Approved consolidated baseline and monitoring methodology ACM0005

"Increasing the blend in cement production"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Sources

This consolidated baseline methodology is based on elements from the following proposed new methodologies:

- NM0045-rev2: "Birla Corporation Limited: CDM Project for "Optimal Utilization of Clinker", whose project design document, and baseline study, monitoring and verification plans were developed by Birla Corporation Limited;
- NM0047-rev: "Indocement's Sustainable Cement Production Project Blended Cement Component", whose project design document, and baseline study, monitoring and verification plans were developed by PT. Indocement Tunggal Perkasa;
- NM0095: "ACC New Wadi Blended Cement Project", whose project design document, and baseline study, monitoring and verification plans were developed by Agrinergy Ltd.;
- NM0106: "Baseline methodology for optimization of clinker use in the cement industry through investment in grinding technology", whose project design document, and baseline study, monitoring and verification plans were developed by Ecosecurities Ldt.

This methodology also refers to the latest approved versions of the following tools:

- "Tool to calculate the emission factor for an electricity system";
- "Tool for the demonstration and assessment of additionality".

For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive Board please refer to <http://cdm.unfccc.int/goto/MPappmeth>.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Existing actual or historical emissions, as applicable".

Definitions

For the purpose of this methodology, the following definitions apply:

Blended cement (BC). Blended cement is a mixture of clinker and additives containing less than 95% clinker.

Blended cement types. Blended cement types are defined by the national standard[1] of the host country. Blended cement types are distinct products with different uses that have different additives and different shares of clinker (for example, Portland Pozzolana Cement or Portland Blast Furnace Slag etc). **Relevant cement type.** Relevant cement type is the type of blended cement produced under the CDM project activity.

[1] In cases, where there is no national standard, revision to the methodology deem necessary.

Additives. Additives are defined as materials (e.g. fly ash, gypsum, slag, pozzolana etc) to be blended with clinker to produce blended cement types.

Greenfield cement plant. Greenfield cement plant is defined as cement plant with no operational history at the start of the CDM project activity.

Applicability

This methodology is applicable to project activities that produce blended cement (BC) beyond current practices in the host country either (i) in Greenfield cement plant or (ii) in existing cement production plant by increasing the share of additives (i.e. reduce the share of clinker). The methodology is applicable under the following conditions:

- There is no shortage of additives related to the lack of blending materials. Project participants should demonstrate that there is no alternative allocation or use for the additional amount of additives used in the project activity. If the surplus availability of additives is not substantiated the project emissions reductions (ERs) will be discounted as outlined below;
- This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement;
- The methodology is not applicable if blending of cement outside the cement production plants is a common practice in the host country.
- This methodology is not applicable for cement plants that do not produce clinker (e.g. grinding only plants).
- Adequate data are available on cement types in the market.

II. BASELINE METHODOLOGY PROCEDURE

Project Boundary

The project boundary includes the cement production plant, any onsite power generation (if applicable), and the power generation in the grid (if applicable).

The power grid or plant from which the cement plant purchases electricity and its losses will be considered in determining indirect emissions. Any transport related emissions for the delivery of additional additives will be included in the emissions related to the project activity as leakage. Emissions reductions from transport of raw materials for clinker production are not taken into account as a conservative simplification.

Table 1: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Calcinations of raw material in the kiln	CO_2	Yes	Direct emission from clinker kiln
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of fuel in the kiln including burner	CO_2	Yes	Direct emissions from clinker kiln
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of fuel for drying raw materials & kiln fuel	CO_2	Excluded	excluded for simplification
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of electricity (grid and self generated) for the preparation of fuels and raw materials for clinker, and for the operation of equipments related to the kiln (engines, compressors, fans etc)	CO_2	Yes	Direct emission from self generation sources and indirect emission from plants connected to the grid supplying the plant with electricity for feeding system, preparation of materials, and driving kiln
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of electricity (grid and self generated) for the preparation of Additives and for Grinding cement types	CO_2	Yes	Direct emission from self generation sources and indirect emission from plants connected to the grid supplying the plant with electricity for crushing and grinding Additives and grinding cement
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
Project activity	Calcinations of raw material in the kiln	Co_2	Yes	Direct emission from clinker kiln.
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of fuel in the kiln including burner	CO_2	Yes	Direct emission from clinker kiln.
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification

	Source	Gas	Included?	Justification / Explanation
	Use of fuel in driers for drying raw materials & kiln fuel	CO_2	Excluded	excluded for simplification
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of electricity (grid and self generated) for the preparation of fuels and raw materials for clinker, and for the operation of equipments related to the kiln (engines, compressors, fans etc)	CO_2	Yes	Direct emission from self generation sources and indirect emission from plants connected to the grid supplying the plant with electricity for feeding system, preparation of materials, and driving kiln
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of electricity (grid and self generated) for the preparation of Additives and for Grinding cement types	CO_2	Yes	Direct emission from self generation sources and indirect emission from plants connected to the grid supplying the plant with electricity for crushing and grinding Additives and grinding cement
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification

Identification of the baseline scenario

Project participants shall identify the most plausible baseline scenario among all realistic and credible alternatives(s). Steps 2 and/or 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" should be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive). Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario.

In doing so, project participants shall consider all realistic and credible production scenarios for the relevant cement type that are consistent with current rules and regulations, including the existing practice of cement production, the proposed project activity, and practices in other manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances. If only two scenarios, i.e. the existing practice of cement production and the proposed project activity, are realistic and credible alternatives, the most likely baseline scenario can be identified with the latest version of the "Tool for the demonstration and assessment of additionality".

Additionality

The additionality of the project activity shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board, which is available on the UNFCCC CDM web site.[2]

In applying the tool, where investment analysis is used, project participants shall apply Option II (investment comparison analysis) or Option III (benchmark analysis).

While calculating the financial indicator for Options II or III, project participants should consider the following components in the analysis:

- Investments related to the equipment/modifications in production lines required for the increase in the share of additives in the production of blended cement e.g. pneumatic systems/conveyors/bucket elevators for transfer of the additives, feeding systems, bag dust collectors, additional laboratory equipment for quality control, Cement Vertical Roller Mills, storage silos, facilities for handling and proportioning of additive materials such as hoppers and feeders;
- Savings related to decrease in energy consumption and other savings as a result of decrease in clinker production due to the increased use of additives;
- Expenses related to the operation and maintenance of the cement production plant;
- Savings related to decrease in buying clinker from third parties, if applicable;
- Expenses related to development of in-house capacity and/or research to operate new blending technology and control the quality of blended cement;
- Expenses related to the sourcing of blending material and material cost for blending;
- If required, other expenses related to the marketing of the new blended cement, e.g. market awareness campaigns; and
- Revenues related to the increase in the share of additives in the production of blended cement.

In applying the latest version of the "Tool for the demonstration and assessment of additionality", where project participants use the barrier analysis, only the following barriers may be claimed:

First of its Kind. Only projects implementing blended cement projects for the first time are allowed to claim this barrier (i.e. project participants which are increasing the percentage of additives from a historical value to a higher value are not allowed to use this barrier).

A proposed project activity may be considered the first-of-its-kind in the applicable geographical area only if project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal.

In order to demonstrate additionality using "First of its Kind" barrier, the methodology requires information concerning the market share for blended cement sold in the domestic market in the host country. The project participants should calculate the market share percentage of the amount of blended cement of the total amount of all cement types produced in the host country (tons blended cement/total tons cement production *x* 100%) during the last three years prior to the implementation of the project activity. The market share value must be based on reliable and publicly available data sources (e.g. cement manufacturers associations or governmental agencies). Plants and grinding operations included in the

[2] Please refer to: < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html >.

analysis which have implemented blended cement projects should not have started the blended cement production for commercial operation prior to a) the start of commercial operation of the project activity or b) the start of validation, whatever is earlier. Other CDM projects should be included in this assessment.

If the market share for blended cement in the host country is below 5%, the project activity is deemed additional without further consideration. If the market share for blended cement in the host country is above 5%, the project activity cannot use this barrier to demonstrate additionality (investment analysis , investment barrier or market acceptability barriers may be used).

Investment barriers. In case that project participants claim for investment barriers (in Sub-step 3a (1)(a) of the tool), they should demonstrate in the PDD that the financing of the project was only assured because of the benefit of the CDM, i.e. it should be demonstrated that the loan approval by the lender (or other the financing decision) takes explicitly the CDM registration into account. Examples of a case where the financing of the project was only assured because of the benefit of the CDM are:

- In case the investment is done by a company which also purchases the CERs and the loan agreement mentions that, then this is a strong case that the CDM facilitated the lending;
- In case that it can be objectively demonstrated that a significant part of the project investment is provided upfront by a company as a pre-payment for expected CERs, then this is a strong case that the CDM actually enabled the financing of the project.

Market acceptability barriers, *inter alia*:

- Perception that high additive blended cement is of inferior quality;
- Lack of awareness of customers on the use high additive blended cement.

Claims on market acceptability barriers shall be supported by objective evidences using one or more of the following:

- Letters of complaints from customers, establishing the failure of blended cement to gain their confidence in the market. It should be demonstrated that such complaints is much higher than those received for any new similar product in the market;
- Circulars/notices or any other communication from public works department (Government Department) on the use of blended cement, clearly establishing their low/no preference for blended cement;
- Independent surveys conducted by third parties concluding that blended cement is not accepted in the market where the blended cement will be supplied.

Project participants should demonstrate in an objective manner how the CDM alleviates the claimed barriers to the new blended cement produced under the project activity, to a level that the project is not prevented anymore from occurring by such barrier. The PP shall provide transparent and documented evidence as presented above and illustrated in the “Tool for the demonstration and assessment of additionality”.

Baseline emissions

The baseline emissions depend on two factors:

- The benchmark of share of clinker in the blended cement types produced in the host country; and
- The CO_2 emissions per tonne of clinker in the base year, which in turn depends on:
  - Quantity and carbon intensity of the fuels used in clinker making;

- Quantity and carbon intensity of electricity;
- CO_2 emissions from calcinations.

This methodology requires data from the base year to calculate the baseline emissions (CO_2 emissions per tonne of clinker in the base year: $BE_{clinker,BSL}$).

In case of existing cement plants, the base year is defined as the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken in determining CO_2 emissions per tonne of clinker.

In case of Greenfield cement plants, the base year for determining CO_2 emissions per tonne of clinker is defined as first operational year. For ex-ante calculation for the preparation of PDD, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions.

Baseline emissions are calculated as follows:

$$BE_y = BC_y * (BE_{clinker,y} * B_{Blend,y} + BE_{ele\_ADD\_BC}) \quad \textbf{(1)}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
BC_y	=	BC production in year *y* (BC)
$BE_{clinker,y}$	=	CO_2 emissions per tonne of clinker in year *y* (t CO_2/t clinker)
$B_{Blend,y}$	=	Baseline benchmark of share of clinker per tonne of BC updated for year *y* (t of clinker/t of BC)
$BE_{ele\_ADD\_BC}$	=	Baseline electricity emissions for BC grinding and preparation of additives (tCO_2/t of BC)

CO_2 emissions per tonne of clinker in year *y* (t CO_2/tonne clinker) is calculated as:

$$BE_{clinker,y} = \min(BE_{clinker,BSL}, PE_{Clinker,y}) \quad \textbf{(2)}$$

Where:

$BE_{clinker,y}$	=	CO_2 emissions per tonne of clinker in year *y* (tCO_2/t clinker)
$BE_{clinker,BSL}$	=	CO_2 emissions per tonne of clinker in the base year (tCO_2/t clinker)
$PE_{clinker,y}$	=	CO_2 emissions per tonne of clinker in the project activity plant in year *y* (tCO_2/t clinker) (See project emission section below)

CO_2 emissions per tonne of clinker in the base year ($BE_{clinker,BSL}$) is calculated as:

$$BE_{clinker,BSL} = BE_{calcin} + BE_{fossil\_fuel} + BE_{ele\_grid\_CLNK} + BE_{ele\_sg\_CLNK} \quad \textbf{(3)}$$

Where:

$BE_{clinker,BSL}$	=	CO_2 emissions per tonne of clinker in the base year (tCO_2/t clinker)
BE_{calcin}	=	Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (tCO_2/t clinker)
BE_{fossil_fuel}	=	Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (tCO_2/t clinker)
$BE_{ele\_grid\_CLNK}$	=	Baseline grid electricity emissions for clinker production per tonne of clinker (tCO_2/t clinker)

$BE_{ele\_sg\_CLNK}$ = Baseline emissions from self generated electricity for clinker production per tonne of clinker (tCO_2/t clinker)

Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (BE_{calcin}) is calculated as:

$$BE_{calcin} = [0.785*(OutCaO - InCaO) + 1.092*(OutMgO - InMgO)] / CLNK_{BSL} \quad \textbf{(4)}$$

Where:

BE_{calcin}	=	Emissions from the calcinations of limestone (tCO_2/t clinker)
0.785	=	Stoichiometric emission factor for CaO (tCO_2/t CaO)
1.092	=	Stoichiometric emission factor for MgO (tCO_2/t MgO)
InCaO	=	Baseline CaO content in the raw material (t CaO)
OutCaO	=	Baseline CaO content in the clinker produced (t CaO)
InMgO	=	Baseline MgO content in the raw material (t MgO)
OutMgO	=	Baseline MgO content in the clinker produced (t MgO)
$CLNK_{BSL}$	=	Annual production of clinker in the base year (clinker)

$$BE_{fossil\_fuel} = (\sum FF_{i,BSL} * EFF_i) / CLNK_{BSL} \quad \textbf{(5)}$$

Where:

BE_{fossil_fuel}	=	Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (tCO_2/t clinker)
$FF_{i,BSL}$	=	Fossil fuel of type i consumed for clinker production in the base year (t fuel)
EFF_i	=	Emission factor for fossil fuel i (tCO_2/t of fuel)
$CLNK_{BSL}$	=	Annual production of clinker in the base year (t clinker)

$$BE_{ele\_grid\_CLNK} = BELE_{grid\_CLNK} * EF_{grid\_BSL} / CLNK_{BSL} \quad \textbf{(6)}$$

Where:

$BE_{ele\_grid\_CLNK}$	=	Baseline grid electricity emissions for clinker production per tonne of clinker (tCO_2/t clinker)
$BELE_{grid\_CLNK}$	=	Grid electricity consumed for clinker production in base year (MWh)
EF_{grid_BSL}	=	Baseline grid emission factor (tCO_2/MWh)
$CLNK_{BSL}$	=	Annual production of clinker in the base year (t clinker)

$$BE_{elee\_sg\_CLNK} = BELE_{sg\_CLNK} * EF_{sg\_BSL} / CLNK_{BSL} \quad \textbf{(7)}$$

Where:

$BE_{elee\_sg\_CLNK}$	=	Baseline emissions from self generated electricity for clinker production per tonne of clinker (tCO_2/ t clinker)
$BELE_{sg\_CLNK}$	=	Self generation of electricity for clinker production in the base year (MWh)
EF_{sg_BSL}	=	Baseline electricity self generation emission factor (tCO_2/MWh)
$CLNK_{BSL}$	=	Annual production of clinker in the base year (t clinker)

Determination of baseline benchmark of share of clinker per tonne of BC updated for year y ($B_{Blend,y}$)

The benchmark of share of clinker per tonne of BC ($B_{Blend,y}$) for calculating baseline emissions is defined as the lowest value among the following, assessed after gathering available data concerning average blending ratio, annual production and import of the relevant cement type (s) in the region, using one year data prior to the start date of CDM project activity.

(i) Identify the amount of the relevant cement type produced for each plant in the region. Determine the average (weighted by production) mass percentage of clinker for the 5 plants producing cement with the highest share of additives of the relevant cement type in the region; If the region comprises of less than 5 plants producing the relevant cement type, the national market should be used as the default region;

(ii) Identify the amount of the relevant cement type produced for each plant in the region. Determine The production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region. If 20% falls on part capacity of a plant, that plant is included in the calculations;

(iii) The mass percentage of clinker in the relevant cement type produced in the proposed project activity plant before the implementation of the CDM project activity, if applicable (For Greenfield cement plant this option shall not be included in the analysis).

In addition to cement production data, if the average annual amount of the relevant cement type imported by the host country is more than 10% of the total production volume in the region, the average mass percentage of clinker in the relevant cement type imported shall also be considered in the analysis under (i) and (ii) above as it would be produced in a virtual one plant. For example, if there are several companies importing the relevant cement type, the imported cement from each company shall be considered as it would have been produced in a virtual one plant. In this case, the clinker share of the imported cement type may be obtained as specified on the cement bag or import document.

For (i) and (ii) above, the project participants can choose between 2 options – either (1) to update the benchmark annually and incorporate only an increasing trend (a decreasing trend would require the baseline to remain constant); or (2) the benchmark incorporates a trend increase, specified ex-ante, in the share of additives in blended cement type based on general market trend or a minimum of an annual 2% increase in additives. For example, if the additives percentage is 15% at the start of the project activity (year 1), for the second year of the crediting period, the percentage of additives increases to 15.3% and is 15.6% for year 3 and so on, for the baseline.

For Option (iii) the highest percentage of additives used over the 3 most recent years and the highest percentage of additives is selected and an increasing trend of a minimum of 2% increase in additives over the percentage of additives at the start of the project activity is incorporated up to the limit of the regulatory/product norm in the region/national market.

At the renewal of the crediting period, the benchmark is recalculated. The basis (between the 3 options) of the benchmark may change from the option selected during the first crediting period.
To determine the benchmark for Option (i) and (ii), statistically significant random sampling is done for the high blend brands in the relevant cement type in the region. In other words, for the cement type under consideration and for high blend brands in the region, random and statistically significant samples are selected and analyzed for the percentage of clinker by an independent laboratory. The sampling of the relevant type of blended cement type produced in the region should exclude cement plants or output from cement plants that have registered blended cement CDM project activities. If reliable and up to date annual data are available from reputable and verifiable external sources (for example, industry manufacturers association or government agencies), these may be used to determine the benchmark.

The "Region" for the benchmark calculation needs to be clearly determined and justified by project participants. The default is the national market but project participants can define a geographic region as the area where each of the following conditions are met: (i) at least 75% of project activity plant's cement production is sold (percentage of domestic sales only); (ii) includes at least 5 other plants with the required published data; and (iii) the production in the region is at least four times the project activity plant's output. Only domestically sold output is considered and any export of cement produced by the project activity

plant are excluded in the estimation of emission reductions.

$$BE_{ele\_ADD\_BC} = BE_{ele\_grid\_BC} + BE_{ele\_sg\_BC} + BE_{ele\_grid\_ADD} + BE_{ele\_sg\_ADD} \quad \textbf{(8)}$$

Where:

$BE_{ele\_ADD\_BC}$	=	Baseline electricity emissions for BC grinding and preparation of additives (tCO_2/t BC)
$BE_{ele\_grid\_BC}$	=	Baseline grid electricity emissions for BC grinding (tCO_2/t BC)
$BE_{ele\_sg\_BC}$	=	Baseline self generated electricity emissions for BC grinding (tCO_2/t BC)
$BE_{ele\_grid\_ADD}$	=	Baseline grid electricity emissions for additive preparation (tCO_2/t BC)
$BE_{ele\_sg\_ADD}$	=	Baseline self generated electricity emissions for additive preparation (tCO_2/t BC)

$$BE_{ele\_grid\_BC} = BELE_{grid\_BC} * EF_{grid\_BSL} / BC_{BSL} \quad \textbf{(9)}$$

Where:

$BE_{ele\_grid\_BC}$	=	Baseline grid electricity emissions for BC grinding (tCO_2/t BC)
$BELE_{grid\_BC}$	=	Baseline grid electricity for grinding BC (MWh)
EF_{grid_BSL}	=	Baseline grid emission factor (tCO_2/MWh)
BC_{BSL}	=	Annual production of BC in the base year (t BC)

$$BE_{ele\_sg\_BC} = BELE_{sg\_BC} * EF_{sg\_BSL} / BC_{BSL} \quad \textbf{(10)}$$

Where:

$BE_{ele\_sg\_BC}$	=	Baseline self generated electricity emissions for BC grinding (tCO_2/t BC)
$BELE_{sg\_BC}$	=	Baseline self generation electricity for grinding BC (MWh)
EF_{sg_BSL}	=	Baseline electricity self generation emission factor (tCO_2/MWh)
BC_{BSL}	=	Annual production of BC in the base year (t BC)

$$BE_{ele\_grid\_ADD} = BELE_{grid\_ADD} * EF_{grid\_BSL} / BC_{BSL} \quad \textbf{(11)}$$

Where:

$BE_{ele\_grid\_ADD}$	=	Baseline grid electricity emissions for additive preparation (tCO_2/t BC)
$BELE_{grid\_ADD}$	=	Baseline grid electricity for grinding additives (MWh)
EF_{grid_BSL}	=	Baseline grid emission factor (tCO_2/MWh)
BC_{BSL}	=	Annual production of BC in the base year (t BC)

$$BE_{ele\_sg\_ADD} = BELE_{sg\_ADD} * EF_{sg\_BSL} / BC_{BSL} \quad \textbf{(12)}$$

Where:

$BE_{ele\_sg\_ADD}$	=	Baseline self generated electricity emissions for additive preparation (tCO_2/t BC)
$BELE_{sg\_ADD}$	=	Baseline self generation electricity for grinding additives (MWh)
EF_{sg_BSL}	=	Baseline electricity self generation emission factor (tCO_2/MWh)
BC_{BSL}	=	Annual production of BC in the base year (t BC)

Project Emissions

In the project activity plant emissions are determined per unit of clinker or per unit of BC accounting for

(i) Emissions from calcinations of limestone;

(ii) Emissions from combustion of fossil fuel and electricity for clinker production and processing of raw material;

(iii) Emissions from electricity used for additives preparation and grinding of cement.

The project emissions are calculated as:

$$PE_y = BC_y * (PE_{clinker,y} * P_{Blend,y} + PE_{ele\_ADD\_BC,y}) \quad \textbf{(13)}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
BC_y	=	BC production in year *y* (t BC)
$PE_{clinker,y}$	=	CO_2 emissions per tonne of clinker in the project activity plant in year *y* (tCO_2/t clinker)
$P_{Blend,y}$	=	Share of clinker per tonne of BC in year *y* (t clinker/t BC)
$PE_{ele\_ADD\_BC,y}$	=	Electricity emissions for BC grinding and preparation of additives in year *y* (tCO_2/t BC)

CO_2 emissions per tonne of clinker in the project activity plant in year *y* is calculated as below:

$$PE_{clinker,y} = PE_{calcin,y} + PE_{fossil\_fuel,y} + PE_{ele\_grid\_CLNK,y} + PE_{ele\_sg\_CLNK,y} \quad \textbf{(14)}$$

Where:

$PE_{clinker,y}$	=	Emissions of CO_2 per tonne of clinker in the project activity plant in year *y* (tCO_2/t clinker)
$PE_{calcin,y}$	=	Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year *y* (tCO_2/t clinker)
$PE_{fossil\_fuel,y}$	=	Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year *y* (tCO_2/t clinker)
$PE_{ele\_grid\_CLNK,y}$	=	Grid electricity emissions for clinker production per tonne of clinker in year *y* (tCO_2/ t clinker)
$PE_{ele\_sg\_CLNK,y}$	=	Emissions from self-generated electricity per tonne of clinker production in year *y* (tCO_2/t clinker)

$$PE_{calcin,y} = [0.785*(OutCaO_y - InCaO_y) + 1.092*(OutMgO_y - InMgO_y)] / CLNK_y \quad \textbf{(15)}$$

Where:

$PE_{calcin,y}$	=	Emissions from the calcinations of limestone (tCO_2/t clinker)
0.785	=	Stoichiometric emission factor for CaO (tCO_2/t CaO)
1.092	=	Stoichiometric emission factor for MgO (tCO_2/t MgO)
$InCaO_{,y}$	=	CaO content (%) of the raw material * raw material quantity (t)
$OutCaO_{,y}$	=	CaO content (%) of the clinker * clinker produced (t)
$InMgO_{,y}$	=	MgO content (%) of the raw material * raw material quantity (t)
$OutMgO_{,y}$	=	MgO content (%) of the clinker * clinker produced (t)
$CLNK_y$	=	Clinker production in year *y* (t clinker)

$$PE_{fossil\_fuel,y} = (\sum FF_{i\_,y} * EFF_i) / CLNK_{,y} \quad \textbf{(16)}$$

Where:

$PE_{fossil\_fuel,y}$ = Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year *y* (tCO_2/t clinker)
$FF_{i,y}$ = Fossil fuel of type i consumed for clinker production in year *y* (t fuel)
EFF_i = Emission factor for fossil fuel i (tCO_2/fuel)
$CLNK_y$ = Clinker production in year *y* (t clinker)

$$PE_{ele\_grid\_CLNK,y} = PELE_{grid\_CLNK,y} * EF_{grid\_y} / CLNK_y \quad \textbf{(17)}$$

Where:

$PE_{ele\_grid\_CLNK,y}$ = Grid electricity emissions for clinker production per tonne of clinker in year *y* (tCO_2/t clinker)
$PELE_{grid\_CLNK,y}$ = Grid electricity for clinker production in year *y* (MWh)
EF_{grid_y} = Grid emission factor in year *y* (tCO_2/MWh)
$CLNK_y$ = Clinker production in year *y* (t clinker)

$$PE_{ele\_sg\_CLNK,y} = PELE_{sg\_CLNK\ ,y} * EF_{sg\_y} / CLNK_y \quad \textbf{(18)}$$

Where:

$PE_{ele\_sg\_CLNK,y}$ = Emissions from self-generated electricity per tonne of clinker production in year *y* (tCO_2/t clinker)
$PELE_{sg\_CLNK,y}$ = Self generation of electricity for clinker production in year *y* (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year *y* (tCO_2/MWh)
$CLNK_y$ = Clinker production in year *y* (t clinker)

$$PE_{ele\_ADD\_BC,y} = PE_{ele\_grid\_BC,y} + PE_{ele\_sg\_BC,y} + PE_{ele\_grid\_ADD,y} + PE_{ele\_sg\_ADD,y} \quad \textbf{(19)}$$

Where:

$PE_{ele\_ADD\_BC,y}$ = Electricity emissions for BC grinding and preparation of additives in year *y* (tCO_2/t BC)
$PE_{ele\_grid\_BC,y}$ = Grid electricity emissions for BC grinding in year *y* (tCO_2/t BC)
$PE_{ele\_sg\_BC,y}$ = Emissions from self generated electricity for BC grinding in year *y* (tCO_2/t BC)
$PE_{ele\_grid\_ADD,y}$ = Grid electricity emissions for additive preparation in year *y* (tCO_2/t BC)
$PE_{ele\_sg\_ADD,y}$ = Emissions from self generated electricity additive preparation in year *y* (tCO_2/t BC)

$$PE_{ele\_grid\_BC,y} = PELE_{grid\_BC,y} * EF_{grid,y} / BC_y \quad \textbf{(20)}$$

Where:

$PE_{ele\_grid\_BC,y}$ = Grid electricity emissions for BC grinding in year *y* (tCO_2/ t BC)
$PELE_{grid\_BC,y}$ = Baseline grid electricity for grinding BC (MWh)
EF_{grid_y} = Grid emission factor in year *y* (tCO_2/MWh)
BC_y = BC production in year *y* (t BC)

$$PE_{ele\_sg\_BC,y} = PELE_{sg\_BC,y} * EF_{sg\_y} / BC_y \quad \textbf{(21)}$$

Where:

$PE_{ele\_sg\_BC,y}$ = Emissions from self generated electricity for BC grinding in year *y* (tCO_2/t BC)
$PELE_{sg\_BC,y}$ = Self generated electricity for grinding BC in year *y* (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year *y* (tCO_2/MWh)
BC_y = BC production in year *y* (t BC)

$$PE_{ele\_grid\_ADD,y} = PELE_{grid\_ADD} * EF_{grid\_y} / BC_y \quad \textbf{(22)}$$

Where:

$PE_{ele\_grid\_ADD,y}$	=	Grid electricity emissions for additive preparation in year *y* (tCO_2/t BC)
$PELE_{grid\_ADD,y}$	=	Baseline grid electricity for grinding additives (MWh)
EF_{grid_y}	=	Grid emission factor in year *y* (tCO_2/MWh)
BC_y	=	BC production in year *y* (t BC)

$$PE_{ele\_sg\_ADD,y} = PELE_{sg\_ADD,y} * EF_{sg\_y} / BC_y \quad \textbf{(23)}$$

Where:

$PE_{ele\_sg\_ADD,y}$	=	Emissions from self generated electricity additive preparation in year *y* (tCO_2/t BC)
$PELE_{sg\_ADD,y}$	=	Baseline self generation electricity for grinding additives (MWh)
EF_{sg_y}	=	Emission factor for self generated electricity in year *y* (tCO_2/MWh)
BC_y	=	BC production in year *y* (t BC)

Electricity Emission Factor

For the calculation of the specific emissions from power generation from the grid

(EF_{grid_BSL} or $EF_{grid\ y}$) the "Tool to calculate the emission factor for an electricity system" is applied.[3]

For cement plants that self-generate power, the average annual emission factor of the self-generated power can be substituted by the emission factor calculated below.

The emission factor for self generation ($EF_{sg,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all self-generating sources in the project boundary serving the system.

$$EF_{sg,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_i}{\sum_j GEN_{j,y}} \quad \textbf{(24)}$$

Where:

$EF_{sg,y}$	=	Emission factor for self generated electricity in year *y* (tCO_2/MWh)
$F_{i,j,y}$	=	Amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*
j	=	On-site power sources
$COEF_i$	=	CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) y
$GEN_{j,y}$	=	Electricity generated by the source *j* in year *y* (MWh)

The CO_2 emission coefficient of fuel *i* ($COEF_i$) is obtained as:

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i \quad \textbf{(25)}$$

[3] Please refer to: <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>.

Where:

$COEF_i$	=	CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*
NCV_i	=	Net calorific value (energy content) per mass or volume unit of a fuel *i*
$OXID_i$	=	Oxidation factor of the fuel *i* (see page 1.29 in the 1996 Revised IPCC Guidelines for default values)
$EF_{CO2,i}$	=	CO_2 emission factor per unit of energy of the fuel *i* (tCO_2/unit of energy)

$$EF_{sg,BSL} = \frac{\sum_{m,n} F_{m,n,BSL} \cdot COEF_m}{\sum_{n} GEN_{n,BSL}} \quad \textbf{(26)}$$

Where:

$EF_{sg,BSL}$	=	Emission factor for self generated electricity in the base year (tCO_2/MWh)
$F_{m,n,BSL}$	=	Amount of fuel *m* (in a mass or volume unit) consumed by relevant power sources *n* in the base year
n	=	On-site power sources
$COEF_m$	=	CO_2 emission coefficient of fuel *m* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *n* and the percent oxidation of the fuel in the base year
$GEN_{n,BSL}$	=	Electricity generated by the source *n* in year y (MWh)

The CO_2 emission coefficient of fuel *i* ($COEF_i$) is obtained as:

$$COEF_m = NCV_m \cdot EF_{CO2,m} \cdot OXID_m \quad \textbf{(27)}$$

Where:

$COEF_m$	=	CO_2 emission coefficient of fuel *m* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *n* and the percent oxidation of the fuel in the base year
NCV_m	=	Net calorific value (energy content) per mass or volume unit of a fuel *m*
$OXID_m$	=	Oxidation factor of the fuel *m*
$EF_{CO2,m}$	=	CO_2 emission factor per unit of energy of the fuel *m* (tCO_2/unit of energy)

Leakage

Emissions due to fuel use for the transport of raw materials (e.g. limestone, gypsum), coal (or other fuels) and additives (blending materials) from offsite locations to the project plant will change due to the implementation of the project. The transport related emissions for raw materials and fuels are likely to decrease. To keep the methodology conservative this change shall not be included. In the project activity, emissions due to transportation of additives will increase. These emissions will be accounted as leakage. Transport related emissions for additives are calculated as below.

$$L_{add\_trans} = TF_{cons} * D_{add\_source} * TEF/Q_{add}/1000 + ELE_{conveyor\_ADD} * EF_{grid,y}/ADD_y \quad \textbf{(28)}$$

Where:

L_{add_trans}	=	Transport related emissions per tonne of additives (tCO_2/t additives)
TF_{cons}	=	Fuel consumption for the vehicle per kilometre (kg fuel/kilometre)
D_{add_source}	=	Distance between the source of additives and the project activity plant (km)
TEF	=	Emission factor for transport fuel (kg CO_2/kg fuel)
$ELE_{conveyor\_ADD}$	=	Annual Electricity consumption for conveyor system for additives (MWh)
$EF_{grid\ y}$	=	Grid emission factor in year *y* (tCO_2/MWh)
Q_{add}	=	Quantity of additives carried in one trip per vehicle (t additives)
ADD_y	=	Annual consumption of additives in year *y* (t additives)

And leakage emissions per tonne of BC due to additional additives are determined by:

$$LE_y = L_{add,trans} * (A_{blend,y} - P_{blend,y}) * BC_y \quad \textbf{(29)}$$

Where:

LE_y	=	Leakage emissions due to transport of additives in year *y* (tCO_2)
$L_{add,trans}$	=	Transport related emissions per tonne of additives (tCO_2/t additives)
BC_y	=	BC production in year *y* (t BC)
$A_{blend,y}$	=	Baseline benchmark share of additives per tonne of BC updated for year *y* (t additives/t BC)
$P_{blend,y}$	=	Share of additives per tonne of BC in year *y* (t additives/t BC)

Another possible leakage is due to the diversion of additives from existing uses. The project participants shall demonstrate that additional amounts of additives used are surplus. If the project participants do not substantiate x tonnes of additives used in the project activity are surplus, the project emissions reductions are reduced by the factor α, which is defined as:

$$\alpha_y = \text{x tonnes of additives in year } y \text{ / total additional additives used in year } y \quad \textbf{(30)}$$

Where:

α_y	=	Reduction factor

Emission Reductions

The project activity mainly reduces CO_2 emissions through substitution of clinker in cement by blending materials. Emissions reductions in year *y* are the difference in the CO_2 emissions per tonne of BC in the baseline and in the project activity multiplied by the production of BC in year *y*. The emissions reductions are discounted for the percentage of additives for which surplus availability is not substantiated.

$$ER_y = (BE_y - PE_y - LE_y) * (1 - \alpha_y) \quad \textbf{(31)}$$

Where:

ER_y	=	Emissions reductions in year *y* due to project activity in year *y* (tCO_2)
BE_y	=	Baseline emissions in year *y* (tCO_2)
PE_y	=	Project emissions in year *y* (tCO_2)
LE_y	=	Leakage emissions due to transport of additives in year *y* (tCO_2)
α_y	=	Reduction factor

In the case that overall negative emission reductions arise in a year, emission reductions are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the year concerned. (For example: if negative emission reductions of 30 tCO_2e occur in the year t and positive emission

reductions of 100 tCO_2e occur in the year t+1, 0 CERs are issued for year t and only 70 CERs are issued for the year t+1.)

In case the project activity consists of production of more than one cement type, the emission reduction shall be calculated following equation 1 to 9 above for each cement type *i* produced. The total emission reduction from the project activity shall be calculated as the sum of emission reductions for all cement types *i* produced.

Data and parameters not monitored

In addition to the data and parameters listed below, the guidance on all tools to which this methodology refers applies.

Parameter:	EFF_i
Data unit:	tCO_2/t fuel
Description:	Emission factor for fossil fuel *i*
Source of data:	Actual measured or local data is to be used. If not available, regional data should be used and, in its absence, IPCC defaults can be used from the most recent version of IPCC Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Any comment:	-

Parameter:	$OXID_i$
Data unit:	-
Description:	oxidation factor of the fuel *i*
Source of data:	see page 1.29 in the 1996 Revised IPCC Guidelines for default values
Measurement procedures (if any):	-
Any comment:	-

Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/unit of energy
Description:	CO_2 emission factor per unit of energy of the fuel *i*
Source of data:	Actual measured or local data is to be used. If not available, regional data should be used and, in its absence, IPCC defaults can be used from the most recent version of IPCC Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Any comment:	-

Parameter:	InCaO
Data unit:	t CaO
Description:	Baseline CaO content in the raw material
Source of data:	On-site measurements in plant records. In case of existing plants, historical data and in case of Greenfield cement plants, the data from first operational year.
Measurement procedures (if any):	This parameter is calculated as the CaO content (%) of the raw material times the raw material quantity [Q_{rm}]
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	OutCaO
Data unit:	t CaO
Description:	Baseline CaO content in the clinker produced
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter is calculated as the CaO content (%) of the clinker times clinker produced [$CLNK_{BSL}$]
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	InMgO
Data unit:	t MgO
Description:	Baseline MgO content in the raw material
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter is calculated as the MgO content (%) of the raw material times the raw material quantity [Q_{rm}]
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	OutMgO
Data unit:	t MgO
Description:	Baseline MgO content in the clinker produced
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter is calculated as the MgO content (%) of the clinker times clinker produced [$CLNK_{BSL}$]
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	Q_{rm}
Data unit:	t raw materials
Description:	Quantity of clinker raw material used in the base year
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Weight meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions This parameter is used to calculate InCaO and InMgO

Parameter:	$CLNK_{BSL}$
Data unit:	t clinker
Description:	Annual production of clinker in the base year
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Weight meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$FF_{i,BSL}$
Data unit:	t fuel
Description:	Fossil fuel of type i consumed for clinker production in the base year
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Weight meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$BELE_{grid\_CLNK}$
Data unit:	MWh
Description:	Grid electricity consumed for clinker production in base year
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Electricity meter
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$BELE_{sg\_CLNK}$
Data unit:	MWh
Description:	Self generation of electricity for clinker production in the base year
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Electricity meter
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$EF_{sg,BSL}$
Data unit:	tCO_2/MWh
Description:	Baseline electricity self generation emission factor
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter shall be calculated as per equation (~~6~~8) above. In doing so, the data should be from the base year. Please see comment below
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	BC_{BSL}
Data unit:	t BC
Description:	Annual production of BC in the base-year
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Weight meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$BELE_{sg\_BC}$
Data unit:	MWh
Description:	Baseline self generation electricity for grinding BC
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Electricity meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$BELE_{grid\ BC}$
Data unit:	MWh
Description:	Baseline grid electricity for grinding BC
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Electricity meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$BELE_{grid\ ADD}$
Data unit:	MWh
Description:	Baseline grid electricity for grinding additives
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Electricity meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$BELE_{sg\_ADD}$
Data unit:	MWh
Description:	Baseline self generation electricity for grinding additives
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Electricity meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$F_{m,n,BSL}$
Data unit:	in a mass or volume unit
Description:	Amount of fuel *m* consumed by relevant power sources *n* in the base year
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use weight or volume meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$GEN_{n,BSL}$
Data unit:	MWh
Description:	Electricity generated by the source n in year y
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meters
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

<table>
<tr><td>Parameter:</td><td>NCV_m</td></tr>
<tr><td>Data unit:</td><td>mass or volume unit</td></tr>
<tr><td>Description:</td><td>Net calorific value (energy content) per mass or volume unit of a fuel m</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>If b) is not available

These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If c) is not available</td></tr>
</table>
</td></tr>
<tr><td>Measurement procedures (if any):</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
</table>

Any comment:	Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken. In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

Parameter:	$OXID_m$
Data unit:	-
Description:	Oxidation factor of the fuel *m*
Source of data:	Refer to the latest version of the IPCC Guidelines for default values
Measurement procedures (if any):	-
Any comment:	-

Parameter:	$EF_{CO2,m}$
Data unit:	tCO_2/unit of energy
Description:	CO_2 emission factor per unit of energy of the fuel *m*
Source of data:	Actual measured or local data is to be used. If not available, regional data should be used and, in its absence, IPCC defaults can be used from the most recent version of IPCC Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Any comment:	In case of existing plants, this parameter shall be based of historical records of the plant for the year prior to the start of the CDM project activity. If data is available for multiple years prior to the start of the project activity, the average value of up to three years shall be taken In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information, quarry test results, latest feasibility study used for plant procurement and latest production plan to calculate the baseline emissions

III. MONITORING METHODOLOGY

Monitoring procedures

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

In addition, the monitoring provisions in the tools referred to in this methodology apply.

Data and parameters monitored

Data / Parameter:	BC_y
Data unit:	t BC
Description:	BC production in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This will be calculated and measured as part of normal operations Use weight meter
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$InCaO_y$
Data unit:	t CaO
Description:	CaO content in the raw material
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter is calculated as the CaO content (%) of the raw material times the raw material quantity [$Q_{rm,y}$]. This will be calculated and measured as part of normal operations
Monitoring frequency:	Daily
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$OutCaO_y$
Data unit:	t CaO
Description:	CaO content in the clinker produced
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter is calculated as the CaO content (%) of the clinker times clinker produced [$CLNK_y$]. This will be calculated and measured as part of normal operations
Monitoring frequency:	Daily
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$InMgO_y$
Data unit:	t MgO
Description:	MgO content in the raw material
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter is calculated as the MgO content (%) of the raw material times the raw material quantity [$Q_{rm,y}$]. This will be calculated and measured as part of normal operations
Monitoring frequency:	Daily
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$OutMgO_y$
Data unit:	t MgO
Description:	MgO content in the clinker produced
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	This parameter is calculated as the MgO content (%) of the clinker times clinker produced [$CLNK_y$]. This will be calculated and measured as part of normal operations
Monitoring frequency:	Daily
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$Q_{rm,y}$
Data unit:	t raw materials
Description:	Quantity of clinker raw material used in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use weight meter
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	Parameter required to calculate $InCaO_y$ and $InMgO_y$

Data / Parameter:	$CLNK_y$
Data unit:	t clinker
Description:	Clinker production in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use weight meter
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$FF_{i,y}$
Data unit:	t fuel
Description:	Fossil fuel of type i consumed for clinker production in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use weight meter
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$PELE_{grid\_CLNK,y}$
Data unit:	MWh
Description:	Grid electricity for clinker production in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$PELE_{sg\_CLNK,y}$
Data unit:	MWh
Description:	Annual consumption of additives in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	ADD_y
Data unit:	t additives
Description:	Amount of additives used for BC production in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use weight meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$PELE_{grid\_BC,y}$
Data unit:	MWh
Description:	Grid electricity for grinding BC in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$PELE_{sg\_BC,y}$
Data unit:	MWh
Description:	Self generated electricity for grinding BC in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$PELE_{grid\_ADD}$
Data unit:	MWh
Description:	Grid electricity for grinding additives in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$PELE_{sg\_ADD,y}$
Data unit:	MWh
Description:	Self generation electricity for grinding additives in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$F_{i,j,y}$
Data unit:	mass or volume unit
Description:	Amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use weight or volume meter
Monitoring frequency:	Monthly
QA/QC procedures:	-
Any comment:	-

<table>
<tr><td>Data / Parameter:</td><td>NCV_i</td></tr>
<tr><td>Data unit:</td><td>mass or volume unit</td></tr>
<tr><td>Description:</td><td>net calorific value (energy content) per mass or volume unit of a fuel i</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>If b) is not available

These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If c) is not available</td></tr>
</table></td></tr>
<tr><td>Measurement procedures (if any):</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency:</td><td>For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated
For c): Review appropriateness of the values annually
For d): Any future revision of the IPCC Guidelines should be taken into account</td></tr>
<tr><td>QA/QC procedures:</td><td>Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards</td></tr>
<tr><td>Any comment:</td><td>-</td></tr>
</table>

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	electricity generated by the source *j*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$P_{blend,y}$
Data unit:	t additives/t BC
Description:	Share of additives per tonne of BC in year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$A_{blend,y}$
Data unit:	t additives/t BC
Description:	Baseline benchmark share of additives per tonne of BC updated for year *y*
Source of data:	On-site measurements in plant records
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	TF_{cons}
Data unit:	kg fuel/kilometre
Description:	Fuel consumption for the vehicle per kilometre
Source of data:	From plant records
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	D_{add_source}
Data unit:	km
Description:	Distance between the source of additives and the project activity plant
Source of data:	From plant records
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	TEF
Data unit:	kg CO_2/kg fuel
Description:	Emission factor for transport fuel
Source of data:	Actual measured or local data is to be used. If not available, regional data should be used and, in its absence, IPCC defaults can be used from the most recent version of IPCC Guidelines for National Greenhouse Gas Inventories
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	Q_{add}
Data unit:	t additives
Description:	Quantity of additives carried in one trip per vehicle
Source of data:	From plant records
Measurement procedures (if any):	Use weight meter
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$ELE_{conveyor\_ADD}$
Data unit:	MWh
Description:	Annual Electricity consumption for conveyor system for additives
Source of data:	From plant records
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	α_y
Data unit:	-
Description:	Reduction factor
Source of data:	From plant records
Measurement procedures (if any):	If x tonnes of additives used in the project activity are not substantiated as surplus, the factor α_y is: α_y = *x tonnes of additives in year y / total additional additives used in year y*
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

IV. REFERENCES AND ANY OTHER INFORMATION

Not applicable.

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History of the document

Version	**Date**	**Nature of revision(s)**
06.0.0	EB 65, Annex 17 25 November 2011	Revision to: • Provide an approach to determine the data to calculate baseline emissions in case of Greenfield cement plants; • Improve the methodology so as to increase its readability, consistency and simplicity; • Clarify that the methodology is not applicable to situations where cement blending is common at the construction site; and • Provide an approach to determine the blending benchmark taking into account the imported cement. • Change of title from "Consolidated Baseline Methodology for Increasing the Blend in Cement Production" to "Increasing the Blend in Cement Production"
05	EB 50, Annex 10 16 October 2009	Revision to include: • Guidance on applying the "Tool for the demonstration and assessment of additionality"; • Updated monitoring tables; and • Editorial changes to improve the clarity of the methodology text.
04	EB 35, Paragraph 24 19 October 2007	Revision to include the Tool to calculate the emission factor for an electricity system.
03	EB 24, Annex 2 19 May 2006	Revision to amend the three options for selecting the benchmark for baseline emissions.
02	EB 22, Annex 7 28 November 2005	Revision to correct some of the formulae relating to leakage and references to the blend content in formulae.
01	EB 21, Annex 12 30 September 2005	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		