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DRAFT GUIDELINE FOR DETERMINATION OF BASELINE AND ADDITIONALITY THRESHOLDS FOR STANDARDIZED BASELINES USING THE PERFORMANCE-PENETRATION APPROACH

I. Introduction

1.   These Guidelines propose a step-wise approach for the determination of suitable thresholds for baseline and additionality for standardized baselines that can be used to calculate baseline emissions and demonstrate additionality of CDM projects, while ensuring environmental integrity. The approach can be used for the development of thresholds for the bottom-up submissions of standardized baselines to the Board by Parties, project participants, as well as international industry organizations or admitted observer organizations, through DNA. The guidelines can also be used by the Board for the development of the top-down thresholds on baseline and additionality for specific categories of sectors/countries and for the assessment of the proposed thresholds.

II. Scope

A. Scope

2.   This Guideline presents the Performance-Penetration Approach to determine the suitable thresholds for baseline and additionality for the measure of "technology switch" (referred as Ya and Yb in the SB guidelines), which is required to the development of standardized baselines. The draft Guideline summarizes the rationale for this approach, followed with step-wise explanation and interpretation of the outcome derived from the approach. It also covers scenarios where disaggregation will be needed in order to define the thresholds more appropriately.

B. Applicability

3.   The approach presented in these guidelines can be used by the developers of standardized baseline (the SB developers or the Board) in determining the suitable thresholds for baseline and additionality for the measure of "technology switch". If the approach elaborated in these guidelines is used in the development of thresholds for the standardized baseline that is submitted by DNA to the Board, the document will also provide the basis for the evaluation of thresholds for the Board and its supporting structures.

4.   The approach presented in the guidelines is not mandatory and it may not apply to the "technology switch" measure in some sectors/countries. In such a case, Parties, project participants, as well as international industry organizations or admitted observer organizations may decide to propose new approaches for consideration by the Board, through DNA. The Board may also decide to develop alternative approaches in the future, for all the measures covered under SB guidelines.

C. Entry into force

5.   These Guidelines will enter into force immediately after the Board approves this draft.

III. Definitions

6.   For the purpose of this guideline, all definitions contained in the SB guidelines and those provided below apply:

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(a) **Performance-Penetration Curve** is a two-dimensional curve plotted to reflect the performance and penetration of the technologies being used in a sector for producing a specific output (e.g., cement) in a host country. In particular, the technology penetration is shown in a cumulative format in X-axis denoting the relative contributions to the production of the output by different technologies, and the performance information is reflected in Y-axis denoting the technologies defined by their relative emission factors (e.g., ton-CO2/ton-Output) and ranked in descending order (i.e., cleaner technology is closer to the origin). Both parameters are plotted on X and Y-Axis, on a scale of 0 to 100% (refer figure-2 in Annex 1). The performance-penetration curve is based on design performance and actual output data based on most recent three years data at the time of development of thresholds. For those technologies which do not have three years output data, use all the data that is available.

(b) **Performance-Penetration Approach** is the approach provided in this document for determining the thresholds for baseline and additionally for standardize baseline, which is based on the Performance-Penetration Curve (hereafter referred to as the approach).

IV. Rationale of the Performance-Penetration Approach

7.   The purpose of performance-penetration approach is to identify common practice technologies in a particular sector of a specific country. The broad assumption of this approach is that when the performance-penetration curve is plotted for a sector, the segment of technologies significantly contributing to the output of the sector with similar performance levels have a relatively "flat" slope on the curve, and that the technologies included within this segment can be defined as common practice technologies. Therefore, the primary aim of this approach is to capture the "flat" segment (referred to as "common practice segment" hereafter) on the curve (refer figure 2 of Annex 1). The common practice segment further facilitates to define the thresholds on baseline and additionality for developing the standardized baselines.

V. Steps for defining the Ya and Yb using Performance-Penetration Approach

8.   The following steps should be applied to define the thresholds of Ya and Yb in setting the standardized baseline:

(a)   Step 1: Construction of the Performance-Penetration Curve

(b)   Step 2: Identification of the Common Practice Segment

(c)   Step 3: Setting the threshold

A. Step-1: Construction of the Performance-Penetration Curve

9.   In order to establish standardized baselines, the standardised baseline developers should collect relevant data, including design performance data of technologies and their respective production data. Based on those data, the Performance-Penetration Curve will be constructed. Detailed sub-steps are described as following:

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(a)   Define the list of technologies used to produce the output in the sector;

(b)   Collect the performance data[1] on emission factors (EF) of the technologies, based on manufacturer's design performance as well as their respective production data;

(c)   Convert the data from absolute terms to relative terms. For performance calculate the relative emission factors (%) of each technology against the maximum emission factor in the range (most carbon intensive technology), then set the minimum emission factor (cleanest technology) as a percentage of maximum emission factor at origin and the maximum emission factor at 100% on the Y-axis. For penetration, calculate the relative contributions (%) of each technology in the total output production and put on a cumulative scale on X-axis, with range denoting 0 to 100% output.

(d)   Identify different technologies with the same performance (e.g., with the same emission factor) and consider them as one same group of technologies. Thus, they should be plotted against one data point on the curve. Draw a horizontal line starting with the first data point (of the least clean technology) and intercepting the Y-axis, this interception point serves the starting point of the performance-penetration curve.

(e)   After constructing the curve, if it is found that highly inefficient technologies with low penetration (on the extreme left side of the performance-penetration curve) exist in the sector, following sub-steps should be followed:

   (i)   Determine the percentage penetration and performance range of such inefficient technologies.

   (ii)   Check if the technologies have 5% or less penetration and have range of emission factor more than 10% of the total range of emission factor.

   (iii)   If such technologies exist, remove them from the list of technologies and reconstruct the performance-penetration curve.

B. Step 2: Identification of the Common Practice Segment

10.   Once the performance-penetration curve is constructed, the following sub-steps should be followed to identify the common practice segment:

(a)   Follow the data points (including the starting point intercepted on Y-axis) on the curve closely. In order to identify the common practice segment, move along the curve from left to right or right to left and identify all the pairs of data points on the performance-penetration curve that comply with the following two conditions. Refer to the figure-2 in Annex-1 below.

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[1] As per the guidelines for establishment of sector specific standardised baselines, technologies are integrated with particular energy source (e.g. in power sector combined cycle power plant cannot operated without a particular energy source i.e. natural gas) or not (e.g. cement kiln can be operated with many combinations of energy sources). For those technologies which are not integrated with a particular energy source, collect design specific energy consumption data (e.g. GJ/ton-cement) on technologies and convert them into emission factor (e.g., kg-CO_2/ton-cement) of the technologies based on emission factor of a fuel (e.g. kg-CO_2/GJ). A common reference fuel should be identified to convert the specific energy consumption to the emission factor of all the technologies.

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(i)   Segment intercepted by two data points covering a minimum of 50% output, e.g., for two selected data points pair (x_1, y_1) and (x_n, y_n), $x_n - x_1 \geq 50\%$. The aim is to cover technologies that collectively contribute 50% output. However, it may lead to selection of data points which increases the coverage of segment beyond 50% of output if one could not find the segment exactly matching 50% on the curve.

(ii)   The range of emission factor (EF) is less than or equal to 20% of total range of emission factors, e.g., for two selected data points pair (x_1, y_1) and (x_n, y_n) the following condition should be satisfied: $y_1 - y_n \leq 20\% \times (y_{max} - y_{min})$[2]. The aim is to cover technologies that have similar performance levels.

(b)   Repeat this exercise for all the pairs of data points while moving on curve from left to right and right to left and while complying with above conditions. In case, none of the pairs of data points complying with the above conditions can be identified, proceed with Scenario 2 in Step 3 directly.

(c)   The segment intercepted on the curve by the two data points will be the common practice segment, provided that the slope of this segment is the least among the slopes of all the segments identified in Step (b) above.

(d)   In case multiple segments are found which have the same slope, select the segment on the right most direction on the curve, in order to be conservative.

11.   High penetration of the technology demonstrates high availability of the technology in the sector. However, in specific circumstances of the host country/sector, some of the technologies in the common practice segment are not available any more. In such cases, this approach should be applied by removing the technologies from the available data and reconstructing the curve with the remaining technologies and identifying the common practice segment in the new curve.

12.   The above steps are illustrated in figure-1 below. As illustrated, consider a box (with a dimension of 50% length and 20% width[3]) moving along the curve to identify segments. The figure on the left shows no segment identified, but the figure on right identifies one segment that meets two conditions as described in paragraph 10 (a). A further example applying the above steps is included in Annex 2.

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[2] y_{max} and y_{min} are the highest and lowest emission factors in the curve.

[3] 20% of total range of the emission factors, i.e., range between y_{max} and $y_{min.}$

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Figure 1
Performance-penetration curve with illustrative segment boxes
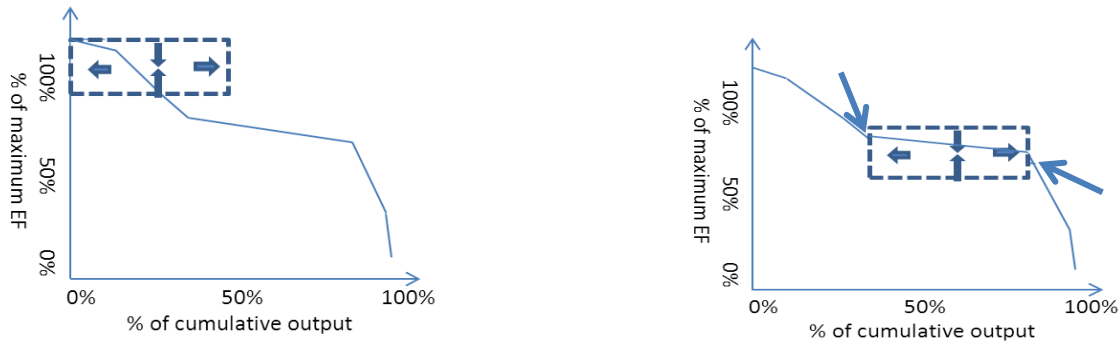
C. Step 3: Setting the thresholds

13. Thresholds of Ya and Yb are defined separately for two possible scenarios depending on the outcome of Step 2 above.

14. **Scenario 1:** If it is established that the common practice segment exists in a sector (or sub-sector) by following Step 2, set the threshold on the X-Axis that corresponds to the weighted average of emission factors of those technologies contributing to the production of least carbon intensive 20% of the cumulative output in the common practice segment. If there is only one technology in the common practice segment, use emission factor of that technology to determine the threshold. It is important to note that weighted average emission factor should be calculated using only 20% output and the corresponding emission factors of technologies, even if the output produced by the most carbon intensive technology contributing to the 20% output is not fully covered in the 20% output range. The weighted average should be based on emission factors of technologies and the weights of their output produced. The technology corresponding to this emission factor is set as the baseline technology and its emission factor is the baseline emission factor and those technologies beyond the baseline technology on the performance-penetration curve constitute the positive list[4]. The cumulative output (on the X-axis) corresponding to baseline technology sets the threshold that applies to both Ya and Yb.

15. In case the cleanest technology on this segment produces output of more than 20% of the total output produced by technologies in the common practice segment, set the threshold at the cumulative output generated using the cleanest technology. In the figure 3 provided in Annex 2, the cleanest technology in the common practice segment contributes to 18% of the output generated by all technologies included in the common practice segment (total output covered by the segment is 55%), therefore weighted average emission factor of last two technologies will be determined (note: the second technology only contributes 2% to calculate the weighted average emission factor, in order to calculate emission factor of cleanest 20% output produced).The cumulative output (on the X-Axis)

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[4] According to the SB guidelines, technologies on the positive list will be additional only when it can also be demonstrated that they are facing barriers or are less commercially attractive than all of those technologies which are before the threshold.

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corresponding to the weighted average emission factor of the last two technologies will depict the threshold for both Ya and Yb, and the specific technology corresponding to that threshold is regarded as baseline technology. All the technologies beyond this point (i.e. on the right of the baseline technology on the curve), are in positive list, as long as the requirements stipulated in SB guidelines are met (refer footnote 7).

16.   *Interpretation of this threshold:* There is considerable output produced in the sector (equal to or more than 50% of total output) that has low change in performance (equal to or less than 20% of total emission factor range). Therefore, the technologies performing in this range of emission factor have large penetration and are regarded as common practice in this sector of host country. The technology that has emission factor equivalent to the weighted average emission factor of technologies that provide the cleanest 20% of output generated from the common practice segment is regarded as the baseline technology that would have been implemented in absence of CDM.

17.   **Scenario 2:** It is possible that the common practice segment is not identifiable for a sector, for example due to the fact that no segment can be defined between two data points that represent 50% or more cumulative output and have range of emission factor of 20% or less. In such case, the standardized baseline developer should adopt the interim values of thresholds set by the Board (i.e., 80% for priority sectors, and 90% for remaining sectors, for both Ya and Yb).

D.   Application to sectors showing staggered performance-penetration curve

18.   The above approach of identification of common practice segment cannot be applied directly for sectors for which the performance-penetration curve is staggered (refer figure 4 in annex 3). For example, one of the following scenarios can depict the staggering of the curve: (i) multiple inflexion points are found in the curve; and/or (ii) the technology at one step is not comparable with technology at another step; for example performance of natural gas based combined cycle power plant (CCGT power plant) is not comparable with performance of super critical coal-based power plant in the case of power sector, because any improvement in the efficiency of a coal based supercritical power plant cannot improve the emission factor to the level of a CCGT power plant. It implies that the technologies before the inflexion point will not be able to achieve the performance of those technologies after the inflexion point. Therefore if a threshold is created without disaggregation for the entire sector, it would create disincentives for the projects that aim to improve the performance of those plants which are at the point on curve before the inflexion point. Therefore such sector has to be first disaggregated into sub-sectors, and thereafter the above approach can be applied to each disaggregated sub-sector to determine baseline and additionality thresholds (refer figure 5 and 6 in annex 3 for illustration).
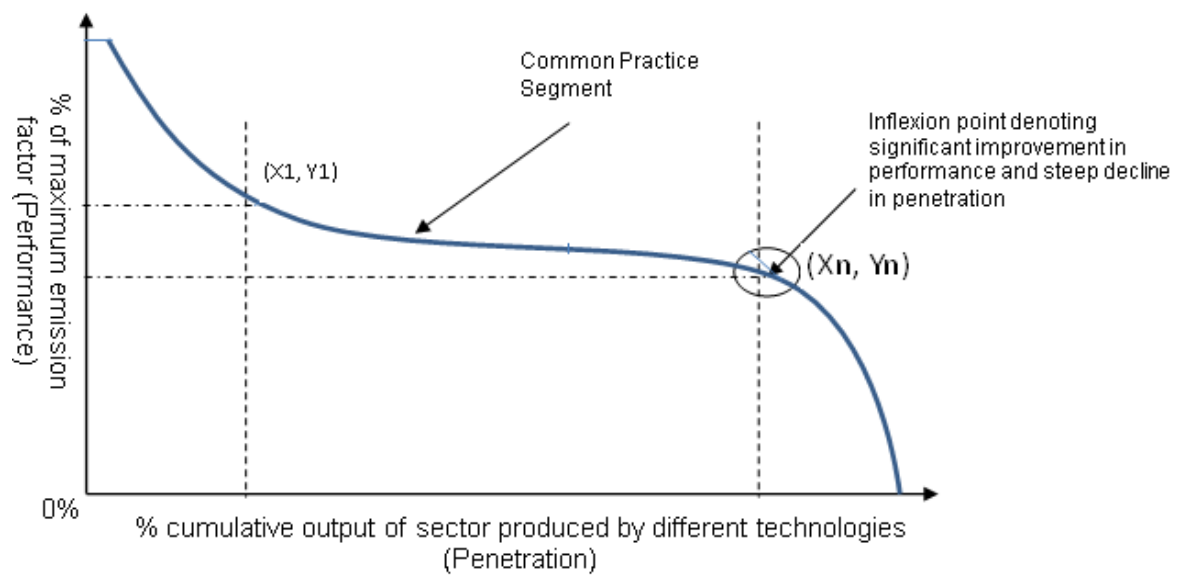
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Appendix 1

Performance-penetration curve

Figure 2
Illustration of performance-penetration curve
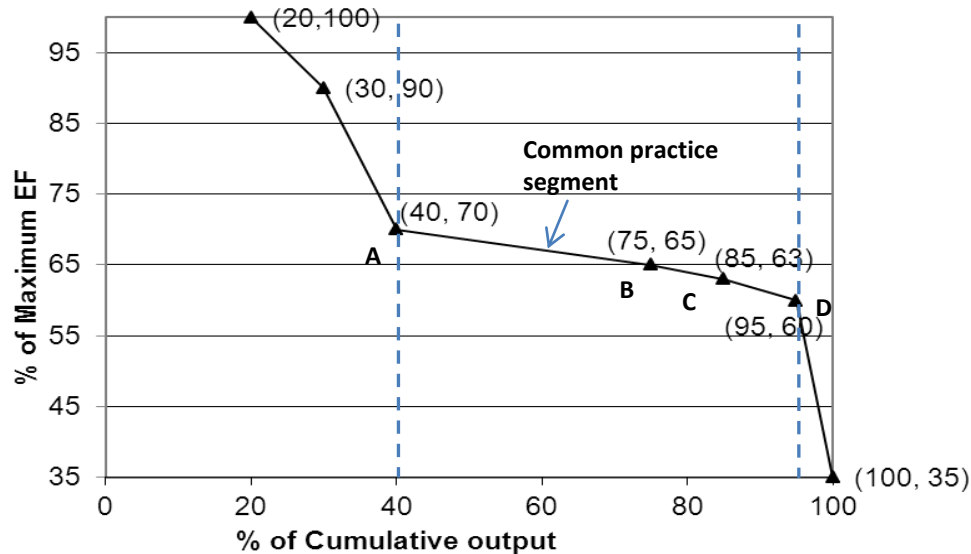
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Appendix 2

Example for identifying common practice segment

1.   Consider the figure 3 below representing the performance-penetration curve of a sector. The segment intercepted by green lines has been finalized as common practice segment after carrying out several iterations across the curve. The rationale for selection of this segment is following:

2.   The data pair comprising of point A (40%, 70%) and point D (95%, 60%), output coverage is 55% (95%-40%=55%) and variation is 15.38% (70%-60%)/(100%-35%)=15.38%). This slope (dy/dx) is lowest among all the pairs of data points complying with the conditions stipulated in paragraph 10.a. Therefore A-D is the common practice segment.
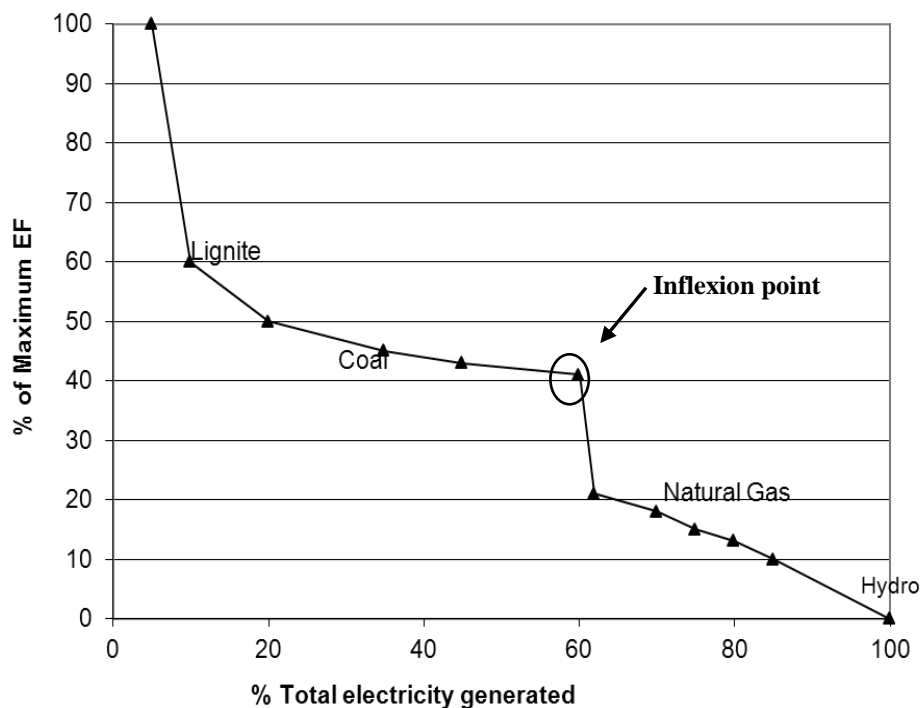
Figure 3
Identification of common practice segment

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Appendix 3

Example of staggered performance-penetration curve and its disaggregation

1.   Figure 4 below serves as an example of performance-penetration curve for power sector in a country. Due to the differences in the use fuel types, the curve shows a staggered shape. One inflexion point followed with significant reduction in the technology emission factor is found as shown in the figure.

2.   In this example, the performance-penetration curve should be disaggregated first before the approach provided in this document can be applied. As a result, the power sector of country A is disaggregated into two sub-sectors based on the fuel types, i.e., disaggregated sub-sector A in figure 5 and disaggregated sub-sector B in figure 6. The above approach defined in this document can be applied to each sub-sector.

Figure 4
Example Performance Penetration Curve of power sector of Country A

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Figure 5
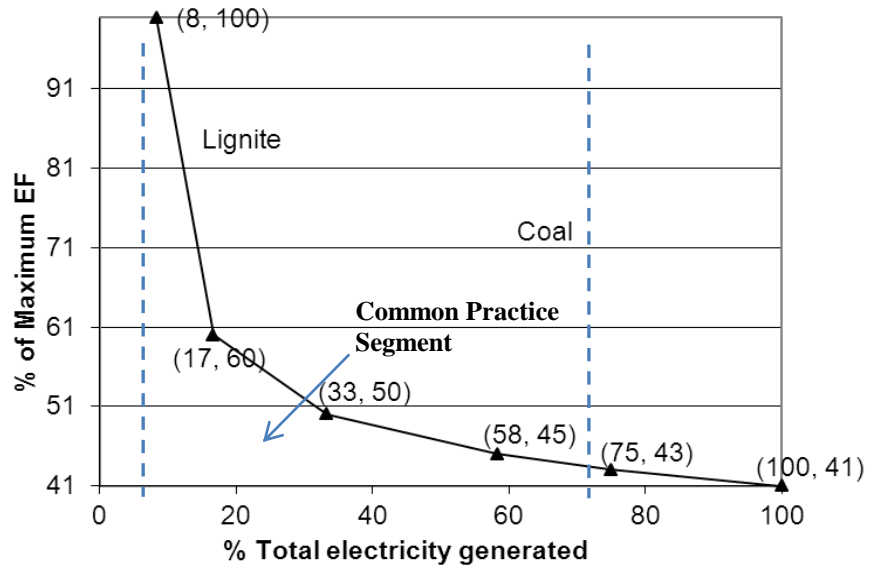**Disaggregated curve of power sector based on fuel type (sub-sector A)**

Figure 6
Disaggregated curve of power sector based on fuel type (sub-sector B)