CLEAN DEVELOPMENT MECHANISM

CDM-EB88-AA-A11

Concept note

Package on further development of a standardized baselines framework

Version 01.0

United Nations
Framework Convention on
Climate Change

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1. Procedural background

1. The Executive Board of the clean development mechanism (CDM), in response to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) (decision 3/CMP.6, paragraph 46), adopted a Standardized baseline guidelines (SB) at its 62nd meeting and since then continuing to improve the guidelines at its various meetings over 2014 and 2015.

2. The Board considered the first draft of the revised SB guidelines at EB 75 and provided inputs. At the same time, the Board agreed to reclassify the “guideline” document as a "standard" when it is adopted.

3. At EB 79, the Board considered a concept note on “Further work on standardized baseline regulatory framework, including development of top-down thresholds on baseline and additionality for underrepresented countries” and requested the secretariat and the Methodologies Panel (Meth Panel): “to jointly prepare an analysis of different options for consideration of the Board at a future meeting(s), including road testing of the options based on submissions of SBs as well as other information available, and assess the options with regard to environmental integrity, attractiveness to CDM projects and comparability across sectors/countries." In response to this mandate the secretariat and Meth panel prepared a draft SB standard and submitted for Boards consideration at EB 81.

4. The Board considered the draft SB standard at EB 81 and requested the secretariat and the Meth Panel to work further on the document (EB81 report, paragraph 48), including:

    (a) Assessing the applicability of the proposed framework to different project types and sectors, considering which of the three approaches (market penetration, performance, costs/barriers) used may be suited for which project types and sectors;

    (b) Exploring other approaches for standardization highlighted in literature, especially, but not limited to a possible process-oriented approach like the development of the performance standard;

    (c) Using the current thresholds as default and considering whether different thresholds values may be more appropriate for specific project types.

5. This work relates to the activity ‘Further development of standardized baselines framework’ under objective 1(c): Develop simplified and user-friendly standards and procedures that increase efficiency and ensure environmental integrity, as referred to in table 4 on page 15 of the Management plan 2016 (EB87, annex 1).

2. Purpose

6. The purpose of this concept note is to (i) respond to the EB 81 request referred to in paragraph 4 above and (ii) recommend a way forward for the revision of the SB guidelines, which is further elaborated in the following sections:

    (a) In section 3.1, the findings of the assessment requested by the Board, the key issues and the proposed solutions are presented;

(b) In section 3.2, alternative approaches for standardization are presented, especially, but not limited to, the process-oriented approaches for developing performance standards. In order to ensure high-quality findings, an extensive literature review was conducted and comparative analysis carried out between alternative standardization approaches and the CDM SB development approach. Based on the outcome of the analysis, recommendations are proposed;

(c) In section 3.3, a conclusion is presented in line with the previous analysis (EB 81 annotations, annex 5, and appendix 3) on the applicability/suitability of current or different thresholds for specific project types/sectors.

7. The purpose of this concept note is also to address key issues presented in section 3.4 related to the MAP 2015 mandate on sector-wide emission factors (EB 82 report, annex 6 – MAP project 110). The Meth Panel and the secretariat considered that there is an overlap between the work on revising the SB guidelines and the work on developing options for sector-wide emission factors. Therefore, it was agreed to prepare a common concept note for these two mandates. This concept note includes preliminary direction in developing sector wide emission factors, whilst a detailed technical options and recommendation to be developed together with the approval of the SB guidelines revision at a later stage. , which will be presented in accordance with its own work plan.

3. Key issues and proposed solutions

8. The key issues correspond to the three mandates received from the Board at EB 81, as referred to in paragraph 4 above. Solutions are proposed for each issue.

3.1. Key issues and proposed solutions related to the applicability of the proposed framework to different project types and sectors

9. The key elements of the draft SB standard that the Board considered at EB 81 were as follows:

(a) The SB standard is applicable to sectors where project activities are implemented for stationary sources. It provides guidance for the developing and assess SBs including additionality demonstration, baseline scenario identification and baseline emission determination;

(b) The SB standard covers the determination of baseline emission factors and positive lists of technologies/fuels/feedstocks for a sector in a country or a group of countries, recognizing that one or several measures for greenhouse gas (GHG) emission reductions may be undertaken within a sector;

(c) The proposed approach is based on a combination of the performance, penetration and costs/barriers of technologies/fuels/feedstocks;

(d) The applicable thresholds for baseline setting and additionality demonstration are: (i) 70^{th} percentile best performers (of the cumulative output of the sector) in addition to cost/barrier assessment and (2) 90^{th} percentile best performers (of the cumulative output of the sector) without cost/barrier assessment.

10. Following the EB 81 mandate, the Meth Panel and the secretariat reviewed relevant literature on possible approaches to standardization, in order to propose new

approaches or improve existing approaches. The summary of the literature research is contained in appendix 1.

11. An analysis of CDM methodologies/tools was also conducted to identify general or particular approaches to SB / additionality that could be applied for specific sectors/project types. The outcome of the analysis provided in appendix 2.

12. In addition to the approved methodologies and tools available for developing SBs, as prescribed in the existing draft SB standard, this concept note describes other possible combinations of criteria to be included in the draft SB standard, as well as their applicability to different sectors/project types. The three criteria proposed in the draft SB standard are as follows:

    (a) Performance:

        (i) Performance refers to the design/actual GHG intensity, specific energy/feedstock consumption, or fuel/feedstock emission factors (as applicable);

        (ii) As all the approaches aim to develop sector-wide performance benchmarks, the performance data of technologies/fuels/feedstock/facilities in a sector are always required;

    (b) Penetration:

        (i) Penetration refers to the relative contribution of each technology, fuel or feedstock to the total output of a sector. If the overall performances of industrial facilities are compared, the penetration is determined by the percentage or market share of the output produced by the facilities at each particular level of performance. For household devices, it may refer to the market share of the technologies at each particular level of performance;

        (ii) For simplification, the level of penetration of all technologies/fuels/feedstock will not need to be determined. A subset of penetration data (so-called “prioritized”) may be used instead of the comprehensive penetration data of all technologies/fuels/feed stocks.

        (iii) If the “Prioritized” penetration is chosen, then (i) penetration from those technologies/fuel/feed stocks, which have better performance (lower GHG/energy/feedstock intensity) than that at the baseline and additionality threshold (see paragraph 9(d) above for explanation on threshold), and (ii) the total output of the sector, are determined;

    (c) Costs or barriers:

        (i) Costs refer to financial attractiveness in terms of levelized cost of output (e.g. USD/tonne of cement) and include capital costs and operational expenditures. For technology switch, capital costs include investment attributed to the technology under consideration; for fuel or feedstock switch, they include the infrastructure that makes the use of the fuel or feedstock possible;

        (ii) When costs are used to demonstrate additionality, technologies/ fuels/feedstocks candidates for the positive list needs to be less attractive

than either: (i) a subset of technologies/fuels/feedstocks contributing to at least 30 per cent of the output generated by the entire sector; or (ii) 30 per cent of the number of technologies/fuels/feedstocks of the entire sector if the penetration of the most attractive technologies/fuels/feedstocks is not determined;

(iii) Barriers refers to technical, financial, infrastructural or any other types of constraints to the implementation of the technology, fuel or feedstock being considered.

13. Five approaches combing the different criteria are proposed, based on the review of literature and existing methodologies and, the experience gained in the development/assessment of CDM methodologies and SBs. All of the combinations aim to develop a sector-wide performance benchmark that standardizes the baseline scenario, baseline emissions and additionality. All are applicable to a broad class of GHG emission reduction activities possessing common features (i.e. measure-specific baseline within a sector). However, the Meth Panel is of the view that these combinations do not apply to the power sector because the outputs delivered by the power sector has some intrinsic characteristics that make this sector incomparable with other sectors (e.g. power dispatch pattern, peak load power versus base load power, diversification concerns to ensure security of supply, some options limited by natural resources of water or wind).

(a) **Approach 1a (Performance, penetration and cost/barrier):**

(i) This approach corresponds to Approach B of the draft SB standard.[1])and ensures a high level of environmental integrity. With a screening baseline threshold of 70 per cent, costs/barriers are the main criteria used to determine the final baseline value and the list of options that are additional (positive list). An example of this approach is given in appendix 3.

(b) **Approach 1b (Performance, prioritized penetration and cost/barrier):**

(i) This approach is similar to Approach 1a, except that:

a. penetration data is collected only for "prioritized" technologies/fuels/feedstocks/facilities (i.e. best performing in the sector and covering 30 per cent output); and

b. the final baseline threshold and the positive list are established through cost analysis of technologies/fuels/feedstocks in potential positive lists by comparing the cost of prioritized penetration options with the costs of 30 per cent of the total number of technologies/fuels/feedstocks (and not on the share to 30 per cent of output of the sector as in case of Approach 1a).

(ii) Alternatively, barrier analysis can also be used for determining the final threshold;

[1] The Meth Panel and secretariat are still discussing the options for defining the positive lists in case where facilities of the sector are ranked to develop the SB. These options may differ from that proposed to EB81. The option/s will be well elaborated in the revised SB guideline to be presented to future meeting of the Board.

(c) **Approach 2a (Performance and penetration):**

(i) This approach proposes the fixed threshold value of 90 per cent for all sectors and does not require cost or barrier analysis. Technology, fuel that are less intensive than the baseline set at 30% and are automatically additional; Example of this approach is provided in appendix 3.

(ii) This approach is developed based on an assumption that the enhanced performance increases the cost, and, that the penetration of technologies/fuels/feedstocks reduces with the increased cost; which in turn means that the technologies/fuels/feedstocks beyond the 90 per cent threshold are more costly or have barriers for implementation.

(iii) Environmental integrity may be further ensured by requiring SB developers to demonstrate this assumption, based on the studies and literature. It should be noted that:

a. This requirement will address the concern over the elimination of cost/barrier criterion to demonstrate additionality and determine baseline;

b. However, there are concerns that the data to meet this requirement may be unavailable;

(d) **Approach 2b (Performance and prioritized penetration):** this approach is similar to Approach 2a, except that only "prioritized" penetration data are required, covering 10 per cent output (for best performing technologies/fuels/feedstocks in the sector);

(e) **Approach 3 (Performance and cost/barrier):**

(i) This approach may be applicable to sectors with project activity types of multiple point emission sources with small-scale (or micro-scale) technologies/equipment/facilities requiring low investments and that have highly distributed nature (e.g. domestic equipment, cookstoves, charcoal or residential lighting). Such sectors pose several difficulties in logistics and data collection, therefore it is challenging to determine penetration levels based on the outputs delivered by each unit;

(ii) Under this approach, the available technologies/fuels/feedstock or facilities are ranked in descending order of their GHG intensity or energy intensity (as applicable). The baseline and the positive list are determined based on consultation with sectoral experts, who are required to justify their

recommendations based on clearly identified indicators, such as costs/barriers and/or common practice, or other relevant factors;[2]

(iii) This approach provides flexibility to SB developers, who can refer to expert opinion to determine the baseline technology/fuel/feedstock that suits the specific circumstances of the sector/region. However, the challenge of this approach is the identification and justification of the baseline technology/fuel/feedstock/facility by experts.

(iv) There is a need to provide additional guidance on possible indicators to experts, in order to help them determine the baseline and positive list of the technologies/fuels/feedstocks.

14. An overview of the approaches is presented in Table 1.

[2] For example, a country has four technologies in residential lighting sector: incandescent bulbs, tube lights (fluorescent lamps), compact fluorescent lamps (CFLs) and light emitting diode (LED) lamps. The technologies can be arranged in the descending order of their energy intensity (Watts/Lumen). The sectoral experts of the country conclude that incandescent bulbs and CFL are most popular in the country; however, CFL is a suitable baseline technology as it represents a conservative option. LED lamps have the lowest energy intensity and are found to be less attractive than all the other technologies. That is, CFL is determined as a baseline technology through expert judgement and LED is included in a positive list through cost analysis.

Table 1. Matrix of approaches for development of standardized baselines for different project types/sectors

Approach	Criteria	Baseline threshold	Challenges for SB developers	Benefits for SB developers/user	Applicable sectors/project types
1 (a)	• Performance • Penetration • Cost/barrier	• Screening baseline threshold is 70% of output of the sector. Final threshold is determined by cost/barrier analysis	• Data intensive (comprehensive data is needed on performance, penetration and cost/barrier)	• Broad application: Any sector can apply this (except power). • Possible more certified emission reductions (CERs) for CDM projects due to a conservative but more realistic level of threshold	All except the power sector for the reasons explained in paragraph 13
1 (b)	• Performance • Prioritized penetration • Cost/barrier	Same as approach 1(a) except that the cost analysis of technologies/fuels/feed-stocks in potential positive lists should be done with costs of 30% of the number of technologies/fuels/ feedstocks (not based on their share to 30% of output of the sector as in case of approach 1(a))		• Broad application: Any sector can apply this (except power). • Possible more CERs for CDM projects due to a conservative but more realistic level of threshold. Reduced burden on data collection: The data on penetration of only those technologies which are beyond threshold need to be collected	All except the power sector

Approach	Criteria	Baseline threshold	Challenges for SB developers	Benefits for SB developers/user	Applicable sectors/project types
2 (a)	• Performance • Penetration	• Baseline threshold is the fixed threshold of 90%. • All technologies/ fuels/ feedstocks improving performance beyond this threshold are additional	• Demonstration of relationship between cost with performance or penetration could be challenging. • The stringent threshold of 90% may be unrealistically conservative	• Reduced burden on data collection: There is no need to collect the data on costs/barriers to demonstrate additionality	All except the power sector, provided that SB developer can demonstrate the cost of technologies/fuels/feed-stocks/facilities increases with the increase in their performance (decrease in carbon intensity or specific energy consumption or fuel/feedstock emission factors), based on the studies and academic/ technical literature
2 (b)	• Performance • Prioritized penetration	Same as approach 2(a)	• Demonstration of relationship between cost with performance or penetration could be challenging. • The stringent threshold of 90% may be unrealistically conservative	• Reduced burden on data collection: (i) There is no need to collect the data on costs/barriers to demonstrate additionality; (ii) Penetration data are required to be collected only for technologies/ fuels/ feedstock in the potential positive list.	Same as approach 2(a).

Approach	Criteria	Baseline threshold	Challenges for SB developers	Benefits for SB developers/user	Applicable sectors/project types
3	• Performance • Costs/barriers	• Screening Baseline technology/fuel/feedstock is determined by expert judgement. • Final technology/ fuel/ feedstock may be determined by cost/barrier analysis (or any other criteria considered appropriate by experts)	• Broad guidance is required for the expert judgement on baseline technology/fuel/feedstock. • For example, this may , include the costs/barriers, common practice indicators	• Reduced burden on data collection: No penetration data is required to be collected	Technology/ fuel/ feedstock switch in sectors where penetration data is impractical to collect

3.2. Key issues related to other approaches for standardization

15. EB 81 requested that other approaches for standardization, highlighted in the literature, are also explored, especially, but not limited to, a possible process-oriented approach such as the development of the performance standard.

16. For the purpose of this concept note, the "process-oriented approach" is defined as the approach in which regulatory bodies: (i) provide minimum requirements for developing standards instead of providing prescriptive requirements to standard developers; (ii) rely on substantive inputs of local/sectoral experts; and (iii) provide guidance on the process, including the process of expert and stakeholder consultation to ensure high quality of inputs.

3.2.1. Review of standardization approaches

17. The Board requested a review of other process-oriented approaches established for standardization highlighted in literature. An analysis of these process-oriented approaches is provided below.

3.2.1.1. Analysis of stages of process for standardization adopted by various standard-setting bodies and standardized baseline procedures

3.2.1.1.1. Consideration of expert consultation in standardized baseline development process under the CDM

18. Summary of the current provisions of the SB development framework under the CDM is provided below:

    (a) SBs can be developed using either of the following approaches. Their combination can be used if properly justified by the standardized baseline developer:

        (i) The approach of the SB guidelines and the approach of the "Guidelines: Establishment of standardized baselines for afforestation and reforestation project activities under the CDM";

        (ii) A methodological approach contained in an approved, proposed new or revised baseline and monitoring methodology;

        (iii) A methodological approach contained in an approved, proposed new or revised methodological tool; or

    (b) Under the current approved approach referred to in paragraph 18(i) above, the applicable thresholds for baseline setting and additionality demonstration are: 80 per cent (of the cumulative output of sector) for sectors of energy for households, energy generation in isolated systems and agriculture; and 90 per cent for all other sectors. The SB developers are allowed to submit new country-specific thresholds along with their proposed SBs with proper justifications;

(c) The expert consultations can be sought in defining country-specific approaches for the development of SBs. The SB framework[3] does not preclude the possibility of undertaking expert consultations during the development of an SB. The expert consultation may be required while developing sector-specific data templates or evaluating the data templates submitted by SB developers to the UNFCCC secretariat, before actual SB development is carried out based on approved template. For the approaches under paragraphs 18(a)(ii) and 18(a)(iii) above, the SB framework allows the bottom-up development of new methodologies/tools or revision to existing methodologies/tools, using the "Procedure: Development, revision and clarification of baseline and monitoring methodologies and methodological tools" (SB procedure);

(d) Similarly, for any approaches mentioned in paragraph 18(a) above, a deviation or combinations can be proposed for the Board's consideration in parallel to or prior to the submission of a proposed SB;

(e) Another document that guides the development of SBs is the "Guideline: Quality assurance and quality control of data used in the establishment of standardized baselines" (QA/QC guideline). It specifies data quality objectives and provides guidance and best practices/examples on practical aspects of data collection, processing, compilation and reporting. The document has the following relevance from expert consultation point of view:

(i) The data quality objectives include relevance, completeness, consistency, credibility, correctness, accuracy, objectivity, conservativeness, security, transparency and traceability. Under the transparency objective of the QA/QC guideline, it is required that public (including expert) consultation on the matters related to a proposed SB is carried out and a report is prepared that includes the objectives of public consultation; process for public consultation; participants who attended the public consultation; and how comments were taken into account. In addition to that the designated national authority (DNA) of the Party in question may involve a third party for checking the data during the development of an SB;

(ii) During the review of the QA/QC system by the DOE/secretariat, sectoral experts can be consulted to check whether the QA/QC system, procedures, approaches, as well as the final SB are reasonable.

3.2.1.1.2. Different stages of process-oriented approaches adopted by various standard-setting bodies

19. Table 2 below compares different stages of the process-oriented approaches deployed by different standard-setting bodies and the outcomes of each stage. Following paragraphs provide for further description of different stages of consideration and development of standards by different standard-setting bodies.

[3] The SB framework contains the standards, guidelines, procedures and forms to enable: (i) an SB developer to plan, develop and submit SBs; (ii) the Board and its support structure to evaluate proposed SBs; and (iii) project participant to develop the project design documents for the projects using SBs.

20. In contrast to the SB framework under the CDM, which provides detailed and prescriptive methodological approaches to establish SBs, other standard-setting bodies allow for development of a standardized method, protocol or standard through a process-based approach. These bodies formulate process-related requirements/guidance from the initiation stage of the development of a standardized method or protocol, which in some cases requires (a) formal process with an official announcement (California Air resource Board (CARB), American National Standards Institute (ANSI)); (b) submission of a concept note to the regulatory body (Verified Carbon Standard(VCS)); (c) internal procedures including screening process, scoping meeting with interested parties (Climate Action Reserve (CAR)); or more (d) informal process such as undertaking a feasibility study (Joint Crediting Mechanism (JCM)), or consultation with member states (European Emission Trading Scheme (EU ETS)).

21. Different standardization bodies differ in the approaches applied to the initiation stage of the development of a standardized method or protocol as explained below:

    (a) If the standard-setting body is not an approver only but also an developer of the protocol or standard (e.g. CAR, EU ETS, and JCM):

        (i) In the majority of these cases, the informal initiation provisions are not very elaborative but consist of different forms of consultations such as consultations with member states (EU ETS); or issuance of papers shared with stakeholders and scoping meetings with interested parties (CAR);

        (ii) This process can be compared to the top-down development of an SB under the CDM. Although the initiation of the process is based on an agreement form submitted by the DNA, the next steps require inputs from the experts (two members of the Small-Scale Working Group (SSC WG) or the MP) and, for a top-down SB, from the DNA on the development plan. The top-down process does not require to undertake consultations with stakeholders from the respective sector (including national/international experts).

    (b) If the standardization approach is used for compliance purposes (CARB, EU ETS, ANSI) or for voluntary application (VCS, CAR):

        (i) Standardization process for compliance purposes include official announcements and a launch of public consultations at the stage of initiation, whereas the standardization process for voluntary purposes are mainly focused on notification to the body involved in the approval and their internal procedures which may or may not include comprehensive public consultations (e.g. CAR includes meeting with interested parties);

        (ii) Under the SB framework the QA/QC guidelines states that the DNA should include stakeholders and sector experts from the planning stage for the SB in order to better understand their perspectives and interests and/or encourage their participation in data collection.

3.2.1.1.3. Development stage

22. At the development stage of a standardized method, protocol or standard, different standardization bodies adopt different approaches to undertaking consultations with experts and stakeholders. They include: combined expert and stakeholder consultations (e.g. industry, non-governmental organizations (NGOs), government representatives (VCS)); public workshops and technical meetings (CARB)); stakeholder consultations and working group involvement (CAR)); and informal stakeholder consultations (JCM).

23. The modalities for undertaking the consultations are also different for different standard-setting bodies. They include: the requirements on the types of stakeholder groups to be involved in the consultations (e.g. VCS); the requirements on an options paper (e.g. CAR); and the preparation of a deliberation report and responding to commenters (e.g. ANSI).

24. In the SB process under the CDM, the QA/QC guidelines state that a third party may be involved to double-check the data quality, and that the DNA may promote the involvement of stakeholders/experts during the overall QA/QC processes and regularly take into account their feedback on the data quality. Prescriptive requirements are not provided for the consultation process. However, an SB developer will use the approved/revised/new approaches for the development of SBs. For new/revised approaches, the approach should be submitted for Board approval, either in parallel to the proposed SB or before the SB is submitted. An SB developer can undertake an expert consultation when formulating new approaches to developing an SB. There are no prescriptive requirements for such consultations.

3.2.1.1.4. Pre-approval/pre-submission stage

25. In some cases, the development stage and the pre-approval/pre-submission stage can overlap and may not be that explicitly distinguished. However, the distinction is made between the requirements on the on-going development of standardized method or protocol, and those on finalized standardized method, protocol or standard before its submission for approval.

26. For this stage, different standard-setting bodies use different requirements, which include:

    (a) Instructions on how to handle issues raised by stakeholders (e.g. deliberation reports (ANSI), justifications on how stakeholders' comments are addressed (VCS));

    (b) Requirements on soliciting additional inputs from stakeholders (e.g. CARB);

    (c) Additional analysis and assessments (e.g. VCS requires validation/verification bodies assessments obtained by the developer and VCSA; CARB requires environmental analysis; EU ETS requires validation).

27. In the SB process under the CDM, the QA/QC guidelines recommends that public consultations (with experts or stakeholders) should be conducted and a consultation report should be prepared on the data and data gathering for the establishment of an SB before its submission to the Board. In the cases where a DOE prepares an assessment report, the assessment on the QA/QC system may also involve experts.

3.2.1.1.5. Documentation requirements for approval

28. Documentation requirements vary among different standard-setting bodies. However, in all cases, stakeholder consultations are reflected and their outcomes are submitted along with other documentation required for the consideration and approval of the standardized methods or protocols (e.g. report on expert consultations (VCS); deliberation reports (ANSI); explanation on decisions made during development of protocol (CARB); consultation report (SB framework under the CDM)).

3.2.1.1.6. Approval stage

29. Although the approval processes that different standard-setting bodies have established are not examined in detail, the information available indicates that in the majority of the cases public comments are solicited by the standard-setting bodies before a standardized method, protocol or standard is approved (e.g. CARB organizes public hearings; JCM publishes proposed methodologies; CAR organizes workshops and publishes proposal on its website; the European Commission publishes proposal on its website and its decisions in Official Journal; ANSI launches a public call).

30. Under the CDM, as per the SB procedure, a proposed SB is published on the CDM website after the initial assessment is successfully concluded. However, the secretariat does not solicit public inputs. Internal processes are followed to ensure that the proposed SB meets relevant standard/quality requirements.

Table 2. Different stages of the processes oriented approaches

Approach	Initiation stage	Development stage	Pre-approval/pre-submission stage	Documentation requirement for approval	Approval stage
Verified Carbon Standard (VCS)	Submission of methodology concept note to VCS	• Full transparency on how the level of the performance benchmark is set. • Expert consultations (industry, environmental NGOs, government and regulatory bodies) to ensure that the level provides environmental integrity and financial incentives. • VCS conducts 30 days of public consultations.	• Developer ensures consensus between stakeholders and provides justification on how inputs by stakeholders were addressed. • Developer pursues assessment of the methodology by Validation Verification Bodies (VVBs). • VCS contracts another VVB to review the methodology and produce second assessment report	• Report on expert consultation process • Proposed Methodology by the developer • Assessment report prepared by VVBs on the data and the methodology	VCS approval
California Air Resource Board (CARB)	Official announcement to develop new offset protocol and public announcement open to all stakeholders	Informal development activities: Public workshops and technical meetings	Environmental analysis: Stakeholders' input on draft protocol	• Proposed Compliance Offset Protocol • Explanation on decisions made during development of Protocol • Analysis to support the Protocol • Analysis of environmental impacts	• CARB holds workshops/technical meetings • Publishes Protocol and staff report • Public Hearing • CARB approval

Approach	Initiation stage	Development stage	Pre-approval/pre-submission stage	Documentation requirement for approval	Approval stage
Joint Crediting Mechanism (JCM)	Feasibility studies/ model pilot projects	Informal consultation on draft methodologies with stakeholders.	Informal consultation on draft methodologies with stakeholders.	• Proposed methodology • Support documentation	• Published for public comments • Joint Committee (governments representatives) for approval
Climate Action Reserve (CAR)	• Screening process followed by issue paper which is shared with stakeholders • Scoping meeting with interested parties	• Multi-stakeholders consultation on the options for development a protocol • Working group (interested parties and observers) • Options paper may be used which is the basis for the draft protocol	• Draft protocol is discussed with working group and revised to reflect inputs • Draft Protocol is posted on the Reserve's website but comments are not solicited	• Proposed Protocol • Issues raised throughout development process	• Public comments (solicited by workshop and through publication on the web-site) are recorded and addressed • CAR Board votes to adopt the protocol in open to the public meeting
European Emission trading scheme (EU ETS)	Consultation with member states.	Consultations with stakeholders and industry associations.	Validation and cross-check by European Commission and consultants.	• Impact assessment • Amendment of the EU ETS Directive • EC decision on benchmarking	European Commission approval.
American National Standards Institute (ANSI)	• Official notification to ANSI using Project Initiation Notification System. • Mandatory deliberations with stakeholder groups	• Deliberation Report prepared • PINS deliberation shall be conveyed in writing to the commenter and ANSI	• Deliberation Reports • Stakeholders can also submit deliberation reports	• Deliberation Reports • Proposed Standard	• List the standards in Standards Action web page • Launch of public call. • Resolutions of any objections should be sought otherwise appeals process should be followed. • The ANSI Board approves the standard

Approach	Initiation stage	Development stage	Pre-approval/pre-submission stage	Documentation requirement for approval	Approval stage
SB framework	Not required in general.	• The data template submitted by the SB developer for approval before developing SB. The data template may require the scrutiny of sectoral expert. • The SB developer may submit a new/revised methodology (containing SB approach) for approval of the Board, . • This methodology is placed for public comments as per relevant procedure. • QA/QC system to be put in a third party may be involved to check data before submission	• Conduct public consultations on data quality, compilation and processing and prepare public consultation report as per QA/QC guideline • DOE/secretariat checks the QA/QC system and can involve experts to prepare assessment report	• Proposed SB/form • Assessment report • Supporting documentation • Letter of approval • QA/QC documentation: • Data delivery protocol (summary reports) • Public consultation report • QC report	• Initial assessment • Publish on web-site no opportunity for public comments • Recommendations – experts may be involved • 2 members/MP/SSC WG • Consideration by the Board • The Board can adopt proposed SB only if it also adopts the underlying approach (methodology/tool) is also adopted by it

3.2.2. Findings of comparative analysis of the standardized baseline process under the CDM with processes of various standard-setting bodies

31. The process-oriented approaches elaborate detailed consultation processes throughout various stages of the development of a standardized method, protocol or standard, to ensure greater transparency. CDM should use comparable process for cases where the guidelines are not used by the DNA.

32. The process-oriented approaches provide the opportunity to solicit inputs from local stakeholders and experts on the trends and specific circumstances of the sector. This may better reflect the reality on-the ground and the business plans for the development of the sector, thus encouraging mitigation activities in the sector.

33. In majority of the standardization processes, other than the SB process under the CDM, the combination of expert and stakeholder consultation processes are included. This could contribute to ensuring a balance between technological/methodological issues, data reliability, environmental, social, economic and other aspects relevant to the consideration of the standardized methods or protocols.

34. The SB framework under the CDM gives SB developers freedom in selecting options on how, at what stage, and under which modalities, expert and stakeholder consultations could be undertaken, including that for defining the approach to develop an SB or reviewing the data quality, compilation and processing. The SB framework also flexibly regulates the expert assessments and consultations at the stages of QA/QC system development and pre-submission through assessment report in cases when a DOE assesses the proposed SB. However, it is recognised that the expert consultations undertaken for SB and process oriented approaches are not comparable and involves stakeholders and experts of different capacities.

35. Recognizing that standard-setting bodies, other than under the CDM, do not prescribe any methodological approaches for developing an SB under the process-based approaches, it is recommended that SB developers should be allowed to propose a country-specific approach for the development of an SB other than those included in the CDM guidelines/standards that aims at standardizing baseline scenario, baseline and additionality. When Board approves a SB, the approach taken need not to be approved as a global CDM methodology or methodological tool, but could be country specific.

36. For this, an elaborated process-oriented approach based on experts' judgment needs to be developed, which requires involvement of experts at an early stage of the development of SBs. The approach will include: the process for expert consultations for the determination of an approach to develop an SB; experts' qualifications; and broad criteria for the development of SBs.

37. In general, more comprehensive stakeholders/expert consultations would result in improved credibility and integrity of the process of developing a standardized methods or protocols. The majority of standard-setting bodies solicit public inputs before the approval of a proposed standardized method, protocol or standard, whereas SBs under the CDM are only published at the UNFCCC website with no solicitation of public inputs. This is understandable in the context of the SB that following the approved guidelines. In such cases there is no need for further consultation on a product that is derived from the approved guidelines. The consultations on the guidelines itself and on the data used to develop the SB is more relevant.It is recognized that the effective implementation of the

consultations can be achieved by providing broader access to stakeholders. Such broader access may be better achieved through the platform for global access on the UNFCCC website, when the submissions are made by DNAs to UNFCCC for SB not using the pre-approved guidelines.

3.3. Key issues related to the use of different threshold values for specific project types

38. The Board requested through paragraph 48(c) of EB 81 report to analyse whether the current default thresholds (i.e. 80 per cent for sectors of energy for households, energy generation in isolated systems and agriculture; and 90 per cent for all other sectors) work well for different project types or sectors and whether different threshold values may be more appropriate for specific project types or sectors.

39. At EB 81, the Board considered a concept note from the Meth Panel and the secretariat (EB81 annotations, annex 5, appendix 3) that elaborated five options to determine baseline thresholds. Two of the five options were recommended, which are maintained as in approach 1 a, b and approach 2 a, b provided in section 3.1 above. For approach, where additional cost/barrier consideration is made to determine the baseline and positive list, a threshold of 70 per cent was recommended. This threshold of 70 per cent meant to serve the role of a screening threshold for baseline setting to identify technologies that are deemed non-additional. Actual baseline scenario and positive list is further determined following investment or barrier analysis. For approach 2, since cost/barrier consideration was not included, a stringent threshold of 90 per cent was recommended to arrive at final baseline and positive list.

40. The Meth Panel and the secretariat maintain the recommendation made to the Board via annotations to EB 81. This recommendation was made based on the analysis of data from various sectors as was presented in the earlier concept note. It is difficult to justify the rationale in the existing SB guidelines to provide different thresholds for priority sectors and other sectors. Therefore only one default threshold to be applied for all types of sectors under each approach has been proposed. The threshold of 70 per cent should be applied to Approaches 1a and 1b and 90 per cent should be applied to Approaches 2a and 2b. For Approach 3, the baseline technology/fuel/feedstock should be determined and justified using sectoral expert consultation and cost/barrier analysis.

41. DNAs should be allowed to seek deviation from the default thresholds recommended above, under their specific national and sectoral situations based on proper justification.

3.4. Key issues related to MAP 2015 mandate on sector wide emission factors

42. Approaches 1a, 1b, 2a and 2b discussed in section 3.1 above can be used to develop an emission factor for any sector in one of the following ways: (i) an emission factor of each facility (tCO2/t output) should be determined first and the baseline emission factor is the result of ranking of outputs of facilities with respect to their performance and applying the baseline threshold to the ranked facilities (hereinafter this method is referred as “conventional method”); or (ii) the measure-specific SBs (such as an SB for technology switch, an SB for fuel switch, and an SB for feedstock switch) should be developed first and then combined (hereinafter this method is referred as “combination method”).

43. The development of a sector-wide emission factor via conventional method requires the determination of baseline emission factor for fuel, baseline emission factor for feedstock and baseline energy consumption of technology and converting them to the baseline emission factor of each facility. Whereas, for developing the sector-wide emission factor by combination method, the DNA should initially develop the measure-specific SBs represented as carbon intensity of baseline fuel, feedstock or specific energy consumption of baseline technology, and a positive list of fuels/feedstock/technologies or regulations.

44. For developing measure-specific SBs, four conditions have to be satisfied (see section 6.2 of the draft SB standard submitted to EB81 as referred to in paragraph 6 (c**).**

45. If all the above referred four conditions are satisfied, measure-specific SBs can be developed and a sector-wide emission factor can be further developed by combining measure-specific SBs. Following points can be considered while combining measure-specific SBs.

(a) The sector-wide baseline emission factor can be developed by combining the energy intensity (in terms of TJ/tonne of output, i.e. technology-switch SB) with fuel carbon intensity (in terms of tCO_2/TJ of fuel energy, i.e. fuel-switch SB) and feedstock (in terms of tCO_2/tonne of feedstock, i.e. feedstock-switch SB). Following equation represents the conversion of measure-specific SBs into sector-wide emission factors.

$$\mathrm{EF}_{sector} = SEC_{TS\_SB} \times CI_{FS\_SB} + CI_{FSS\_SB} \times FSI$$

Equation (1)

Where:

EF_{sector}	=	Sector-wide emission factor (Tonne CO_2/tonne output)
SEC_{TS_SB}	=	Technology-switch standardized baseline (specific energy consumption in TJ/tonne output)
CI_{FS_SB}	=	Fuel-switch standardized Baseline (carbon intensity of baseline fuel in tCO_2/TJ fuel energy)
CI_{FSS_SB}	=	Feedstock-switch standardized baseline (carbon intensity of baseline feedstock in tCO_2/tonne feedstock)
FSI	=	Feedstock intensity (tonne feedstock/tonne output)[4]

(b) The positive lists of measure-specific SBs can be merged, and is applicable to sector-wide emission factor. For example, if three SBs that are developed for measures of technology switch, fuel switch and feedstock switch in the sector are combined, the combined positive list shall include technologies, fuels and feedstock of the positive lists of individual SBs.

3.5. Conclusions and proposed solutions

46. Based on the key issues discussed above, the following solutions are proposed.

47. Five approaches, as described in section 3.1 above, can be applied for the development of SBs, with clear applicability conditions and eligibility criteria. All the five approaches

[4] Example of feedstock intensity: Tonnes of limestone required to produce one tonne of cement clinker.

ensure a high level of environmental integrity and four of them can be applied to all the sectors (except the power sector), whereas one can be applied to distributed sectors only. Although it is recognised that some of the approaches are more data intensive (particularly Approaches 1a and 2a) than the other (Approaches 1b, 2b and 3) and can be challenging in some cases, they potentially provide for more attractive baseline values and positive lists from the SB user's perspective.

48. The analysis performed to conduct the road testing for the application of approaches concludes that the approaches result in a reasonably conservative baseline values and positive lists. The analysis also suggests that the sector-wide emission factor (tonne CO_2/tonne output) can be developed following all the approaches. The sector-wide emission factor encompasses the possibility to implement different types of measures (projects) that help achieve scalability of the CDM. Therefore all the efforts should be made to provide maximum flexibility in the selection of approaches in order to achieve high scaling-up of the CDM. The guidance for combination of measure-specific SBs should be included in the revision of the SB guidelines.

49. While the process oriented approaches provide consistent procedures to arrive at a standard it does not necessarily ensure consistency among various standards. The SB framework relies on approved approaches to determine a baseline, additionality, and/or baseline emissions factor in a way that ensures consistency among the outcomes.

50. It is recommended that SB developers are allowed to propose a country-specific approach for the development of an SB other than those included in the CDM guidelines/standards related to establishment of baseline and additionality. When such a proposed SB is approved by the Board, the approach taken need not be approved as a separate CDM methodology or methodological tool.

51. It is recognized that for providing opportunities for submission of global stakeholder comments and improved transparency it can be considered by the Board to require the launch of a call for public input on a proposed SB during its consideration by the Board and/or the Meth Panel or SSC WG if the SB is not developed following the guidelines.

52. The baseline thresholds must be designed while finalizing various approaches to establish SBs. The Meth Panel and the secretariat uphold their recommendation made previously to the Board via EB 81 annotations. The baseline thresholds of 70 per cent and 90 per cent can be applied to Approaches 1 (1a and 1b) and 2 (2a and 2b) respectively, without distinguishing thresholds between priority sectors and other sectors. For Approach 3, it is recommended that an expert consultation be undertaken to decide the baseline fuel/feedstock/technology; however an elaborated guidance for expert consultations is required. This is more in line with the principles of process-oriented approaches.

4. Impacts

53. The solutions proposed in section 3.5 above would help improve the SB guidelines (the future SB standard) by expanding its scope and making it more flexible and clearer. The flexible and clearer document would facilitate DNAs to develop SBs with relative ease and enhanced predictability of the outcome.

54. The solution suggested to open up the SB process to completely process-oriented approaches will help receive many new proposals from DNAs and SB developers to

address the country- and sector-specific circumstances/limitations, which cannot be known to the Board while prescribing the approaches.

55. The solution suggested to invite global public comments during the consideration of proposed SBs that do not follow the guidelines will increase the transparency of the process and help resolve the issues to which the Board and its support structure do not have access.

56. A solution to propose the default baseline screening thresholds of 70 per cent will help attract more SB developers and more CDM projects in the end, while ensuring environmental integrity.

5. Subsequent work and timelines

57. If the Board agrees to the proposed solutions referred to in section 3.5 above, the secretariat and the Meth Panel will revise the SB guidelines (while reclassifying them to the SB standard) for the establishment of sector-specific SBs for the consideration of the Board at its future meeting.

6. Recommendations to the Board

58. The secretariat recommends that the Board agree to the proposed solutions mentioned above and provide further guidance on how to proceed further, especially with respect to the following:

(a) Introducing five approaches for the development of SBs, as described in section 3.1 above, in the draft SB standard submitted to future EB meeting;

(b) Development of guidelines with in the SB standard for process-oriented approach including expert consultation for the development of SBs.

(c) Launching of a call for public input on a proposed SB during its consideration by the Board and/or the Meth Panel or Small Scale Working Group , and including it in the relevant procedure.

Appendix 1. Literature research

1. Schneider et al. 2014. Crediting emission reductions in new market mechanisms

1.1. Part I: Additionality assessment and baseline setting without pledges

1.1.1. Baseline

1. This paper discusses different approaches about baseline settings (including standardization) and lists down the key challenges associated with the approaches that need to be taken into account.

2. Reference technology.

3. Benchmarking: use of data from a defined peer group.

    (a) The size, number, vintage, and technical lifetime of the installations: in some sectors, the plant size and/or plant age can significantly influence costs and performance;

    (b) The comparability of performance and costs of technologies;

    (c) The types of outputs or services;

    (d) The rate of current and future expected innovation in the sector;

    (e) Other technical, economic and social circumstances.

1.1.2. Additionality

4. The paper provides an overview of the different approaches deployed and proposed in the literature for additionality demonstration. It also discusses key issues associated with the respective approach and the way forward:

    (a) Investment analysis (commercial attractiveness);

    (b) Barrier analysis;

    (c) Market penetration rates or common practice analysis.

5. **Emission benchmarks:** Comparison of the GHG performance of the project with an emissions benchmark. A project is deemed additional if its GHG performance is better than the benchmark. Applicable to project types with homogenous outputs (e.g. grey cement clinker) and for which low GHG performers are likely to be additional.

2. Schneider at al. 2012. Standardized baselines for the CDM- Are we on the Right Track?

6. The paper dwells upon possible pitfalls under the current approach in the SB guideline on setting baseline/additionality and discusses possible way forward.

7. Key messages:

(a) **Avoiding the use of one single methodological approach for different sectors, project types and locations**, and exploring practical, robust and data driven approaches that are developed for specific project types. The development of such approaches should be based on actual projects and conducted in close consultation with experts in specific sectors and practitioners in the field. The methodological approaches should reflect the particular circumstances of the sector, project type and location and "account for the technology and context specific factors";

(b) Ensuring that **standardized performance benchmarks, emission factors or default values change over time** and/or reflect the actual situation for sectors with significant technological innovation or significantly changing trends, such as a new fuel type becoming available.

3. Daisuke Hayashi & Axel Michaelowa. 2012. Standardization of baseline and additionality determination under the CDM

8. This paper discusses the potential challenges for top-down approach to the performance standard based on analysis of 14 large-scale CDM methodologies that use performance standard approaches.

9. Three types of performance indicators proposed or implemented most widely in climate change mitigation:

(a) **Emission or energy standard:** A threshold value can be determined by the performance of peers and/or GHG emissions or energy efficiency standards implemented in a relevant jurisdiction;

(b) **Technology or practice standard: normative specifications** on technology or practice are used to determine baseline emissions or assess additionality of a CDM project. For example, such specifications may be based on the best available technology or practice in a given geographical boundary (e.g. use of an anaerobic digester for the control of methane emissions from dairy livestock);

(c) **Market penetration rate:** The rationale for this approach is that emerging technologies (i.e. those for which the penetration rate is lower than a threshold) are likely to require some type of support in order to compete with other technologies available in the market. For instance, CDM projects for the distribution of compact fluorescent lamp may be deemed additional until a market penetration rate of the technology exceeds 5%.

4. SEI. 2011. Study on the integrity of the CDM, Stockholm Environmental Institute

4.1. Baseline/Additionality

10. The report presents evaluation of specific standardization approaches – emissions performance standards, market penetration assessments, default/deemed values, and positive/negative lists – at different levels of aggregation (project specific vs. sector-based). This evaluation is done against the predefined criteria.

(a) Emissions performance standards or benchmarks;

(b) Criteria:

(i) Homogeneous product or services;

(ii) Relatively tight or normal distribution of emissions intensity;

(iii) Extensive data availability on emissions performance.

11. **Example: applicable sector/project types**.

12. Cement, steel, aluminium (PFC emissions), glass production; appliances (refrigerators), N2O, PFC, SF6, and HFCs; boilers, motors; tail gas CO2 recovery; electrical transformers

4.2. Positive list

13. Underlying rationale can be project size, performance, market penetration, financial attractiveness or a combination of these. Applicable to specific project types (e.g. micro-scale projects).

4.2.1. Criteria

14. No other revenues than CER; CERs fundamentally change.

15. Economics; Reference technology that is common practice (e.g. > 80%); Innovative technology facing barriers (cost, acceptance, etc.)

4.2.2. Example: applicable sector/project types

16. High GWP gas destruction or avoidance (adipic acid, nitric acid, HFC 23 destruction, SF6, etc.); Manure management (lagoons).

17. Efficient lighting (incandescent light).

18. Efficient charcoal production.

(a) **Market penetration rate (activity standard):** Cumulative penetration rate: e.g. technology in use at 20% or less of all installations (e.g. methane recovery and combustion at landfills) as used in some US voluntary offset program methodologies (Climate Leaders and Climate Action Reserve);

(b) **Criteria:**

(i) Homogeneous product or services (tight or normal distribution of emissions intensities not necessarily required);

(ii) Where stimulation of emerging technologies is a desired objective;

(c) Data available on market shares or sales by technology or practice.

4.2.3. Example: applicable sector/project types

19. Higher-efficiency technologies; small-scale renewable energy technologies; blended cement; natural gas cogeneration; landfill gas combustion; biogas; composting.

20. **Deemed values** are particularly valuable for projects in the household, agricultural, and transport sectors where large numbers of smaller, individual devices or practices are implemented. They figure prominently for example in methodologies designed for LDCs and underserved sectors, such as water purification or rural electrification. Since they may involve sweeping assumptions with major implications for baseline emissions and CERs generated by a project, they tend to be quite conservatively estimated. Examples:

    (a) Weighted average cost of capital by country;

    (b) Energy use per light bulb;

    (c) 5.5 litres of purified water per person per day (baseline, AMS.IV.V).

4.2.4. Criteria

21. Commonly used technologies with similar performance characteristics (e.g. light bulbs, vehicles).

22. High measurement costs.

4.2.5. Example: applicable sector/project types

23. Small-scale projects or small, distributed (energy using) technologies.

Appendix 2. Analysis of various performance benchmark approaches used in CDM methodologies/tools[5]

1. Many approved methodologies and tools have adopted various performance benchmark approaches for additionality demonstration, baseline identification, and/or determination of baseline emission factors.

2. The secretariat conducted an analysis of various standardized approaches used for baseline identification or baseline emission calculations in CDM methodologies in order to identify the reasons why and how performance, penetration and cost & barriers are considered in those methodologies/tools. Methodologies applying a standardized approach for additionality only are not included in the analysis. key findings are presented after the table.

Table 1. Application of performance, penetration or cost & barriers for baseline identification or additionality demonstration in CDM methodologies/tools

Type	Sub-type	Methodology/Tool	Application of Performance Benchmarks, Penetration or Cost/Barriers (with possible rationales)
Energy Efficiency, industry	General	AM0017: Steam system efficiency improvements by replacing steam traps and returning condensate	Baseline scenario: Performance Baseline emission factor: Performance How: Historical emissions, adjusted for improvement in five similar facilities Why: uncertainty with the historical baseline, to ensure that baseline is not inflated Additionality: Performance How: Pre-project performance, steam trap failure rate and relative steam return, is 5% better than the average of five similar facilities in the same sector Why: energy efficiency measure likely to be cost effective, but faces barriers
		AM0044: Energy efficiency improvement projects - boiler rehabilitation or replacement in industrial and district heating sectors	Baseline scenario: Cost/Barrier (AT). Baseline emission factor: Performance How: Only if no baseline efficiency data is not available, an alternative approach to determine the baseline boiler's efficiency using a conservative thermal efficiency based on other similar boilers in the region. No specifics to define similar boilers. Why: Lack of efficiency data Additionality: Cost/Barrier (AT)

[5] The benchmark approaches are the approaches where the additionality, the baseline scenarios and/or baseline emissions are determined based on the performance of similar facilities/units.

Type	Sub-type	Methodology/Tool	Application of Performance Benchmarks, Penetration or Cost/Barriers (with possible rationales)
	Steel	AM0109: Introduction of hot supply of Direct Reduced Iron in Electric Arc Furnaces	Baseline scenario: Cost/Barrier (CT) and Penetration How: if penetration of baseline technology is more than 50%, then reference plant is the latest plant Why: penetration or CP test as a reality check Baseline emissions: Reference plant Additionality: Cost/Barrier (CT) and Penetration How: penetration of project is less than 50% Why: penetration or CP test as a reality check
EE, households	Lighting	AM0046: Distribution of efficient light bulbs to households	Baseline: Performance, penetration How: Baseline sample group to determine baseline scenario and emission factor (lower bound of 95% CI) Why: Distributed household appliances; users are not PPs; performance and penetration can reflect users' choice in baseline. Additionality: Investment analysis is mandatory. Why: Energy efficiency measures are likely to be cost-effective
		AM0113: Distribution of compact fluorescent lamps (CFL) and light-emitting diode (LED) lamps to households	Baseline: Performance, penetration How: lamps collected and replaced by the project activity Why: Distributed household appliances; users are not PPs; performance and penetration can reflect users' choice in baseline. Additionality: For CFL: regulation or cost/barriers(AT); For LED: automatically additional
		AMS-II.J: Demand-side activities for efficient lighting technologies	Both Baseline and Additinality are aligned with AM0113 above
	Stove	AM0094: Distribution of biomass based stove and/or heater for household or institutional use	Baseline scenario: Cost/barrier (CT) Baseline emission factor: Performance, penetration How: Baseline sample group to determine baseline efficiency and fuel Why: Distributed household appliances; users are not PPs; performance and penetration can reflect users' choice in baseline Additionality: Cost/barrier (CT)

Type	Sub-type	Methodology/Tool	Application of Performance Benchmarks, Penetration or Cost/Barriers (with possible rationales)
		AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass	Baseline emission factor: Performance, penetration How: Baseline sample group to determine baseline efficiency and fuel; penetration (prevalence) of baseline technology (default value) Why: Distributed household appliances; users are not PPs; performance and penetration can reflect users' choice in baseline Additionality: Cost/barrier/size
	Water purification	AM0086: Distribution of zero energy water purification systems for safe drinking water	Baseline: Performance, penetration How: Average of the sample technology and fuel to boil water and penetration of project technology Why: Distributed household appliances; users are not PPs; performance and penetration can reflect users' choice in baseline. Additionality: cost/barrier, penetration How: AT, or improved drinking-water sources is equal to or less than 60 per cent
		AMS-III.AV: Low greenhouse gas emitting safe drinking water production systems	Baseline: Performance, penetration How: Average of the sample technology and fuel to boil water; penetration (prevalence) of baseline technology (default value) Why: Distributed household appliances; users are not PPs; performance and penetration can reflect users' choice in baseline Additionality: cost/barrier/size
	Appliances (refrigerator)	AM0070: Manufacturing of energy efficient domestic refrigerators	Baseline: Performance, penetration How: Performance is based on minimum of manufacturer benchmark and market benchmark of kWh/year*litre, penetration is based on the calculated figure using number of units sold in market and selected by national labelling scheme for each respective adjusted storage volume class and design (DC or FF), taking into account autonomous energy efficiency improvement (3.5% or average over 10 years) Why: Distributed household appliances; users are not PPs; performance and penetration can reflect users' choice in baseline. Additionality: same as baseline

Type	Sub-type	Methodology/Tool	Application of Performance Benchmarks, Penetration or Cost/Barriers (with possible rationales)
		AMS-II.O: Dissemination of energy efficient household appliances	Baseline: Performance How: Energy consumption corresponding to the benchmark rating based on EU labelling scheme (class A) Why: Class A of EU standard is presumed to be a very conservative baseline in a context of developing countries. Additionality: barrier/cost/size
	New buildings	AM0091: Energy efficiency technologies and fuel switching in new buildings	Baseline: For retrofitting/new, cost/barrier (AT) and modelling. For new buildings, performance. Investment analysis is mandatory for fuel switch measures How: benchmark from top 20% (based on number, and not output) from last 5 years for new building, but investment analysis is mandatory for fuel switch measures Why: Distributed sources; users are not PPs; performance and penetration can reflect users' choice in baseline. Fuel switch for new buildings is not likely to be additional Additionality: same as baseline
EE, service	IT	AM0105: Energy efficiency in data centres through dynamic power management	Baseline scenario: Cost/barrier (CT) Baseline emissions: penetration How: Survey for determining the market share of the baseline technology to discount baseline emissions Why: IT is a fast-evolving sectors prone to adopting new technologies Additionality: Cost/barrier (CT)
EE, supply side	Cogeneration	AM0102: Greenfield cogeneration facility supplying electricity and steam to a Greenfield Industrial Consumer and exporting excess electricity to a grid and/or project customer(s)	Baseline scenario: Cost/barrier (CT) Baseline emission factors: Performance How: Reference facility (least carbon intensive from five similar plants) to determine the baseline emission factors Why: Greenfield Additionality: Cost/barrier (CT)
	Higher efficiency fossil fuel power	ACM0013: Construction and operation of new grid connected fossil fuel fired power plants using a less GHG intensive technology	Baseline: performance, penetration How: Identification of the top 15% (based on the output delivered) performer plants Why: Greenfield & energy efficiency is likely to be cost effective; uncertainty with baseline emissions due to signal-to-noise issue. Additionality: Cost/barrier (AT)

Type	Sub-type	Methodology/Tool	Application of Performance Benchmarks, Penetration or Cost/Barriers (with possible rationales)
EE, own generation	Iron & steel heat	AM0095: Waste gas based combined cycle power plant in a Greenfield iron and steel plant	Baseline scenario: Cost/barrier (AT) Baseline emission factor: performance, penetration How: baseline efficiency is higher (Top 20% based on output delivered, highest of 3 manufacturers design efficiency) Why: Greenfield & energy efficiency is likely to be cost effective Additionality: Cost/barrier (AT)
	General	ACM0012: Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects	Baseline scenario: Barrier/cost/performance to identify baseline scenario Baseline emission factor: performance, penetration How: to determine the baseline WECM use in a greenfield plant, use the best among the >80% plants that partially recover WECM Why: Greenfield & energy efficiency is likely to be cost effective Additionality: Cost/barrier (AT) How: For greenfield, less than 20% facilities recover WECM fully Why: Greenfield & energy efficiency is likely to be cost effective
Renewables	Renewable power	AM0026: Methodology for zero-emissions grid-connected electricity generation from renewable sources in Chile or in countries with merit order based dispatch grid	Baseline emission factor: performance, penetration (Combined margin) Additionality: Cost/barrier (AT)
		ACM0002: Grid-connected electricity generation from renewable sources	Baseline emission factor: performance, penetration (Combined margin) Additionality: Cost/barrier (AT).
Biomass	Biomass power	ACM0018: Electricity generation from biomass residues in power-only plants	Baseline scenario: Cost/barrier Baseline emission factor: performance, penetration How: As one option to determine the baseline efficiency, use 37%/39% or the average efficiency of the top 20% of 10 facilities Why: lack of efficiency data Additionality: Cost/barrier

Type	Sub-type	Methodology/Tool	Application of Performance Benchmarks, Penetration or Cost/Barriers (with possible rationales)
Energy distribution	Efficient electricity distribution	AM0067: Methodology for installation of energy efficient transformers in a power distribution grid	Baseline scenario: Cost/barrier (CT) Baseline emission factors: performance, penetration How: baseline is determined as the min of average of top 20% of the transformers and national standard Why: distributed sources, energy efficiency measure likely to be cost effective, but faces barriers Additionality: Cost/barrier (CT)
	Connection of isolated grid	AM0104: Interconnection of electricity grids in countries with economic merit order dispatch	Baseline scenario: Survey for determining the market share of the baseline technology to discount baseline emissions Baseline emission factor: performance, penetration How: Baseline isolated grid emission factor using CM Additionality: Survey for determining the market share of the baseline technology to discount baseline emissions.
		AM0108: Interconnection between electricity systems for energy exchange	Baseline scenario: Barrier/cost/performance Baseline emission factor: performance, penetration How: OM & BM calculation for electricity emission factor Additionality: Cost/barrier (AT).
CO2 usage	CO2 recycling	AM0063: Recovery of CO_2 from tail gas in industrial facilities to substitute the use of fossil fuels for production of CO_2	Baseline scenario: Cost/barrier (CT) Baseline emission factor: For greenfield or expansion, performance, penetration How: weighted average (of baseline emission index and share of output) of minimum five similar plants Why: Greenfield/expansion Additionality: Investment analysis is mandatory
PFCs	PFCs	AM0111: Abatement of fluorinated greenhouse gases in semiconductor manufacturing	Baseline scenario: Cost/barrier (CT) Baseline emissions: penetration How: Survey for determining the market share of the baseline technology to discount baseline emissions Why: Semiconductor is a fast-evolving sectors prone to adopting new technologies Additionality: Cost/barrier (CT)
		AM0030: PFC emission reductions from anode effect mitigation at primary aluminium smelting facilities	Baseline/Additionality: performance, penetration How: min (benchmark, historical), benchmark is the minimum of the average values of the top 20% performing plants using the respective aluminium smelting technology. Why: data is available from IAI.

Type	Sub-type	Methodology/Tool	Application of Performance Benchmarks, Penetration or Cost/Barriers (with possible rationales)
		AM0059: Reduction in GHGs emission from primary aluminium smelters	Baseline scenario: Cost/barrier (CT) Baseline emission factor: for expanded capacity, performance, penetration How: average of the top 20% performing plants using the respective aluminium smelting technology Why: data is available from IAI Additionality: Cost/barrier (CT)
Cement	Clinker replacement	ACM0005: Increasing the blend in cement production	Baseline scenario: Cost/barrier (AT) Baseline emission factor: performance, penetration How: Survey for determining the market share of the clinker per tonne BC, lowest of (weighted average of top 5 plants, weighted average of top 20%, historical if existing plant) to discount baseline emissions Why: blending is like to be cost-effective Additionality: Cost/barrier (AT)
		ACM0015: Consolidated baseline and monitoring methodology for project activities using alternative raw materials that do not contain carbonates for clinker manufacturing in cement kilns	Baseline scenario: Cost/barrier (AT) Baseline emission factor: Several benchmarks for baseline parameters for Greenfield to be determined based on performance (depend on the parameter)and penetration (output of clinker facilities) How: raw materials from carbonated sources and a kiln technology with energy efficiency comparable to the average of the 20 per cent best performing plants established in the last five years identified in the region Why: Greenfield Additionality: Cost/barrier (AT).

1.1.1. Findings from the methodological analysis

3. Benchmark methodologies are developed widely in almost all sectors. There seem to be following reasons why the benchmark approaches are developed instead of other approaches to determine baseline:

   (a) Uncertainty with the historical baseline (AM0017);

   (b) Project technology is likely to be cost effective (energy efficiency measure AM0017, feedstock switch in ACM0015, ACM0013);

   (c) Determination of household energy efficiency (EE) (AM0046, AM0070) requires cohort study and cohort performance due to distributed nature of this sector;

   (d) Benchmarks better represent baselines for Greenfield or expansion projects (AM0063, AM0091, AM0095, AM0102, ACM0013, ACM0012);

(e) Issuance of credits for the project will be spread over the duration of the crediting period and for a fast evolving sector a dynamic benchmark is necessary to judge continuing eligibility of project to receive credits (AM0070);

(f) To assess whether the project activity exceeds what is the best performance in the respective market (AM0070).

4. It is evident from above that CDM methodologies have not followed similar approaches for baseline and additionality, even for similar project types or sectors which may raise concerns about overall consistency. This is probably because the CDM methodologies have been developed based on bottom-up submissions from project proponents considering the specific circumstances of their project activities. Following examples can be quoted on the inconsistencies:

(a) In case of efficient lighting CDM methodologies, while “AM0046: Distribution of efficient light bulbs to households” use a performance benchmark approach based on control group setting, “AM0113: Distribution of compact fluorescent lamps (CFL) and light-emitting diode (LED) lamps to households” and “AMS-II.J: Demand-side activities for efficient lighting technologies” determine the baseline based on current technology choices/emissions;

(b) Although it is understood that baseline and additionality are the two sides of same aspect and complement each other, they are determined by different approaches in the same methodology. For example, in a few cases, only additionality is demonstrated using standardized approach (performance, penetration etc) and baseline determination using historical emissions;

(c) Also, in some cases, the performance standard approach is used only for baseline setting, and in other cases, the performance approach is used for both baseline setting/additionality demonstration. And, in cases where the performance approach is used only for baseline setting, “Tool for the demonstration and assessment of additionality” is often used for additionality demonstration;

(d) How to calculate the performance benchmark is unique to the specific situation where the CDM methodology is developed. For example, the calculation of performance benchmark is different among ACM0002 “Grid-connected electricity generation from renewable sources”, ACM0013 “Construction and operation of new grid connected fossil fuel fired power plants using a less GHG intensive technology” and ACM0018 “Electricity generation from biomass residues in power-only plants”, although they belong to the same sector, i.e. the power sector:

(i) ACM0002: Combined margin of the grid tool;

(ii) ACM0013: Top 15% performer plants (baseline efficiency);

(iii) ACM0018: As one option to determine the baseline efficiency, use 37%/39% or the average efficiency of the top 20% of 10 facilities;

(e) In some methodologies, dynamic baselines are considered, due to several reasons such as: a) Project technology is likely to be adopted later (control group in AM0017, penetration of project technology in AM0086); b) Technology evolves

fast for IT technologies (penetration of baseline technology in AM0105, AM0111); c) Technology evolves fast for consumer products (3.5% or average over 10 years in AM0070); d) Technology evolves fast for the power sector (ACM0013);

(f) In some methodologies, investment analysis is mandatory because: a) Energy efficiency measures are likely to be cost-effective (AM0046, AM0102, ACM0013); b) Greenfield activities implying large investment based on economic rationale (AM0063, AM0102, ACM0013); c) Fuel switch measure for buildings (AM0091). However, there are some methodologies which do not require cost/barrier analysis for additionality. For example, additionality is demonstrated by criteria such as: improved drinking-water sources is equal to or less than 60 per cent (AM0086), Analysis to show barrier for project technology to develop automatic additionality criteria, high penetration of baseline scenario (ACM0022);

(g) Baseline emissions are calculated based on various stringency levels: usually top 20%, but sometimes average (AM0094,AM 0086,AM 00 63) 15% top (ACM0013), 50% (AM0109), 5% better than average (AM0017).

5. Based on these findings, the existing CDM methodologies do not show a consistent application of the three criteria (penetration, performance, costs/barriers) or their combinations to determine the benchmark for different project types and sectors. It is possible to conclude that performance and penetration are always used to determine the benchmark.

Appendix 3. Examples of application of approaches to develop standardized baselines

1. Example for the application of approach 1a: Cement clinker sector case study

1. The development of a sector wide emission factor (EF) and positive list for the clinker sector of Ethiopia (proposed standardized baseline PSB0002) based on data is presented in a step-wise manner below, as an example.

2. Step-1: Estimation of the sector wide baseline emission factor:

   (a) The emission factor per facility is calculated and arranged in the descending order of their carbon intensity, as shown in following table (table 1). The facility that lies on the 70 per cent represents the initial baseline for this sector. Table below identifies the facility "National Cement Rennovation Project" as the facility that falls on 70 Per cent. Therefore the baseline sector wide emission factor, based on initial baseline, for the proposed standardized baseline for Ethiopia is 1.079 tCO_2/t-clinker.

Table 1. Facility emission factors

Facility	Clinker output	Specific emissions from clinker production (tCO2/t-clinker)	cumulative production	% cumulative production
East Cement	19434.700	1.301	19434.700	4.10
Pioneer cement	26720.885	1.273	46155.585	9.74
Huang Shang Cement plc	95000.000	1.180	141155.585	29.80
Debresina Business Industries plc phase I	20176.667	1.175	161332.252	34.06
Abyssinya Cement plc I phase and phase II	38805.667	1.136	200137.918	42.26
CH Clinker	14700.000	1.128	214837.918	45.36
Jema Cement plc I phase and II phase	99000.000	1.083	313837.918	66.26
National Cement Rennovation Project	112538.6667	1.079	426376.585	90.02
Derba Dashen Cement	47257.333	1.073	473633.918	100

3. Step-2: Determination of positive list:

   (a) Whence approved, any project activity that applies this standardized baseline should have emissions less than the baseline emission factor, i.e. 1.079 tCO_2/t-clinker;

(b) Project activities can implement either one measure or combination of measures in a project activity. For example only fuel switch or feedstock switch or combination by selecting fuel/feedstock/technology from the positive list:

(i) Positive list for fuels[6]:

a. In the determination of positive list of fuels the fuels are ranked in terms of their cost attractiveness and the fuels which meet following conditions are included in positive list which meet both the conditions stated below:

i. Fuels that have a cost higher than a subset of fuels which contribute to at least 30 per cent of the sector; and

ii. Fuels with a lower emission factor than the emission factor of the fuel of baseline facility;

b. For the PSB0002 the positive list for the fuels is defined by the 'fuel or combination of fuels whose emission factor is less than 92.62 tCO_2/TJ and cost is more than 28 USD/TJ' (based on lowest cost of any combination producing 30% output);

c. 92.62 tCO_2/TJ is the emission factor of the fuels used at the facility which is at 70 per cent threshold, i.e. the National Cement Rennovation Project (that uses 27 per cent HFO and 73 per cent coal with emission factors of 77.4 and 98.3 tCO_2/TJ respectively) (*see Table-2 below*);

d. Lowest cost of fuel in a subset of fuels representing 40.96% of output is 28 USD/TJ (*see Tables-2, 3 and 4 below*);

e. Possible example of positive list is: (a) HFO, (b) HFO with Coal in combinations, which meets the above requirements, (c) other alternate fuels.

Table 2. Associated fuel costs (<u>assumed</u>)

Fuel	Cost of fuels (USD/TJ)	NCV GJ/t fuel	EF (tCO2/TJ)
HFO	60	40.19	77.4
Coal	30	25.8	98.3
Pet coke	28	32.5	97.5

[6] As mentioned in section 3.1 of main text that Meth Panel and Secretariat are still discussing options for development of positive lists using approach 1(a), this example for positive list indicates only one of the options under consideration.

Table 3. Fuels costs per facility based on weighted averages of fuels used

Facility, *j*	Facility	Clinker output (t-clinker)	Contribution in production (%)	Fuel costs (tCO2/TJ)
1	East Cement	19434.700	4.10	60
2	Pioneer cement	26720.885	5.64	28
3	Huang Shang Cement plc	95000.000	20.06	28
4	Debresina Business Industries plc I phase	20176.667	4.26	28
5	Abyssinya Cement plc I phase and II phase	38805.667	8.19	28
6	CH Clinker	14700.000	3.10	28.77
7	Jema Cement plc I phase and II phase	99000.000	20.90	28
8	National Cement Rennovation Project	112538.667	23.76	38.16
9	Derba Dashen Cement	47257.333	9.98	28

Table 4. Sample combinations producing the 30 per cent output in baseline and cost

Plant nos. (constituting 30% of baseline segment)	**Total production (%)**	**weighted average Cost of fuel**
1,2,3,4	34.063	31.85
1,3,4,5	36.614	31.59
1,3,4.6	31.525	32.2
3,4	40.960	28
Other combinations		

4. In the similar fashion, as above, the positive list for feedstocks and technologies should be determined.

5. It is clear from the final positive lists of fuels, feedstocks and technologies that the facility “Debresina Business Industries plc I phase” with lower emission factor than the baseline emission factor has implemented technology or fuel or feedstock from positive lists. Therefore the initial baseline at 70% threshold is considered to be final, as the baseline does not shift anymore to cleaner facility.

2. Example for the application of approach 2a: Household sector

6. Data presented in table 5 and 6 tinclude usage of different fuels in the households sector of a country, the energy generated by each fuel and the cost per unit energy for each fuel for each year.

7. To establish the standardized baseline for fuel switch measure, it is essential that the fuels are switchable among the households (e.g. boiler in the building). It is safe to assume that the households using fuel oil, kerosene and LPG can use each of these fuels interchangeably.

8. From the costs of fuels per unit of energy (table 5) and emission factors of fuels (table 6) it is clear that the cost of fuel increases with the decrease in carbon intensity of fuels sources.

9. Table 6 demonstrates that when the fuels are ranked on the descending order of carbon intensity, at 90th percentile the fuel that falls is LPG. Therefore the baseline fuel emission factor applicable to the fuel switch projects in the sector is 0.0616 tCO2/GJ. All the fuels/energy sources cleaner than LPG, although not available in the household sector of the country[7], will be the part of positive list of fuels/energy sources.

Table 5. Energy consumptions and costs of fuels in the household sector of a country

	unit	2009	2005	2001
Fuel oil	GJ	6.17E+08	9.08E+08	7.50E+08
Kerosene	GJ	2.53E+07	2.11E+07	5.28E+07
LPG	GJ	5.19E+08	5.49E+08	4.01E+08
cost per unit of energy				
Fuel oil	USD /GJ	16.61	14.04	8.42
Kerosene	USD /GJ	19.34	11.37	9.85
LPG	USD /GJ	21.71	20.03	13.96

Table 6. Cumulative energy production based on emission factors of fuels

fuel	**EF**	**cumulative energy delivered (GJ)**			**cumulative energy delivered (%)**		
		2009	2005	2001	2009	2005	2001
Fuel oil	0.0726	616,628,080	908,048,200	749,667,700	53.09%	61.43%	62.28%
Kerosene	0.0708	641,968,960	929,165,600	802,461,200	55.27%	62.86%	66.67%
LPG	0.0616	1,161,457,000	1,478,218,000	1,203,691,800	100.00%	100.00%	100.00 %

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[7] The positive list can cover technologies/fuels/feedstocks which are less carbon/energy intensive than baseline, however are not available in the country.

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