CLEAN DEVELOPMENT MECHANISM

CDM-MP63-A05

Draft Large-scale Consolidated Methodology

ACM0015: ~~Consolidated baseline and monitoring methodology for project activities using alternative raw materials that do not contain carbonates for clinker production in cement kilns~~ Emission reductions from raw material switch in clinker production

Version 04.0

Sectoral scope(s): 04

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) at its fifty-third meeting requested the Methodologies Panel (hereinafter referred to as the Meth Panel) to consider methodological approaches applicable to the estimation of baseline emissions for possible CDM project activities using less GHG intensive raw materials in Greenfield cement plants, and report back to the Board.

2. The Meth Panel, at its various meetings considered this issue, taking into account the consultants reports and comments from other stakeholders.

2. Purpose

3. The purpose of the draft revision is to broaden the applicability of the approved methodology ACM0015 to include project activities implemented in Greenfield facility.

3. Key issues and proposed solutions

4. Not applicable.

4. Impacts

5. The revision of the methodology, if approved, will broaden the applicability by including project activities implemented in Greenfield facility.

5. Subsequent work and timelines

6. The draft revised methodology is recommended by the Meth Panel to be considered by the Board at its seventy-ninth meeting. No further work is envisaged.

6. Recommendations to the Board

7. The Methodologies Panel recommend that the Board adopt this final draft revised methodology, to be made effective at the time of the Board’s approval.

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1. Introduction

1.1. Background

1. The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical projects	Partial or full switch to alternative raw materials that do not contain carbonates (AMC) in the production of clinker in cement kilns
Type of GHG emissions mitigation action	• Feedstock switch; Avoidance of process CO_2 emissions by switching to carbonate free feedstock in the production of clinker. • Energy efficiency; Additional energy efficiency measures may be implemented

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology applies to project activities that use alternative raw materials that do not contain carbonates for clinker production (AMC) in cement kilns, with or without additional energy efficiency measures.

2.2. Applicability

3. This methodology is applicable to project activities that use alternative raw materials that do not contain carbonates for clinker production (AMC) in cement kilns, with or without additional energy efficiency measures. The AMC partially or fully substitutes raw materials that contain calcium and/or magnesium carbonates (e.g. limestone) and that would otherwise be used in the kilns.

4. This methodology is applicable under the following additional conditions:

(a) Use of alternative materials shall increase neither the installed capacity (expressed in tonnes clinker/year) of clinker production nor the lifetime of equipment;

(b) The methodology is applicable to existing as well as Greenfield cement plants ~~only~~;

(c) Type and quality[1] of produced clinker remain the same in both baseline and project case;

[1] The quality of clinker (for example lime saturation factor, silica ratio, alumina ratio) should be defined as per the historical data for existing plant and as per the national/international standards for Greenfield plants during the PDD preparation. This parameter should be checked during the crediting period. 10 per cent variations in the specification based on historical data may be accepted during the crediting period.

(d) Alternative raw materials have never been used in the clinker production facility prior to the implementation of the project activity (test trials not exceeding a duration of more than 90 days are permitted for the purpose of assessing the potential/impact of AMC in the plant);

(e) The quantity of AMC available shall be at least 1.5 times the quantity required for meeting the aggregate demand of the proposed project activity and all existing users, including other uses than in the cement industry, consuming the same AMC in the ~~project area~~ region~~, i.e. the total quantity required for the project as well as other users of the alternative raw materials~~. ~~Project area in this context is defined as the area defined by a radius of 200 km around the project activity including at least the ten cement plants nearest to the plant of the project activity~~. The project participants shall repeat this assessment during renewable of crediting period, for the project activity applying renewable crediting periods.

~~(f) There is sufficient historical information about the clinker production facility, the raw materials used, and energy performance of the kiln.~~

5. Fuel switching is not precluded from the project activity but it is assumed that this fuel switching would have occurred in baseline, and thus no emission reductions are accounted for in this methodology. In cases where fuel switching is implemented as CDM project activity, project participants are encourages to use other approved methodologies for example "ACM0003: Partial substitution of fossil fuels in cement or quicklime manufacture''.

6. Energy efficiency measures may be implemented as part of the proposed project activity. However, reductions may only be claimed for those measures demonstrated to be additional. For any other measures it is assumed that they would have occurred in the baseline. ~~This methodology is not applicable for the following activities~~:

~~(a) Energy efficiency initiatives for improvements in process equipment (up-grade towers, grinding separators, burners, expert control systems, etc.);~~

~~(b) Fuel switching.~~

~~7. The quantity of clinker used for producing new varieties of cement following project implementation is excluded from calculation of emissions, since these new varieties do not belong to the common-practice cement category~~.

2.3. Entry into force

7. The date of entry into force is the date of the publication of the EB 79 meeting report on 1 June 2014.

3. Normative references

8. This consolidated baseline and monitoring methodology is based on the following proposed new methodologies;

(a) "NM0163: Use of calcined ashes and fluorite for clinker production in the Cement Plant of Huichapan, Mexico", whose baseline and monitoring methodology and project design document were prepared by MGM International;

(b) "NM0123-rev: Methodology for use of non-carbonated calcium sources in the raw mix for cement processing" proposed by Lafarge Brasil, whose baseline study was prepared by Lafarge Brasil and ICF Consulting.

9. This methodology also refers to the latest approved versions of the following tools;

(a) "Tool to calculate the emission factor for an electricity system";

(b) "Tool for the demonstration and assessment of additionality";

(c) "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period";

(d) "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

10. For more information regarding the proposed new methodolog~~y~~ies and ~~the~~ tools, as well as their consideration by the ~~CDM Executive Board~~ Executive Board (hereinafter referred to as the Board) of the clean development mechanism please refer to ~~http://cdm.unfccc.int/goto/MPappmeth~~ <http://cdm.unfccc.int/methodologies/PAmethodologies/index.html>.

3.1. Selected approach from paragraph 48 of the CDM modalities and procedures

11. "Actual or historical emissions, as applicable"; and/or

12. "The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category".

4. Definitions

13. The definitions contained in the Glossary of CDM terms shall apply.

(a) **Alternative raw materials that do not contain carbonates for clinker production ~~(AMC)~~ or AMC** - are defined as any mineral or synthetic substances or compounds that do not contain carbonates in its chemical composition; are obtained from mining, transformation or as by-products of other industrial processes; and chemically react with raw materials commonly used for clinker production. These alternative raw materials could include, among others: waste ash from fuel combustion in thermal power plants, blast furnace slag, gypsum, anhydrite, and fluorite etc. that are not used in normal production conditions;

(b) **Raw materials** - are a general designation for input material to the cement kiln for the purpose of production of clinker;

(c) **Greenfield cement plant** - is defined as cement plant which has not been operational at the start date of the CDM project activity;

(d) **Region –** is the geographical area defined by a radius of 200 km around the project activity including at least the five cement plants nearest to the plant of the project activity. In the event the five plants do not exist within 200 km radius the radius should be increased to accommodate at least five plants. The cement plants having the registered CDM projects which similar applicability conditions (for example projects using ACM0003) are not included in the region;

(e) **Kiln technology -** refers to the pyro-process that may include an integrated system encompassing several in line stages comprising of a multi stage pre-heater, followed by an inline pre-calciner, kiln tube and grate cooler.

5. Baseline methodology

5.1. Project boundary

14. The spatial extent of project boundary includes all process units related to the production of clinker in the cement kiln, from reception of raw materials and fuel to the delivery of clinker to the cooler.

15. Transportation of raw materials and alternative raw materials are excluded from the project boundary and accounted as leakage. Emissions generated from transportation and electricity consumption in cement production, and potential effects due to a higher consumption of clinker when producing the different kinds of cement will also be accounted as leakage, where applicable.

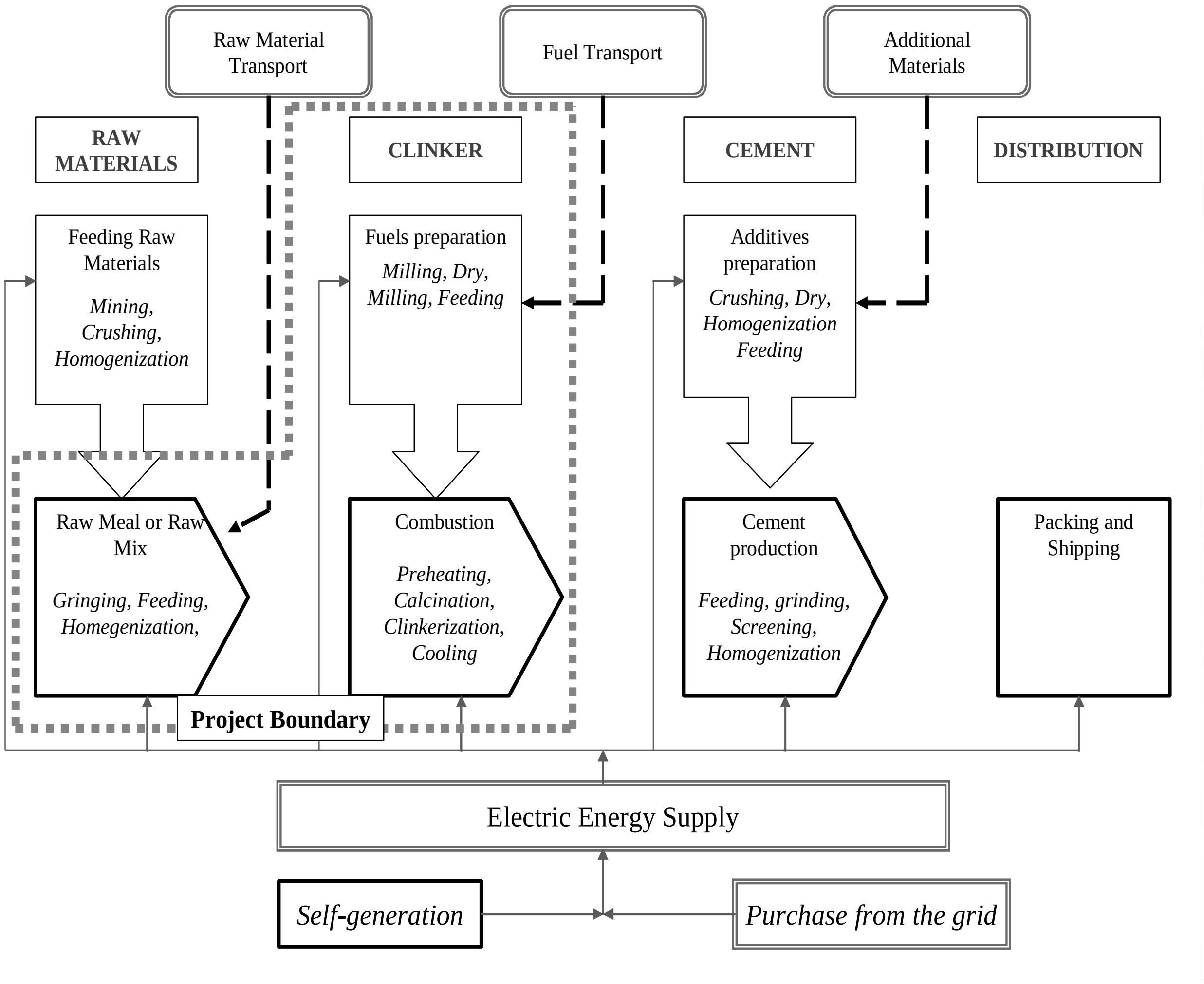
Table 2. Emission sources included in or excluded from the project boundary

	Source	Gas	Included	Justification/Explanation
Baseline	Calcination of raw materials in the kiln	CO_2	Yes	Direct emission from clinker kiln. It includes effects for By-pass and Clinker Kiln Dust productions systems
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification
	Use of fuels in the kiln, including main burner and pre-calcinator (fossil, alternative fossil and non-fossil)	CO_2	Yes	Direct emissions from clinker kiln
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification
	Use of fuels for the preparation of alternative raw materials and fuels (e.g. drying of materials or fuels using external dryers)	CO_2	Yes	Only if there exists an additional consumption of fuels during the preparation of raw materials or fuels, for example, drying of materials using burners
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification
	Use of electricity (grid and self-generated) for the preparation of raw materials and fuels, and for the operation of equipment related to the kiln (engines, compressors, fans, etc.)	CO_2	Yes	Changes in feeding system and preparation of materials
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification

	Source	Gas	Included	Justification/Explanation
Project activity	Calcination of raw materials	CO_2	Yes	Direct emission from clinker kiln. It includes effects for By-pass and Clinker Kiln Dust productions systems
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification
	Use of fuels in the kiln, including main burner and pre-calcinator (fossil, alternative fossil and non-fossil)	CO_2	Yes	Direct emission from clinker kiln
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification
	Use of fuels for the preparation of alternative raw materials and fuels (e.g. drying of materials or fuels using external dryers)	CO_2	Yes	Only if the new material would have a fuel consumption specific component for the adaptation of material, for instance, drying
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification
	Use of electricity (grid and self-generated) for the preparation of raw materials and fuels, and for the operation of equipment related to the kiln (engines, compressors, fans, etc.)	CO_2	Yes	Changes in feeding system and preparation of materials
		CH_4	No	Emissions negligible, excluded for simplification
		N_2O	No	Emissions negligible, excluded for simplification

16. The ~~green square~~ dotted line in the figure below represents the project boundary.

Figure 1. Project boundary



5.2. Procedure for the identification of the most plausible baseline scenario

5.2.1. Step 1: Identification of alternative scenarios to the proposed CDM project activity that are consistent with current laws and regulations

17. Identify all realistic and credible alternatives to the project activity that are consistent with current laws and regulations. In doing so, project participants shall consider all realistic and credible production scenarios for the relevant clinker type that are consistent with current rules and regulations, including the existing practice of clinker production, the proposed project activity not undertaken as a CDM project activity and practices in other production plants in the region[2] using similar input/raw materials, and facing similar economic, market and technical circumstances.

[2] ~~Region in this context is defined as the geographic area defined by a radius of 200 km around the project activity including at least the ten cement plants nearest to the plant of the project activity~~.

18. At least, the following scenarios have to be considered:

    (a) The continuation of the current practice, i.e. a scenario in which the company continues cement production using the existing technology, fuel materials and raw materials. In case a CDM project activity is on a Greenfield plant, a scenario where the company uses raw materials from carbonated sources and a kiln technology with thermal energy efficiency (expressed in MJ/t clinker) comparable to the average of the 20 per cent best performing plants established in the last five years identified in the region, before the start date of the project activity and the kiln fuel type of the project activity or default values referred in the baseline. Project participants may use published literatures mentioning the performance for the region, specifying the type and quality of raw materials etc. The examples of the publications may include the annual reports of cement manufacturers associations, energy efficiency reports of the specific plant etc. The analysis of the samples must be undertaken as per established local or international standards;

~~(b) A scenario in which traditional raw materials, limestone and clay, are partially substituted by AMC at a different rate than that of the project scenario. If relevant, develop different scenarios varying the degrees of different raw materials. These scenarios should reflect all relevant policies and regulations;~~

    (b) The proposed project activity not undertaken as a CDM project.

19. The alternatives should go through Step 2 and/or Step 3 of the "Tool for the demonstration and assessment of additionality"; ~~one of the following analysis~~.

~~**5.2.2. Step 2: Barrier analysis to eliminate alternatives to the project activity that face prohibitive barriers**~~

~~20. Establish a complete list of barriers that would prevent alternative scenarios in the absence of the CDM, using the guidance in Step 3 (barrier test) of the latest version of the "Tool for the demonstration and assessment of additionality".~~

~~21. Show which alternatives are prevented by at least one of the barriers previously identified and eliminate those alternatives from further consideration. All alternatives shall be evaluated for a common set of barriers.~~

~~22. If there is only one alternative that is not prevented by any barrier then this alternative is identified as the baseline scenario. Where more than one credible and plausible alternative remains, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario, or conduct an investment analysis (Step 3).~~

~~**5.2.3. Step 3: Investment analysis**~~

~~C23. Conduct an investment analysis, consistent with the guidance in Step 2 of the latest version of the "Tool for the demonstration and assessment of additionality". The economically most attractive combination of alternatives is deemed as the most plausible baseline scenario.~~

~~24. The following additional instructions should be followed:~~

~~(a) Calculate the financial costs (e.g. capital and variable costs) and account cost savings due to net energy gains, if any, from project activity;~~

~~(b) A sensitivity analysis should be performed to assess the robustness of the selection of the most likely future scenario to reasonable variations in critical assumptions and to establish that the project is not the baseline. The financial indicator is calculated conservatively if assumptions tend to make the CDM project's indicators more attractive and the alternatives' indicators less attractive;~~

~~(c) The baseline scenario should take into account relevant national/local and sectoral policies and circumstances, and the project proponent should demonstrate that the key factors, assumptions and parameters of the baseline scenario are conservative.~~

20. This methodology is applicable only if the most likely baseline scenario is the following:

(a) For existing plant: continuation of the clinker production with existing technology, fuel and raw materials; ~~practice using current processes~~;

(b) For Greenfield plant: a scenario where the company uses raw materials from carbonated sources and a kiln technology with energy efficiency comparable to the average of the 20 per cent best performing plants established in the last five years identified in the region or default value referred in methodology, before the start date of the project activity plant and the kiln fuel type of the project activity.

5.3. Additionality

21. 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 Board, which is available on the UNFCCC website.[3]

22. Project participants can use the step zero ‘first of its kind’ for the project activities in Greenfield and existing plants.

23. In case the AMC is a waste material within the control of project participant the internal cost to be avoided (considered zero), however, project related costs associated with the processing and transportation may be included.

5.3.1. Additionality demonstration for the project activities without energy efficiency in existing plant

24. If the investment analysis is chosen, project participants shall demonstrate that the use of ~~non-carbonated calcium sources~~ AMC is not attractive ~~n-profitable~~ using the net present value (NPV) analysis and explicitly state the following parameters:

(a) Investment requirements for raw materials switching;

(b) A discount rate appropriate to the country and sector;

(c) Current price and projected price (variable costs) of non-carbonated calcium source;

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

(d) Revenues due to the substitution of limestone and clay by non-carbonated calcium source;

(e) Lifetime of the project, equal to the remaining lifetime of the existing equipment(s);

(f) Cost savings accounting fuel consumption reduction due to energy gains of a non-occurrence of some chemical reactions that were expected in the regular way of clinker processing.

25. The project is additional if the NPV of the project activity is negative.

~~31. If the barrier analysis is chosen, the project participants shall demonstrate that the use of AMC non-carbonated calcium sources in the region or country is the "first of its kind" and no project activity of this type is currently operational in the host country or region ("region" is also defined here as the geographic area defined by a radius of 200 km around the project activity including at least the ten 10 cement plants nearest to the plant of the project activity). Project participants shall demonstrate that the identified barrier prevent the implementation of the proposed project activity and can only be overcome by registering the project as a CDM project activity. If the project participant faces other barriers than being the "first of its kind", they should use Step 2 (investment analysis) by monetized these barriers and including them in the investment analysis.~~

5.3.2. Additionality demonstration for the project activities with energy efficiency measure(s) in existing plant

26. Investment analysis to be performed for three different elements.

(a) Considering the investment related with the AMC use in the project and investment related with the energy efficiency measure(s) and benefits from both the components;

(b) Considering the investment related with the AMC use and benefits related to this only and keeping the kiln technology constant (and related cost and benefits) for both baseline and project (no efficiency gains);

(c) Considering the investment related with the energy efficiency measure(s) and benefits related with this only, and keeping the raw material (and related cost and benefits) constant for both baseline and project.

27. During the investment analysis, if it can be demonstrated that all the elements above are additional; project activity may claim emission reductions associated with the energy efficiency as well.

28. If elements (a) and (b) are additional and (c) is not additional; the emission reduction should not be claimed for the efficiency component of the project activity (i.e. the kiln efficiency in project activity should be used in the baseline emissions).

29. Additionality of the project activity should be demonstrated for AMC (element b); the methodology is not applicable for the additionality demonstration only energy efficiency measure(s) (element c).

5.3.3. Additionality demonstration for the project activities in Greenfield plants

30. In case barrier analysis is chosen, only Step 0 (First of its kind) is allowed, otherwise Step 2 of the tool, investment analysis, is mandatory for the Greenfield project activities.

31. In applying Step 2, the project participants shall consider the following guidance:

32. While doing the investment comparison analysis the cost and benefits related to other alternatives (for example the energy efficiency values defined in section 5.4.2.1 and 5.4.5.1 and the carbonated feedstock used as defined in section 5.4.1.1) shall be considered.

33. **Case 1:** Where the project activity is implemented with energy efficiency measure(s) (when the energy efficiency of Greenfield plant is better than the relevant values defined in section 5.4.2.1 and 5.4.5.1): In this case the project participants should do the investment analysis for three elements mentioned below:

    (a) Considering the investment related with the AMC use in the project and investment related with the energy efficiency measure(s) and benefits from both the components;

    (b) Considering the investment related with the AMC use and benefits related to this only and keeping the kiln technology constant (and related cost and benefits) for both baseline and project (no efficiency gains);

    (c) Considering the investment related with the energy efficiency measure(s) and benefits related with this only, and keeping the raw material (and related cost and benefits) constant for both baseline and project.

34. During the investment analysis, if it can be demonstrated that all the elements above are additional; project activity may claim for the emission reductions associated with the energy efficiency measure(s) as well.

35. If elements (a) and (b) are additional and (c) is not additional; the emission reduction should not be claimed for the efficiency component of the project activity (i.e. the kiln efficiency in project activity should be used in the baseline emissions).

36. If element (a) is additional and element (b) is not additional (element (c) may or may not additional) or element (a) is not additional; project activity is not additional.

37. **Case 2**: Where the project activity is implemented without energy efficiency measure(s): In this case the project participants should do the investment analysis only for the investment related with the AMC use and benefits related to this only (no investment related to energy efficiency equipment(s) or increased cost due to higher fuel used should be considered in this case).

5.4. Baseline emissions

38. Baseline emissions are calculated as follows:

$$BE_y = BE_{Calcin} + BE_{FC\_Calcin} + BE_{Dust} + BE_{FC\_Dry} + BE_{Elec} \cancel{+ BE_{Elec\_Grid} + BE_{Elec\_SG}} \qquad \text{Equation (1)}$$

Where:

BE	=	Baseline emissions for the year *y* (t CO_2)
BE_{Calcin}	=	Baseline ~~CO_2~~ emissions from calcination of calcium carbonate and magnesium carbonate (t CO_2)
BE_{FC_Calcin}	=	Baseline ~~CO_2~~ emissions from combustion of fuels in clinker production (t CO_2)
BE_{Dust}	=	Baseline ~~CO_2~~ emissions due to discarded dust from bypass and dedusting units (CDK) system (t CO_2)
BE_{FC_Dry}	=	Baseline ~~CO_2~~ emissions due to fuel consumption for drying of raw materials or fuel preparation (t CO_2)
$\cancel{BE_{Elec\_Grid}}$	~~=~~	~~Baseline CO_2 emissions for the grid electricity consumption for clinker production (t CO_2)~~
$\cancel{BE_{Elec\_SG}}$	~~=~~	~~Baseline CO_2 emissions for self-generated electricity used for clinker production (t CO_2)~~
BE_{Elec}	=	Baseline emissions due to electricity consumption used for clinker production (t CO_2)

39. ~~Each one of~~ The above baseline emissions components shall be calculated as follows:

5.4.1. Baseline ~~CO_2~~ emissions from calcination of carbonates (BE_{Calcin})

40. For estimation of CO_2 emissions resulting from calcination, only the proportion of calcium oxides and magnesium oxides present in the produced clinker will be considered. Measured values of CaO and MgO contents, corrected for the non-carbonate sources (for example, deducting any calcium that comes from use of calcium silicates or fly ash used as raw materials) shall be used. CO_2 emissions from calcination with correction for non-carbonate sources shall be determined as follows:

$$BE_{Calcin} = \frac{CLNK_y}{CLNK_{BSL}} \times \Big(0.785 \times \left(CaO_{CLNK,BSL} \times CLNK_{BSL} - CaO_{RM,BSL} \times RM_{BSL}\right) + 1.092 \times \left(MgO_{CLNK,BSL} \times CLNK_{BSL} - MgO_{RM,BSL} \times RM_{BSL}\right)\Big)$$ Equation (2)

Where:

BE_{Calcin}	=	Baseline ~~CO_2~~ emissions from calcination of calcium carbonate and magnesium carbonate (t CO_2)
0.785	=	Stoichiometric emission factor for CaO (t CO_2/t~~onnes~~ of CaO)
1.092	=	Stoichiometric emission factor for MgO (t CO_2/t~~onnes~~ of MgO)
$CaO_{RM,BSL}$	=	Non-carbonated CaO content in the raw materials in the baseline (t~~onnes~~ of CaO/t~~onnes~~ of raw material). These non-carbonated sources must be different from the non-carbonated materials used in the project activity
$CaO_{CLNK,BSL}$	=	CaO content in the clinker produced in the baseline (t~~onnes~~ of CaO/t~~onnes~~ of clinker)
$MgO_{RM,BSL}$	=	Non-carbonated MgO content in the raw materials in the baseline (t~~onnes~~ of MgO/t~~onnes~~ of raw material). These non-carbonated sources must be different from the non-carbonated materials used in the project activity
$MgO_{CLNK,BSL}$	=	MgO content in the clinker produced in the baseline (t~~onnes~~ of MgO/t~~onnes~~ of clinker)
RM_{BSL}	=	Annual consumption of non-carbonated raw materials in the baseline (t~~onnes~~)
$CLNK_{BSL}$	=	Annual production of clinker in the baseline (t~~onnes~~)
$CLNK_y$	=	Annual production of clinker in the year y (t~~onnes~~)

5.4.1.1. Guidance for CDM projects on Greenfield cement plants

41. For Greenfield projects, where data is not available for CaO and MgO contents of inputs (i.e. raw materials) and outputs (i.e. clinker), and for the annual consumption of non-carbonated raw materials under the baseline, the calculation of parameters $CaO_{RM,BSL}$, $CaO_{CLNK,BSL}$, $MgO_{RM,BSL}$, $MgO_{CLNK,BSL}$ and RM_{BSL} shall be based upon one of the following

three options. Project participants must use Option 1 or Option 2 where feasible. Only where these options are deemed unfeasible, Project participants can use Option 3. In such cases, the reasons for not using Options 1 or 2 must be described clearly and adequately by the project participant. The choice among the options shall be specified in the PDD, and cannot be changed during the crediting period.

42. **Option 1**: Lab analysis result report based on the raw material sample obtained in the region in the baseline scenario - Under this option, to obtain the values for $CaO_{RM,BSL}$, $CaO_{CLNK,BSL}$,$MgO_{RM,BSL}$, $MgO_{CLNK,BSL}$ and RM_{BSL}, samples/reports must be taken from the clinker production line (which may be owned by the same owner) with the lowest CO_2 emission per ton of clinker in the region.

43. **Option 2**: Values based on the sample obtained through authoritative sources (i.e. information from regulatory government authorities, sectoral ministries or publications of academic institutions etc.) - Under this option, to obtain the values for $CaO_{RM,BSL}$, $CaO_{CLNK,BSL}$,$MgO_{RM,BSL}$, $MgO_{CLNK,BSL}$ and RM_{BSL}, samples/reports must be taken from clinker production lines whose performance are among the top five or the top 20 per cent (top 5 or top 20 per cent with least emissions of CO_2 per ton of clinker) and which has been put into operation most recently (in the last five years before the start date or commissioning) in the defined region. The average values obtained from this option shall be used in the equation. The performance of the clinker production lines are based on the recently published information provided by authorized bodies or official documents.

44. **Option 3**: Rational and conservative simplification method: set the non-carbonated portion of the equation to zero (assume baseline plants use carbonated sources, limestone and clay). Equation simplifies to:

$$BE_{Calcin} = CLNK_y \times \left(0.785 \times \left(CaO_{CLNK,BSL}\right) + 1.092 \times \left(MgO_{CLNK,BSL}\right)\right)$$ Equation (3)

45. Then use any of the following two options:

(a) Take the values of parameters ($CLNKy$, $CaO_{CLNK,BSLy}$, $MgO_{CLNK,BSLy}$) from the project plant ($CaO_{CLNK,y}$, $MgO_{CLNK,y}$) and use for the baseline;

(b) Take IPCC clinker calcinations emission factor value for as 0.50 t CO_2/t clinker, for the baseline.

5.4.2. Baseline ~~CO2~~ emissions from combustion of fuels in the kiln for calcination (*BE_{FC_Calcin}*)

46. In order to calculate the CO_2 emissions related to fuel consumption, the historical kiln energy consumption performance values shall be used.

$$BE_{FC\_Calcin} = SKC_{BSL} \times \frac{\sum\left(FC_{i,Calcin,y} \times NCV_i \times EF_{CO2,i}\right)}{\sum\left(FC_{i,Calcin,y} \times NCV_i\right)} \times CLNK_y$$ Equation (4)

Where:

BE_{FC_Calcin}	=	Baseline ~~CO_2~~ emissions from combustion of fuels in clinker production (t CO_2)
SKC_{BSL}	=	Specific Kiln Calorific Consumption for the baseline scenario (GJ/t~~onnes~~ of clinker)
$FC_{i,Calcin,y}$	=	Fuel type *i* consumed for calcination in clinker production during the year *y* (mass or volume units)
$EF_{CO2,i}$	=	CO_2 emission factor for fuel type *i* (t CO_2/GJ)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)
NCV_i	=	Net calorific value of the fuel type *i* (GJ/mass or volume units)

47. In order to ensure that emission reductions for fuel switching measures, if any, undertaken during the project activity are not claimed, the types of fuel used during project activity are used to estimate BE_{FC_Calcin}.[4]

5.4.2.1. Guidance for CDM projects on Greenfield cement plants

48. For Greenfield projects, where data is not available for the baseline specific kiln calorific consumption (SKC_{BSL}), this parameter shall be determined using one of the following three options. The project participant shall undertake to calculate SKC_{BSL} according to Option 1 where this is feasible. However, this option may be deemed unfeasible due to data availability. In these cases Option 2 or Option 3 may be chosen. The choice among the options shall be specified in the PDD, and cannot be changed during the crediting period.

49. **Option 1**: Use of the average factor SKC_{BSL} of the top 20 per cent or top five best performing plants from a database covering installations built in the most recent five years in the region before the start date or commissioning.

50. **Option 2:** Use of the following default values as provided in the 2007 EU IPPC Reference Document on Best Available Technologies in the Cement and Lime Manufacturing Industries. In order to ensure conservativeness, these values represent the low end of a range of typical values provided in that document. 3000 MJ/tonne clinker for the dry process, multi-stage (three to six stages) cyclone preheater and precalcining kilns.

51. **Option 3**: Use same value as used in project activity (no claim of emission reduction from this component).

52. Note that for Greenfield projects, this methodology is used such that the fuel type(s) and corresponding emission factor(s) identified in the baseline is the same as that used in the project. Therefore, fuel type(s) in the baseline scenario should be deemed the same as in the project scenario. Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

[4] In this way, fuel switching is not precluded from the project activity, but it is assumed that this fuel switching would have occurred anyway in the baseline, and thus no emission reductions are accounted for in this case.

5.4.3. Baseline emissions due to discarded dust from bypass and de-dusting units (*CDK*) system (*BE_{Dust}*)

53. If there is a discarded dust leaving the kiln system from the bypass and de-dusting unit (*CDK*), the baseline emissions due to discarded dust leaving the kiln system shall be determined as follows:

$$BE_{Dust} = \frac{\left\{(C_{BSL} \times ByPass_{BSL}) + \frac{C_{BSL} \times d_{BSL}}{[C_{BSL} \times (1 - d_{BSL}) + 1]} \times \cancel{CKD}CDK_{BSL}\right\}}{CLNK_{BSL}} \times CLNK_y \quad \text{Equation (5)}$$

Where:

BE_{Dust}	=	Baseline CO_2 emissions factor due to discarded dust from bypass and dedusting units (CDK) system (t CO_2)
C_{BSL}	=	Baseline calcination emissions factor due to both de-carbonization reaction and fuel consumption in clinker production (t CO_2/t~~onne of~~ clinker)
$ByPass_{BSL}$	=	Annual production of Bypass dust leaving kiln system (t~~onnes~~)
$C\cancel{KD}DK_{BSL}$	=	Annual production of ~~CKD~~ CDK dust leaving kiln system in the baseline (t~~onnes~~)
d_{BSL}	=	~~CKD~~ CDK calcination rate (released CO_2 expressed as a fraction of the total carbonate CO_2 in the raw materials)
$CLNK_{BSL}$	=	Annual production of clinker in the baseline (t~~onnes~~)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)

54. The parameter C_{BSL} should be calculated as follows:

$$C_{BSL} = \frac{BE_{Calcin} + BE_{FC\_Calcin}}{CLNK_{BSL}} \quad \text{Equation (6)}$$

Where:

C_{BSL}	=	Baseline calcination factor due to both de-carbonization reaction and fuel consumption in clinker production (t CO_2/t~~onne of~~ clinker)
BE_{Calcin}	=	Baseline CO_2 emissions from calcination of calcium carbonate and magnesium carbonate (t CO_2)
BE_{FC_Calcin}	=	Baseline CO_2 emissions from fuel consumption in clinker production (t CO_2)
$CLNK_{BSL}$	=	Annual production of clinker in the baseline (t~~onnes of~~ clinker)

5.4.3.1. Guidance for CDM projects on Greenfield cement plants

55. For Greenfield projects, where data is not available for the parameters $ByPass_{BSL}$, CKD_{BSL}, and d_{BSL}, these values shall be determined using one of the following two options. The project participant shall undertake to calculate these parameters according to Option 1 where this is feasible. However, this option may be deemed unfeasible due to data availability in these cases, Option 2 may be chosen. The choice among the options shall be specified in the PDD, and cannot be changed during the crediting period.

56. **Option 1**: Use of the average factors of the top 20 per cent of five recently built plants of similar kiln technology in the region before the start date - Use of weighted average factors (weighted by clinker production) of the top 20 per cent or five plants built in the last five year before the start date of project activity in the region of similar kiln technology. For parameters $ByPass_{BSL}$ and CDK_{BSL}, these data must be normalised as average benchmark values based upon clinker production data (i.e. tonnes/tonne clinker). The actual values (i.e. average benchmark values multiplied with the $CLNK_y$) for $ByPass_{BSL}$ and CDK_{BSL} in tonnes can then be used in the calculation of BE_{Dust}. In cases where the data is available only for CDK_{BSL}, project participants can assume $ByPass_{BSL}$ as zero. In the absence of data upon which to calculate the calcination parameter d_{BSL}, a conservative default factor of 1 must be applied as recommended in the WBCSD/CSI CO_2 Accounting and Reporting Standard for the Cement Industry.

57. **Option 2**: Use of the IPCC Reporting Guidelines for National Greenhouse Gas Inventories default value of CO_2 from discarded dust (combining both CDK and bypass dust i.e. $ByPass_{BSL}$ and CDK_{BSL}) representing an additional two per cent to clinker CO_2 emissions. Therefore, where this option is chosen, BE_{Dust} should be calculated as :

$$BE_{Dust} = 0.02\ x\ (BE_{Calcin} + BE_{FC\_Calcin} + BE_{FC\_Dry} + BE_{EC}) \qquad \text{Equation (7)}$$

5.4.4. Baseline emissions from fuel consumption for drying of raw material or fuel preparation (*BE*$_{FC\_Dry}$)

$$BE_{FC\_Dry} = \frac{\sum(FC_{Dry,i} \times EF_{CO2,i} \times NCV_i)}{CLNK_{BSL}} \times CLNK_y \qquad \text{Equation (8)}$$

Where:

BE_{FC_Dry}	=	Baseline ~~CO_2~~ emissions due to fuel consumption for drying of raw materials or fuel preparation (t CO_2)
$FC_{Dry,i}$	=	Fossil fuel *i* consumed for drying raw materials or fuel preparation in the baseline (t~~onnes~~)
$EF_{CO2,i}$	=	CO_2 emission factor for fuel type *i* (t CO_2/GJ)
NCV_i	=	Net calorific value of the fuel type *i* (GJ/mass or volume units)
$CLNK_{BSL}$	=	Annual production of clinker in the baseline (t~~onnes~~)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)

5.4.4.1. Guidance for CDM projects on Greenfield cement plants

58. For Greenfield projects, where data is not available for the baseline fossil fuel consumption used in drying ($FC_{Dry,i}$), this value shall be determined using one of the following two options. The project participant shall undertake to calculate $FC_{Dry,I}$ according to Option 1 where this is feasible. However, this option may be deemed unfeasible due to data availability. In these cases Option 2 may be chosen. The choice among the options shall be specified in the PDD, and cannot be changed during the crediting period.

59. **Option 1**: Use of the weighted average factor $FC_{Dry,i}$ (weighted by clinker production) of the top 20 per cent or five most recently built plants built in the last five year in the region before the start date of the project activity. This factor must be normalised as an average benchmark value based upon clinker production data (i.e. tonnes/tonne clinker). The actual value in tonnes can then be used in the calculation of BE_{FC_Dry} based on the value for $CLNK_y$.

$$FC_{Dry,i} = \frac{FC_{Dry,i,a}}{CLNK_{y,a}} \times CLNK_y \quad \text{Equation (9)}$$

Where:

$FC_{Dry,i,a}$	=	Fossil fuel *i* consumed for drying raw materials or fuel preparation in all the plants in the region (t)
$CLNK_{y,a}$	=	Annual production of clinker in the all the plants in the region (t)

60. **Option 2**: Based on raw mill/fuel mill design basics - Identify the raw drying fuel type used in the top 20 per cent or five most recently built plants built in the region in last five years before start date of project activity. If anyone (which is top 20 per cent) of the plants don't use drying fossil fuel, then the baseline is zero and no claims from this component. Otherwise (if 100 per cent) use drying fuel, identify the fuel type with lowest emission (in terms of energy expressed in t CO_2/TJ) factor and adapt the following equation:

$$BE_{FC_{Dry,i},y} = \frac{\sum FC_{Dry,i} \times EF_{CO2,i}}{CLNK_{BSL}} \times CLNK_y \quad \text{Equation (10)}$$

Where:

$FC_{DRY,i}$	=	Total fuel consumed for drying (GJ)

$$FC_{Dry,i} = \frac{Hxh_{y,i} \times 4.186}{1000000} \quad \text{Equation (11)}$$

Where:

H	=	Heat requirement for raw material (kCal/hrs)
$h_{y,i}$	=	Annual operating hours of the mill grinding/drying raw material (hrs)
$4.186/1000000$	=	Conversion factor from kCal to GJ

$$H = (M_m \times L) + C_p \times M_m \times (\Delta T) \quad \text{Equation (12)}$$

Where:

M_m	=	Moisture to be evaporated, (kg/hrs)
L	=	Latent heat required to evaporate water at 20 °C, in Kcal/hrs, (empirical value= 540)
Cp	=	Specific heat of water =1 Kcal/Kg º C
ΔT	=	Outlet gas temperature º C - ambient gas temperatureº C

$$M_m = \frac{(m_b - m_a)}{(100 - m_b)} \times M_e \quad \text{Equation (13)}$$

Where:

M_m	=	Moisture to be evaporated, (kg/hrs)
m_b	=	Minimum moisture content before drying (%)
m_a	=	Moisture content after drying (%)
Me	=	Mill capacity (t/hrs)

61. Similar with case of fuel in project emissions, PPs must keep the moisture content before and after mill, of the project raw materials as the moisture content of the baseline raw material. The saving must only come from avoiding/reduced use of drying fuel used in baseline dryers. PP who can't establish $CLNK_{BSL}$ may keep the clinker output of the baseline and project equal in each crediting year (conservative).

62. Note that for Greenfield projects, this methodology is used such that the fuel type(s) and corresponding emission factor(s) identified in the baseline is the same as that used in the project. Therefore, fuel type(s) in the baseline scenario should be deemed the same as in the project scenario. Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

5.4.5. Baseline emissions due to ~~from grid~~ electricity consumption for clinker production ($BE_{Elec\cancel{Elec\_Grid}}$)

$$BE_{Elec\cancel{\_Grid}} = \frac{BE_{EC,y}\cancel{\left(EC_{RM,Grid} + EC_{Feed,Grid} + EC_{KO,Grid}\right) \times EF_{CO2,Elec\_Grid}}}{CLNK_{BSL}} \times CLNK_y \quad \text{Equation (14)}$$

Where:

$\cancel{BE_{Elec\_Grid}}$	~~=~~	~~Baseline CO_2 emissions factor for the grid electricity consumption for clinker production (t CO_2)~~
$\cancel{EC_{RM,Grid}}$	~~=~~	~~Baseline grid electricity consumption for raw materials grinding (MWh)~~
$\cancel{EC_{Feed,Grid}}$	~~=~~	~~Baseline grid electricity consumption for fuel feeding (MWh)~~
$\cancel{EC_{KO,Grid}}$	~~=~~	~~Baseline grid electricity consumption for kiln operation (MWh)~~
$\cancel{EF_{CO2,Elec\_Grid}}$	~~=~~	~~CO_2 emission factor of the grid (t CO_2/MWh)~~
$CLNK_{BSL}$	=	Annual production of clinker in the baseline (t~~onnes~~)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)
BE_{Elec}	=	Baseline emissions due to electricity consumption used for clinker production (t CO_2)
$BE_{EC,y}$	=	Baseline emissions from electricity consumption in year *y* (t CO_2)

63. CO_2 emissions from electricity consumption in year *y* ($BE_{EC,y}$) should be calculated using the latest approved version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". Electricity consumption from each relevant source (raw material grinding, fuel feeding and kiln operation) should be monitored and summed up to $EC_{BL,k,y}$.

~~68. CO_2 emission factor of the grid ($EF_{CO2,Elec\_Grid}$) shall be calculated in accordance with the procedures and guidelines provided in latest version of the approved "Tool to calculate the emission factor for an electricity system".~~

~~5.4.6. Baseline emissions from self-generation of electricity for clinker production (BEElec_SG)~~

$$\cancel{BE_{Elec\_SG} = \frac{\left(EC_{RM,SG} + EC_{Feed,SG} + EC_{KO,SG}\right) \times EF_{CO2,Elec\_SG}}{CLNK_{BSL}} \times CLNK_y} \quad \text{~~Equation 15~~}$$

~~Where:~~

$\cancel{BE_{Elec\_SG}}$	~~=~~	~~Baseline CO_2 emissions for self-generated electricity used for clinker production (t CO_2)~~

~~$EC_{RM,SG}$~~	~~=~~	~~Baseline self-generated electricity consumed for raw materials grinding (MWh)~~
~~$EC_{Feed,SG}$~~	~~=~~	~~Baseline self-generated electricity consumed for fuel feeding (MWh)~~
~~$EC_{KO,SG}$~~	~~=~~	~~Baseline self-generated electricity consumed for kiln operation (MWh)~~
~~$EF_{CO2,Elec\_SG}$~~	~~=~~	~~CO_2 emission factor of selfd-generated electricity (t CO_2/MWh)~~
~~$CLNK_{BSL}$~~	~~=~~	~~Annual production of clinker in the baseline (tonnes)~~
~~$CLNK_y$~~	~~=~~	~~Annual production of clinker in the year *y* (tonnes)~~

~~69. CO_2 emission factor for self-generated electricity ($EF_{CO2,Elec\_SG}$) shall be determined as the generation-weighted average emissions per electricity unit (t CO_2/MWh) of all self-generating sources in the project boundary serving the facility.~~

$$\cancel{EF_{CO2,Elec\_SG} = \frac{\sum_{i,j} F_{i,j} \times COEF_i}{\sum_j GEN_j}} \quad \text{~~Equation 16~~}$$

~~Where:~~

~~$EF_{CO2,Elec\_SG}$~~	~~=~~	~~CO_2 emission factor of selfd-generated electricity (t CO_2/MWh)~~
~~$F_{i,j}$~~	~~=~~	~~Amount of fuel i consumed by relevant power sources *j* (mass or volume units)~~
~~j~~	~~=~~	~~On-site power sources~~
~~$COEF_i$~~	~~=~~	~~CO_2 emission coefficient of fuel *i* (t CO_2/mass or volume units)~~
~~GEN_j~~	~~=~~	~~Electricity generated by the source *j* (MWh)~~

~~70. The CO_2 emission coefficient $COEF_i$ is obtained as:~~

$$\cancel{COEF_i = NCV_i \times EF_{CO2,i} \times OXID_i} \quad \text{~~Equation 17~~}$$

~~Where:~~

~~$COEF_i$~~	~~=~~	~~CO_2 emission coefficient of fuel *i* (t CO_2/mass or volume units)~~
~~NCV_i~~	~~=~~	~~Net calorific value of the fuel type *i* (GJ/mass or volume units)~~
~~$OXID_i$~~	~~=~~	~~Oxidation factor of the fuel *i* (see Table 1-4 in the 2006 IPCC Guidelines, Vol. 2, page 1.25, for default values)~~
~~$EF_{CO2,i}$~~	~~=~~	~~CO_2 emission factor for fuel type *i* (t CO_2/GJ)~~

5.4.6.1. Guidance for CDM projects on Greenfield cement plants

64. For Greenfield projects, where data is not available for the electricity consumption in the baseline the following two options can be used. The project participant shall undertake Option 1 where this is feasible. However, this option may be deemed unfeasible due to

data availability, in this case Option 2 may be chosen. The choice among the options shall be specified in the PDD, and cannot be changed during the crediting period.

65. **Option 1**: Use of the summed (aggregate) actual values for *EC* and $CLNK_{BSL}$ for the top 20 per cent or five most recently built plants in the region of similar kiln technology before the start date or commissioning. The use of these summed values must then be used to develop a benchmark figure (i.e. kWh/tonne clinker) by dividing ∑ EC by ∑ CLNK. The actual value (i.e. MWh) for EC can then be used in the calculation of BE_{Elec} based on the value for $CLNK_{BSL}$. The proportion for electricity in the baseline shall be considered in same proportion in the project i.e. if the 60 per cent electricity in project is sourced from grid the same proportion should be used in baseline.

$$EC_{BL,k,y} = \frac{EC_{BL,k,y,a}}{CLNK_{y,a}} \times CLNK_y \quad \text{Equation (15)}$$

Where:

$EC_{BL,k,y}$	=	Quantity of electricity that would be consumed by the baseline electricity consumption source *k* in year *y*
$EC_{BL,k,y,a}$	=	Quantity of electricity consumed by all plants in the region for clinker production in year *y* (MWh/yr)
$CLNK_{y,a}$	=	Annual production of clinker in the all the plants in the region (t)

66. **Option 2**: Use of same specific electricity consumption rate for baseline and project emissions. In the case where a self-generation power plant is operated under the project, it is assumed that the same plant would operate in the baseline.

67. In estimating baseline emissions above from emission sources covered from section 5.4.1 to 5.4.5; in case of existing plants, historical data on the project plant for at least one full year before the start date is required. For Greenfield plants historical data on the sample plants in the region for at least one full calendar year before the start date or commissioning is required, wherever defaults under the options provided above are not chosen. More over PP who can’t establish $CLNK_{BSL}$ may keep the clinker output of the baseline and project equal in each crediting year.

5.5. Project emissions

68. Similar to the baseline emissions, project activity emissions shall be expressed as CO_2 emissions ~~factor per ton of clinker produced~~, as follows:

$$PE_y = PE_{Calcin,y} + PE_{FC\_Calcin,y} + PE_{Dust,y} + PE_{FC\_Dry,y} + PE_{Elec\cancel{\_Grid},y} \cancel{+ PE_{Elec\_SG,y}} \quad \text{Equation (16)}$$

Where:

PE_y	=	Project emissions in the year *y* (t CO_2)
$PE_{Calcin,y}$	=	Project ~~CO_2~~ emissions from calcination of calcium carbonate and magnesium carbonate in the year *y* (t CO_2)
$PE_{FC\_Calcin,y}$	=	Project ~~CO_2~~ emissions from for combustion of fuels in clinker production in the year *y* (t CO_2)
$PE_{Dust,y}$	=	Project ~~CO_2~~ emissions due to discarded dust from bypass and dedusting units (CDK) system in the year *y* (t CO_2)
$PE_{FC\_Dry,y}$	=	Project ~~CO_2~~ emissions due to fuel consumption for drying of raw material or fuel preparation in the year *y* (t CO_2)
$PE_{Elec\cancel{\_Grid},y}$	=	Project ~~CO_2~~ emissions ~~factor for the grid~~ due to electricity consumption for clinker production in the year *y* (t CO_2)
~~$PE_{Elec\_SG,y}$~~	~~=~~	~~Project CO_2 emissions for self-generated electricity used for clinker production in the year *y* (t CO_2)~~

5.5.1. Project emissions from calcination of carbonates (*$PE_{Calcin,y}$*)

69. For estimation of CO_2 emissions resulting from calcination, only the proportion of calcium oxides and magnesium oxides present in the produced clinker will be considered. Measured values of CaO and MgO contents, corrected for the non-carbonate sources (for example, deducting any calcium that comes from use of calcium silicates or fly ash used as raw materials) shall be used. CO_2 emissions from calcination with correction for non-carbonate sources shall be determined as follows:

$$PE_{Calcin,y} = 0.785 \times \left(CaO_{CLNK,y} \times CLNK_y - CaO_{RM,y} \times RM_y\right) + 1.092 \times \left(MgO_{CLNK,y} \times CLNK_y - MgO_{RM,y} \times RM_y\right) \quad \text{Equation (17)}$$

Where:

$PE_{Calcin,y}$	=	Project ~~CO_2~~ emissions from calcination of calcium carbonate and magnesium carbonate in the year *y* (t CO_2)
0.785	=	Stoichiometric emission factor for CaO (t CO_2/t~~onnes of~~ CaO)
1.092	=	Stoichiometric emission factor for MgO (t CO_2/t~~onnes of~~ MgO)
$CaO_{RM,y}$	=	Non-carbonated CaO content in the raw materials in the year *y* (t~~onnes of~~ CaO/t~~onnes of~~ raw material)
$CaO_{CLNK,y}$	=	CaO content in the clinker produced in the year *y* (t~~onnes~~ of CaO/t~~onnes of~~ clinker)
$MgO_{RM,y}$	=	Non-carbonated MgO content in the raw materials in the year *y* (t~~onnes of~~ MgO/t~~onnes of~~ raw material)
$MgO_{CLNK,y}$	=	Product of the MgO content in the clinker produced in the year *y* (t~~onnes of~~ MgO/t~~onnes of~~ clinker)

RM_y	=	Annual consumption of non-carbonated raw materials in the year *y* (t~~onnes~~)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)

5.5.2. Project emissions from combustion of fuels in the kiln for calcination ($PE_{FC\_Calcin,y}$)

$$PE_{FC\_Calcin,y} = SKC_y \times \frac{\sum(FC_{i,Calcin,y} \times NCV_i \times EF_{CO2,i})}{\sum(FC_{i,Calcin,y} \times NCV_i)} \times CLNK_y$$ Equation (18)

Where:

$PE_{FC\_Calcin,y}$	=	Project ~~CO_2~~ emissions from combustion of fuels in clinker production in the year *y* (t CO_2)
SKC_y	=	Specific Kiln Calorific Consumption for the year *y* (GJ/t~~onnes of~~ clinker)
$FC_{i,Calcin,y}$	=	Fuel type *i* consumed for calcination in clinker production during the year *y* (mass or volume units)
$EF_{CO2,i}$	=	CO_2 emission factor for fuel type *i* (t CO_2/GJ)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)
NCV_i	=	Net calorific value of the fuel type *i* (GJ/mass or volume units)

5.5.2.1. Procedure to ensure that emission reductions are claimed only for the alternative materials used

70. This procedure is not applicable for the project activities where the energy efficiency is included and it has been demonstrated as additional.

71. ~~As this methodology is restricted to the use of new alternative material for clinker production and not to efficiency improvement measures that could take place at the same time as the project activity, t~~ The following procedure shall be used to ensure the emission reductions from project activity are claimed only for the alternative materials used for the project activity where energy efficiency project is not implemented or non-additional. ~~Diagram 1.1~~ Figure 2 below, gives a graphic description of comparative procedure for project emission calculation. The procedures is based on comparison of the actual kiln energy performance in the year *y* ($SKC_{y,measured}$) with the baseline kiln energy performance (SKC_{BSL}) and the expected value with the project activity (SKC_{ex}). SKC_{ex} shall be estimated by means of industrial samples that follow an ex ante monitoring procedure described in the appendix 1 to this methodology. The following rule (also explained in the ~~diagram 1.1~~ Figure 2) applies for assigning value to SKC_y in equation 21 ~~12~~:

(a) If $SKC_{y,measured} \geq SKC_{BSL}$ then $SKC_y = SKC_{y,measured}$;

(b) If $SKC_{y,measured} < SKC_{BSL}$, choose either the conservative approach (Option A) or follow the detailed procedure (Option B);

(c) Option A: Use $SKC_y = SKC_{BSL}$ (conservative approach); or

(d) Option B: Follow the detailed procedure below;

(i) If $\%AMC_y$ falls out of “$\%AMC_{ex}$ optimal range”, then,

$$SKC_y = SKC_{BSL}$$ Equation (19)

(ii) If $\%AMC_y$ falls between the “$\%AMC_{ex}$ optimal range”; and $SKC_{y,measured}$ falls between “SKC_{ex} *optimal range*”, respectively, then

$$SKC_y = SKC_{y,measured}$$ Equation (20)

(iii) If $\%AMC_y$ falls between the “$\%AMC_{ex}$ optimal range and if $SKC_{y,measured}$ is lower than any value of the interval “SKC_{ex} *optimal range*”, SKC_y shall be calculated as follows:

$$SKC_y = \overline{SKC_j}$$ Equation (21)

(*j* runs from 1 to “y-1” years following project implementation in iii above). ~~This average shall exclude SKC_j values that were higher than SKC_{BSL}, i.e. allowed SKC_j values fall within the following range:~~

$$\cancel{\overline{SKC_{ex}} < SKC_j \leq SKC_{BSL}}$$ ~~Equation (22)~~

Where:

SKC_y = Specific Kiln Calorific Consumption for the year *y* (GJ/t~~onnes of~~ clinker)

$SKC_{y,measured}$ = Specific Kiln Calorific Consumption measured in the year *y* (GJ/t~~onne~~ clinker)

SKC_{BSL} = Specific Kiln Calorific Consumption for the baseline scenario (GJ/t~~onnes of~~ clinker)

$\overline{SKC_{ex}}$ = Arithmetic mean of Specific Kiln Calorific Consumption during ex ante monitoring (GJ/t~~onne~~ clinker). See appendix 1

$SKC_{ex} optimal\ range$ = Interval of 95 per cent of confidence for specific kiln calorific consumption during ex ante monitoring (GJ/t~~onne~~ clinker). See appendix 1

$\overline{SKC_j}$ = Average of specific kiln calorific consumption following project activity prior to the year *y*. Label *j* is a counter that runs from 1 to “y-1”. (GJ/t~~onne~~ clinker). If *y* = 1, $\overline{SKC_j}$ = SKC_{BSL}

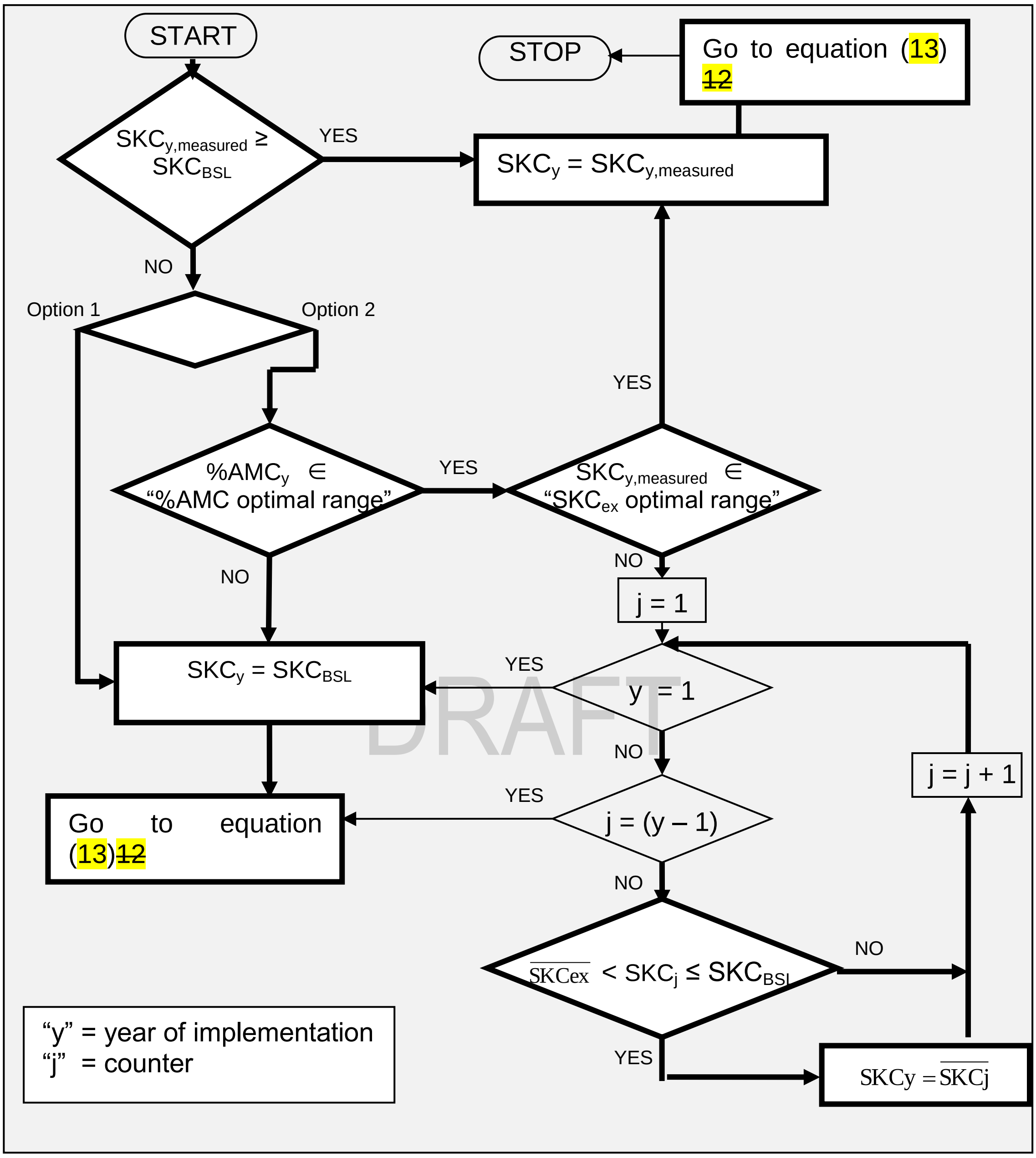
$FC_{i,Calcin,y}$ = Fuel type *i* consumed for calcination in clinker production during the year *y* (mass or volume units)

$EF_{CO2,i}$ = CO_2 emission factor for fuel type *i* (t CO_2/GJ)

$\%AMC_y$	=	Percentage of Alternative Materials in the raw materials production in the year *y* due to project activity implementation. The %AMC could be %SO3 or % (SO3 and CaF2) or Lime Saturation Factor (LSF) or raw materials particle size (fineness)
$\overline{\%AMC_{ex}}$	=	Arithmetic mean of %AMC in the raw materials during ex ante monitoring. See appendix 1
$\%AMC_{ex} optimal\ range$	=	Interval of 95 per cent of confidence for AMC content in the raw materials during ex ante monitoring. See appendix 1

72. ~~In case (ii)~~ Option B (ii) above, the project participants ~~proponents~~ can opt for a conservative but a simpler approach to assign value to SKC_y choosing Option A ($SKC_y = SKC_{BSL}$) which disregard the emission reductions from the reduced use of fossil fuel. Should the project proponents want to claim emission reductions from reduced use of fossil fuel, they can opt for Option B following the detailed procedure. Under the detailed procedure, project participants shall demonstrate that the higher energy performance is only due to the utilization of alternative materials. To do so, the project participants ~~proponents~~ have to compare the actual specific kiln calorific consumption ($SKC_{y,measured}$) for the year *y* with the results of the ex ante monitoring at the beginning of the project implementation (SKC_{ex}) (See Figure 2 ~~Diagram 1.1~~). This ex ante monitoring procedure is explained in appendix 1. The main purpose of this ex ante monitoring procedure is to develop an industrial testing procedure (where kiln operational variables are under total control) that shows the highest specific consumption reduction (“optimum”) that is possible to achieve during project implementation. The optimum values will only be used as reference.

Figure 2. Flowchart to assign value to *SKC$_y$* in equation 13 ~~12~~



5.5.3. Project emissions due to discarded dust from bypass and dedusting units (*CDK*) system (*PE$_{Dust,y}$*)

73. If there is a discarded dust from the bypass and dedusting unit (CDK), the emissions due to discarded dust shall be determined as follows:

$$PE_{Dust,y} = (C_y \times ByPass_y) + \frac{C_y \times d_y}{[C_y \times (1 - d_y) + 1]} \times C\cancel{KD}DK_y \qquad \text{Equation (23)}$$

Where:

$PE_{Dust,y}$	=	Project ~~CO_2~~ emissions factor due to discarded dust from bypass and dedusting units (CDK) system in the year *y* (t CO_2)
C_y	=	Project calcination factor due to both de-carbonization reaction and fuel consumption in clinker production (t CO_2/t~~onne of~~ clinker)
$ByPass_y$	=	Annual production of Bypass dust leaving kiln system (tonnes)
$C\cancel{KD}DK_y$	=	Annual production of ~~CKD~~ CDK dust leaving kiln system (t~~onnes~~)
d_y	=	~~CKD~~ CDK calcination rate (released CO_2 expressed as a fraction of the total carbonate CO_2 in the raw materials)

74. The parameter C_y should be calculated as follows:

$$C_y = \frac{PE_{Calcin,y} + PE_{FC\_Calcin,y}}{CLNK_y} \quad \text{Equation (24)}$$

Where:

C_y	=	Project calcination factor due to both de-carbonization reaction and fuel consumption in clinker production (t CO_2/t~~onne of~~ clinker)
$PE_{Calcin,y}$	=	Project ~~CO_2~~ emissions from calcination of calcium carbonate and magnesium carbonate in the year *y* (t CO_2)
$PE_{FC\_Calcin,y}$	=	Project ~~CO_2~~ emissions from fuel consumption in clinker production in the year *y* (t CO_2)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)

5.5.4. Project emissions from fuel consumption for drying of raw material or fuel preparation ($PE_{FC\_Dry,y}$)

$$PE_{FC\_Dry,y} = \sum \left(FC_{Dry\_Addl,i,y} \times EF_{CO2,i} \times NCV_i \right) \quad \text{Equation (25)}$$

Where:

$PE_{FC\_Dry,y}$	=	Project CO_2 emissions factor due to fuel consumption for drying of raw material or fuel preparation in the year *y* (t CO_2)
$FC_{Dry\_Addl,\cancel{i}i,y}$	=	Fossil fuel *i* consumed for drying raw materials or fuel preparation in the year *y* (mass or volume units)
$EF_{CO2,i}$	=	CO_2 emission factor for fuel type *i* (t CO_2/GJ)
NCV_i	=	Net calorific value of the fuel type *i* (GJ/mass or volume units)

5.5.5. Project emissions from grid electricity consumption for clinker production ($PE_{Elec\_Grid,y}$)

$$\cancel{PE_{Elec\_Grid,y} = (EC_{RM,Grid,y} + EC_{Feed,Grid,y} + EC_{KO,Grid,y}) \times EF_{CO2,Elec\_Grid,y}}$$ ~~Equation 26~~

~~Where:~~

~~$PE_{Elec\_Grid,y}$~~	~~=~~	~~Project CO_2 emissions factor for the grid electricity consumption for clinker production in the year *y* (t CO_2)~~
~~$EC_{RM,Grid,y}$~~	~~=~~	~~Grid electricity consumption for raw materials grinding (MWh)~~
~~$EC_{Feed,Grid,y}$~~	~~=~~	~~Grid electricity consumption for fuel feeding (MWh)~~
~~$EC_{KO,Grid,y}$~~	~~=~~	~~Grid electricity consumption for kiln operation (MWh)~~
~~$EF_{CO2,Elec\_Grid,y}$~~	~~=~~	~~CO_2 emission factor of the grid (t CO_2/MWh)~~

75. CO_2 emissions from electricity consumption ($PE_{EC,y}$) should be calculated using the latest approved version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". Electricity consumption from each relevant source (raw material grinding, fuel feeding and kiln operation) should be monitored and summed up to $EC_{PJ,y}$.

76. For the project activities where energy efficiency measures are additional the actual measured values to be used in the project emission calculation.

~~81. CO_2 emission factor of the grid ($EF_{CO2,Elec\_Grid,y}$) shall be calculated in accordance with the procedures and guidelines provided in latest version of the approved "Tool to calculate the emission factor for an electricity system".~~

77. For the project activities where energy efficiency measures are not implemented or not additional ~~As this methodology is restricted to the use of new alternative raw materials only for clinker production and not for any reduction in electricity energy consumption for raw materials or kiln operations,~~ the $EC_{PJ,y}$ ~~project CO_2 emissions from grid electricity consumption ($PE_{Elec\_grid,y}$) from the grid~~ shall be the maximum between the measured value in project and baseline. ~~base on the following considerations. The value of $EC_{RM,Grid,y}$ and $EC_{KO,Grid,y}$ shall be as follows:~~

$$\cancel{EC_{RM,Grid,y} = max(EC_{RM,Grid,y}, EC_{RM,Grid})}$$ ~~Equation 26~~

$$\cancel{EC_{KO,Grid,y} = max(EC_{KO,Grid,y}, EC_{KO,Grid})}$$ ~~Equation 27~~

$$EC_{PJ,y} = max(EC_{PJ,y}, EC_{BL,k,y})$$ Equation (26)

~~5.5.6. Project emissions from self-generation of electricity for clinker production ($PE_{Elec\_SG,y}$)~~

$$PE_{Elec\_SG,y} = \left(EC_{RM,SG,y} + EC_{Feed,SG,y} + EC_{KO,SG,y}\right) \times EF_{CO2,Elec\_SG} \quad \text{Equation 27}$$

~~Where:~~

$PE_{Elec\_SG,y}$	=	~~Project CO_2 emissions for self-generated electricity used for clinker production in the year *y* (t CO_2)~~
$EC_{RM,SG,y}$	=	~~Self-generated electricity consumed for raw materials grinding (MWh)~~
$EC_{Feed,SG,y}$	=	~~Self-generated electricity consumed for fuel feeding (MWh)~~
$EC_{KO,SG,y}$	=	~~Self-generated electricity consumed for kiln operation (MWh)~~
$EF_{CO2,Elec\_SG}$	=	~~CO_2 emission factor of self-generated electricity (t CO_2/MWh)~~

~~78. The value of $EC_{RM,SG,y}$ and $EC_{KO\_SG,y}$ is calculated as:~~

$$EC_{RM,SG,y} = max\left(EC_{RM,SG,y}, EC_{RM,Grid}\right) \quad \text{Equation 28}$$

$$EC_{KO,SG,y} = max\left(EC_{KO,SG,y}, EC_{KO,Grid}\right) \quad \text{Equation 29}$$

~~83. CO_2 emission factor for self-generated electricity ($EF_{CO2,Elec\_SG,y}$) shall be determined as the generation-weighted average emissions per electricity unit (t CO_2/MWh) of all self-generating sources in the project boundary serving the facility.~~

$$EF_{CO2,Elec\_SG,y} = \frac{\sum_{i,j} F_{i,j} \times COEF_i}{\sum_j GEN_j} \quad \text{Equation 30}$$

~~Where:~~

$EF_{CO2,Elec\_SG,y}$	=	~~CO_2 emission factor of selfd-generated electricity (tCO_2/MWh)~~
$F_{i,j}$	=	~~Amount of fuel *i* consumed by relevant power sources *j* (mass or volume units)~~
j	=	~~On-site power sources~~
$COEF_i$	=	~~CO_2 emission coefficient of fuel *i* (t CO_2/mass or volume units)~~
GEN_j	=	~~Electricity generated by the source *j* (MWh)~~

~~84. The CO_2 emission coefficient $COEF_i$ is obtained as:~~

$$COEF_i = NCV_i \times EF_{CO2,i} \times OXID_i \quad \text{Equation 31}$$

~~Where:~~

$COEF_i$	=	~~CO_2 emission coefficient of fuel *i* (t CO_2/mass or volume units)~~

~~NCV_i~~	~~=~~	~~Net calorific value of the fuel type *i* (GJ/mass or volume units)~~
~~$OXID_i$~~	~~=~~	~~Oxidation factor of the fuel *i* (see Table 1-4 in the 2006 IPCC Guidelines, Vol. 2, page 1.25, for default values)~~
~~$EF_{CO2,i}$~~	~~=~~	~~CO_2 emission factor for fuel type *i* (t CO_2/GJ)~~

5.6. Leakage

79. The following emission sources shall be considered as leakage under this methodology:

(a) Any incremental increase in transportation of clinker raw material (limestone, clay and iron ore), fuels (fossil fuels and alternative fuels) and new alternative materials (blast furnace slag, fly ash, waste ash from fuel combustion in thermal power plants, gypsum and others) from offsite locations to the project plant site. Any decrease in transport-related emissions for existing clinker raw materials and fuels change shall not be accounted; The Greenfield plant shall use the transport related emissions only from the new alternative raw material;

~~(b) Emissions due to transport of alternative raw materials will be accounted as leakage~~;

(b) Emissions from grid electricity consumption for conveyor system for alternative materials where new conveyor system is installed due to the project activity and consumption is not included in the project emissions section;

(c) In case, electricity consumption in cement raw material grinding, preparation and feeding for blended cement production, due to indirect effects of the change of clinker conditions in cement production (i.e. the clinker could be harder to grind; therefore, the cement grinding needs more electricity consumption in order to produce the same quality of common-practice blended cement);

(d) Changes in clinker proportion in cement production due to the same effects of the potential changes in the physical and mineralogical condition of clinker, in common-practice blended cement production (i.e. the project participants ~~proponents~~ could need more or less clinker in order to produce the same quality of common-practice blended cement).

~~83. Another possible leakage is due to the diversion of alternative raw materials from existing uses. The project participants proponents shall demonstrate that the quantities of AMC alternative raw materials used in the project are surplus. For this purpose the project participants need to conduct a survey to demonstrate that the alternative raw materials are available in the region by at least 1.5 times the demand for the same alternative raw materials from all existing users including the project plant. Otherwise, this methodology is not applicable.~~

80. The leakage from the project activity is expressed as:

$$LE_y = LE_{Trans,y} + LE_{Elec\_Conv,y} + LE_{ele\_cto,y} + LE_{Cto,y} \quad \text{Equation (27)}$$

Where:

LE_y	=	CO_2 emissions due to leakage during the year *y* (t CO_2)
$LE_{Trans,y}$	=	CO_2 leakage due to transportation of new materials during the year *y* (t CO_2)
$LE_{Elec\_Conv,y}$	=	CO_2 emissions from electricity consumption for conveyor systems for alternative materials during the year *y* (t CO_2)
$LE_{ele\_cto,y}$	=	CO_2 leakage due to additional electricity consumption in blended cements grinding during the year *y* (t CO_2)
$LE_{Cto,y}$	=	CO_2 leakage due to higher clinker consumption in blended cements during the year *y* (t CO_2)

5.6.1. Leakage due to transportation of new alternative raw materials (*LE_{Trans}*)

81. Transport-related emissions for alternative raw materials shall be determined as follows:

$$LE_{Trans,y} = \frac{\left[FC_{Trans,i} \times Dist \times NCV_i \times EF_{CO2,i}\right]}{\left(Q_{Trip} \times 1000\right)} \times ALTM_y \quad \text{Equation (28)}$$

Where:

$LE_{Trans,y}$	=	CO_2 leakage due to transportation of new materials during the year *y* (t CO_2)
$FC_{Trans,i}$	=	Fuel consumption of the vehicle per kilometer (mass or volume unit of fuel/kilometer)
$Dist$	=	Distance between the source of fuel and the project activity plant (km)
$EF_{CO2,i}$	=	CO_2 emission factor for fuel type *i* (t CO_2/GJ)
Q_{Trip}	=	Quantity of alternative materials carried in one trip per vehicle (t~~onnes~~)
$ALTM_y$	=	Annual consumption of alternative materials in raw materials in year *y* (t~~onnes~~)
NCV_i	=	Net calorific value of the fuel type *i* (GJ/mass or volume units)

5.6.2. Leakage from electricity consumption for conveyors system, where new system is installed due to project activity (*$LE_{ElecConv,y}$*)

$$LE_{Elec\_Conv,y} = EC_{Conv,y} \times EF_{CO2,Elec\_Grid,y} \quad \text{Equation (29)}$$

Where:

$LE_{Elec\_Conv,y}$	=	CO_2 emissions from electricity consumption for conveyor systems for alternative materials during the year *y* (t CO_2)
$EC_{Conv,y}$	=	Electricity consumed for conveyors during the year *y* (MWh)
$EF_{CO2,Elec\_Grid,y}$	=	CO_2 emission factor of the grid electricity during the year *y* (t CO_2/MWh)

82. CO_2 emission factor of the grid ($EF_{CO2,Elec\_Grid,y}$) shall be calculated in accordance with the procedures and guidelines provided in latest version of the approved "Tool to calculate the emission factor for an electricity system".

5.6.3. Leakage calculation due to change in electricity consumption in cement grinding and production

83. Since changes in electricity consumption in cement grinding and production cannot be determined precisely due to the new conditions of the clinker (for instance, harder to grind), for the purpose of calculating leakage in a conservative way, only the higher consumption is considered according to:

$$LE_{ele\_cto,y} = \sum \left[EC_{Cto,y} - EC_{Cto,BSL} \right] \times EF_{CO2,Elec\_Grid,y} \quad \text{Equation (30)}$$

Where:

$LE_{ele\_cto,y}$	=	CO_2 leakage due to additional electricity consumption in blended cements grinding during the year *y* (t CO_2)
$EC_{Cto,BSL}$	=	Baseline electricity consumption for cement grinding (MWh)
$EC_{Cto,y}$	=	Electricity consumption for cement grinding in year *y* (MWh)
$EF_{CO2,Elec\_Grid,y}$	=	Electricity grid emission factor (t CO_2/MWh)

84. If $LE_{ele\_cto,y} < 0$, conservatively LE_{ele_cto} shall be taken as zero.

85. This leakage is not applicable for project activities in Greenfield plant.

5.6.4. Leakage calculation of a potential higher consumption of clinker in cement production

86. Leakage shall be quantified due to a potential higher consumption of clinker in cement production, according to the clinker factor of the project activity, as follows:

$$LE_{Cto,y} = \sum CTO_{m,y} \times \left(P_{blend,y} - B_{blend} \right) \times \frac{PE_y}{CLNK_y} \quad \text{Equation (31)}$$

Where:

$LE_{Cto,y}$	=	CO_2 emissions due to higher consumption of clinker in Portland-type common-practice blended cement (t CO_2)
PE_y	=	Emissions of CO_2 in the project activity plant in year *y* (t CO_2)

$CTO_{m,y}$	=	Annual production of common-practice blended cement by type *m* in year *y* (t~~onnes~~)
B_{blend}	=	Baseline average percentage of clinker in common-practice blended cement based on the total blended cement production of the last three years prior to project implementation (t~~onnes of~~ clinker/t~~onnes of~~ blended cement)
$P_{blend,y}$	=	Percentage of clinker in common-practice blended cement in year *y* (t~~onnes of~~ clinker/t~~onnes of~~ blended cement)
$CLNK_y$	=	Annual production of clinker in the year *y* (t~~onnes~~)

87. If $LE_{Cto,y} < 0$, conservatively $LE_{Cto,y}$ shall be taken as zero.

88. Common-practice blended cement is defined as the types of cements that have been produced in the cement plant prior to project implementation. Blended cement is defined as a product with different uses that has gypsum and/or different additives and different clinker ratios (for example, limestone, pozzolana, blast furnace slag, silica flume, fly ash and others). The domestic and export types of cement are included if they are common-practice blended cement.

89. In accordance with these definitions, for the identification of the baseline percentage of clinker considered in common-practice cement production (B_{blend}), the project participants ~~proponents~~ shall monitor the annual weighted percentage of clinker consumed in the total of blended cement produced for three years before implementing the project activity. To do this, the project participants ~~proponents~~ shall monitor the total clinker consumption and total cement produced by each blended cement type *m* every year of the three year period before implementing the project activity. The definition of each blended cement type *m* must be in accordance with the respective regulatory cement norm of the cement market where the common-practice cement product has been commercialized.

90. The percentage of clinker in common-practice cement production (B_{blend}) is calculated as follows:

$$B_{blend} = AVERAGE\left(\sum CLNK_{BSL\_CNSM,m}/CTO_{BSL,m}\right) \quad \text{Equation (32)}$$

Where:

B_{blend}	=	Baseline average percentage of clinker in common-practice blended cement based on the total blended cement production of the last three years prior to project implementation (t~~onnes of~~ clinker/t~~onnes of~~ blended cement)
$CLNK_{BSL\_CNSM,m}$	=	Annual clinker consumption in each blended cement type *m* in the last three years prior to project implementation (t~~onnes of~~ clinker)
$CTO_{BSL,m}$	=	Annual blended cement type *m* production in the last three years prior to project implementation (t~~onnes of~~ blended cement)

91. For the identification of the percentage of clinker in common-practice blended cement production in the year *y* following project implementation ($P_{blend,y}$), the project proponents

shall monitor the total amount of clinker consumed and total blended cement production in the year *y* for each cement type m defined in the baseline as blended cement of common-practice ~~(see formula 3.4)~~.

92. The percentage of clinker in common-practice cement production ($P_{blend,y}$) in the year *y* is calculated as follows:

$$P_{blend,y} = AVERAGE\left(\sum CLNK_{CONSM,m,y} / \sum CTO_{m,y}\right)$$ Equation (33)

Where:

$P_{blend,y}$	=	Percentage of clinker in common-practice blended cement in the year *y* (t~~onnes of~~ clinker/t~~onnes of~~ blended cement)
$CLNK_{CONSM,m,y}$	=	Annual consumption of clinker of each common-practice blended cement type *m* in the year *y* (t~~onnes of~~ clinker)
$CTO_{m,y}$	=	Annual production of common-practice blended cement by type *m* in the year *y* (t~~onnes~~)

93. This leakage is not applicable for project activities in Greenfield plant.

5.7. Emission reductions

94. Quantification of CO_2 emission reductions for year *y* following project implementation shall be calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$ Equation (34)

Where:

ER_y	=	Emission reductions in year *y* due to project activity (t CO_2)
BE_y	=	Baseline emissions of CO_2 in the project activity plant (t CO_2)
PE_y	=	Emissions of CO_2 in the project activity plant in year *y* (t CO_2)
LE_y	=	CO_2 emissions due to leakage (t CO_2)

~~98. The total annual consumption of clinker in type m of common-practice blended cement production in year y (tonnes of clinker) must be determined according to the procedure of above.~~

5.8. Changes required for methodology implementation in 2nd and 3rd crediting periods

95. Refer to the latest approved version of the methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.

~~100. The procedure to select the baseline scenario, in the tool . mentioned above, should be applied to assess whether the chosen baseline scenario is still valid taking in account new data. For determining the CO_2 emissions from calcination of carbonates in the~~

~~baseline scenario, the fraction of non-carbonate CaO and MgO shall be based on sampling using one of the following approaches:~~

~~5.8.1. Option 1: Lab analysis based on the raw material sample obtained in the region in the baseline scenario~~

~~101. Under this option, samples, to obtain the values for Non-carbonate CaO and MgO are taken from the clinker production line (which may be owned by the same owner) with the lowest CO_2 emission in the region. The clinker production line sampled should use the same raw materials (limestone and clay) that is commonly used in the region and as in the identified baseline scenario and produces the same type and quality of clinker as done by the project activity. "Region" is defined as the geographic area defined by a radius of 200 km around the project activity including at least the ten cement plants nearest to the plant of the project activity.~~

~~102. The historical information during the year previous to project implementation (previous to the proposed project implementation, at least twelve monthly measurements) shall be used if available. Alternatively, the ex post monitoring is carried out. The size and frequency of sampling for this lab analysis should be statistically significant with a maximum uncertainty range of 20 per cent at a 95 per cent confidence level. Possible impurities in the raw materials should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO2 emissions only, or corrected otherwise.~~

~~103. The analysis of the samples is as per established standards.~~

~~5.8.2. Option 2: Lab analysis based on the sample obtained through authorized information~~

~~104. The non-carbonate content is estimated as the average of value from clinker production lines whose performance are among the top 5 or the top 20 per cent and which has been put into operation most recently in the defined region. The non-carbonate CaO and MgO for each clinker production line is based on sampling procedure as defined above. "Region" is defined as the geographic area defined by a radius of 200 km around the project activity including at least the ten cement plants nearest to the plant of the project activity. The properties of the clinker production lines are based on the recently published information provided by authorized or official documents.~~

~~105. The lab analysis shall be carried out by an independent authorized entity. It shall be ensured that the composition of the sample of raw materials taken for each clinker production line is the same as that identified in the baseline scenario. The size and frequency of sampling for each production line should be statistically significant with a maximum uncertainty range of 20 per cent at a 95 per cent confidence level. Possible impurities in the raw materials should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO_2 emissions only, or corrected otherwise. The values are established before the project implementation and will not be changed during the crediting period.~~

5.9. Data and parameters not monitored

96. In case of Greenfield plants, the guidance provided under each component provided under options in "Baseline emissions" section supersedes and modifies the contents of the tables below. PPs shall objectively refill tables affected by guidance. Wherever the

guidance eliminates the requirement or parameter; no such monitoring table shall be required. PPs shall objectively refill tables affected by guidance. A~~nnex~~ppendix 1 is for existing plants only.

Data / Parameter table 1.

Data / Parameter:	**Quality of clinker**
Data unit:	Specification in accordance with national/international standards mentioning (example lime saturation factor, silica ratio, alumina ratio)
Description:	Quality of clinker produced
Source of data:	It is determined based on plant data for existing plant and national/international standards for Greenfield
Measurement procedures (if any):	(a) Historical data for previous three years as part of production control procedures for the existing plants; (b) As per national/international standards for Greenfield plant
Monitoring frequency:	National standards for the greenfield plants
QA/QC procedures:	As per the standard procedures in the country
Any comment:	Monthly (recorded) for existing and once for Greenfield

Data / Parameter table 2.

Data / Parameter:	**$ByPass_{BSL}$**
Data unit:	t ~~Tonnes~~
Description:	Annual production of bypass dust leaving kiln system
Source of data:	It is determined based on historical data for previous ~~3~~ three years as part of production control procedures
Measurement procedures (if any):	Weighfeeders/Weighbridge at previous ~~3~~ three years
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	**$CaO_{CLNK,BSL}$**
Data unit:	t~~onnes of~~ CaO/t~~onnes of~~ clinker
Description:	CaO content in the clinker produced in the baseline
Source of data:	It is determined based on historical data for previous at least ~~3~~ three years, as part of laboratory quality control procedure
Measurement procedures (if any):	Sampling of at least ~~3~~ three years preceding the start of the project activity
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	**$CaO_{RM, BSL}$**
Data unit:	t ~~Tonnes~~
Description:	Non-carbonated CaO content in the raw materials in the baseline (t~~onnes of~~ CaO/t~~onnes of~~ raw material). These non-carbonated sources must be different from the non-carbonated materials used in the project activity
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is based on laboratory quality control procedures
Measurement procedures (if any):	Sampling. Historical data of the previous ~~3~~ three years plant records
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	**$CDK\cancel{D}_{BSL}$**
Data unit:	t ~~Tonnes~~
Description:	Annual production of CDK~~D~~ dust leaving kiln system in the baseline
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is sourced from production control procedures
Measurement procedures (if any):	Weighfeeders/Weighbridge at previous ~~3~~ three years
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	**$CLNK_{BSL}$**
Data unit:	Tonnes
Description:	Annual production of clinker in the baseline
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is sourced from inventories control procedures
Measurement procedures (if any):	Weighfeeders/Stockpile control at previous ~~3~~ three years

Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 7.

Data / Parameter:	$CLNK_{BSL\_CNSM,m}$
Data unit:	t~~onnes~~ of clinker
Description:	Annual clinker consumption in each blended cement type *m* in the last three years prior to project implementation
Source of data:	It is determined based on historical data for previous ~~3~~ three years as part of production control procedures
Measurement procedures (if any):	Weighfeeders/field instruments at previous ~~3~~ three years
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 8.

Data / Parameter:	$CTO_{BSL,m}$
Data unit:	t ~~Tonnes~~
Description:	Annual blended cement type *m* production in the last three years prior to project implementation
Source of data:	It is determined based on historical data for previous ~~3~~ three years as part of production control procedures
Measurement procedures (if any):	Weighfeeders/field instruments at previous ~~3~~ three years
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 9.

Data / Parameter:	d_{BSL}
Data unit:	Fraction
Description:	C~~K~~DK calcination rate (released CO_2 expressed as a fraction of the total carbonate CO_2 in the raw materials)
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is sourced from inventories control procedures

Measurement procedures (if any):	Sampling at previous ~~3~~ three years
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	It could be estimated

Data / Parameter table 10.

Data / Parameter:	**$EC_{Cto,BSL}$**
Data unit:	MWh
Description:	Baseline electricity consumption for cement grinding
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is sourced from production control procedures
Measurement procedures (if any):	Field instruments at previous ~~3~~ three years
Monitoring frequency:	Annually
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

~~**Data / Parameter table 10.**~~

~~**Data / Parameter:**~~	~~$EC_{Feed,Grid}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Baseline grid electricity consumption for fuel feeding~~
~~Source of data:~~	~~It is determined based on historical data for at least 3 three years preceding the start of the project activity. The data is sourced from production control procedures~~
~~Measurement procedures (if any):~~	~~Field instruments at previous 3 three years~~
~~Monitoring frequency:~~	~~Monthly (recorded)~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~**Data / Parameter table 11**~~

~~**Data / Parameter:**~~	~~$EC_{RM,Grid}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Baseline grid electricity consumption due to raw materials grinding~~
~~Source of data:~~	~~It is determined based on historical data for at least 3 three years preceding the start of the project activity. The data is sourced from production control procedures~~

~~Measurement procedures (if any):~~	~~Field instruments at previous 3 three years~~
~~Monitoring frequency:~~	~~Monthly (recorded)~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 12~~

~~Data / Parameter:~~	~~$EC_{Feed,SG}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Baseline self-generated electricity consumption due to fuel feeding~~
~~Source of data:~~	~~It is determined based on historical data for at least 3 three years preceding the start of the project activity. The data is sourced from production control procedures~~
~~Measurement procedures (if any):~~	~~Field instruments at previous 3 three years~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 13~~

~~Data / Parameter:~~	~~$EC_{KO,SG}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Baseline self-generated electricity consumption due to kiln operation~~
~~Source of data:~~	~~It is determined based on historical data for at least 3 three years preceding the start of the project activity. The data is sourced from production control procedures~~
~~Measurement procedures (if any):~~	~~Field instruments at previous 3 three years~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 14~~

~~Data / Parameter:~~	~~$EC_{KO,Grid}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Baseline grid electricity consumption due to kiln operation~~
~~Source of data:~~	~~It is determined based on historical data for at least 3 three years preceding the start of the project activity. The data is sourced from production control procedures~~

~~Measurement procedures (if any):~~	~~Field instruments at previous 3 three years~~
~~Monitoring frequency:~~	~~Monthly (recorded)~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 15~~

~~Data / Parameter:~~	~~$EC_{RM,SG}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Baseline self-generated electricity consumption due to raw materials grinding~~
~~Source of data:~~	~~It is determined based on historical data for at least 3 three years preceding the start of the project activity. The data is sourced from production control procedures~~
~~Measurement procedures (if any):~~	~~Field instruments at previous 3 three years~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

Data / Parameter table 11.

Data / Parameter:	**$MgO_{CLNK, BSL}$**
Data unit:	t~~onnes of~~ MgO/t~~onnes of~~ raw material
Description:	MgO content in the clinker produced in the baseline
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is based on laboratory quality control procedures
Measurement procedures (if any):	Sampling at previous ~~3~~ three years
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 12.

Data / Parameter:	**$MgO_{RM,BSL}$**
Data unit:	t~~onnes of~~ MgO/t~~onnes of~~ raw material
Description:	Non-carbonated MgO content in the raw materials in the baseline. These non-carbonated sources must be different from the non-carbonated materials used in the project activity

Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is based on laboratory quality control procedures
Measurement procedures (if any):	Sampling. Historical data at previous ~~3~~ three years
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 13.

Data / Parameter:	**RM_{BSL}**
Data unit:	t ~~Tonnes~~
Description:	Annual consumption of non-carbonated raw materials in the base year
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is based on inventories
Measurement procedures (if any):	Weighfeeders/Weighbridge/Stockpile control at previous ~~3~~ three years
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 14.

Data / Parameter:	**SKC_{BSL}**
Data unit:	GJ/t~~onnes~~
Description:	Specific Kiln Calorific Consumption for the baseline scenario
Source of data:	Calculated as part of energy efficiency evaluation in baseline (at least three previous year)
Measurement procedures (if any):	Historical data of the Plant records
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be calculated as part of normal plant level operations for energy performance evaluation. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	The specific fuel consumption of a kiln is arguably the most important operating parameter

Data / Parameter table 15.

Data / Parameter:	$FC_{Dry,i}$
Data unit:	t ~~Tonnes~~
Description:	Fossil fuel *i* consumed for drying raw materials or fuel preparation in the baseline
Source of data:	It is determined based on historical data for at least ~~3~~ three years preceding the start of the project activity. The data is sourced from production control procedures
Measurement procedures (if any):	Weighfeeders/Weighbridge/Stockpile control at previous year
Monitoring frequency:	Monthly (recorded)
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

6. Monitoring methodology

6.1. Monitoring procedures

97. Describe and specify in the CDM-PDD all monitoring procedures, including the type of measurement instrumentation used and the responsibilities for monitoring and QA/QC procedures that will be applied. Meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with relevant standards. If such standards are not available, use national standards. If a national standard is not available, then use international standards.

98. All data collected as part of monitoring shall be archived electronically and be kept at least for two years after the end of the last crediting period. One hundred per cent of the data shall be monitored if not indicated otherwise in the tables below. All measurements shall be conducted with calibrated measurement equipment according to relevant industry standards.

99. The monitoring provisions in the tools referred to in this methodology apply.

100. In case of Greenfield plants, the guidance provided under each component provided under options in “Baseline emissions” section supersedes and modifies the contents of the tables below. PPs shall objectively refill tables affected by guidance. Wherever the guidance eliminates the requirement or parameter; no such monitoring table shall be required. PPs shall objectively refill tables affected by guidance. A~~nnex~~ppendix 1 is for existing plants only.

6.2. Data and parameters monitored

Data / Parameter table 16.

Data / Parameter:	$\overline{SKC_{ex}}$
Data unit:	GJ/t~~onne~~ clinker
Description:	Arithmetic mean of Specific Kiln Calorific Consumption during ex ante monitoring. See appendix 1
Source of data:	Calculated as part of ex ante monitoring procedure
Measurement procedures (if any):	Ex ante monitoring procedure record
Monitoring frequency:	Monthly
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 17.

Data / Parameter:	$\overline{\%AMC}ex$
Data unit:	%
Description:	Arithmetic mean of %AMC in the raw materials during ex ante monitoring. See appendix 1
Source of data:	Result data of ex ante monitoring procedure
Measurement procedures (if any):	Ex ante monitoring procedure record
Monitoring frequency:	Monthly
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 18.

Data / Parameter:	**$\%AMC_{ex}$ optimal range**
Data unit:	% (interval)
Description:	Interval of 95 per cent of confidence for AMC content in the raw materials during ex ante monitoring. See appendix 1
Source of data:	Result data of ex ante monitoring procedure
Measurement procedures (if any):	Ex ante monitoring procedure record
Monitoring frequency:	Monthly
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 19.

Data / Parameter:	SKC_{ex} **optimal range**
Data unit:	GJ/t~~onne~~ clinker
Description:	Interval of 95 per cent of confidence for specific kiln calorific consumption during ex ante monitoring (GJ/t~~onne~~ clinker). See appendix 1
Source of data:	Result data of ex ante monitoring procedure
Measurement procedures (if any):	Ex ante monitoring procedure record
Monitoring frequency:	Monthly
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 20.

Data / Parameter:	$\overline{SKC_j}$
Data unit:	GJ/t~~onne~~ clinker
Description:	Average of specific kiln calorific consumption following project activity prior to the year *y*. Label *j* is a counter that runs from 1 to “y-1”. If y = 1, $\overline{SKC_j} = SKC_{BSL}$
Source of data:	Calculated as part of energy efficiency evaluation for project activity
Measurement procedures (if any):	Plant records
Monitoring frequency:	Annually
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 21.

Data / Parameter:	$\%AMC_y$
Data unit:	%
Description:	Percentage of Alternative Materials in the raw materials production in the year *y* due to project activity implementation. The %*AMC* could be %SO3 or % (SO3 and CaF2) or Lime Saturation Factor (LSF) or raw materials particle size (fineness)
Source of data:	It will be measured as part of laboratory quality control procedure for project activity
Measurement procedures (if any):	Sampling

Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 22.

Data / Parameter:	**$ALTM_y$**
Data unit:	t ~~Tonne~~
Description:	Annual consumption of alternative materials in raw materials in year *y*
Source of data:	It will be registered as part of inventories control
Measurement procedures (if any):	Weighbridge/Stockpile control data
Monitoring frequency:	Per trip
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 23.

Data / Parameter:	**$ByPass_y$**
Data unit:	t ~~Tonnes~~
Description:	Annual production of Bypass dust leaving kiln system in year *y*
Source of data:	It will be measured as part of normal operations
Measurement procedures (if any):	Weighfeeders/Weighbridge
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 24.

Data / Parameter:	**$CaO_{CLINK,y}$**
Data unit:	t~~onnes of~~ CaO/t~~onnes of~~ clinker).
Description:	CaO content in the clinker produced in the year *y*
Source of data:	It will be measured as part of laboratory quality control procedure
Measurement procedures (if any):	Sampling
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 25.

Data / Parameter:	**$CaO_{RM,y}$**
Data unit:	t~~onnes of~~ CaO/t~~onnes of~~ raw material
Description:	Non-carbonated CaO content in the raw materials in the year *y*
Source of data:	It will be measured as part of laboratory quality control procedure
Measurement procedures (if any):	Sampling
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 26.

Data / Parameter:	**$CDK\cancel{D}_{y}$**
Data unit:	t ~~Tonnes~~
Description:	Annual production of CDK~~D~~ dust leaving kiln system
Source of data:	It will be measured as part of normal operations
Measurement procedures (if any):	Weighfeeders/Weighbridge
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 27.

Data / Parameter:	**$CLNK_{CONSM,m,y}$**
Data unit:	t~~onnes of~~ clinker
Description:	Annual consumption of clinker in each common-practice blended cement type *m* in the year *y*
Source of data:	It will be measured with field instruments and checked with production control procedures
Measurement procedures (if any):	Weighfeeders/Stock piles control
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 28.

Data / Parameter:	**$CLNK_y$**
Data unit:	t ~~Tonnes~~
Description:	Annual production of clinker in the year *y*
Source of data:	It will be measured with field instruments and checked with inventories control procedure
Measurement procedures (if any):	Weighfeeders/Stockpile control
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 29.

Data / Parameter:	**$CTO_{m,y}$**
Data unit:	t ~~Tonnes~~
Description:	Annual production of common-practice blended cement by type *m* in year *y*
Source of data:	It will be determined as part of production control procedures
Measurement procedures (if any):	Weighfeeders/field instruments
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 30.

Data / Parameter:	**Daily $CLNK_{ex}$**
Data unit:	t ~~Tonne of~~ clinker produced/day
Description:	Daily clinker production in 30 days of continuous operation
Source of data:	It will be measured as part ex ante monitoring procedure through field instruments
Measurement procedures (if any):	Weighfeeders. Ex ante monitoring procedure record
Monitoring frequency:	Daily
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 31.

Data / Parameter:	**Daily SKC_{ex}**
Data unit:	GJ/t~~onne~~ clinker produced/day
Description:	Daily Specific Kiln Calorific Consumption in each 30 day of ex ante monitoring
Source of data:	Calculated as part of ex ante monitoring procedure
Measurement procedures (if any):	Ex ante monitoring procedure record
Monitoring frequency:	Daily
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 32.

Data / Parameter:	**Daily $\%AMC_{ex}$**
Data unit:	%
Description:	Daily percentage of alternative material composition in clinker production due to the implementation of project activity in 30 days of continuous operation. The *%AMC* could be $\%SO_3$ or $\%(SO_3$ and $CaF_2)$ or Lime Saturation Factor (LSF) or raw materials particle size (fineness)
Source of data:	It will be measured as part of ex ante monitoring data
Measurement procedures (if any):	Sampling
Monitoring frequency:	Hour
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 33.

Data / Parameter:	**Daily $FF_{ex\ i}$**
Data unit:	t~~onne~~ fuel/day
Description:	Daily consumption of fuel type *i* 30 days of continuous operation
Source of data:	It will be measured as part ex ante monitoring procedure through weighfeeders
Measurement procedures (if any):	Weighfeeders. Ex ante monitoring procedure record
Monitoring frequency:	Daily
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 34.

Data / Parameter:	**d_y**
Data unit:	Fraction
Description:	C~~DKD~~ calcination rate (released CO_2 expressed as a fraction of the total carbonate CO_2 in the raw materials)
Source of data:	It will be measured as part of normal operations
Measurement procedures (if any):	Sampling
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	This parameter could be estimated

Data / Parameter table 35.

Data / Parameter:	**Dist**
Data unit:	Km
Description:	Distance between the source of fuel and the project activity plant
Source of data:	It will be registered on logistic department as part of inventories control
Measurement procedures (if any):	Logistic records or purchased tickets
Monitoring frequency:	Per trip
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 36.

Data / Parameter:	**$EC_{Conv,y}$**
Data unit:	MWh
Description:	Annual electricity consumption for conveyor system for alternative materials
Source of data:	It will be measured with field instruments and checked with production control procedures
Measurement procedures (if any):	Field instruments
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 37.

Data / Parameter:	**$EC_{Cto,y}$**
Data unit:	MWh
Description:	Electricity consumption for cement grinding in year *y*
Source of data:	It will be determined as part of production control procedures
Measurement procedures (if any):	Field instruments
Monitoring frequency:	Annually
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

~~**Data / Parameter table 43.**~~

~~**Data / Parameter:**~~	~~$EC_{Feed,Grid,y}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Grid electricity consumption for fuel feeding~~
~~Source of data:~~	~~It will be measured with field instruments and checked with production control procedures~~
~~Measurement procedures (if any):~~	~~Field/automatic instruments~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~**Data / Parameter table 44.**~~

~~**Data / Parameter:**~~	~~$EC_{Feed,SG,y}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Self-generated electricity consumed for fuel feeding~~
~~Source of data:~~	~~It will be measured with field instruments and checked with production control procedures~~
~~Measurement procedures (if any):~~	~~Field/automatic instruments~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 45~~

~~Data / Parameter:~~	~~$EC_{KO,Grid,y}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Grid electricity consumption for kiln operation (MWh)~~
~~Source of data:~~	~~It will be measured with field instruments and checked with production control procedures~~
~~Measurement procedures (if any):~~	~~Field/automatic instruments~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 46.~~

~~Data / Parameter:~~	~~$EC_{KO,SG,y}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Self-generated electricity consumed for kiln operation~~
~~Source of data:~~	~~It will be measured with field instruments and checked with production control procedures~~
~~Measurement procedures (if any):~~	~~Field/automatic instruments~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 47.~~

~~Data / Parameter:~~	~~$EC_{RM,Grid,y}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Grid electricity consumption for raw materials grinding~~
~~Source of data:~~	~~It will be measured with field instruments and checked with production control procedures~~
~~Measurement procedures (if any):~~	~~Field/automatic instruments~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 48~~

~~Data / Parameter:~~	~~$EC_{RM,SG,y}$~~
~~Data unit:~~	~~MWh~~
~~Description:~~	~~Self-generated electricity consumed for raw materials grinding~~
~~Source of data:~~	~~It will be measured with field instruments and checked with production control procedures~~
~~Measurement procedures (if any):~~	~~Field/automatic instruments~~
~~Monitoring frequency:~~	~~Monthly~~
~~QA/QC procedures:~~	~~These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems~~
~~Any comment:~~	~~-~~

~~Data / Parameter table 49.~~

~~Data / Parameter:~~	~~$EF_{CO2,Elec\_Grid,y}$ and $EF_{CO2,Elec\_Grid}$~~
~~Data unit:~~	~~t CO_2/MWh~~
~~Description:~~	~~CO_2 emission factor of the grid~~
~~Source of data:~~	~~Calculated as per the "Tool to calculate the emission factor for an electricity system"~~
~~Measurement procedures (if any):~~	~~-~~
~~Monitoring frequency:~~	~~-~~
~~QA/QC procedures:~~	~~-~~
~~Any comment:~~	~~-~~

Data / Parameter table 38.

Data / Parameter:	**Quality of clinker**
Data unit:	Specification in accordance with national/international standards mentioning (example lime saturation factor, silica ratio, alumina ratio)
Description:	Quality of clinker produced
Source of data:	Project Plant
Measurement procedures (if any):	As per national/international standards
Monitoring frequency:	Monthly
QA/QC procedures:	As per the standard procedures in the country
Any comment:	-

Data / Parameter table 39.

Data / Parameter:	$FC_{Dry\_addl,i,y}$
Data unit:	mass or volume units
Description:	Fossil fuel *i* consumed for drying raw materials or fuel preparation in the year *y*

Source of data:	It will be measured with field instruments and checked with inventories control procedure
Measurement procedures (if any):	Weighfeeders/Weighbridge/Stockpile control
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 40.

Data / Parameter:	$FC_{i,Calcin,y}$
Data unit:	mass or volume units
Description:	Fuel type *i* consumed for calcination in clinker production during the year *y*
Source of data:	It will be measured with field instruments and checked with inventories control procedure
Measurement procedures (if any):	Weighfeeders/Stockpile control
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 41.

Data / Parameter:	$FC_{Trans,i}$
Data unit:	mass or volume unit of fuel/kilometer
Description:	Fuel consumption of the vehicle per kilometer
Source of data:	Estimated as part of fuel consumption evaluation of logistic department or data from external suppliers
Measurement procedures (if any):	Logistic registered data or third part
Monitoring frequency:	Annually
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 42.

Data / Parameter:	***GENj***
Data unit:	MWh
Description:	Electricity (MWh) generated by the source *j*

Source of data:	It will be measured with field instruments and checked with inventories control for self-generation
Measurement procedures (if any):	Field/automatic instruments
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 43.

Data / Parameter:	$F_{i,j,y}$
Data unit:	mass or volume units
Description:	Amount of fuel *i* consumed by relevant power sources *j*
Source of data:	It will be measured with field instruments and checked with inventories control for self-power generation
Measurement procedures (if any):	Weighfeeders/Weighbridge/Stockpile control
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 44.

Data / Parameter:	$MgO_{CLNK,y}$
Data unit:	t~~onnes of~~ MgO/t~~onnes of~~ clinker
Description:	Product of the MgO content in the clinker produced in the year *y*
Source of data:	It will be measured as part of laboratory quality control procedure
Measurement procedures (if any):	Sampling
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 45.

Data / Parameter:	$MgO_{RM,y}$
Data unit:	t~~onnes of~~ MgO/t~~onnes of~~ raw material
Description:	Non-carbonated MgO content in the raw materials in the year *y*
Source of data:	It will be measured as part of laboratory quality control procedure
Measurement procedures (if any):	Sampling

Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 46.

Data / Parameter:	**RM_y**
Data unit:	t ~~Tonnes~~
Description:	Annual consumption of non-carbonated raw materials in the year *y*
Source of data:	It will be measured with field instruments and checked with inventories control procedure
Measurement procedures (if any):	Weighfeeders/Weighbridge/Stockpile control
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 47.

Data / Parameter:	**SKC_y**
Data unit:	GJ/tonnes of clinker
Description:	Specific Kiln Calorific Consumption for the year *y*
Source of data:	Calculated as part of project emission results
Measurement procedures (if any):	Plant records
Monitoring frequency:	Monthly
QA/QC procedures:	QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 48.

Data / Parameter:	**$SKC_{y,measured}$**
Data unit:	GJ/t~~onnes of~~ clinker
Description:	Specific Kiln Calorific Consumption measured in the year *y*
Source of data:	Calculated as part of energy efficiency evaluation in year *y*
Measurement procedures (if any):	Plant records
Monitoring frequency:	Monthly
QA/QC procedures:	These data will be collected as part of normal plant level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 49.

Data / Parameter:	**Q_{trip}**
Data unit:	t ~~Tonnes~~
Description:	Quantity of alternative materials carried in one trip per vehicle
Source of data:	It will be registered on logistic department as part of inventories control
Measurement procedures (if any):	Weighbridge data and purchase receipts
Monitoring frequency:	Per trip
QA/QC procedures:	These data will be collected as part of normal logistic level operations. QA/QC requirements according to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter table 50.

<table>
<tr><td>Data / Parameter:</td><td>$EF_{CO2,i}$</td></tr>
<tr><td>Data unit:</td><td>t CO_2/GJ</td></tr>
<tr><td>Description:</td><td>CO_2 emission factor for the fossil fuel type i</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></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 (a) 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 per cent confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If (a) is not available</td></tr>
</table>
</td></tr>
</table>

Measurement procedures (if any):	For (a) and (b): Measurements should be undertaken in line with national or international fuel standards. For (a): if the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, Options (b), (c) or (d) should be used

Monitoring frequency:	For (a) and (b): the emission factor 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

QA/QC procedures:	-
Any comment:	-

Data / Parameter table 51.

Data / Parameter:	**NCV_i**
Data unit:	GJ/mass or volume units
Description:	Weighted average net calorific value for fuel type *i*
Source of data:	The following data sources may be used if the relevant conditions apply: (see table below)
Measurement procedures (if any):	For (a) and (b): Measurements should be undertaken in line with national or international fuel standards

Data source	Conditions for using the data source
(a) Values provided by the fuel supplier in invoices	This is the preferred source
(b) Measurements by the project participants	If (a) is not available
(c) Regional or national default values	If (a) 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)
(d) IPCC default values at the upper limit of the uncertainty at a 95 per cent confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If (a) is not available

Monitoring frequency:	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

QA/QC procedures:	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
Any comment:	Note that for the NCV the same basis (pressure and temperature) should be used as for the fuel consumption

Data / Parameter table 52.

Data / Parameter:	**$OXID_i$**
Data unit:	Fraction
Description:	Oxidation factor of the fuel *i*
Source of data:	Refer to the Table 1-4 in the 2006 IPCC Guidelines, Vol. 2, page 1.25, for default values
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Appendix 1. Procedure for ex ante determination of specific kiln calorific consumption

1. **Title**: Procedure for ex ante monitoring to be implemented at the beginning of the project implementation.

1. Objective

2. The main purpose of this ex ante monitoring is to develop an industrial testing procedure (where kiln operational variables are under total control) that shows the highest specific consumption reduction that is possible to be achieved during project implementation.

2. Development

(a) Laboratory research and Protocol of sampling definition

(i) Develop a burnability analysis of raw materials (1) in order to identify the theoretical “optimum-range” of concentration of new raw materials and the design of the raw materials that would permit the reduction of energy consumption for clinker preparation;

(ii) The outputs of the burnability analysis are the “Free Lime vs. Concentration of alternative materials (%AMC)” and “Free Lime vs. Temperature” graphics;

(iii) Design the Industrial testing Protocol. The Protocol must follow all the Plant procedures for quality control (QC) and quality assurance (QA) in order to guarantee the representative sampling in terms of size, frequency, chemical and physical analysis with its respective quality index control (2). The Protocol has to define the equipment involved, all material specifications and requirements of data records. The Protocol for ex ante monitoring shall consider the following points:

(b) Initial operational adjustments and production of new raw materials

(i) Develop a program for total consumption of the inventory of raw materials produced for clinker production prior to project implementation and replacement with the new raw material according to a laboratory design;

(ii) Develop operational adjustments and stabilization of operating conditions. The period of time for 2.2. And 2.3 could be adjustable according to the particular operating conditions of each cement plant.

(c) The operational transitional process

(i) Start the kiln operation with the new design of raw materials according burnability test results (project activity);

(ii) Daily follow-up of the operational data obtained and recording the global results. The principal records of the Plant during the monitoring procedure are:

a. Concentration of alternative material (%AMC) in the raw materials feeding, The *%AMC* could be %SO3 or %(SO3 and CaF2) or Lime Saturation Factor (LSF) or raw materials particle size (fineness);

b. Fuel consumption with its LHV;

c. Total clinker production;

d. The main operational variables of the kiln as indicators of general conditions of operations.

(d) Kiln operation under total control of the operational variables

(i) Guarantee the stabilization and operation at as regular operational conditions as possible – 30-day of continuous operation ~~(3);~~

(ii) Follow up the same daily data of the operational transitional process parameters defined above. The objective is to seek a repetition of the previous month values;

(iii) Register the "optimal range" with 95 per cent of statistical confidence level of the 30 –day samples of the concentration of alternative material used (AMC) in the raw materials and the specific consumption in the kiln (SKCex) during 30 days continuous operational samples;

(iv) Make the final report with the analysis of the results and carry out the analysis to show that these results have been proved to be with the theoretical research and quality control, as well as with quality assurance procedures.~~(4)~~

3. Results

(a) Obtain and record the following data:

Where:

$Daily\ SKC_{ex}$	=	Daily Specific Kiln Calorificfic Consumption in each 30-day period of ex ante monitoring (GJ/t~~onne~~ clinker/day). Daily $SKC_{ex\text{-}ante}$ = Σ(Daily FF_{ex} i x $LHV_{ex}i$)/Daily $CLNK_{ex}$ ~~(3.1)~~
$Daily\ \%AMC_{ex}$	=	Daily percentage of alternative material composition in clinker production due to the implementation of project activity in 30 days of continuous operation. The *%AMC* could be %SO3 or %(SO3 and CaF2) or Lime Saturation Factor (LSF) or raw materials particle size (fineness)
$Daily\ FF_{ex}i$	=	Daily consumption of fuel type *i* 30 days of continuous operation (t~~onne~~ fuel/day)
$LHV_{ex}i$	=	Daily low heating value of fuel type *i* in 30 days of continuous operation (GJ/t~~onne~~ fuel/day)

$Daily\ CLNK_{ex}$	=	Daily clinker production in 30 days of continuous operation (t~~onne~~ clinker/day)
$\overline{SKC_{ex}}$	=	Arithmetic mean of Specific Kiln Calorific Consumption during each day of 30 days of continuous operation (GJ/t~~onne~~ clinker)
$\overline{\%AMC_{ex}}$	=	Arithmetic mean of %*AMC* in the raw materials during ex ante monitoring
σ	=	Standard deviation of 30 days of continuous operation
$1.96\ \frac{\sigma}{\sqrt{30}}$	=	Interval of 95 per cent of confidence of 30 samples in ex ante monitoring
"$\%AMC_{ex}\ optimal\ range$ $\overline{\%AMC_{ex}} \pm 1.96\ \frac{\sigma}{\sqrt{30}}$	=	Interval of 95 per cent of confidence for %*AMC* content in the raw materials during ex ante monitoring
"$SKC_{ex}\ optimal\ range$ $\overline{SKC_{ex}} \pm 1.96\ \frac{\sigma}{\sqrt{30}}$	=	Interval of 95 per cent of confidence for specific kiln calorific consumption during ex ante monitoring (GJ/t~~onne~~ clinker)

4. References and notes

(a) "Burnability" is the term used to describe how easily the clinker transformation happens and the behavior of the raw materials in the sintering process (clinker phases formation). The burnability analysis is a common procedure in Cement Industry and was developed by F.L.Smidth (Fundal 1979 and Theisen 1992) that helps to optimize the raw materials design, with regard to chemical and mineral composition and fineness of the material;

(b) The minimum quality control procedures are described in "The Cement Plant Operations Handbook 4th Edition", International Cement Review, 2005, Chapter 6;

(c) Thirty continuously days of sample (one month) is the minimum amount of daily average values that reflect the operational conditions and evaluate if the process complies with the minimum quality assurance specifications. Besides, the standard unit of time for Cement Industry is a month. Plant operational records are normally measured in this period of time (i.e. raw material inventories, fuel consumption and kiln energy performance);

(d) The consistency between industrial testing and the laboratory research results guarantees that project activity are related only by means of new alternative materials and not as the results of other energy efficiency measures or fuel switching options that may occur at the same time as the project implementation.

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Document information

Version	*Date*	*Description*
04.0	14 May 2014	MP 63, Annex 5 To be considered by the Board at EB 79. The draft revised methodology was available for public input from 12 to 27 February 2014. No inputs were received. The revision: (i) expands the applicability of the methodology to Greenfield cement plants, (ii) and changes the title from “Consolidated baseline and monitoring methodology for project activities using alternative raw materials that do not contain carbonates for clinker production in cement kilns” to “Emission reductions from raw material switch in clinker production”.
03	26 March 2010	EB 53, Annex 8 The revision restricts the application of the methodology to existing plants only, modifies equations (4) and (13) in order to correct the units of the involved parameters and changes the definitions of some parameters in order to make their identification clearer.
02	25 March 2009	EB 46, Annex 9 The revision changes in procedure to assign value to SKC_y in equation 12, providing simpler and conservative approach; replaces the word ‘manufacturing’ by ‘production’; and applies other editorial changes.
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