Methodological Tool

“ Draft tool for baseline emissions calculation”

(Version 01)

I. SCOPE AND APPLICABILITY

The tool provides a general framework for the calculation of the baseline emissions in case the baseline is (i) historical or actual emissions or (ii) benchmark emissions.

Project participants may also propose other procedures or tools for calculation of baseline emissions to the CDM Executive Board (EB) for its consideration.

In validating the application of this tool, Designated Operational Entities (DOEs) should carefully assess and verify the reliability and credibility of all data, rationales, assumptions, justifications and documentation provided by project participants.

II. METHODOLOGY PROCEDURE

II.1. Baseline emissions calculation for historical and actual emissions

The continuation of historical or current situation is identified as baseline in the following cases:

- MABS 1: Fuel and feed-stock switch
- MABS 2: Energy efficiency improvement
- MABS 3: GHG destruction and GHG use avoidance
- MABS 4: GHG formation avoidance

II.1.1. Fuel switch

For fuel swich projects, only the amount of output produced by the project up to the pre project level can have as baseline the historical or current situation.

Determine the pre project amount of output produced based on the three most recent years of historical activities unless otherwise defined in the methodology.

Determine F_{pmax} the quantity of project fuel that deliver the pre project output. Fmax is determined once before the project.

$F_b = \min (F_{py}, F_{pmax})* NCV_{Fp}/ NCV_{Fb}*\eta_p/\eta_b$

F_b = Quantity of baseline fuel tonne/year

F_{py} = Quantity of fuel consumed by the project during year y in tonne/year

NCV_{Fp} = Net calorific value of the project fuel

NCV_{Fb} = Net calorific value of the baseline fuel

η_p = efficiency of the energy recovery for fuel switch under the project scenario

η_b = efficiency of the energy recovery for fuel switch under the project scenario

F_{py} , NCV_{Fp} , NCV_{Fb}, η_p are monitored.

The carbon emission factor of the baseline fuel CEF_{Fb} is used to calculate the baseline emissions

$BE = F_b * CEF_{Fb}$

BE = Baseline emissions in tCO2/year

CEF_{Fb} = Carbon emission factor of the baseline fuel in tCO2/tonne of fuel

The remaining issue is how to calculate η_b

II.1.2. Feed stock switch

For feed stock swich projects, only the amount of output produced by the project up to the pre project level can have as baseline the historical or current situation.

Determine the pre project output based on the three most recent years of historical activities unless otherwise defined in the methodology.

Determine F_{pmax} the quantity of project feed stock that deliver the pre project output. Fmax is determined once before the project.

$F_b = \min(F_{py}, F_{pmax}) * RMC_{Fp} / RMC_{Fb} * \eta_p / \eta_b$

F_b = Quantity of baseline feed stock tonne/year

F_{py} = Quantity of feed stock consumed by the project during year y in tonne/year

RMC_{Fp} = Relevant matter content of the project feed stock

RMC_{Fb} = Relevant matter content of the baseline feed stock

η_p = efficiency of the recovery of the relevant mass content of the project scenario feed stock

η_b = efficiency of the recovery of the relevant mass content of the project scenario feed stock

F_{py} , RMC_{Fp} , RMC_{Fb}, η_p are monitored.

The carbon emission factor of the baseline feed stock CEF_{Fb} is used to calculate the baseline emissions

$BE = F_b * CEF_{Fb}$

BE = Baseline emissions in tCO2/year

CEF_{Fb} = Carbon emission factor of the baseline feed stock in tCO_2/tonne

The remaining issue is how to calculate η_b

II.1.3. Energy Efficiency Improvement

For energy efficiency improvement projects, only the amount of output produced by the project up to the pre project level can have as baseline the historical or current situation.

Determine the baseline output based on the three most recent years of historical activities unless otherwise defined in the methodology.

Determine E_{pmax} the energy consumption under the project that deliver the pre project amount of output

$E_{by} = \min(E_{py}, E_{pmax}) * SEC_b / SEC_p$

E_{by} = Quantity of baseline energy that would have been consumed in GJ/year

E_{py} = Quantity of energy consumed by the project during year y in GJ/year

SEC_b = Specific energy consumption under the baseline scenario

SEC_p = Specific energy consumption under the project scenario

E_{py}, E_{pmax}, SEC_p are monitored.

The emission factor of the baseline energy consumed EF_{Eb} is used to calculate the baseline emissions

$BE_y = E_{by} * EF_{Eby}$

EF_{Eby} is calculated based on the historical data in tCO_2/MWh.

- Case of heat produced through a heat only generation process

EF_{Eby} is calculated using the quantity of fuel i F_{iy} consumed during year y, their carbon emission factor CEF_i and the quantity of heat generated during year y E_y

- Case of power produced through a power only generation process

If the electricity is generated from a captive power plant, then EF_{Eby} is calculated using the quantities of fuel i F_{iy} consumed during year y, their carbon emission factor CEF_i and the quantity of electricity generated during year y E_y.

If the electricity is generated from the grid, the emission factor EF_{Eby} is the emission factor of the grid

- Case of heat H or power P produced through a cogeneration process

Determine the ratio $r_y = H_y*(1- T_a/T_{av,y})/P_y$ that compares the exergy content of the heat and the power produced during year y

H_y = Heat generated by the cogeneration system during the year y in MWh

P_y = Power generated by the cogeneration system during the year y in MWh

T_a is the ambient temperature

$T_{av,y}$ is the weighted average temperature of the heat

$T_{av,y} = \sum_i H_{y,i} * T_i / H_y$

$H_{y,i}$ = Quantity of heat which temperature is in the i^{th} interval of 2°C length between T_{max} and T_{min} (between T_i and T_i + 2°C) produced by the cogeneration system during year y

T_{max} is the maximum temperature of the heat supplied by the cogeneration system during year y

T_{min} is the minimum temperature of the heat supplied by the cogeneration system during year y

T_i average temperature in the ith interval (T_i and T_i + 2°C) of temperature between T_{min} and T_{max}.

F_{yi} and CEF_i are the quantity of fuel i consumed by the cogeneration system during year y and their carbon emission factor:

The quantity of CO_2 emissions related to the production of heat by the cogeneration system is:

$\sum_i F_{yi} * CEF_i * r_y$

The emission factor of the heat produced from the cogeneration system is:

$EF_{Hby} = \sum_i F_{yi} * CEF_i * r_y / H_y$

The quantity of CO_2 emissions related to the production of power by the cogeneration system is:

$\sum_i F_{yi} * CEF_i * (1 - r_y)$

The emission factor of the power produced from the cogeneration system is:

$EF_{Pby} = \sum_i F_{yi} * CEF_i * (1 - r_y) / P_y$

The remaining issue is how to calculate SEC_b?

II.1.4. Calculation of historical performance (i) η_b for fuel/feed-stock switch or (ii) SEC_b for energy efficiency improvement or (iii)emission factor EF_b (tonne GHG/tonne of output) for industrial gas destruction or GHG use

Different approaches for the determination of historical or current performances are to be considered:

a. Fixed performance determined once before the project and not monitored

This performance is specific to the pre project condition and cannot be updated at the renewal of the crediting period. This approach can only be used in the following conditions:

- the baseline technology is not expected to change significantly during the crediting periods and /or its change might not affect the baseline emission (the acceptable level of increase of the benchmark performance is to be defined in the methodology)
- the operating conditions during the project scenario can be kept comparable to the operating conditions during the baseline scenario,

- the baseline conditions cannot be reproduced during the project

The industrial gas facilities do not comply with these requirements. In case a fuel/feed-stock switch project or an energy efficiency improvement project complies with these requirements, the historical performance η_b or SEC_b can be defined once before the project implementation.

The project participants will claim no emission reduction if the operating conditions during the project differ from the operating conditions under the baseline. The thresholds are to be defined in the methodology depending on the sensitivity of the variation of the operating parameters on the emission reductions.

b. Conduction of campaigns to determine the baseline performances before the project implementation

This is applicable under the following conditions:

- the technology is not expected to change significantly during the crediting periods (the acceptable level of increase of the average performance of the technology is to be defined in the methodology)
- the operating conditions cannot be kept in a narrow range of variation during the project operation (case of facilities having equipments such as heat exchangers or catalysts which performances evolve with time and might affect the emission factor of the installation)
- the baseline conditions cannot be reproduced during the project.

It is of the utmost importance with this approach to identify all the influencing operating parameters which variation might affect η_b or SEC_b and their possible range of variation during the project. If the number of influencing parameters that might affect η_b or SEC_b are limited (less than N to be defined) and if their range of variation is narrow (Normal value + or - X%), the baseline performances could be determined through the conduction of campaigns. During these campaigns, the performances under the baseline scenario η_b or SEC_b or EF_b are determined when the influencing operating parameters vary in their possible range of variation during the project.

The project proponent might decide to use conservatively the highest performance obtained during the campaign. This is the simplest approach. They might also use the outcome of the campaign to determine for each operating condition under the project scenario, the corresponding value of η_b or SEC_b or EF_b.

The project participants will claim no emission reduction if the operating conditions during the project differ from the operating condition under the baseline. The thresholds are to be defined in the methodology depending on the sensitivity of the variation of the operating parameter on the emission reductions.

c. Conduction of campaigns to determine the baseline performances during the project

This case applies under the following conditions:

- The performances η_b or SEC_b under the baseline scenario are influenced by parameters that cannot be kept within a given range of values for which a campaign might be conducted before the project.
- The conditions of the baseline scenario can be reproduced under the project scenario.

The industrial gas facilities do not comply with the second requirement because the measurement of the GHG concentration at the stack under the baseline scenario would require to by-pass the GHG destruction equipment.

After a change in the configuration of the project operating conditions, the baseline performances are to be determined under the new configuration. The change might be related to a variation of the quality of the feedstock or the quality of the outputs. It might also be the consequence of a decrease of performance of an equipment like the scaling of a heat exchanger or a catalyst. Finally, it might also be a variation of the operating parameters.

If a new configuration under the project leads to X% of difference of performance as compared to previous conditions, then it is a change of configuration.

d. Autonomous improvement of the efficiency

For cases where the path of efficiency improvement can be anticipated, an autonomous improvement factor shall be used to define the baseline efficiency for each year of the project.

e The baseline performance is considered higher than a benchmark performance

This approach might be used in all cases particularly if the equipment has a short lifetime and/or the technology it uses might improve significantly during a crediting period. It shall be applied for the destruction of industrial gases. The performance of the baseline equipment is considered higher than a benchmark performance that is to be updated.

This requires the development of a tool for benchmarking (see the tool for benchmarking).

II.1.5. Determination of historical emission for GHG formation avoidance

The emission factor is determined based on the latest version of the IPCC Guidelines

II.1.6. Determination of historical emission factor EF_b (tonne GHG/tonne of output) for displaced output

a. In case the displaced output is energy.

EF_{Eby} is calculated based on the historical data in tCO2/MWh.

- Case of heat produced through a heat only generation process

EF_{Eby} is calculated using the quantity of fuel i F_{iy} consumed during year y, their carbon emission factor CEF_i and the quantity of heat generated during year y E_y

- Case of power produced through a power only generation process

If the electricity is generated from a captive power plant, then EF_{Eby} is calculated using the quantities of fuel i F_{iy} consumed during year y, their carbon emission factor CEF_i and the quantity of electricity generated during year y E_y.

If the electricity is generated from the grid, the emission factor EF_{Eby} is the emission factor of the grid calculated using the tool for grid EF calculation

- Case of heat H or power P produced through a cogeneration process

Determine the ratio $r_y = H_y*(1- T_a/T_{av,y})/P_y$ that compares the exergy content of the heat and the power produced during year y

H_y = Heat generated by the cogeneration system during the year y in MWh

P_y = Power generated by the cogeneration system during the year y in MWh

T_a is the yearly average ambient temperature

$T_{av,y}$ is the weighted average temperature of the heat

$T_{av,y} = \sum_i H_{y,i}*T_i/H_y$

$H_{y,i}$ = Quantity of heat which temperature is in the i^{th} interval of 2°C length between T_{max} and T_{min} (between T_i and T_i + 2°C) produced by the cogeneration system during year y

T_{max} is the maximum temperature of the heat supplied by the cogeneration system during year y

T_{min} is the minimum temperature of the heat supplied by the cogeneration system during year y

T_i average temperature in the ith interval (T_i and T_i + 2°C) of temperature between T_{min} and T_{max}.

F_{yi} and CEF_i are the quantity of fuel i consumed by the cogeneration system during year y and their carbon emission factor:

The quantity of CO_2 emissions related to the production of heat by the cogeneration system is:

$\sum_i F_{yi} * CEF_i * r_y$

The emission factor of the heat produced from the cogeneration system is:

$EF_{Hby} = \sum_i F_{yi} * CEF_i * r_y /H_y$

The quantity of CO_2 emissions related to the production of power by the cogeneration system is:

$\sum_i F_{yi} * CEF_i * (1- r_y)$

The emission factor of the power produced from the cogeneration system is:

$EF_{Pby} = \sum_i F_{yi} * CEF_i * (1 - r_y) /P_y$

b. In case the displaced output is not energy.

The same approach as in d1 is used.

For the displacement of more GHG intense outputs, identify for each output of the project, the displaced output that would have satisfied the same need under the baseline scenario. Determine its emission factor.

In case of displacement of outputs whose emission factor cannot be determined separately under the baseline scenario (because it is one product of a multiple product process for example), the corresponding outputs under the project scenario are also to be considered together.

If the corresponding outputs are not delivered by the project, a tool for the apportioning of GHG emissions on multiple products is to be developed.

II.2. Baseline emissions calculation based on benchmark

This tool have to address the following questions:

- What is to be benchmarked?
- Which indicator is the most appropriate?
- Which target or what should be the level of stringency and why?
- Which data are relevant?
- Which level of aggregation?
- Which vintage for updating the benchmarks?

The response to some of these questions will be methodology specific. It means that each methodology has to address all these questions either by referring to the tool for benchmarking or by providing methodology specific responses.

For the purpose of identifying benchmark emission factor for an output, provide an overview of other technologies or practices that provide outputs with comparable quality, properties and application areas as the proposed CDM project and that have been implemented previously or are currently underway in the relevant geographical area. The relevant geographical area should in principle be the market of the output. It might be the host country of the proposed CDM project activity, or a wider space for output sold in a wider market. A region within the country could be the relevant geographical area if the market of the output is limited to this region.

However, the relevant geographical area should include preferably ten facilities (or projects) that provide outputs with comparable quality, properties and application areas as the proposed CDM project activity. If less than ten facilities (or projects) that provide outputs with comparable quality, properties and application areas as the proposed CDM project activity are found in the region/Host country, the geographical area may be expanded to an area that covers if possible, ten such facilities (or projects). In cases where the above described definition of geographical area is not suitable, the project proponents should provide an alternative definition of geographical area. Other registered CDM project activities are not to be included in this analysis. Provide relevant documentation to support the results of the analysis.

Table 1: Basis for the development of benchmarks under the differents methodological approaches for baseline setting

	Fuel/feed-stock switch	**Technology switch**	**Industrial GHG destruction**	**Destruction of GHG from waste**	**GHG avoidance**	**Output displacement**
What is to be benchmarked?	Type of fuel/feed-stock used for an application similar to the project application	Efficiency of the baseline technology	Baseline GHG Emission Factor of the output	Baseline treatment of the waste	Baseline use of the GHG emitter	Emission factor of the displaced output
Which indicator is the most appropriate?	Methodology specific. It might be an average fuel carbon emission factor, a percent of blending, etc	Output (same than the one of the project) /Input (same as the input of the project)	Tonne GHG/tonne product	Type of treatment (no treatment, open lagoon, etc)	Methodology specific	tCO2eq/tonne output
Which target or what should be the level of stringency and why?	EF of the 20% less GHG emissions intense fuel used for the project application. 20% less GHG intensive feed-stock used for the project application	Top 20% best performance or methodology specific	Top 20% best performance or methodology specific	Performance of the 20% less GHG emitter treatments or methodology specific	Methodology specific	20% lower GHG EF or according to the tool for EF determination or methodology speci II.1. Baseline emissions calculation for historical and actual emissions fic
Which data are relevant?	Type of fuel or feed-stock used for the project application and thheir CEF	Efficiency of technologies using comparable inputs to provide the same output (boiler, GT, coal power plants, etc..	Emission factor of facilities producing the same output (HCFC22 plants, adipic acid plants, nitric acid plants,…) or using the same technology (catalyst)	Type of treatment undertaken on the same type of waste	Type of use of the GHG emitter	GHG emitted and outputs produced by the facilities producing the same output
Which level of aggregation?	The market of the project output or otherwise defined in the methodologies	Regions presenting the same capability to have access to the technologies than the project region	All regions	Country or region within a country	Country or region within a country	The market of the output (might be a grid, a pipeline or a region)

Which vintage for updating the benchmarks?	Yearly basis or methodology specific	Once at the end of the lifetime of the equipment **or** at the renewal of the crediting period **or** methodology specific	Methodology specific **or** end of a crediting period **or** after the end life time of the elements of the installation influencing the performance of the facilities such as the catalyst. The tool for the determination of the remaining lifetime of equipment might be used.	Renewal of the crediting period **or** methodology specific	Renewal of the crediting period **or** methodology specific	Yearly basis or methodology specific