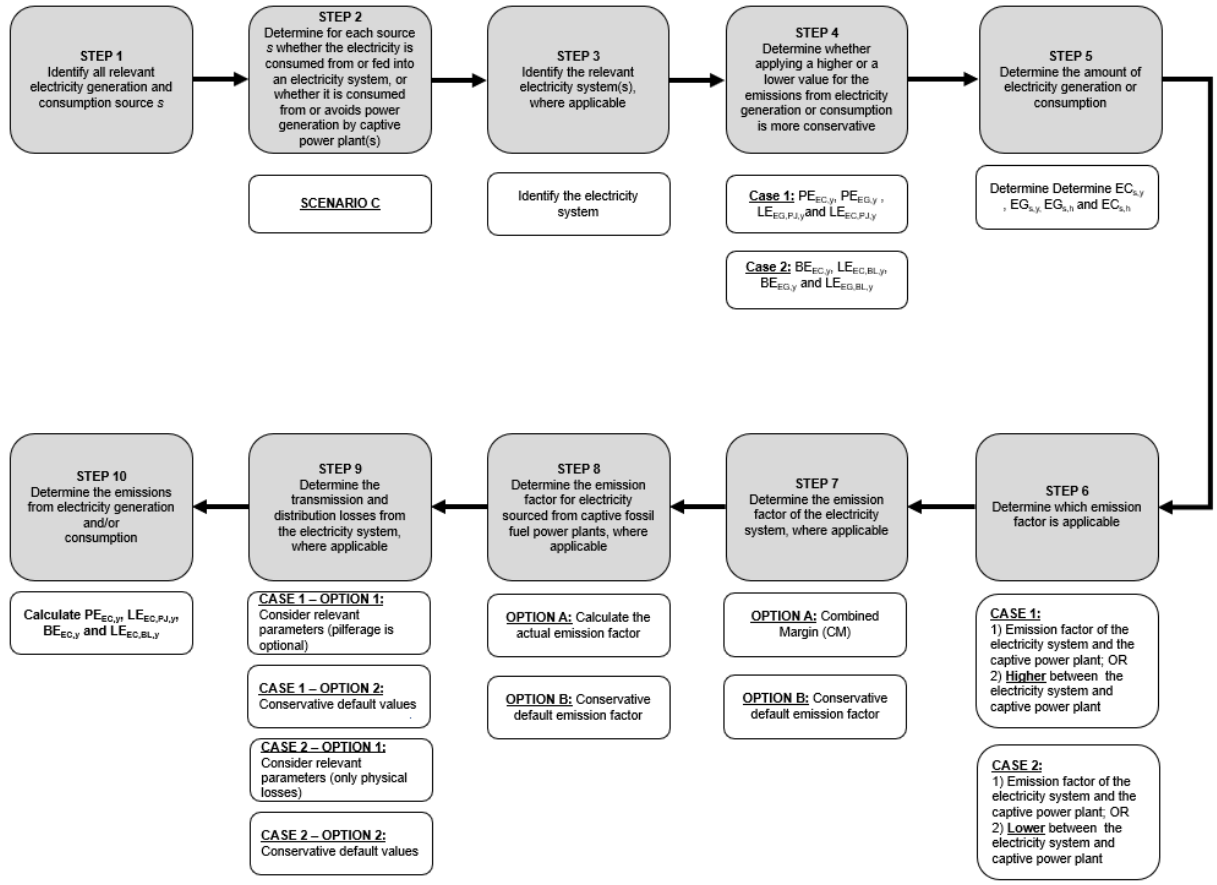


Figure 3. Flowchart to calculate the emissions from electricity consumption and/or generation for energy sources falling under Scenario C



Appendix 2. Values for the parameters $F_{OM,simple}$, $F_{OM,av}$ and F_{BM}

1. Table 1 sets out values to be used for the parameters $F_{OM,simple}$, $F_{OM,av}$ and F_{BM}. In accordance with paragraphs 83 and 97 of the main part of the methodological tool, activity participants shall use either the global value indicated in the first line or the relevant country-specific value.[1]

2. The values in Table 1 were computed based on a regression analysis of how the carbon dioxide intensity of electricity generation changed over the most recent ten-year period for which data is available (2015 to 2024). All countries for which data was available were considered in the analysis. An uncertainty analysis was conducted, and the lower confidence value was used here to account for uncertainty. The uncertainty was estimated using the standard error of the slope derived from the linear regression analysis. A 95 per cent confidence interval was calculated for the regression coefficient, and the lower bound of this interval was applied to ensure a conservative estimate. Data provided by Ember was used for this purpose.[2] For some countries, sufficient data is not available. In these instances, the global value shall be used.

Table 1. Global and country-level values for $F_{OM,simple}$, $F_{OM,av}$ and F_{BM}

Country	$F_{OM,simple}$	$F_{OM,avg}$	F_{BM}
Global	**0.23%**	**1.46%**	**9.21%**
Afghanistan	1.28%	2.72%	0.00%
Albania	Use global value	0.12%	6.30%
Algeria	0.01%	0.14%	21.49%
Angola	1.05%	14.29%	105.17%
Antigua and Barbuda	0.30%	1.05%	Use global value
Argentina	0.42%	3.22%	14.06%
Armenia	0.00%	0.29%	13.82%
Australia	0.17%	4.00%	58.87%
Austria	3.15%	6.48%	16.92%
Azerbaijan	0.00%	0.81%	27.13%
Bahamas	0.06%	0.19%	0.36%
Bahrain	0.01%	0.05%	Use global value
Bangladesh	0.02%	0.00%	0.00%
Barbados	0.03%	1.11%	Use global value
Belarus	0.07%	6.50%	34.80%
Belgium	1.48%	8.16%	12.69%
Belize	2.95%	0.00%	Use global value
Benin	1.86%	2.28%	Use global value

[1] In the case of electricity systems involving more than one country, an average value, weighted by electricity generation, from the relevant countries shall be used instead of a country-specific value.

[2] See https://ember-energy.org/data/.

Country	$F_{OM,simple}$	$F_{OM,avg}$	F_{BM}
Bhutan	Use global value	0.00%	Use global value
Bolivia (Plurinational State of)	0.05%	3.53%	20.21%
Bosnia and Herzegovina	0.09%	2.53%	84.84%
Botswana	0.24%	0.31%	Use global value
Brazil	0.36%	8.63%	16.07%
Brunei Darussalam	0.19%	0.19%	11.06%
Bulgaria	1.05%	8.09%	34.14%
Burkina Faso	0.13%	1.45%	0.17%
Burundi	2.23%	0.00%	Use global value
Cabo Verde	0.25%	2.73%	0.26%
Cambodia	0.50%	5.62%	29.73%
Cameroon	0.17%	2.93%	Use global value
Canada	1.06%	2.26%	0.70%
Central African Republic	Use global value	Use global value	Use global value
Chad	0.53%	0.65%	Use global value
Chile	1.20%	8.47%	48.48%
China	0.35%	2.14%	10.04%
Colombia	0.00%	4.47%	22.42%
Comoros	1.59%	1.59%	Use global value
Congo	0.11%	0.00%	0.00%
Cook Islands	7.16%	16.54%	Use global value
Costa Rica	5.12%	12.08%	46.20%
Cote d'Ivoire	0.20%	3.53%	125.80%
Croatia	5.52%	5.82%	23.87%
Cuba	0.07%	0.20%	27.25%
Cyprus	0.01%	2.50%	112.18%
Czechia	0.76%	4.19%	55.01%
Democratic People's Republic of Korea	0.00%	6.67%	18.73%
Democratic Republic of the Congo	0.00%	1.83%	2.30%
Denmark	1.37%	12.34%	21.76%
Djibouti	0.00%	7.75%	Use global value
Dominica	0.72%	1.37%	Use global value
Dominican Republic	0.00%	1.11%	24.18%
Ecuador	0.26%	14.66%	0.70%
Egypt	0.07%	0.81%	26.51%
El Salvador	0.13%	15.70%	39.14%
Equatorial Guinea	0.19%	0.00%	26.31%
Eritrea	0.24%	3.00%	6.15%
Estonia	0.03%	7.39%	46.17%
Eswatini	0.00%	8.60%	Use global value
Ethiopia	Use global value	0.65%	40.02%
Fiji	0.38%	5.69%	85.04%
Finland	1.55%	13.35%	31.36%

Country	$F_{OM,simple}$	$F_{OM,avg}$	F_{BM}
France	3.51%	7.06%	32.86%
Gabon	0.79%	3.86%	Use global value
Gambia	0.09%	0.09%	Use global value
Georgia	0.10%	1.56%	80.63%
Germany	2.03%	5.21%	42.54%
Ghana	0.09%	0.00%	31.35%
Greece	4.38%	8.58%	58.90%
Grenada	0.84%	0.84%	Use global value
Guatemala	1.24%	9.54%	65.14%
Guinea	0.34%	7.90%	86.34%
Guinea-Bissau	1.74%	1.74%	Use global value
Guyana	0.11%	0.47%	0.61%
Haiti	0.25%	2.57%	Use global value
Honduras	0.13%	5.64%	30.31%
Hungary	3.68%	6.68%	42.18%
Iceland	Use global value	0.03%	7.38%
India	0.06%	1.05%	15.70%
Indonesia	0.00%	0.36%	3.30%
Iran (Islamic Republic of)	0.00%	0.25%	0.84%
Iraq	0.00%	0.00%	1.00%
Ireland	2.98%	6.51%	74.88%
Israel	1.66%	2.62%	23.42%
Italy	2.20%	4.42%	9.43%
Jamaica	0.72%	1.74%	2.72%
Japan	0.00%	2.11%	5.26%
Jordan	0.13%	4.14%	67.48%
Kazakhstan	0.00%	0.67%	35.34%
Kenya	0.14%	8.23%	26.88%
Kiribati	0.00%	7.52%	Use global value
Kuwait	0.00%	0.39%	16.13%
Kyrgyzstan	0.38%	3.41%	97.24%
Lao People's Democratic Republic	0.00%	11.34%	80.51%
Latvia	0.10%	8.37%	19.57%
Lebanon	0.01%	10.24%	40.01%
Lesotho	Use global value	1.00%	Use global value
Liberia	0.50%	9.48%	Use global value
Libya	0.01%	0.01%	9.60%
Lithuania	1.05%	10.93%	29.05%
Luxembourg	0.00%	11.26%	19.15%
Madagascar	0.00%	0.00%	92.07%
Malawi	5.23%	12.12%	87.52%
Malaysia	0.12%	1.49%	24.70%
Maldives	0.07%	0.90%	Use global value

Country	$F_{OM,simple}$	$F_{OM,avg}$	F_{BM}
Mali	0.14%	0.02%	17.98%
Malta	2.84%	3.35%	99.19%
Mauritania	0.05%	1.08%	Use global value
Mauritius	0.72%	0.68%	53.51%
Mexico	0.63%	2.50%	7.10%
Mongolia	0.23%	1.29%	23.97%
Montenegro	0.04%	4.43%	9.80%
Morocco	0.00%	1.64%	96.23%
Mozambique	0.02%	6.19%	Use global value
Myanmar	0.32%	0.00%	25.33%
Namibia	0.39%	5.14%	39.95%
Nauru	0.00%	0.00%	Use global value
Nepal	Use global value	0.92%	0.90%
Netherlands	4.35%	9.32%	63.17%
New Zealand	0.00%	4.01%	38.69%
Nicaragua	0.05%	5.69%	73.62%
Niger	0.83%	0.90%	3.69%
Nigeria	0.00%	0.73%	18.24%
North Macedonia	2.68%	2.84%	22.71%
Norway	0.08%	2.60%	11.33%
Oman	0.01%	0.70%	32.52%
Pakistan	0.00%	3.20%	17.61%
Panama	1.43%	9.09%	46.37%
Papua New Guinea	0.07%	0.00%	36.74%
Paraguay	Use global value	0.00%	Use global value
Peru	0.27%	3.46%	30.07%
Philippines	0.00%	0.00%	18.29%
Poland	1.30%	4.07%	28.92%
Portugal	7.16%	15.28%	26.05%
Qatar	0.00%	0.00%	Use global value
Republic of Korea	0.94%	3.33%	14.37%
Republic of Moldova	0.08%	1.28%	Use global value
Romania	1.87%	5.91%	31.24%
Russian Federation	0.00%	0.56%	20.51%
Rwanda	0.02%	5.95%	63.78%
Saint Kitts and Nevis	0.72%	0.61%	Use global value
Saint Lucia	0.32%	0.95%	Use global value
Saint Vincent and the Grenadines	0.65%	0.66%	Use global value
Samoa	0.93%	4.96%	Use global value
Sao Tome and Principe	2.97%	4.90%	Use global value
Saudi Arabia	0.00%	0.22%	22.27%
Senegal	0.34%	2.90%	32.69%
Serbia	0.72%	2.10%	17.47%

Country	$F_{OM,simple}$	$F_{OM,avg}$	F_{BM}
Seychelles	0.35%	2.89%	4.06%
Sierra Leone	0.00%	34.46%	67.95%
Singapore	0.00%	0.26%	25.27%
Slovakia	4.57%	8.98%	29.61%
Slovenia	0.86%	5.44%	94.95%
Solomon Islands	0.36%	2.29%	Use global value
Somalia	0.35%	3.49%	Use global value
South Africa	0.24%	1.39%	22.34%
South Sudan	0.25%	1.53%	0.70%
Spain	4.82%	10.41%	30.52%
Sri Lanka	0.20%	5.58%	87.27%
State of Palestine	0.57%	5.35%	61.16%
Sudan	0.02%	7.03%	85.85%
Suriname	0.19%	7.74%	0.45%
Sweden	0.58%	2.72%	25.61%
Switzerland	0.00%	4.77%	5.49%
Syrian Arab Republic	1.00%	1.43%	Use global value
Tajikistan	1.44%	0.00%	175.03%
Thailand	0.38%	1.15%	1.23%
Timor-Leste	0.00%	0.00%	Use global value
Togo	2.36%	2.60%	Use global value
Tonga	0.59%	2.51%	Use global value
Trinidad and Tobago	0.00%	0.00%	Use global value
Tunisia	0.09%	0.20%	30.37%
Türkiye	0.00%	1.94%	26.96%
Turkmenistan	0.00%	0.01%	0.01%
Uganda	2.22%	2.41%	70.87%
Ukraine	0.79%	8.54%	25.49%
United Arab Emirates	0.02%	5.74%	40.71%
United Kingdom	5.21%	8.51%	12.36%
United Republic of Tanzania	2.21%	2.94%	14.61%
United States of America	1.85%	3.35%	19.39%
Uruguay	0.50%	1.25%	13.22%
Uzbekistan	0.40%	0.13%	23.34%
Vanuatu	0.77%	5.29%	Use global value
Venezuela (Bolivarian Republic of)	0.00%	13.86%	32.17%
Viet Nam	0.00%	1.61%	12.02%
Yemen	1.10%	4.26%	18.55%
Zambia	0.00%	4.93%	62.12%
Zimbabwe	0.05%	9.39%	0.00%

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Document information

Version	*Date*	*Description*
02.0	4 February 2026	MEP 011, Annex 2 To be considered by the A6.4 Supervisory Body at SBM 020.
01.0	10 December 2025	MEP 010, Annex 1. A call for input on this document will be issued following the conclusion of MEP 010 meeting. The input received will be considered by the MEP for the further development of this document at a future meeting.

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