ARTICLE 6.4 MECHANISM

A6.4-MEP011-A03

Draft Methodological tool

Determination of the technical lifetime of equipment

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 clean development mechanism (CDM) methodologies / methodological tools / Standard / Guidelines, including the "Methodological tool: Determination of the technical lifetime of equipment".

2. Purpose

2. This methodological tool provides requirements and options to determine the technical lifetime and the remaining technical lifetime of equipment. The tool can be used to estimate the remaining technical lifetime of equipment used in the baseline to calculate baseline emissions. It can also be used with the "Methodological tool: Analysis of lock-in risk" to estimate the technical lifetime of equipment used in A6.4 activities to evaluate the activity's potential for lock-in risk.

3. Key issues and proposed solutions

3. The methodological tool provides options and requirements for the determination of the technical lifetime and/or remaining technical lifetime of the equipment, in order of priority:

   (a) Use of manufacturer's specified technical lifetime (section 5.2);

   (b) Use of an expert evaluation (for existing equipment only) (section 5.3); or

   (c) Use of default values (section 5.4).

4. The definition of equipment from the CDM tool has been streamlined to enhance readability in this methodological tool (see paragraph 5(a)). The MEP notes that these changes are intended to be editorial in nature and are not intended to indicate a change in the applicability of the tool relative to the previous draft shared for public comment.

5. The MEP has determined that, where uncertainty is involved, the technical lifetime of equipment or remaining technical lifetime of equipment may be best represented by a range of values, rather than a single parameter. When a range of values is used, there are implications for the application of the conservativeness principle depending on whether the tool is used to estimate baseline emissions or address lock-in risk. In the context of estimating baseline emissions, the conservative value is the shorter end of the range of values. In the context of addressing lock-in risk, the conservative value is the longer end of the range of values (see paragraph 19).

6. The MEP has developed a procedure to determine the technical lifetime and/or remaining technical lifetime of equipment that contains an assembly of several components (e.g., a coal power plant), rather than a single component (e.g., a steam turbine). These provisions allow the tool to be used to calculate these parameters directly for an assembly of several components for option (b) (section 5.3) and option (c) (section 5.4), and

indirectly through a conservative analysis of relevant single components for all options (see paragraph 20).

3.1. Consideration of public comments

7. A call for public inputs was launched after MEP 010, from 10 to 31 December 2025. The MEP received two submissions in response to the call. The MEP would like to thank the authors of the inputs. The inputs received could be classified under the following sub-headings:

   (a) Applicability of the tool for programme of activities: These inputs were considered by the MEP and the paragraph on the applicability of the tool for other scales was considered to be standard text and hence retained (see section 3);

   (b) Application of the default values and consideration of uncertainty: These inputs were considered by the MEP and the tool was revised to include a table indicating a range of values that can be used in such a way to ensure conservativeness, without the need for adjustments based on uncertainty (see table 2). The MEP notes that these conservative default values are based on literature cited as normative references (see paragraph 13);

   (c) Applicability of the tool for an assembly of components (e.g., power plants): These inputs were considered by the MEP and the tool was revised to explicitly apply to an assembly of components (e.g., a power plant), rather than just at the level of a single component (e.g., a steam turbine) (see paragraph 20);

   (d) General requirements for the calculation of the remaining technical lifetime: The MEP clarified the requirement that the equipment has been operated and maintained according to the recommendations and operation manuals of the equipment supplier to ensure that the technical lifetime specified applies only to option (a) (section 5.2) and option (c) (section 5.4) (see paragraph 23); and

   (e) Clarity on the requirements for the expert conducting the technical evaluation (option (b) in section 5.3): These inputs were considered by the MEP and the provisions for the technical expert were deemed to be sufficiently clear and flexible (see paragraph 30).

4. Impacts

8. This methodological tool provides clear procedures and default values to establish the technical lifetime and remaining technical lifetime of equipment used in the baseline scenario, as well as to establish the technical lifetime for the purpose of analysing lock-in risk.

5. Subsequent work and timelines

9. The methodological tool may be amended in the future to expand its applicability to cover activities implemented at other scales (e.g., programmes of activities, policies, sectoral approaches, etc.)

6. Recommendations to the Supervisory Body

10. The MEP recommends the Supervisory Body to adopt this methodological tool.

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1. Introduction

1.1. Scope

1. This methodological tool provides requirements and options to determine the technical lifetime and the remaining technical lifetime of equipment used in the baseline scenario and/or in the Article 6.4 activity scenario (see table 1).

Table 1 Parameters determined

Parameter	SI Unit	Description
TL	years or hours	Technical lifetime of equipment
RTL	years or hours	Remaining technical lifetime of equipment

1.2. Entry into force and validity

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

3. The methodological tool remains valid for five years, until DD/MM/2031, 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).[1]

2. Definitions

2.1. General Terms

4. The following general terms are applied to this 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;

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

2.2. Methodological terms and definitions

5. The following methodological tool terms and definitions are applied to this methodological tool:

   (a) **Equipment:** Machinery and tools related to industrial, commercial, residential, agricultural facilities, e.g., power plant equipment such as boilers, turbines (steam, gas, wind, hydro), electric generators, pumps, motors, engines, and heat transfer equipment such as ovens, heaters, chillers, etc. In the context of this tool, the term equipment may refer to a single component (e.g., a steam turbine), or an assembly of several components (e.g., a power plant);

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

(b) **Operational time:** The total time that the equipment has been operating since its first commissioning. The operational time is expressed in years or cumulative hours of operation;

(c) **Remaining technical lifetime:** The estimated time during which the existing equipment can continue to operate before it must be replaced or discarded for technical reasons, failure to meet norms and regulations, safety reasons, or deteriorated performance. The remaining technical lifetime is expressed in years or hours of operation;

(d) **Technical lifetime:** The total period during which an equipment can be expected to remain functional and deliver its intended service if maintained according to the manufacturer's specifications or standard industrial practices, as measured from the date of commissioning.

6. 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

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

8. The methodological tool is applicable to Article 6.4 activities implemented at the project level. The methodological tool may be amended in the future to expand its applicability to cover activities implemented at other scales (e.g., programmes of activities, policies, sectoral approaches, etc.).

9. This methodological tool is only applicable where mechanism methodologies include a reference to this methodological tool and specifies, or provides guidance for how activity participants applying this tool shall address the following elements:

(a) Determining whether the tool is used to determine the technical lifetime and/or the remaining lifetime; and

(b) Determining for what equipment the tool is to be applied, including whether the tool is to be applied to a single component (e.g., a steam turbine) and/or an assembly of several components (e.g., a power plant).

10. This methodological tool may be used, inter alia, for the following purposes:

(a) Estimation of the remaining technical lifetime of baseline equipment of Article 6.4 activities which replace existing equipment, and the baseline scenario is identified to be the continued usage of the existing equipment;

(b) Estimation of the technical lifetime of baseline equipment of Article 6.4 activities which install new equipment, and the baseline is also identified to be the installation of new equipment;

(c) Estimation of the remaining technical lifetime of existing equipment which is retrofitted under an Article 6.4 activity; and

(d) Estimation of the technical lifetime for the analysis of lock-in risk.

11. Mechanism methodologies may provide further specifications and requirements for how this methodological tool shall be applied by activity participants in the context of the type of mitigation activities covered by the methodology.

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

4. Normative and informative references

13. The following documents provide supporting information that may assist in the application of this methodological tool:

    (a) IPCC (2006): 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 1: General guidance and reporting. Chapter 3: Uncertainties;[2]

    (b) IPCC (2019): 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories;[3]

    (c) IEA (International Energy Agency) (2020): Projected Costs of Generating Electricity;[4]

    (d) IEA (2025): World Energy Outlook;[5]

    (e) IEA – ETSAP (2010): Industrial Combustion Boilers;[6]

    (f) NREL (National Renewable Energy Laboratory) (2024): Annual Technology Baseline (ATB);[7]

    (g) EIA (U.S. Energy Information Administration) (2024): Capital Cost and Performance Characteristics of Power Generation Technologies;[8]

    (h) IPCC AR6 WGIII (2023): Chapter 6: Energy systems and infrastructure lifetimes;[9]

    (i) Lazard (2025): Levelized Cost of Energy Analysis (technology assumptions); and

    (j) NRC (U.S. Nuclear Regulatory Commission) (2023): Nuclear plant license extension documentation.

[2] See https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_3_Ch3_Uncertainties.pdf.

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

[4] See https://www.iea.org/reports/projected-costs-of-generating-electricity-2020.

[5] See https://www.iea.org/reports/world-energy-outlook-2025.

[6] See https://iea-etsap.org/PDF/I01-ind_boilers-GS-AD-gct.pdf.

[7] See https://atb.nrel.gov/electricity/2024/technologies.

[8] See https://www.eia.gov/analysis/studies/powerplants/capitalcost/pdf/capital_cost_AEO2025.pdf.

[9] See https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Chapter06.pdf.

5. Methodological approaches

14. Activity participants using this tool shall determine the technical lifetime and/or remaining technical lifetime of relevant equipment using one of the following options, in order of preference:

    (a) Use of manufacturer's specified technical lifetime (option (a) in section 5.2);

    (b) Use of an expert evaluation conducted by a certified or suitably qualified expert (option (b) in section 5.3), noting that this option is only available for addressing existing equipment and not new equipment; or

    (c) Use of default values provided in table 2 (option (c) in section 5.4).

15. Option (b) shall only be used if activity participants demonstrate that it is infeasible to implement option (a). Option (c) shall only be used if activity participants demonstrate that it is infeasible to implement options (a) and option (b).

16. Activity participants using this tool shall also apply the general requirements (section 5.1), including section 5.1.1 and, as applicable, either section 5.1.2 or section 5.1.3.

5.1. General requirements

5.1.1. General requirements for all uses of this tool

17. Activity participants shall specify in the Article 6.4 project design document (A6.4-PDD) all relevant pieces of equipment, consistent with the mechanism methodology referring to this tool, and justify how the technical lifetime and/or remaining technical lifetime was conservatively determined for each relevant piece of equipment, including references to all documentation relied upon.

18. Small equipment accessories and components that are normally replaced as part of regular maintenance activities (e.g., small pumps, motors, valves) do not need to be included in the scope of determination of the remaining technical lifetime.

19. If the application of this tool results in a range of values for the technical lifetime or for the remaining technical lifetime of equipment, rather than a single value, activity participants shall apply the conservativeness principle by selecting:

    (a) The lower end of the range, when estimating baseline emissions (e.g., pursuant to paragraphs 10(a) through 10(c)) or in other relevant scenarios where a shorter lifetime leads to a conservative outcome;[10] and

    (b) The higher end of the range, when addressing lock-in risks (e.g., pursuant to paragraph 10(d)) or in other relevant scenarios where a longer lifetime leads to a conservative outcome.[11]

[10] For example, when using default parameters under option (c), activity participants shall select the minimum lifetime in table 2.

[11] For example, when using default parameters under option (c), activity participants shall select the maximum lifetime in table 2.

20. For Article 6.4 activities that involve equipment with an assembly of components, activity participants shall determine the remaining technical lifetime of the assembly of components:

    (a) Only for the purposes of option (b) (section 5.3) or option (c) (section 5.4), by determining the remaining technical lifetime of the assembly of components as a whole; or

    (b) For any of the available options in this tool, by determining the most conservative remaining technical lifetime among all relevant individual components and applying that parameter to the assembly of components.

5.1.2. General requirements for determining the technical lifetime

21. In determining the remaining technical lifetime of equipment, activity participants shall demonstrate that:

    (a) There are no periodic replacement schedules or scheduled replacement practices specific to the facility that require early replacement of the equipment before the expiry of the technical lifetime; and

    (b) The equipment has no design fault or defect and has not experienced any industrial accident that would prevent it from operating at the rated performance levels.

5.1.3. General requirements for determining the remaining technical lifetime

22. The remaining technical lifetime shall be determined prior to the implementation of the Article 6.4 activity. The remaining technical lifetime is determined as the difference between the technical lifetime and the operational time since the date of first commissioning. In the case of new equipment, the remaining technical lifetime is equal to the technical lifetime.

23. In determining the remaining technical lifetime of existing equipment, activity participants shall demonstrate that:

    (a) There are no periodic replacement schedules or scheduled replacement practices specific to the facility that require early replacement of the equipment before the expiry of the technical lifetime;

    (b) The equipment has no design fault or defect and has not experienced any industrial accident that would prevent it from operating at the rated performance levels; and

    (c) Either of the following conditions is true:

        (i) The equipment has been operated and maintained according to the recommendations and operations manuals of the equipment supplier to ensure that the technical lifetime specified by the manufacturer is not reduced (options (a) and (c) in sections 5.2 and 5.4); or

        (ii) An expert evaluation pursuant to section 5.3 accounts for the inability to establish the requirements stated in (i) and incorporates the expected effects in the estimated remaining technical lifetime of the equipment (option (b) in section 5.3).

24. The operational time of the relevant equipment shall be determined based on the operational history of the equipment, as measured from the date of its first commissioning.

In the case of relocated equipment that was operated at one or more previous sites, the operational history at the previous site(s) shall be considered when establishing the operational time.

5.2. Option (a): Use of the manufacturer's specified technical lifetime

5.2.1. Requirements for determining the technical lifetime

25. The technical lifetime of a piece of equipment shall be determined based on the manufacturer's specifications and operation manuals.

26. Activity participants shall also identify the uncertainty associated with the technical lifetime for the purpose of assessing overall uncertainty, consistent with the mechanism methodology referring to this tool. The uncertainty specified by the manufacturer shall be used where available.

5.2.2. Requirements for determining the remaining technical lifetime

27. The remaining technical lifetime of a piece of equipment may be different if it has been retrofitted after its original installation (e.g., where the equipment was retrofitted prior to the implementation of the Article 6.4 activity or underwent energy efficiency improvement measures that increased its remaining technical lifetime). In such cases, the original technical lifetime provided by the equipment manufacturer may no longer be accurate and activity participants shall:

    (a) Apply a revised estimate of the technical lifetime from the equipment manufacturer, if the retrofit was undertaken by the equipment manufacturer; or

    (b) Apply the original technical lifetime provided by the equipment manufacturer at the time of equipment installation, but only in applications where assuming a shorter lifetime than is expected would be conservative.

28. If the requirements in paragraph 27 cannot be satisfied, activity proponents shall follow the requirements in section 5.3 or 5.4, as applicable.

5.3. Option (b): Use of an expert evaluation

5.3.1. Requirements for determining the technical lifetime

29. Activity participants shall not use this option to determine the technical lifetime of new equipment.

5.3.2. Requirements for determining the remaining technical lifetime

30. For existing equipment, activity participants shall determine the remaining technical lifetime based on a third-party assessment by a certified or suitably qualified expert. The third-party expert shall provide an opinion to determine the remaining technical lifetime of equipment based on the following considerations:

    (a) The operational history of the equipment to identify the past performance, such as maintenance records, any failures or accidents, any capacity upgrades or degradations, and any equipment retrofits or replacements;

    (b) Current operation and maintenance practices;

(c) Documented specific sectoral or industry practices for replacements; and

(d) Tests conducted on the equipment.

31. The expert shall document their methods and conclusions and provide a range for the applicable lifetime of each piece of equipment, based on the expert's judgment of the uncertainty, consistent with the guidance on expert judgement in the 2006 IPCC Guidelines for national GHG inventories and its 2019 Refinement.

5.4. Option (c): Use of conservative default values

32. Activity participants shall use the conservative default values for the technical lifetime provided in table 2.

Table 2. Conservative default values for the technical lifetime[12]

Equipment	Minimum Lifetime (years)	Maximum Lifetime (years)	Sources[13]
Biomass Power Plant	25	40	IEA
Boilers	25	40	IEA-ETSAP
Coal Power Plant	30	60	IEA, EIA
Geothermal Power Plant	30	50	IEA, NREL
Hydropower Plant	50	100	IEA, IPCC AR6 WGIII
Natural Gas Combined Cycle	25	40	IEA, NREL
Natural Gas Simple Cycle	20	35	EIA
Nuclear Power Plant	40	80	NRC, IEA
Onshore Wind Turbine	20	30	NREL, IEA
Offshore Wind Turbine	20	30	NREL, IEA
Pumped Hydro Storage	50	100	IEA
Solar PV (Utility-scale)	25	40	NREL, IEA
Solar PV (Residential)	20	35	NREL
Steam Turbine	25	30	IEA
Transformers	25	40	EPRI
Transmission Lines	40	80	IEA, EPRI

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[12] The table does not prejudge the eligibility of the type of activities listed as Article 6.4 activities.

[13] The sources listed here align with the normative references listed in section 4.

Document information

Version	*Date*	*Description*
0.2	03 February 2026	MEP 011, Annex 3. To be considered by the A6.4 Supervisory Body at SBM 020.
01.0	10 December 2025	MEP 010, Annex 2. 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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