Project design document form for CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Clinker Optimization in cement types production at Derba MIDROC cement plant
Version number of the PDD	02
Completion date of the PDD	08/01/2016
Project participant(s)	(1) Derba MIDROC Cement PLC (2) Ethan Bio-Fuels PLC
Host Party	Federal Democratic Republic of Ethiopia
Sectoral scope and **selected methodology (ies), and where applicable, selected standardized baseline(s)**	Scope 04; Manufacturing Industries, Methodology : Approved consolidated baseline and monitoring methodology ACM0005 Version 07.1.0; "Increasing the blend in cement production"
Estimated amount of annual average GHG emission reductions	329,091 **tCO_{2e}**

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The project activity, “Clinker optimization in cement types’ production at Derba MIDROC cement plant”, intends to implement increased additives in cement blending on a [1]Greenfield cement plant. The project previously requested registration under Ref no 7632. The relevant ruling note (CDM-PA7632-RULE01) states that it can request registration again with appropriate revision, in [2]baseline section. As there were no remaining issues with Additionality, redesign would focus on Baseline section. Para 125 of the PCP Version 9 also provides guidance for request for registration of previously rejected project activity. Hence this is a re-application for registration largely focused in revised design of the baseline section of the last PDD.

The project activity measure is cement feedstock switch / increases the additive blend (increased use of additives displacing clinker) in cement production towards production of different blended cement types, recognized under the host country cement [3]standard while fulfilling all the quality requirement of the Ethiopian cement standard. [4]Blended cement types is cement produced as per the national standard. The project activity wishes to pioneer introducing low carbon cement technology to the domestic market to allow reduce carbon intensity of cement through increased additives while allows the host country achieving aspiration for sustainable development. It is planned to be achieved by producing several blended cement types through decreasing clinker below the benchmark clinker share (increased additives) in each type of project cement. Portland Pozzolana Cement (PPC), Portland Limestone Cement (PLC) and Pozzolana Cement (PC) are the relevant cement types of the project activity. As per Ethiopian standard, Blended cement is produced as a composition of Clinker + Additive + Gypsum (0-5%). The regulatory norm for default clinker proportion and the minimum clinker share and the type of Additive for each cement types are stated in national cement standards.

- Scenario existing prior to the start of the implementation of the project activity:

The scenario existing prior to the implementation of the project activity is characterized by the production or import of Ordinary Portland Cement (OPC) as well as production of PPC by other plants at high clinker share. These are the only two types of cement existed in the market. Annexed statistical data show that there exists production practice of these OPC and PPC cement types with high clinker share in the region (host country) and import of OPC into the host country.

- Project scenario

Through availing optimum clinker cement outputs increasing the share and types of additives beyond the current practice, cement consistent with the national cement standard could be produced for sustainable development while providing the required service. The cement PC, PPC and PLC are types of blended cement produced under CDM project activity. This would avail options to use diversified additives and opportunity for increased volume of low carbon cement yet adding cement types that allow users to capture additional qualities for application areas. The purpose of this project activity is to manufacture, promote and market domestically, optimum clinker blended cement types using various additives but meeting all the specification of the host country cement standard and the intended construction applications.

[1] As defined in the methodology ACM 0005V7.1.0

[2] Baseline benchmark to consider all plants in the “region”

[3] ES 1177;2005

[4] Methodology

The project blending scale for PPC, have not been realized by any developer in the host country (the region) by the start date. More over Pozollanic Cement, (PC) and Portland Limestone cement (PLC) has never been produced in the host country before the start date of the project activity. To help achieve the desired result, Geber Pfeiffer Vertical roller & ball mills in addition to a state of the art kiln system with dual chamber five stage suspended cyclone pre-heaters, a pre-calciner, a rotary kiln, grate cooler, efficient dust control with inline re-calciner, additive concessions, additive miner, conveyor, crushers, dryers, stores, processing facilities, laboratories and cement mills for each type have been invested on. The state of the art kiln will reduce the carbon intensity of clinker in addition to the reduction due to increased blending.

- Baseline scenario

The baseline scenarios for each type of output of the project activity are as follows as demonstrated in stepwise assessment of alternatives under section B.4:

I. Output 1: Blended Cement Type PPC

Alternative C Continuation of the current production practice of this type of cement in manufacturing plants of other plants in the region (host country) i.e Production at benchmark rate of 72.86% clinker share. PPC is produced using natural Pozzolana or natural heated Pozzolana as additive.

The weighted average Clinker share of this cement type in the region is 72.86%.

II. Output 2,3 respectively: Blended Cement Types PC and PLC

These cement types have never been produced in the host country. Hence the baseline scenario for this product type is **Alternative b**; other realistic and credible alternative scenarios (s) to the proposed CDM project activity scenario that deliver this output or cement of comparable quality. The credible scenario is producing them at the regulatory default benchmark clinker and additive proportion for the particular type of cement. The baseline scenario is listed below for each of the cement types;

In case of PC: Since this relevant project activity cement type has not been produced or imported, Production of PC itself at its regulatory default [5] (89%)clinker share, (6-11) % siliceous fly ash, (0-5) % Gypsum, is the only remaining realistic, credible and mandatory alternative. This is found in the regulatory norm for PC and much conservative than taking the share of unblended OPC imported or produced in the region (host country). PC cement is produced using siliceous fly ash as major additive. PC cement offers additional quality of Sulfate resistance.

In case of PLC : Since this relevant project activity cement type has not been produced or imported, production of PLC itself at its regulatory default [6] (94%)clinker share, (1-6)% Limestone and (0-5)% Gypsum, is the only remaining realistic, credible and mandatory alternative. The default clinker share is found in the regulatory norm for PLC and is a bit conservative than taking the unblended 95% share. PLC is produced using Limestone as major additive. PLC cement offers additional quality of Sulfate resistance in Class 1 sulfate conditions.

Through the project activity, low carbon cement is increasingly availed through diversified additives as well as increased share of additives that displace some amount of clinker that could have otherwise filled a carbon intensive gap. The project would herald a new era of resource efficiency, product diversification and efficient energy utilization in cement production in the Ethiopian construction industry and contributes to low carbon cities. Clinker production is inherently associated with GHG emission from calcinations of limestone (i.e. with main reaction equation of

[5] Please refer table 001 for Ethiopian standard on clinker share in cement types

[6] shown in table 001 for Ethiopian standard on clinker share in cement types

$CaCO_3 \rightarrow CaO+CO_2$), emission from burning kiln fuel and electricity consumption for running process equipment. Reducing the share of clinker in cement by the project activity would therefore result in reducing emission per unit cement product.

The proposed project activity reduces greenhouse gas emissions by reducing the GHG intensity in cement produced, through installation of additive conveying and processing equipments utilizing additives from mining to displace some clinker share which would otherwise have resulted in GHG emissions. This substitution results in reduced emission of CO_2 from:-

- Reduced burning of limestone / reduced decarbonisation reaction in clinker making
- Reduced need of kiln fuel consumption used for enacting the de-carbonization reaction in clinker making

Contribution to sustainable development:

1. Some natural resources are finite; cement raw materials being some. Balanced utilization of additives helps in extending the life of reserves, thereby bequeathing the provision of all cement types to current and future generations. Instead of availing few cement types for a certain generation until key resources are depleted and then migrating to other types for subsequent generations, all types could be availed to all generations alike through balanced utilization. This is exactly in line with the famous definition of sustainable development. This will also allow distributing delivery risk instead of limiting a plant to particular few types.
2. Production of diversified cement allows capturing, in addition to standard cement qualities, unique benefits of each type of blended cement in construction applications. The project Introduces sulphate resistant cement indirectly contributing to increased building of hydroelectric dams, irrigation structures, water wells and foundation walls.
3. The largest demand of cement in modern world (and Ethiopia) targets the provision of affordable housing and institutional dwellings. Compressive strength requirement in such construction applications vary from 0MPa to 42.5MPa while all cement types can meet this at a certain setting time. Yet people use high carbon cement for all of them due to lack of awareness and availability. Availing as much blended cement with awareness campaign towards meeting the national Growth & Transformation plan (17 million tons per year) allows achieving the same result at lower carbon emissions intensity than otherwise. This has a great contribution to building low carbon cities.
4. The Project achieves carbon intensity of 0.52 tCO_2/t-cement and making it transparently easy to compare anytime (including in future mechanisms) with any ton of cement produced in the host country
5. Additionally reduce CO_2 emissions from using the most energy efficient kiln in the country although credits are not claimed under this project activity
6. Avail job for increased number of workers as part of the entire cement investment and marketing value chain
7. Reduces the annually imported Ordinary Portland cement volume thereby saving foreign currency expenditure and associated emission
8. The host country has also confirmed contribution of this project to its sustainable development

Annual average and total GHG emission reductions for chosen crediting period:

Expected annual average GHG emission reductions: 329,091 tCO_2e (rounded)

Total expected GHG emission reductions over 10 years: 3,290,913 tCO_2e

A.2. Location of project activity

A.2.1. Host Party

Federal Democratic Republic of Ethiopia (FDRE)

A.2.2. Region/State/Province etc.

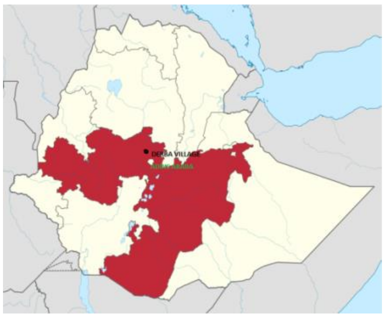
Oromia is political region where plant is found.

A.2.3. City/Town/Community etc.

Derba village

A.2.4. Physical/Geographical location

The coordinates and elevation of the plant areas are given below. The project location has representative Coordinates: Latitude: 09^0 27.5'28" N and Longitude: 38^0 34.5'31" E and is shown in the indicative map below. Elevation of Plant site: 2380 m to 2420 m above Mean Sea Level (MSL)



A.3. Technologies and/or measures

The measure implemented by the project activity is feedstock (additive) switch measure. The Technology implemented by the project activity is production of the following blended cement types that will allow feedstock switch either by increasing the share of additive in each of the existing or new cement types beyond the benchmark of the specific cement type in the applicable region (host country).

	Project technology (cement type)	**Produced in Host country before**	**Additive**	**Project technology**
1	Portland Pozzolana Cement-(PPC)	Yes	Natural Pozzolana or natural heated Pozzolana	Increased additive share
2	Portland Limestone Cement-(PLC)	No	Limestone	Switch to limestone and increased share
3	Pozollanic Cement-(PC)	No	Siliceous fly ash	Switch to Siliceous fly ash and Increased share

Table 001: Project technology and measure

Brief description of Ethiopian Cement Standard

Ethiopian cements standard ES 1177-1:2005 composes of five families (i.e CEM I to CEM V). Each family of cement mothers couple of cement types.

Family of cement of the Project activity plant	Project Plant Cement Types	Minimum legal limit for clinker share, %	Default legal limit for clinker share, %	[7] Regulatory options for Additive alternatives that can are available to PP
CEM I	OPC	95	99	-
CEM II	PPC	65	94	Natural Pozzolana or natural heated Pozzolana (Pumice)
	PLC	65	94	Limestone
CEM IV	PC	45	89	Siliceous fly ash & some Limestone,

Table 0.02a Family of cement in Ethiopian Standard

As outlined in Ethiopian cement standard ES 1177-1: 2005 section 7, Ethiopian cement standard has three requirements, i.e the Mechanical requirements, the physical requirements and the chemical requirements for assuring quality of the five main family of cement i.e CEM I to CEM V.

- The mechanical requirements are the *Standard compressive strength (N) and early strength (R). As shown in* section 7.1.1 of Ethiopian cement standard ES 1177-1: 2005, Ethiopian standard has three standard strength classes i.e 32.5, 42.5 and 52.5 suggesting that all cement types can attain these compressive strength (N) characteristics at 28 days. As per section 7.1.2, early strengths (R) are observed at 2 days and 7 days.

- *The Physical requirements are the* initial *setting time and the soundness*. Table 2 of the same standard under 7.1.2 shows that all the 32.5 class, 42.5 class and 52.5 class need to exhibit Initial setting time in 75 minutes, 60 minutes and 45 minutes respectively. All of these strength classes in all cement types need have also 10mm soundness requirement, suggesting that all cement types under each strength class need to attain similar physical requirements.

- The chemical requirements investigate % of Loss on Ignition (LOI), insoluble residue, sulphate content and pozzolanicity. None other cement types than CEM I and CEM III have LOI requirements while the % requirement for other parameters overlap depending on strength class.

The most commonly observed requirement in construction practice, the mechanical requirement, has been tabulated below.

[7] All cement types technically need Gypsum 1-5% to delay setting and allow grinding clinker lumps.

Class of cement	Compressive strength MPa				Initial setting Time (min)	Soundness (expansion) mm
	Early strength		Standard strength			
	2 days	7 days	28 days			
[8]32.5N	-	16	32.5	52.5	75	10
32.5R	10					
42.5N	10		42.5	52.5	60	
42.5R	20					
52.5N	20		52.5		45	
52.5R	30					

Table 002b: Ethiopian Cement classes, physical and mechanical quality requirements

All of the Ethiopian cement families (i.e CEM I to CEM V) can achieve the above cement classes and should confirm to the above requirement. The smallest compressive strength of the mortar cube as per this standard is 32.5 MPA and should be achievable in 28days after casting (as mortar cube or the cement concrete). The highest compressive strength of the mortar cube required by the standard is 52.5 and greater percentage of it should be attained in 28 days. Each of the cement types can be manufactured to suit the specific construction requirement on *when* the strength is intended to be achieved. For example; a manufacturer can produce PPC cement to a 32.5R class whereby it would achieve 10MPA strength in 2 days after casting and achieve 32.5MPA strength in 28days after casting. If attaining early strength of 10MPa in 2 days is not required by consumer application, it can produce and market 32.5N class which would anyway attain at least 32.5MPa at the 28ths day after casting. The initial setting time describes the time in minutes after casting, which the concrete mixed using the specific cement class, would start to cure (lose all water). It nearly starts within one hour as shown in above table with small deviation on both sides depending on cement class. The soundness is common for all classes.

Early strength class (denoted by R in first column of table 002b) is the compressive strength obtained in earlier days of the total 27 days curing time. Ultimate/standard strength class (denoted by N in table 002b) is the strength achieved at the end of the 27 days curing time. In terms of ease of achieving the standard, the higher the clinker share in cement is the easier it is to get high early strength (R) and higher standard (ultimate) strength (N). However high ultimate compressive strength (N) is still possible to achieve with lower clinker share (higher additive share) but requires the relevant technology in that the additives be well dried, ground with increased fineness and hence requires increased effort and cost in conveying, drying, crushing and processing. The ease of achieving fineness is also a factor of the type of Additive handling itself.

The project activity measure is increasing additives in cement through substitution of some portion of clinker with well prepared additives. In practice the less the intended clinker share is, the more fine the relevant additives should be for the cement to achieve the requirements as per the above standard. The project activity achieves this through significant efforts and investment on installation/operation of the required conveying systems, storages, dryers and improved additive processing technology. Among the 27 brands of the standard under the five families of cement, the following blended cement types will be produced by the project activity. These project types will be used in Ethiopian construction applications as required by the building code.

[8] Key: This class achieves 7 day compressive strength of 16 MPA, standard strength of 32.5MPA and ultimate (28days) strength of 52.5MPa.

No	Cement type	[9] Lowest regulatory clinker limit of regulatory norm in the National standard (%)	Lowest Clinker share (%) targeted by project activity
1	PPC	65	65
2	PLC	65	65
3	PC	45	45

Table 002c: Project activity cement types and ultimately targeted share of clinker

The project cement types will also easily meet all the characteristic compressive Strength requirements of cement concrete as per the Ethiopian building code standard (EBCS 2); as tabulated below

Ethiopian Grades of Concrete	C5	C15	C20	C25	C30	C40	C50	C60
Compressive strength, F_{ck} in MPa	0	12	16	20	24	32	40	48

[10]Table 003: Characteristic compressive strength requirement of cement concrete

As shown in the above table, cement concrete products used in Ethiopian construction applications can have Grades ranging from C5 to C60. C5 cement is used in lean concrete and doesn't require compressive strength at all but only bonding characteristics. The smallest compressive strength requirement is 12MPa and the highest is 48MPa. All of the cement family (i.e CEM I to CEM V) can achieve all of these strength requirements as described in the previous paragraphs. This being the case; some cement types are sometimes preferred for additional construction applications (workability, setting time) or enhance concrete resistance against hazards (ex: sulfate resistance).

- Raw mix preparation

Before going to the raw mill, raw materials are suitability proportioned in the raw mix so that they may deliver the quality of clinker required. The project raw materials will largely contain limestone. Material is crushed before batched to the mix preparation stage. The prepared mix is sent to the raw mill for grinding and drying. The raw mix will be ground to the required size in the raw mill to the required minimum sieve diameter.

It also goes through drying process simultaneously with milling. The heat for drying the raw mix will be sourced from the pre heater or cooler end of the kiln. The ground mix will be sent to a homogenizer which intern sends it to the kiln through the pre heater end. The raw mill is operated by power sourced from the grid.

- The kiln system

The project activity kiln system is composed of the pre heaters, the pre-Calciner, the rotary kiln, the cooler, the burners, the dust control devices and other auxiliary accessories each with specific purposes. The kiln system performs the thermal decomposition processing of the raw mix to deliver clinker. Clinker is a product which is the main constituent in any cement type. It comes out from kiln as balls of agglomerates. Power required for moving equipment is sourced from the grid. The

[9]Ethiopian cement standard ES 1177 - 1:2005 (now named CES 28), Page 8

[10] Ethiopian building code standard (EBCS 2); chapter 2

thermal performance of the kiln is about 3.2GJ/t-clinker which matches global state of the art kiln. None of the plants in region or host country match this kiln performance. But kiln efficiency is not credited under this project activity.

- Additive preparation and cement grinding

The clinker from the kiln system will then be further processed to cement after grinding with gypsum to change to powder and relevant additive co-grounded for producing the relevant type of cement. All additives will be sourced from quarry sources identified and leased in concession. *Gypsum* which is an additive mandatorily added to help delay clinker setting and allow crush clinker is used in all cement types and ranges from 1-5%.

The project gypsum is sourced from the same quarry as that of limestone. Additives targeted for blended cement are siliceous fly ash, Pozzolana (pumice) and limestone. Limestone will be sourced from the same quarry where limestone used for clinker making is sourced. Pumice (volcanic ash) will be sourced from pumice quarry located around AlemTena locality about 125km from plant. The same source would provide siliceous fly ash through further processing. All of the additives are available in massive reserve leased by plant operator under concession for several decades. The mining certificates are available and submitted for validation together with PDD.

While all other ingredients are transported in conveyor belts, the additives will be mined and transported using trucks to the plant site for crushing. Interim storage, crushers, sieves, dryers, hoppers and stackers will be used to store intermediate products.

After drying, crushing and grinding to the required size, it will be sent to the cement mills to be ground with the set percentage share of clinker to produce cement. Similarly limestone will be ground with set percentage of clinker to produce cement type. It can be difficult to introduce at once new cement type at its lowest allowable clinker share to the market due to consumer stigma and brand risk associated with it. Therefore, the share of new cement types in the total production would be subject to level of market absorption. Hence clinker share in cement may be accordingly reduced towards the lowest allowable limit along the crediting period, especially in new cement types. When the product promotion allows the target would be, as much increased production of new types and as much reduced clinker share as possible without exceeding the lowest limit. All of the cement types will be tested on continuous spot sampling using methods and frequencies as per the requirements of the national standard before being sent to the market. Finally cement is sent to the market in bulk or after packaging. A typical process flow in cement production is shown in diagram 002.

- Equipment and machineries of the project plant related to the project activity.

All major equipments of cement plant are indicated in the table below. The equipments related to sourcing additives and cement grinding is the equipment directly related to incremental investment. Raw and additives quarry equipment will be utilized to mine raw materials and additives. Land transport trucks will be used to transport Pumice while product collection &Conveyor belts (cross country and in plant) will be used to deliver the rest of the materials and fuel to the processing equipment.

The Kiln system is the equipment that processes clinker raw materials into clinker. Cement Mills (3) will be used to grind clinker with additives to deliver the cement types of the project activity. Cement packing equipments pack cement into standard bags. The X-ray fluorescence, Lab equipments, weigh feeders, weighbridges& meters will be used to measure either mineralogical contents of materials or the amount of material flowing into a process thereby sending data to the nearby computer of the central control room. Central Control Room is the rooms where all plant control parameters are monitored and corrective actions taken in each stage of process. It is also where most of the CDM specific data are monitored.

[11]Statistical data of cement plants in the host country before starting date of project activity dictate that there is only one type of blended cement produced historically. Plants produce it at higher clinker share than the project activity and using only one type of Additive. The project activity proposes to produce various types of blended cement among the types covered under the national cement standard through utilizing optimum clinker share in each type and diversifying Additive types.

Without the project activity,

a. PPC would have been produced at the regional benchmark clinker share of 72.86 %.
b. PLC would have been produced at the corresponding regulatory default benchmark clinker and additive proportion
c. PC would have been produced at the corresponding regulatory default benchmark clinker and additive proportion

All of these conditions would have produced more GHG emission than the project activity.

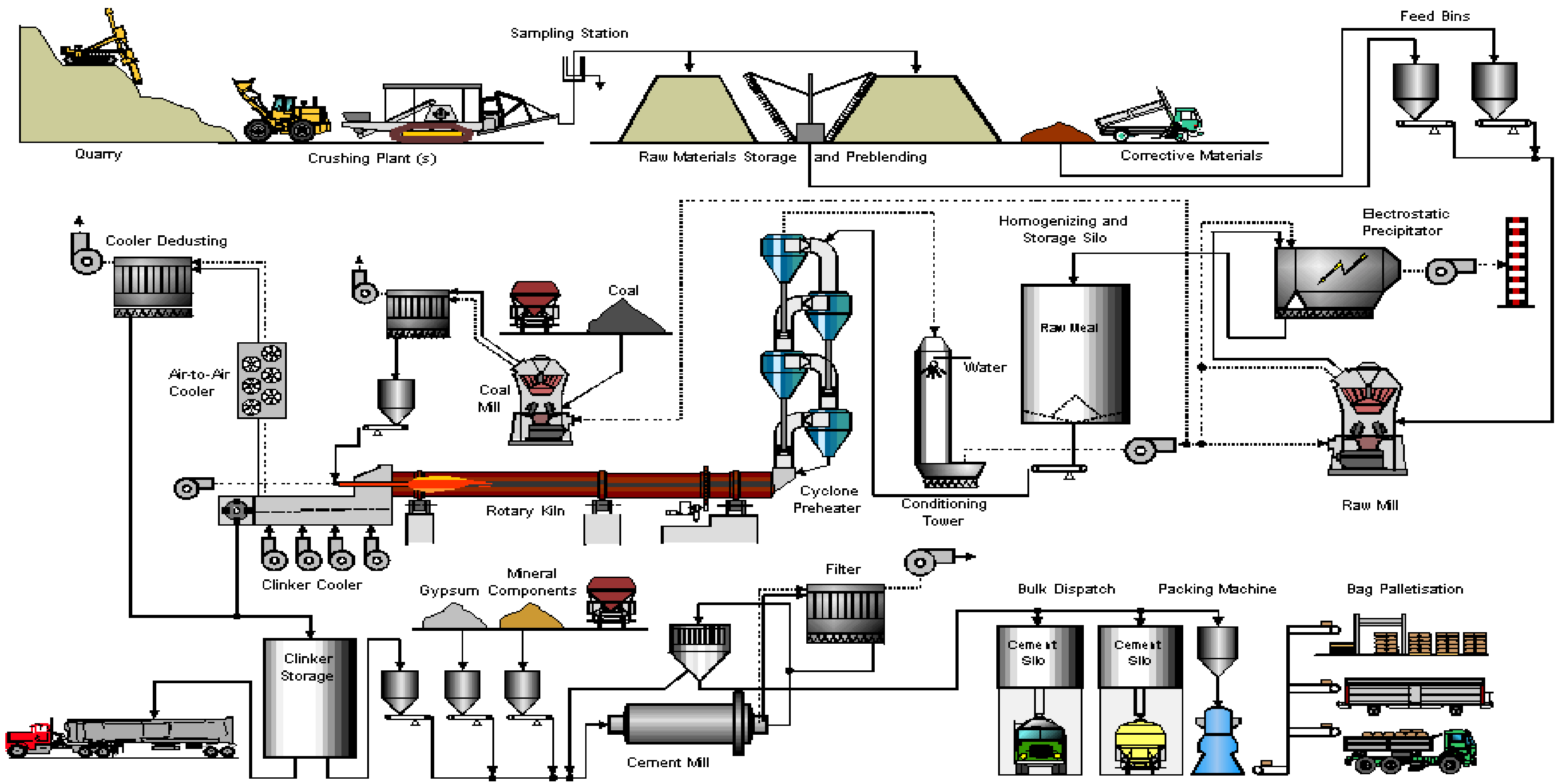
With respect to domestic environmental contribution, the chosen cement technology is state of the art globally in every section and process. The clinker manufacturing technology is a dry process dual chamber five stage suspended pre heater with pre-calciner kiln. No similar technology (in efficiency and scale) has ever been transferred into the host country before. The cement grinding technology is also state of the art mills to help achieve the required cement quality specifications. The dust capture devices are top performing with maximum dust release less than 25mg/Nm3. In addition the kiln has inline re-calciner to recycle. The superior kiln efficiency helps to reduce the amount of coal consumed, the associated particulate emission and the associated import expenditure. On the first crediting year production of PPC at the PA blending rate and pilot test of the PLC & PC varieties will be performed. The ultimate plan is to distribute the clinker capacity to gradually achieve a production grid of 20%PLC, 30%PC, 40% PPC and 10% OPC. A tentative cement production plan is provided to the DoE.

The project participants (Derba MIDROC Cement and Ethan Bio-Fuels PLC) will launch a grand plan to;

- Educate the public on challenges and benefits of low carbon cement
- Create awareness to the association of Ethiopian Architects over the challenges and benefits of low carbon cement as well as how to integrate them in design specifications
- Create awareness to the construction industry on how to responsibly utilize low carbon cement types and safeguard over abuse
- Engage policy makers to creating favourable environment both for consumption as well as enforcement of responsible consumption
- Use radio and TV sessions to host series of awareness campaigns over challenges and opportunities of low carbon cement
- Engage municipalities over contribution of low carbon cement to low carbon cities
- Engage academic institutions over R&D in cementitious products using low carbon cement

[11] Supporting documents listed in annex 3

Diagram 002: typical cement production process pectoral illustration



A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ethiopia	Derba MIDROC Cement PLC	No
Ethiopia	Ethan Bio-Fuels PLC	No

A.5. Public funding of project activity

There is no ODA or public funding involved for the project activity from Parties included in Annex I.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

The Project Activity would apply Approved consolidated baseline and monitoring methodology ACM0005, Increasing the Blend in Cement Production. Version 07.1.0

- "Tool to calculate the emission factor for an electricity system" (Version 5.0)
- "Tool for the demonstration and assessment of Additionality" (Version 07.0.0)
- Additionality of first-of-its-kind project activities (Version 03.0)
- "Guidelines for objective demonstration and assessment of barriers" (Version 01.0)
- "Assessment of the validity of the original/current baseline and to update of the baseline at the renewal of crediting period" (Version 03.0.1)
- "Project and leakage emissions from road transport of freight" (Version 01.1.0)

More information about the methodology, tools and guidance can be found on the website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

B.2. Applicability of methodology and standardized baseline

The Applicability conditions extracted from the relevant approved methodology and project conditions have been tabulated below.

	Applicability Conditions	Project conditions
1	The Methodology is Applicable where there is National Cement standard	Ethiopia has a national cement standard which is more or less the same as the British standard.
2	This methodology is applicable to project activities that produce blended cement (BC) beyond current practices in the host country either: (i) in Greenfield cement plant or (ii) in existing cement production plant by increasing the share of additives (i.e. reduce the share of clinker)."	This project activity produce blended cement (BC) beyond current practices in the host country, in Greenfield cement plant
3	The project activity plant is Greenfield.	Greenfield cement plant is defined as cement plant with no operational history at the start date of the CDM project activity. The project plant had no operational history at the start date of the project activity which is August 14,2009
4	This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement (if any);	Blended cement types are basically for domestic market and in any case only those domestically sold cement types will be included in and accounted for in the project activity.
5	The methodology is not applicable if blending of cement outside the cement production plants is a common practice in the host	Cement availed to the Ethiopian market (and transported to construction sites) is supplied only either from existing

	country (ex: localized blending in construction sites).	manufacturing plants or imported from international market. As per the confirmation letter dated November 4, 2013 obtained from Ethiopian Standards Agency of the Government of F.D.R Ethiopia, cement production requires continuous spot sampling/testing and that it is not permitted to produce blended cement outside cement plants. Hence, there is no cement blending/grinding activity taking place outside cement plants (on construction sites). . Therefore blending of clinker and additives to produce cement outside the cement production plants (on construction sites) is not a common practice in the host country.
6	All clinker used in the project activity shall be produced by the cement plant that is included within the project boundary, hence, cement grinding only plants cannot use this methodology (e.g. plants with no clinker manufacturing facility)	The TEFR and other supporting documents submitted for validation to DOE show that the project plant is an integrated cement plant (Raw mill + Clinker Kiln + Additive mill+ cement mill) and hence it is not cement grinding only plant. These evidence documents as well as the actual installed kiln capacity also demonstrate that all of the project activity clinker (guaranteed minimum design of 5600tpd) will be produced by the clinker kiln of the project activity plant, within the project boundary.
7	Adequate data are available on cement types in the market	The "market" is defined as the host country. In terms of cement type: PLC, PC and PPC cement, are considered as defined in Ethiopian cement Standard shown in table 002a. Cement availed to the market is supplied only either from existing manufacturing plants or imported from international market. There is adequate statistical data of cement in the market (i.e on cement production by name of plant, type of cement produced, type of cement imported, clinker share and annual volume for the relevant years. All of these data were obtained from regulatory Government Authorities and submitted to DOE for validation.

All of the applicability conditions of the methodology ACM0005 (Version 07.1.0) are fulfilled by the Project activity as explained above and supported with evidences submitted to DOE.

B.3. Project boundary

The project boundary includes cement production plant, Diesel power plant and Ethiopia National grid.

	Source	Gas	Included?	Justification / Explanation
Baseline	Calcinations of raw material in the kiln	Co_2	Yes	Direct emission from clinker kiln.
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of fuel in the kiln including burner	CO_2	Yes	Direct emissions from clinker kiln.
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of fuel for drying raw materials & kiln fuel	CO_2	Excluded	excluded for simplification
		CH_4	Excluded	Emissions negligible, excluded for simplification
		N_2O	Excluded	Emissions negligible, excluded for simplification
	Use of electricity (grid and self-generated)	CO_2	Yes	Direct emission from self-generation sources and indirect emission from

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

Table 004: table of GHG gases and sources in the project boundary

B.4. Establishment and description of baseline scenario

As per the guidance under "Identification of the baseline scenario" Page 4/36 of ACMM0005 Version 7.1.0, "Project participants shall identify the most plausible baseline scenario among all realistic and credible alternatives(s). Steps 2 and/or 3 of the latest approved version of the Tool for the demonstration and assessment of Additionality should be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive). Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario. In doing so, project participants shall consider all realistic and credible production scenarios for the relevant cement type that are consistent with current rules and regulations, including the existing practice of cement production, the proposed project activity, and practices in other manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances. "

The applicable "Region" has been chosen as the host country.

For the demonstration of Additionality and establishing baseline scenario; the flow chart on Figure 1 of the Additionality tool and the steps outlined in the tool has been followed. Guidance in the applied Methodology and other regulatory documents referred to in the Additionality tool have also been considered.

Step 0: Demonstration whether the proposed project activity is the first-of- its-kind

As per the Methodological tool "Additionality of first-of-its-kind project activities" (Version 03.0); project activity is an FOIK if;

(a) The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;

The technology of the project activity is different by the following;

a. *Size of total annual production output*
b. *Cement type and Feedstock type*
c. *Percentage of feedstock(Additive) in cement*

The start date of the project activity is August 14, 2009. [12]Data on existing cement plants before the start date have been collected with annual production output; cement types produced and clinker share of each.

- *The project activity annual production output (scale) is more than twice the largest cement plant in the host country.*
- *The project activity intends to produce PLC and PC, for the first time in the host country, which has not been realized by any plant in host country).*
- *Moreover the project activity intends to produce PPC at 65% clinker share which has not been achieved by any plant in the host country.*

[12] Data is found in the CERs spreadsheet and supporting documents has been submitted to DOE

Hence the CDM Project will be the first among plants in the region (host country) to apply the technology (produce the cement types using the additive types or blending scale of additives), by the start date of the project activity.

(b) The project implements one or more of the measures;

The project activity implements feedstock switch measure

(c) The project participants selected a crediting period for the project activity that is "a maximum of 10 years with no option of renewal".

The project participants selected a fixed crediting period for the project activity that is "a maximum of 10 years".

Hence the Project activity is proven First of Its Kind.

In addition to the guideline the methodology ACM 005 V 7.1.0 itself requires demonstrating the following additional requirement for claiming FOIK.

- **No Blending on the plant before:** "Only projects implementing blended cement projects for the first time are allowed to claim this barrier (i.e. project participants which are increasing the percentage of additives from a historical value to a higher value are not allowed to use this barrier).

The project plant is Greenfield and hence implements Blended cement for the first time (is not increasing clinker share from historical value).

- **Diffusion/Penetration of technology :** 5% threshold in the methodology page 5/36

The relevant blended cement, as defined by the methodology, is the blended cement output of the project activity. The project activity targets to produce the following cement outputs. Hence the 5% compliance check is performed accordingly.

- Produce PLC for the first time in host country
- Produce PC for the first time in host country
- Produce PPC at 65% Clinker share for the first time in host country

As per the provision of the Methodology on page 5/36 the project activity shall be considered as the one that applies a technology that is different from any other technologies (FOIK) able to deliver the same output if the market share for the blended cement in the host country is below 5%. "The market share shall be calculated as the percentage of the amount of blended cement in the total amount of all cement types produced in the host country (tons blended cement/total tons cement production x 100%) during the last three years prior to: (a) the start date of the CDM project activity; or (b) the start of validation, whatever is earlier. The Start date of the project activity was August 14, 2009 while the start of first validation is November 2011. Hence the start date is earlier to the start date of validation. [13]Statistical cement production data analyzed in the relevant spreadsheet results as follows;

1. Different technology is defined as in FOIK tool Para 11. The Project activity applies a different technology (produces output of the same quality but using different types of additives or varying percentage of Additives) than all other plants in the host country. Data on all plants in the host country shows that cement plants producing PPC at additive rate much higher than the proposed project activity. Moreover none of the cement plants in the host country produced PLC. Similarly none of the cement plants in the host country

[13] CERs spreadsheet and FOIK

produced PC. The market penetration of PA blended cement output produced (blending achieved) by the project activity (PA technology) is therefore 0%.

Cement	**% Share of PA blended cement output from total cement in Host country,2007**	**% Share of PA blended cement output from total cement in host country,2008**	**Average**	**Conclusion**
PLC	0.00%	0.00	0.00	< 5%
PPC at the PA blending rate	0.00	0.00	0.00	< 5%
PC	0.00%	0.00%	0.00%	< 5%

Table 005**:** % penetration of the project technology

Therefore it is FOIK as per the provision of the further guidance on page 6/36 under the methodology.

As per Para 18 of the tool; if FOIK is demonstrated common practice test is not required and the project activity is **Additional.**

Outcome of Step 0: the Project Activity is Additional

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

As per "**Identification of the baseline scenario**" of ACM 0005 V07.1.0, "The most plausible baseline scenario among all realistic and credible alternatives(s) is identified using Steps 2 and/or 3 of the latest approved version of the "Tool for the demonstration and assessment of Additionality"

In doing so, "project participants (PPs) shall consider all realistic and credible production scenarios for the relevant cement type that are consistent with current rules and regulations, including the existing practice of cement production, the proposed project activity, and practices in other manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances. The most likely baseline scenario can be identified with the latest version of the "Tool for the demonstration and assessment of Additionality." Moreover; the methodology requires baselines to be dependent based on clinker benchmark. Hence identifying alternative scenarios requires consideration of the following elements of the methodology;

- Clinker benchmark needs to consider only the relevant cement type of the project activity (Page 9/36). As per the methodology (Page 2/36), relevant cement type is the type of blended cement produced under the CDM project activity.

- The benchmark of share of clinker in the blended cement types produced in the host country is used to set the benchmark clinker share (Page 6/36). Blended cement types are defined (Page 1/36) by the national standard of the host country and in fact the methodology is not applicable if there is no national cement standard. The National cement standard is the source of the regulatory bottom and default ceiling clinker limit for each relevant blended cement type.

- In case the project activity consists of production of more than one cement type, the emission reduction shall be calculated for each cement type i produced (Page 20/36) and summed up.

- The Methodology also requires imports of the relevant types of cement to be considered as if being produced by one virtual plant.

[14]In doing so; the relevant statistics of plants (commissioning dates, types of cement produced, clinker share, annual production etc) producing cement in the selected region (host country) have been collected and documented.

[15]Moreover the import statistics for the relevant years have also been collected and documented.

Step 3 of the "Tool for the demonstration and assessment of Additionality"V.07.0.0 is used to determine the most plausible baseline scenario as follows.

The Additionality tool states "Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity." Alternatives available to plant owners in the region(host country) before the start date are included for assessment.

Moreover Para 21 of the tool states "If the proposed CDM project activity includes several different facilities, technologies, outputs or services, alternative scenarios for each of them should be identified separately." Alternatives of producing each of the project activity cement types, available to plant owners in the region(host country) before the start date are included for assessment.

The project produces different output (distinct blended cement types) using different input raw materials (Additives). Project will decrease clinker share in PPC cement types and produce new cement types PLC and PC with respective additive types decreasing clinker until it reaches the lowest allowable clinker threshold in each. Hence separate identification of alternative scenarios is made for the project activity cement types.

Sub-step 1a: Identification of alternatives to the Project Activity

The following alternatives are considered as appropriate;

Alternative a; the project activity undertaken without being registered as a CDM project activity

Alternative b; other realistic and credible alternative scenarios (s) to the proposed CDM project activity scenario that deliver this output

Alternative c; If applicable**;** Continuation of the current production practice

Outcome of Sub-step 1a: identified realistic and credible alternatives scenarios to the Project Activity

The following alternatives have been identified as appropriate for each cement type based on similar input/raw materials (Additive) produced under similar economic circumstances (in the region of the project activity) that are consistent with all applicable mandatory laws and regulations identified corresponding to the relevant project activity cement types, each separately;

I. Output 1: Blended Cement Type PPC

Alternative a; the project activity undertaken without being registered as a CDM project activity

---

[14] Source: official government documents and data collected by Government Authorities from cement plants, submitted to DOE

[15] Source: Ethiopian Quality and Standard Authority, submitted to DOE

Alternative b; other realistic and credible alternative scenarios (s) to the proposed CDM project activity scenario that deliver this output i.e Production of this cement type at regulatory default clinker ceiling share (94%) Clinker; (1-6) % Pozzolana and (0-5) % gypsum;

Alternative c; If applicable**;** Continuation of the current production practice (at the bench mark rate) of this type of cement in manufacturing plants of other cement plants in the region including import of cement i.e. the continuation of production as per the current benchmark blending / clinker share practice of this cement type in the region(host country). The weighted average Clinker share of this cement type in the region (host country) is 72.86%.

II. Output 2,3 respectively: Blended Cement Types PLC and PC

Alternative a; the project activity undertaken without being registered as a CDM project activity

Alternative b; other realistic and credible alternative scenarios (s) to the proposed CDM project activity scenario that deliver this output ; Production of the specific cement type using the regulatory default clinker ceiling share. i.e Production of PLC at 94% clinker, (1-6)% Limestone and (0-5)% Gypsum. In regards to PC it would be Production of PC at 89% clinker, (6-11) % siliceous fly ash, (0-5) % Gypsum

Alternative c: continuation of the current manufacturing practice of this type of cement in other manufacturing plants in the region (host country). But as there is no current manufacturing practice of this type of cement in the region or host country, this is not realistic alternative and hence dropped.

Sub-step 1b: Consistency with mandatory laws and regulations

As per [16]Ethiopian Cement standard; cement types are identified by the clinker bottom and ceiling limits as well as the types of additives used in blending. For a cement to be named as either type it has to fall within the regulatory clinker range, use the respective additive and meet the requirements. Producers who wish to produce a certain blended cement type should therefore at least meet the default maximum clinker share in the respective cement type and the associated minimum additives percentage.

Outcome of Sub-step 1b: All of the realistic and credible alternatives identified above for each cement type are in compliance with mandatory legislation and regulation in Ethiopian cement sector.

Step 2: Investment analysis has been skipped and rather Step 3 followed.

Step3: Barrier analysis

Sub step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity;

The project activity would be impeded by the following realistic and credible barriers if it was not registered as a CDM project activity. Hence the following are established allowable list of barriers, and would prevent alternative scenarios in the absence of CDM;

[16] Ethiopian cement standard which is equivalent to European standard EN 197

Moreover the host country is an LDC and uses "Guideline regarding Least Developed Countries" in "GUIDELINES FOR OBJECTIVE DEMONSTRATION AND ASSESSMENT OF BARRIERS" (Version 01) "Guideline 7 is clearly applicable. Guideline 7 reads;-

"For projects in Least Developed Countries, it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries. Projects in Least Developed Countries are not bound by the provisions in this guideline" and "may be sufficient to demonstrate a history of non implementation" to demonstrate the relevance of a barrier. It further reads **"**Rationale: Projects in Least Developed Countries can be assumed in general to face significant barriers to their implementation. At the same time, data availability in these countries is considerably limited which complicates the demonstration of Additionality and therefore further increases transaction costs. "

The following barriers have been transparently described as relevant barriers.

a. Technology barriers

- **Technology barrier due to Scale**: The project activity scale [17](~2.8million-tons/annum) is at least [18] twice the production scale of the largest plant in the host country (~<1million-tons/annum). There is no domestic experience whatsoever of implementing and operating cement factory in such a scale of production as well as technical complexity and hence an operation risk barrier. Obviously the production scale of the Project activity escalates to 2.9 million tons when blending rate is enhanced since the same annual clinker volume is used to produce more tonnage of low carbon cement in the project activity than otherwise.

- [19] **Technology Barrier due to technical complexity**: The plant feasibility as well as implementation supervision was performed by a foreign entity. The plant design, manufacturing as well as erection were made by foreign entities including for maintenance & operation of the plant for further duration. This implies that the technology is new to the plant owner exposing him to significant technology risk. On product side; plants would normally choose to either produce what is already practiced or what is mandatorily enforced; with respect to cement types; to avoid risk of failure. DOE visit confirmed that OPC and PPC are the only ones being produced in the host country. Blending various additives to produce various desired cement types hence exposes to increased risk associated with process technology, equipment wear & damage and risk of technological failure. This needs procuring expat labour and skills.

b. Manpower barriers

- [20]**Skilled manpower barrier:** There is significant shortage of skilled cement manpower in the host country as demonstrated by hiring of foreign consultants for operation management as well as training interns entirely new to the cement market. So far four hundred medium skill and sixteen engineers are hired fresh from school and are being trained by the foreign consultants along with plant commissioning. The remaining two local employees employed so far were recently working for other plants, showing that skilled cement sector manpower is severely short in the domestic market. This otherwise leads to an unacceptably high risk of equipment disrepair and malfunctioning or other underperformance. This is further aggravated when

[17] As per the project production plan under CERs spreadsheet and Appendix 4

[18] FOIK Additionality, benchmark and CERs spreadsheet

[19] Contract documents with Technology supplier and Feasibility consultant

[20] DOE onsite visit witnessed tens of Chinese experts still working on plant three years after plant commissioned

product is diversified; output increases and the input materials vary and still conformity requirements need to be met through spot sampling and testing.

DOE on site visit experienced foreign expat workers working on the plant management. CDM revenue would critically serve as source of hard currency expenditure for foreign experts, [21]which is not always available in least developed countries commonly characterized by foreign trade deficit (i.e export earning falls short off import expenditure). These barriers cannot be overcome by monetizing the barriers. Some of the CDM revenue would also at least cover some cost of training towards cultivating skilled manpower for the complex technology.

c. The Particular technology of project activity is not available in the relevant region(host country)

There is no PLC and PC production in the region (host country). There is no plant that produces PPC at the project activity blending rate of 65%. The cement production plant is itself procured from abroad and is not a technology that is available in the host country. Obviously there are many unknowns and risks in being a pioneer producer.

Outcome of sub step 3a: All of the identified barriers prevent implementation of the proposed Project Activity without the CDM

Sub step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

I. Output 1: Blended Cement Type PPC

Alternative (c) is commonly being implemented now in the region, and alternative (b) has long been surpassed and barriers are hence already overcome**.** Hence identified barriers would not prevent their implementation.

II. Output 2,3 respectively: Blended Cement Types PLC and CEM PC

Alternative b; other realistic and credible alternative scenarios (s) to the proposed CDM project activity scenario that deliver this output i.e Production of a specific cement type using the regulatory default clinker ceiling proportion is not prevented by the above barriers. This is because;

a. The alternative is in fact mandatorily enforced by the regulatory norm (cement standard). Producers wishing to produce PLC need to produce it at least at 94% clinker, (1-6)% Limestone and (0-5)% Gypsum and label its package as per the [22]designation requirement of the national standard. Similarly producers wishing to produce PC need to produce it at least at 89% clinker, (0-11) % (siliceous fly ash & limestone), (0-5)% Gypsum and label its package as per the designation requirement of the national standard. On the other hand producers are not obliged by the regulation (cement standard) to increase additive and reduce clinker share below the regulatory default.

b. Once a plant decides to produce PLC and PC; producing them at the regulatory norm is less exposed to risks associated with production scale, technology risks, manpower risks and market barriers than the CDM Project activity

[21]http://www.addisfortune.com/Vol_13_No_647_Archive/agenda.htm

http://www.addisfortune.com/Vol%2010%20No%20489%20Archive/ecconomic_commentary.htm

[22] ES 1177-1:2005; 8 (Standard designation)

Outcome of sub step 3b: There is at least one alternative scenario, other than the proposed project activity, not prevented by any of the identified barriers

Step 4: Common Practice Analysis

As per the flow chart of the tool and Para 18 of the tool; projects that have demonstrated FOIK do not need to perform common practice test.

Outcome of step 4: Project activity is not a common practice

The Additionality of the project activity has been established at Step 0,

The remaining alternatives that are not prevented by the barriers are the baseline scenarios for each of the relevant project activity cement types.

The baseline scenarios for each type of output i.e which are not prevented by barriers are as follows:

i. Output 1: Blended Cement Type PPC

For this type of cement Alternative C; continuation of the current practice is the baseline scenario. As per the tool, if more than one alternative exists, the alternative resulting in the lowest baseline emission among the possible alternatives scenarios is the baseline scenario.

Alternative C continuation of the current production practice of this type of cement in manufacturing plants of other plants in the region i.e production at benchmark rate of 72.86% clinker share; is the baseline scenario.

ii. Output 2,3 respectively: Blended Cement Types PLC and CEM PC

For these types of cement**, Alternative b**; other realistic and credible alternative scenarios (s) to the proposed CDM project activity scenario that deliver this output or cement of comparable quality, is the baseline scenario for both types. Separately described;

In case of PC: The Baseline Scenario is the remaining Scenario which is production of PC at regulatory default. In regards to PC would in the baseline be produced at 89% clinker, (6-11) % siliceous fly ash, (0-5) % Gypsum

In case of PLC: The Baseline Scenario is the remaining alternative which is production of PLC but at regulatory default. Production of PLC at 94% clinker, (1-6) % Limestone and (0-5) % Gypsum would be the baseline scenario.

B.5. Demonstration of Additionality

Additionality has already been demonstrated in B.4 as per the tool at Step 0 due to FOIK outcome.

Conclusion: The project activity is **Additional.**

Prior CDM consideration and continuous pursuit of carbon financing

The Start date of the project activity is August 14, 2009, which is after 2nd August 2008as shown in table below.

The Start date of the project activity is August 14, 2009, which is after 2nd August 2008. PP's have notified prior CDM consideration to UNFCCC and DNA on November 9, 2009 and acknowledged by UNFCCC on November 17, 2009. Moreover, in complying with Para 5 of annex 13 of EB 62, PPs informed the UNFCCC secretariat on November 17, 2011 (within two years of the initial

notification) regarding its progress. The following chronology of CDM events are recorded and documented showing early CDM consideration

Time	Key Event	Importance	Documentation
January 2006	First feasibility completed for 5000tpd	Preliminary Cement Project study	Available
January 2007	Engineering Design, Procurement & Construction Contract (EPC) Signed with a Technology supplier on Turnkey basis	Project office established at Addis Ababa	Signed EPC document
May 2007	Decided to apply for loan and financier requested revision of feasibility	TEFR revision and EIA preparation	Indicated on of Final TEFR
June18, 2007	2% Advance to CNBM	to start design Equipment and civil structures in consultation with TEFR consultant	Receipt confirmation from CNBM'S Bank
June 17,2007	Initial comment on EIA from EPA		Letter from EPA
October 10, 2007	Initial letter of engagement of Ethan Bio-Fuels Ltd with MIDROC group for CDM projects identification	CDM promoted, Awareness created, Introduction of CDM project manager and CDM project development services	Letter with CEO of MIDROC Group and subsequent meetings
October 2007	Final Feasibility (TEFR) report completed for 5600 tpd capacity and estimated preliminary CO_2 emission from clinker production estimated	Shows the project technology, unit cost of raw materials, sources, availability and project equipment	Shown on final TEFR,
December 2007	EIA study completed,	Carbon Finance considered on section 6.2.1.1	Final EIA
January 17, 2008	Power transmission line Design and supervision contract signed with EEPCO	Design of Grid Power transmission line	Agreement

Time	Key Event	Importance	Documentation
January 27, 2008	letter for commercial agreement between EBF and Derba MIDROC for up scaling CDM	Further CDM awareness campaign to Derba, Scope of the envisaged CDM project activities and pre agreement negotiation meeting	Letter with Executive Director of Derba MIDROC
February 28, 2008	CDM project activities enhanced study document	Presentation of potentials, product possibilities , scope of abatement potential	CDM technical, feasibility & pre-implementation document
March 7,2008	Full advance to CNBM	Speed up plant design	Invoice
March 20, 2008	Derba CDM product (output) variety and plan	Assessment of abatement potential	Summary table
May 27,2008	Mining License	Concession for raw materials	License
May 28, 2008	Further Agreement between EBF and Derba MIDROC for up scaling CDM	Further scale up for baseline documentation, PDD development, CDM management and marketing	Letter with Executive Director of Derba MIDROC for NDA
June 14, 2008	Marketing efforts and networking	To secure buyers	Emails
June 23, 2008	Signing of Loan agreement with four banks for project financing	Agreement made but equity precondition to be fulfilled by Derba before actual disbursement.	Financiers' websites Agreement signing pages
June 30, 2008	NDA signed	Further Formalization	Agreement signing pages
October 8, 2008	Further agreement between EBF and Derba MIDROC for joint project development	Baseline establishment and PDD writing started based on methodology	Agreement signing pages
October 21, 2008	Final EIA approval obtained	Federal clearance to enter site for any actual construction to start	Letter from EPA (14/02/2001 Ethiopian Calendar)
Ongoing from October	Marketing of CDM projects started	To engage Annex I buyer	Several Email Exchanges
November 12, 2008	Letter of No Objection	Host country endorsement	Letter from DNA (old project name)
January 9, 2009	First notice to the sponsor to effect EPC equipment payment	First Notice towards decision to invest on major equipment	Letter from Derba Executive to the sponsor
March 27,2009	EB ordered Methodology ACM 0005 on hold	Further Development of PDD and marketing kept on hold	Email alert news from UNFCCC
August 6,2009	Final notice to meet preconditions of debt	Final Notice to request for decision to invest on supply of major	Letter from Derba Executive to the sponsor (**major decision**)

Time	Key Event	Importance	Documentation
	finance	equipment	
August 14, 2009	Derba fulfilled its equity contribution and reached its "point of no return"	Critical investment decision by settling major payment for equipments (**starting date of project activity**)	Two successive Bank transfers to CNBM
August 28, 2009	Visa requested for CNBM workers to enter the country	For starting to supply, erect and commission	Letter from Derba to Embassy of Ethiopia in Peoples Republic of China
September, 2009	Pumice extraction agreement with regional Authorities	Additive source acquisition through long term concession	Agreement signed
October 12, 2009	LOA requested	PDD (Version 1)	Letter to DNA
October 30, 2009	Revised Methodology ACM 005,V5 released	Further development of PDD	www.unfccc.int, EB 50
November 09, 2009	F-CDM-Prior consideration form filled/ dispatched	Prior consideration justification	www.unfccc.int, Email to UNFCCC and Letter to DNA office
November 17,2009	Notification of Prior consideration acknowledged by UNFCCC		Email response from UNFCCC CDM team
November 26, 2009	LOA obtained	Host Country Approval	Letter from DNA Ethiopia
December 2009	Start of Equipment import and erection	-	Maritime transit documents
December 23, 2010	Bank Loan Disbursement	Full scale implementation	Financiers' websites
Dec 2010 – May 2011	Marketing to engage Annex I participant and also waiting CDM loan scheme	To cover validation, registration, verification costs (not successful)	Emails Ex: email on 20/05/2010
May 2011 to August 2011	Validation DOE & cost assessment	To asses cost of engaging validation DOE	Emails Ex: email on 23/11/2011
September 2011	New FOIK and common practice guidance	PDD adjustment required	Annex to EB 62 report
November 17, 2011	Notification of extension of Prior Consideration notice	compliance of para 5 of annex 13 of EB 62	Email to and from UNFCCC
November 25, 2011	Methodology revised to ACM 0005 V6	PDD finalized to Version 2	Report of EB 65
November 28, 2011	Recent production plan	guide for production/output	Summary table
November 30, 2011	PP's signed DOE contract for validation	Validation kick start	Agreement
July 2012	Commissioning	Testing plant & equipment done	Plan/newspaper
December 12, 2012	Request for registration		

Time	Key Event	Importance	Documentation
January 1, 2013	Start of commercial production	First operational year of plant	
February 21, 2014	EB ruling	Rejected for baseline reasons only related to bifurcation of private and public plants	EB Ruling note CDM-PA7632-RULE01
April 8, 2014	PP complaint to EB	PP complaint on ruling compared to other similar projects yet registered	Registered project 8726, 8748 and 6811
14 June 2014	EB responded with confidential response	Registered projects used 200km radius region from project plants	Confidential EB letter dated 14 June 2014 Reference: AST/JK/jma
June 4, 2015	Newly revised PDD Version 1 & 2 completed	PDD revised taking the 200km region approach as region.	
June 3, 2015	New DOE engaged	Validation for re-submission of request for registration	PP agreement with DOE
October 28, 2015	GSP		UNFCCC-CDM website

Table 06; Prior CDM consideration and continued action chronology table

B.6. Emission Reductions

B.6.1. Explanation of methodological choices

As per the methodology, the project emissions, baseline emissions, leakage emissions and emission reductions are calculated as per the following equations:

According to ACM0005 V07.1.0, the emissions reductions of the project activity during a given year "y" is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y). The project activity reduces CO_2 emissions through substitution of clinker in cement types by using blending materials.

Baseline Emission

The baseline emissions are a function of two factors:

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

The methodology requires data from the base year to calculate the baseline emissions (Co_2 emissions per ton of clinker in the base year, i.e. $BE_{Clinker,BSL}$. Since the project plant is Greenfield, the base year is the first year of operation.

The base year is the year when data on parameters required for calculating $BE_{Clinker}$ are to be collected. In earlier version PP took the first crediting year of PA set as the base year. We now

took year 2013, the first operational year (commercial operation) of project plant as base year. The required parameters are commonly monitored under standard plant record norm.

Since the project plant is new, ex-ante estimation for the preparation of PDD adapted data are obtained from

- technology supplier information,
- quarry test results,
- latest feasibility study used for plant procurement and
- Latest production plan.

Emission per ton of each blended cement type (BC) is determined using monitored values during each crediting year. For values, refer CER sheet.

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

Where:

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

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

Step 1: Determination of $BE_{clinker,y}$

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

Where:

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

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

Step 1.1: Determination of $BE_{clinker,BSL}$

$$BE_{clinker,BSL} = BE_{calcin} + BE_{fossil\ fuel} + BE_{ele,grid,CLNK} + BE_{ele,sg,CLNK} \quad \textbf{(3)}$$

Where:

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

Step 1.1.1: Determination of BE_{calcin}

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

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

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

Step 1.1.2: Determination of $BE_{fossil\ fuel}$

$$BE_{Fossil\_fuel} = [\Sigma FF_{i\_BSL} * EFF_i] / [CLNK_{BSL}] \quad (5)$$

Where:

$BE_{fossilfuel}$= Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (t CO_2/t clinker)
$FF_{i,BSL}$= Fossil fuel of type i consumed for clinker production in the base year (tfuel*i*)
EFF_i= Emission factor for fossil fuel i (t CO_2/t fuel)
$CLNK_{BSL}$ = Annual production of clinker in the base year (t clinker)

Step 1.1.3: Determination of $BE_{ele,grid,CLNK}$

$$BE_{ele,grid,CLNK} = [BELE_{grid,CLNK} * EF_{grid,BSL}] / CLNK_{BSL} \quad (6)$$

Where:

$BE_{ele,grid,CLNK}$= Baseline grid electricity emissions for clinker production per tonne of clinker (t CO_2/t clinker)
$BELE_{grid,CLNK}$= grid electricity consumed for clinker production in base year (MWh)
$EF_{grid,BSL}$= Baseline grid emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (t of clinker)

$EF_{grid,BSL}$ is the Ex-ante combined margin emission factor at the base year. The Ex-ante combined margin emission factor estimated in 2008 was0.00591tCO_2/MWh) and hence this value is neglegible.Hence$BE_{ele,grid,CLNK}$~0for ex-ante calculation only**.** However it will be [23]estimated on base year and included during the estimation of the crediting year.

Step 1.1.4: Determination of $BE_{ele,sg,CLNK}$

$$BE_{elec,sg,CLNK} = [BELE_{sg,CLNK} * EF_{sg,BSL}] / [CLNK_{BSL}] \quad (7)$$

Where:

$BE_{elec,sg,CLNK}$= Baseline emissions from self-generated electricity for clinker production per tonne of clinker (t CO_2/tonne clinker)
$BELE_{sg,CLNK}$= self-generation of electricity consumed for clinker production in base year (MWh)
$EF_{sg,BSL}$= Baseline electricity self-generation emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (t of clinker)

[23]Alternatively, the latest available Grid Emission Factor from DNA office will be used

The project activity plant doesn't have a captive power plant. Only in case of emergency, it will run an emergency 1701KW self-generated power currently installed. Since there is barely any incidence of interruption since commissioning, the ex-ante emissions reduction will consider zero electricity consumption from self generated electricity. However for the actual monitored value in base year will be used in calculating baseline emission in crediting period. i.e. the value $BELE_{sg,CLNK}$ is assumed zero. Hence$BE_{elec_sg_CLNK}$=0.

Step 2: Determination of $B_{Blend,y}$

The region for this project activity is defined as the host country.

***Step 2.1:* Determination of baseline benchmark of share of clinker per tonne of BC at the start of the project activity ($B_{Blend,1}$)**

Data concerning average blending ratio, annual production and import of the relevant cement type(s) in the region shall be collected for one year prior to the start date of CDM project activity. These relevant data for year 2008 has been collected and documented.

Bench mark has been set using the lowest value among (a) and (b) taking the national statistical data for year 2008 and taking into consideration the guidance in the methodology on consideration of imported cement. Since plant is Greenfield, option c is not considered.

As per the applied methodology page 19/34;

"In case the project activity consists of production of more than one cement type, the emission reduction shall be calculated above for each cement type *i* produced." Hence benchmark has been calculated for each cement type of the project activity.

As per "Determination of baseline benchmark of share of clinker per tonne of BC at the start of project activity ($B_{Blend,1}$)" of the methodology, benchmark of each relevant cement type which shall be used in the calculation of the first year of each crediting period is determined as the lowest value among the following procedure,

a. average (weighted by production) mass percentage of clinker for the 5 plants producing cement with the highest share of additives of the relevant cement type in the region

- Identify the amount of the relevant cement type produced for each plant in the region.
- Determine average (weighted by production) mass fraction of clinker for the 5 plants producing cement with the highest share of additives of the relevant cement type in the region

b. Production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region.

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

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

Note: In addition to the above, if the average annual amount of the relevant cement type imported by the host country is more than 10% of the total production volume in the region, the average

mass percentage of clinker in the relevant cement type imported shall also be considered in the analysis under (a) and (b) above as if it would be produced in a virtual one plant.

Since the amount of imported cement in year 2008 is more than 10% of the total production in the host country, this option could also be considered but are not the relevant PA cement types. All of cement imported was Ordinary Portland cement and needs to fulfill all requirements for Ordinary Portland cement (including the minimum clinker share of [24]95% of the national cement standard) to obtain certificate of approval as to whether its specification meets the national standard. The Quality and Standards authority ([25]now the Ethiopian standards Agency) issues this certificate and the statistics used in this PDD is obtained from this Authority through letter dated March 2009.

Methodology also states that, to determine the benchmark for option (a) and (b), "If reliable and up to date annual data are available from reputable and verifiable external sources (for example, industry manufacturers association or government agencies), these may be used to determine the benchmark."

Therefore, data for year 2008 obtained from [26] regulatory government institutions is used to determine the bench mark. The base year benchmark share of clinker ($B_{Blend,1}$) is calculated using the above guidance and then compared (for conservativeness) with the maximum clinker share allowable in each type as follows:

- PPC: Year 2008 data from manufacturing plants producing PPC has been assessed including imports using the guidance in Step 2.1 of the methodology. As per step 2.1 of the methodology the weighted average clinker share of plants in the region of project plant calculated is 72.86%.

- PLC: Year 2008 data from manufacturing plants producing PLC has been assessed including imports using the guidance. There is no plant producing these types. Year 2008 import data shows that all of the cement imported into the host country is Portland cement type (which should contain at least 95% clinker) and the import volume constitutes > 10% of the total domestic production. As there is no local production of PLC the default regulatory benchmark clinker share of 94% is automatically taken as the only alternative.

- PC: Year 2008 data from manufacturing plants producing PC has been assessed including imports using the guidance. There is no plant producing types PC. Year 2008 import data shows that all of the cement imported into the host country is Portland cement type (which should contain at least 95% clinker) and the import volume constitutes > 10% of the total domestic production. As there is no local production of type PC production at the default regulatory benchmark clinker share of PC (89%) is automatically taken as the only alternative.

In line with the same, the following summary table shows the bench mark for each type obtained after the weighted average analysis. The spreadsheet showing full analysis is attached with PDD.

SN	Cement type	Benchmark Clinker share
1	OPC	>95% (not in PA)
2	PPC	72.86%
3	PLC	94%%
4	PC	89%

[24] E1177-1:2005; Page 8; Table 1 -The 27 products in the family of common cements

[25] http://www.ethiostandards.org/ESA/CommonPage.aspx?Id=1

[26]Letter from Quality and standards Authority (regarding import), Statistics collected by EPA

Table 07: bench marks for relevant project activity cement types

Step 2.2: Updating of baseline benchmark of share of clinker per tonne of BC for year y within the crediting period

The Project Participants shall recalculate the benchmark value for each crediting year y within the crediting period, starting from second year.

Baseline benchmark of share of clinker per tonne of BC updated for year y ($B_{Blend,y}$) is determined as Follows:-

The methodology states; 'For approaches (a) and (b) above, the project participants shall choose between two options to update the benchmark of share of clinker per tonne of BC',

The project participants have chosen to apply Option 2. Option 2 states:-

'Update the benchmark annually based on 2% default increase in the share of additives (i.e. decreasing share of clinker) up to the limit of the regulatory/product norm in the region/national market.'

As there is no accurate data regarding annual trend of increase in additives, project baseline benchmark update adapts option (2) with 2% annual increase in additives share (with corresponding decrease in clinker share), for the baseline.

Step 2.3: Updating of baseline benchmark of share of clinker per tonne of BC at the renewal of the Crediting period

Since there is only one fixed crediting period, no renewal of benchmarks is required at end of the fixed crediting period.

Step 3: Determination of $BE_{ele,ADD,BC}$

$$BE_{ele,ADD,BC} = BE_{ele,grid,BC} + BE_{ele,sg,BC} + BE_{ele,grid,ADD} + BE_{ele,sg,ADD} \quad \textbf{(8)}$$

Where:

$BE_{ele,ADD,BC}$= Baseline electricity emissions for BC grinding and preparation of additives (tCO2/tonne of BC)
$BE_{ele,grid,BC}$= Baseline grid electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele,sg,BC}$= Baseline self-generated electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele,grid,ADD}$= Baseline grid electricity emissions for additive preparation (tCO2/tonne of BC)
$BE_{ele,sg,ADD}$= Baseline self-generated electricity emissions for additive preparation (tCO2/tonne of BC)

- [27]$EF_{grid,BSL}$ is the Ex-ante combined margin emission factor at the base year. The Ex-ante combined margin emission factor in 2008 was 0.00591tCO_2/MWh) and hence this value is negligible. Hence $BE_{ele,grid,BC}$ =$BE_{ele,grid,ADD}$= ~0 for ex-ante calculation only. However it will

[27] More than 93% of power plants are based on renewable energy sources.

http://www.eepco.gov.et/generation_op2.php

be monitored (estimated) on Base Year and included during the estimation of the crediting year.

- TEFR shows that the project requires 45 MVA power capacity that would be entirely met from Grid. It also shows that a rated power requirement of 50KWh/t-clinker and 88KWh/t-cement is required. The project activity plant doesn't have a captive power plant. Only in case of emergency, it will run the 1701KW bckup power currently installed. Since the emergency capacity 1.7MW cannot run the plant that requires 45MW, the ex-ante emissions reduction will consider zero electricity consumption from self generated electricity. However, if captive generation of capacity that can run kiln or cement mill is installed in the crediting year, the actual monitored value in base year will be used in calculating baseline emission in crediting period. i.e the value $BELE_{sg,CLNK}$ is assumed zero. Hence $BELE_{sg,BC}$ = $BELE_{sg,ADD}$ =0.

- Hence $BE_{ele,ADD,BC}$~0 for ex-ante CERs estimation purpose only. It will be calculated from the monitored value of the Base Year during the crediting period.

- Equations 9 to 12 are covered here

Project Emission

PE_{BC}, y are estimated as below. In the project activity plant emissions are determined per unit of clinker or per unit of BC accounting for:-

(i) Emissions from calcinations of limestone;

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

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

$PE_y = BC_y*(PE_{clinker,y} * P_{Blend,y} + PE_{ele,ADD,BC,y})$ **(13)**

Where:

PE_y	=	Project emissions in year *y* (tCO_2)
BC_y	=	Blended Cement produced and sold in the domestic market in year *y* (t BC)
$PE_{clinker,y}$	=	CO_2 emissions per tonne of clinker in the project activity plant in year *y* (tCO_2/t clinker)
$P_{Blend,y}$	=	Share of clinker per tonne of BC in year *y* (t clinker/t BC)
$PE_{ele,ADD,BC,y}$	=	Electricity emissions for BC grinding and preparation of additives in year *y* (tCO_2/t BC)

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

Step 4: Determination of $PE_{clinker,y}$

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

Where:

$PE_{clinker,y}$= Emissions of CO_2 per tonne of clinker in the project activity plant in year *y* (t CO_2/t clinker)
$PE_{calcin,y}$= Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year *y* (t CO_2/t clinker)

$PE_{fossil,fuel,y}$= Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year *y* (t CO_2/t clinker)
$Pe_{ele,grid,CLNK,y}$= Grid electricity emissions for clinker production per tonne of clinker in year *y* (t CO_2/t clinker)
$Pe_{ele,sg,CLNK,y}$= Emissions from self-generated electricity per tonne of clinker production in year *y* (t CO_2/t clinker)

Step 4.1: Determination of $PE_{calcin,y}$

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

Where:

$PE_{calcin,y}$= Emissions from the calcinations of limestone (tCO2/t clinker)
0.785 = Stoichiometric emission factor for CaO (tCO2/t CaO)
1.092 = Stoichiometric emission factor for MgO (tCO2/t MgO)
$InCaO_{,y}$= Non-carbonated CaO content of the raw material (tCaO)
$OutCaO_{,y}$= CaO content of the clinker (tCaO)
$InMgO_{,y}$= Non-carbonated MgO content of the raw material (tMgO)
$OutMgO_{,y}$= MgO content of the clinker (tMgO)
CLNKy = Clinker production in year y (t clinker)

Step 4.2: Determination of $PE_{fossilfuel,y}$

$PE_{fossil,fuel,\ y}$ = [$\Sigma FF_{i,,y}$* EFF_i] /$CLNK_{,y}$ **(16)**

Where:
$PE_{fossil,fuel,y}$= Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year *y* (t CO_2/t clinker)
$FF_{i,,y}$= Fossil fuel of type i consumed for clinker production in year *y* (t fuel *i*)
EFF_i= Emission factor for fossil fuel i (tCO_2/t fuel)
$CLNK_y$= Annual production of clinker in year *y* (t clinker)

Step 4.3: Determination of $PE_{ele,grid,CLNK,y}$

$PE_{ele,grid,CLNK,y}$= [$PELE_{grid,CLNK,y}$* $EF_{grid,y}$] / [$CLNK_y$] **(17)**

Where:

$PE_{ele,grid,CLNK,y}$= Grid electricity emissions for clinker production per tonne of clinker in year *y* (t CO_2/tonne clinker)
$PELE_{grid,CLNK,y}$= Grid electricity for clinker production in year *y* (MWh)
$EF_{grid,y}$= Grid emission factor in year *y* (t CO_2/MWh)
$CLNK_y$= Annual production of clinker in year *y* (kilotonnes of clinker)

$EF_{grid,y}$will be the Ex-ante Combined Margin Emission factor for the crediting year. However for ex-ante CERs estimation only it is assumed to be the Ex-ante combined margin emission factor in 2008 was 0.00591tCO_2/MWh)

Step 4.4: Determination of $PE_{ele,sg,CLNK,y}$

$PE_{elec,sg,CLNK,y}$= [$PELE_{sg,CLNK\ ,y}$* EF_{sg_y}] /[$CLNK_y$] **(18)**

Where:

$PE_{elec,sg,CLNK,y}$= Emissions from self-generated electricity per tonne of clinker production in year *y* (t CO_2/tonne clinker)
$PELE_{sg,CLNK,y}$= Self generation of electricity for clinker production in year *y* (MWh)
EF_{sg_y}= Emission factor for self-generated electricity in year *y* (t CO_2/MWh)
$CLNK_y$= Annual production of clinker in year *y* (kilotonnes of clinker)

TEFR shows that the project requires 45 MVA power capacity that would be entirely met from Grid. It also shows that a rated power requirement of 50KWh/t-clinker and 88KWh/t-cement is required. The project activity plant doesn't have a captive power plant. Only in case of emergency, it will run an emergency 1701KW self-generated power currently installed. This 1.7MW capacity generator cannot run a 45MW capacity plant requirement and is only purposed for lighting and protecting damage from abrupt kiln stoppage. Since this capacity cannot run kiln, the ex-ante emissions reduction will consider a zero electricity consumption from self generated electricity. Hence $PELE_{sg,CLNK,y}$ =0.$PE_{elec\_sg\_CLNK,y}$=0. However, if captive generation of capacity that can run kiln is installed in the crediting year, the actual monitored value in each crediting year will be used in calculating project emission in crediting period. $EF_{sg,y,}$ will also be determined in each crediting period.

Step 5: Determination of $PE_{ele,ADD,BC,y}$

$$PE_{ele,ADD,BC,y} = PE_{ele,grid,BC,y} + PE_{ele,sg,BC,y} + PE_{ele,grid,ADD,y} + PE_{ele,sg,ADD,y} \quad \textbf{(19)}$$

Where:

$Pe_{ele,ADD,BC,y}$= Electricity emissions for BC grinding and preparation of additives in year *y*(tCO2/tonne of BC)
$Pe_{ele,grid,BC,y}$= Grid electricity emissions for BC grinding in year *y* (tCO_2/tonne of BC)
$Pe_{ele,sg,BC,y}$= Emissions from self-generated electricity for BC grinding in year *y* (tCO_2/tone of BC)
$Pe_{ele,grid,ADD,y}$= Grid electricity emissions for additive preparation in year *y* (tCO_2/tonne of BC)
$Pe_{ele,sg,ADD,y}$= Emissions from self-generated electricity additive preparation in year *y*(tCO_2/tonne of BC)

Step 5.1: Determination of $PE_{ele,grid,BC,y}$

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

Where:
$PE_{ele\_grid\_BC,y}$= Grid electricity emissions for BC grinding in year *y* (tCO_2/tonne of BC)
$PELE_{grid\_BC,y}$= Grid electricity for grinding BC (MWh)
EF_{grid_y}= Grid emission factor in year *y* (t CO_2/MWh)
BC_y= Blended Cement produced and sold in the domestic market in year *y* (t BC)

$EF_{grid,y}$ will be the Ex-ante Combined Margin Emission factor for the crediting year. However for ex-ante CERs estimation only it is assumed to be the Ex-ante combined margin emission factor in 2008, which was 0.00591tCO_2/MWh). Hence $PE_{ele\_grid\_BC,y}$ =0

Step 5.2: Determination of $PE_{ele,sg,BC,y}$

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

Where:

$PE_{elec\_sg\_BC,y}$= Emissions from self-generated electricity for BC grinding in year *y* (tCO_2/tonne of BC)
$PELE_{sg\_BC,y}$= Self-generated electricity for grinding BC in year *y* (MWh)
EF_{sg_y}= Emission factor for self-generated electricity in year *y* (t CO_2/MWh)

BC_y= Blended Cement produced and sold in the domestic market in year *y* (t BC)

TEFR shows that the project requires 45 MVA power capacity that would be entirely met from Grid. The project activity plant doesn't have a captive power plant. Only in case of emergency, it will run an emergency 1701KW self-generated power currently installed. The ex-ante emissions reduction will consider zero electricity consumption from self generated electricity. Hence $PELE_{sg,BC,y}$ =0, $PE_{elec\_sg\_BC,y}$=0. However, if captive generation of capacity that can run cement mill is installed in the crediting year, the actual monitored value in each crediting year will be used in calculating project emission in crediting period. $EF_{sg,y}$, will also be determined in each crediting period.

Step 5.3: Determination of $PE_{ele,grid,ADD,y}$

$PE_{ele\_grid\_ADD,y}$= [$PELE_{grid\_ADD}$* EF_{grid_y}] /[BC_y] **(22)**

Where:

$PE_{ele\_grid\_ADD,y}$= Grid electricity emissions for additive preparation in year *y* (tCO_2/tonne of BC)
$BPELE_{grid\_ADD,y}$= Baseline grid electricity for grinding additives (MWh)
EF_{grid_y}= Grid emission factor in year *y* (t CO_2/MWh)
BC_y= Blended Cement produced and sold in the domestic market in year *y* (t BC)

$EF_{grid,y}$ will be the Ex-ante Combined Margin Emission factor for the crediting year which will be calculated at the base year. However for ex-ante CERs estimation only it is assumed to be the Ex-ante combined margin emission factor in 2008, which was 0.00591tCO_2/MWh). Hence $PE_{ele\_grid\_ADD,y}$ =0

Step 5.4: Determination of $PE_{ele,sg,ADD,y}$

$PE_{elec\_sg\_ADD,y}$= [$PELE_{sg\_ADD,y}$* EF_{sg_y}] / [BC_y] **(23)**

Where:

$PE_{elec\_sg\_ADD,y}$= Emissions from self-generated electricity additive preparation in year *y* (tCO_2/tonne of BC)
$PELE_{sg\_ADD,y}$= Baseline self-generation electricity for grinding additives (MWh)
EF_{sg_y}= Emission factor for self-generated electricity in year *y* (t CO_2/MWh)
BC_y= Blended Cement produced and sold in the domestic market in year *y* (t BC)

TEFR shows that the project requires 45 MVA power capacity that would be entirely met from Grid. The project activity plant doesn't have a captive power plant. Only in case of emergency, it will run an emergency 1701KW self-generated power currently installed. The ex-ante emissions reduction will consider zero electricity consumption from self generated electricity. Hence $PELE_{sg\_ADD,y}$=0.$PE_{elec\_sg\_ADD,y}$=0. However, if self generation of capacity that can run additive processor is installed in the crediting year, the actual monitored value in each crediting year will be used in calculating project emission in crediting period. $EF_{sg,y}$, will also be determined in each crediting period.

Therefore, after summation of the above zero values, $PE_{ele,ADD,BC,y}$= 0 for ex-ante CERs estimation only. Equastions 24 to 27 are covered here.

Leakage

Leakage emissions consist of:

- Leakage emissions due to transport of additional additives; and
- Leakage emissions due to the diversion of additives from existing uses.

$LE_y = LE_{TR,y} + LE_{ADD,y}$ **(28)**

Where:

LE_y = Leakage emissions in year y (t CO2)
$LE_{TR,y}$ = Leakage emissions due to transport of additional additives in year y (t CO2)
$LE_{ADD,y}$ = Leakage emissions due to the diversion of additives from existing uses in year y (t CO2)

Step 7: **Determination of leakage emissions due to transport of additional additives**

Leakage emissions due to transport of additional additives in year y ($LE_{TR,y}$) are calculated applying the latest approved version of the methodological tool "Project and leakage emissions from road transportation of freight" where $LE_{TR,y}$ corresponds to $LE_{TR,m}$ in the tool, and $Q_{ADD,y}$ corresponds to $FR_{f,m}$ in the tool.

Step 7.1: Determination of $Q_{ADD,y}$

Determination of $Q_{ADD,y}$

$Q_{ADD,y} = (A_{PJ,blend,y} - A_{BSL,blend,y}) \times BC_y$ **(29)**

Where:

$Q_{ADD,y}$ = Quantify of additional additives transported in year y (t additives). This parameter shall be used instead of $FR_{f,m}$ in the tool 'Project and leakage emissions from road transportation of freight'"
BC_y = Blended cement produced and sold in the domestic market in year y(t BC)
$A_{PJ,blend,y}$ = Share of additives per tonne of BC in year y (t additives/t BC)
$A_{BSL,blend,y}$ = Baseline share of additives per tonne of BC updated for year y (t additives /t BC)

From the tool;

$$LE_{TR,m} = \sum D_{f,m} x FR_{f,m} x EF_{CO2,f} x 10^{-6}$$

Where:
$PE_{TR,m}$= Project emissions from road transportation of freight monitoring period *m* (t CO_2)
$LE_{TR,m}$= Leakage emissions from road transportation of freight monitoring period *m* (t CO_2)
$D_{f,m}$= Return trip road distance between the origin and destination of freight transportation activity *f* in monitoring period *m* (km)
$FR_{f,m}$= Total mass of freight transported in freight transportation activity *f* in monitoring period *m* (t)
$EF_{CO2,f}$= Default CO_2 emission factor for freight transportation activity *f* (g CO_2 / t km)
f = Freight transportation activities conducted in the project activity in monitoring period *m*

A value of $D_{f,m}$(since a fixed source)and $EF_{CO2,f}$ (taking the default value in the tool) have been proposed ex-ante.

Step 8: **Determination of leakage emissions due to the diversion of additives from existing uses**

As per the guidance in the methodology, L1; 'Demonstrate that at the sites from where the project activity is receiving additives, the additives have not been collected or utilized but have been dumped, land-filled, not excavated or burnt prior to the implementation of the project activity. Demonstrate that this practice would continue in the absence of the CDM project activity, e.g. by showing that in the monitored period no market has emerged for the additives considered, no price has been allocated for the additives other than transport, excavation and/or processing or by showing that it would still not be feasible to utilize the additives for any purposes (e.g. due to the remote location where the additives are generated). At the renewal of crediting period, the project

participants shall re-demonstrate this requirement. This approach is applicable to situations where project participants use only additives from specific sites and do not purchase additives from the market. During each verification, the DOE shall check that the additives are sourced from the same site as indicated in the PDD.'

Where project participants wish to use approach L1 and did not meet the above condition in L1, the leakage emissions due to the diversion of additives from existing uses in year *y* shall be calculated as
Follows;

$$LEADD,y = (BE_y - PE_y) \times \alpha_y \quad \textbf{(30)}$$

Where:

$LE_{ADD,y}$= Leakage emissions due to the diversion of additives from existing uses in year *y* (t CO_2)
BE_y= Baseline emissions in year y (t CO_2)
PE_y= Project emissions in year y (t CO_2)

α_y= Leakage penalty factor in year y (fraction)

Step 8.1: Determination of α_y

$$\alpha_y = ADD_{NS,y} / ADD_y \quad \textbf{(31)}$$

Where:

α_y= Leakage penalty factor in year y (fraction)
$ADD_{NS,y}$= Amount of additives used for BC production in project plant for which the project participants could not substantiate that they are surplus in year *y* (t additives)
ADD_y= Amount of additives used for BC production in project plant in year *y* (t additives)

Where project participants wish to use approach L2 and did not meet the above condition in L2 in any of the crediting year, emission reductions for that crediting year shall be regarded as zero.

PP chose option L1 and demonstrates that at the sites from where the project activity is receiving additives, the additives would not be excavated prior to the implementation of the project activity. This is always the case because the source of additive is under PP concession and no one would excavate it except the PP and only under the project activity.

Emission Factor

Grid Emission Factor

As per step 6.1; "Baseline grid emission factor ($EF_{grid,BSL}$) and grid emission factor in year *y* ($EF_{grid,y}$) shall be calculated using the latest version of the [28]Tool to calculate the emission factor for an electricity system".[29] Grid emission factor will be calculated using ex-ante combined margin emission factor of the grid.

For the sake of Ex-ante CERs estimation only, the Ex-ante combined margin grid emission factor calculated in 2008 from three years data available by Ethiopian DNA supported by the Austrian Government is 0.00591tCO_2/MWh. It is Calculation of the Combined margin emission factor of

---

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

[29]Alternatively latest available Grid Emission factor will be used

Ethiopia´s electric power system according the UNFCCC Methodological tool "Tool to calculate the emission factor for an electricity system. The step by step procedure of the tool is used. The full calculation document has been submitted to validating DOE. The value is negligible since the host country had a hydro dominated grid. We have also checked the same is true taking most recent grid data as per the tool.

Emission Factor for Self Generated Power

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

Emission factor for self generated electricity in the base year ($EF_{sg,BSL}$) is calculated as the generation-weighted average emissions per electricity unit (t CO_2/MWh) of all self-generating sources in the project boundary serving the system in the base year.

$$EF_{sg,BSL} = \frac{\sum_{m,n} F_{m,n,BSL} \times COEF_m}{\sum_{n} GEN_{n,BSL}} \quad \textbf{(1)}$$

Where:

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

CO_2 emission coefficient of fuel *m* ($COEF_m$) is obtained as:

$$COEF_m = NCV_m \times EF_{CO2,m} \times OXID_m \quad \textbf{(2)}$$

Where:

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

The emission factor for self generated electricity in year *y* ($EF_{sg,y}$) is calculated as the generation-weighted average emissions per electricity unit (t CO_2/MWh) of all self-generating sources in the project boundary serving the system in year *y*.

$$EF_{sg,y} = \frac{\sum_{k,j} F_{k,j,y} \times COEF_k}{\sum_{j} GEN_{j,y}} \quad \textbf{(3)}$$

Where:

$EF_{sg,y}$	=	Emission factor for self generated electricity in year *y* (t CO_2/MWh)
$F_{k,j,y}$	=	Amount of fuel *k* consumed by relevant power sources *j* in year *y* (mass or volume unit)
j	=	On-sitepower sources
$COEF_k$	=	CO_2 emission coefficient of fuel *k*, taking into account the carbon content of

		the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year *y* (t CO_2/mass or volume unit)
$GEN_{j,y}$	=	Electricity generated by the source *j* in year *y* (MWh)

CO_2 emission coefficient of fuel *k* ($COEF_k$) is obtained as:

$$COEF_k = NCV_k \times EF_{CO2,k} \times OXID_k \quad \textbf{(4)}$$

Where:

$COEF_k$	=	CO_2 emission coefficient of fuel *k*, taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year *y* (t CO_2/mass or volume unit)
NCV_k	=	Net calorific value per mass or volume unit of a fuel *k* (GJ/ mass or volume unit)
$OXID_k$	=	Oxidation factor of the fuel *k* (2006 Revised IPCC Guidelines for default values)
$EF_{CO2,k}$	=	CO_2 emission factor per unit of energy of the fuel *k*(t CO_2/GJ)

There is no self generation at the project site except emergency backup generator of 1.7MW found at site which cannot run the plant demand of 45MW. It is a back up that automatically switches on when grid power is interrupted and only for purpose of lighting and protecting the rotary kiln in-line from breakage due to abrupt stoppage. Hence $F_{k,j,y}$ and $F_{m,n,BSL}$ are both zero at the moment. However if self generation of capacity that can run any kiln/cement equipment is installed in the crediting year, it will be monitored and values included in relevant section.

Emission Reduction

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(32)}$$

Where:

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

Methodology includes guidance in case of negative emission reduction, i.e “In the case that overall negative emission reductions arise in a year, emission reductions are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the year concerned. (For example: if negative emission reductions of 30 tCO_2e occur in the year t and positive emission reductions of 100 tCO_2e occur in the year t+1, 0 CERs are issued for year t and only 70 CERs are issued for the year t+1.)”

Moreover, for multiple types of cement (output), it says; “In case the project activity consists of production of more than one cement type, the emission reduction shall be calculated following equation 1 to 9 above for each cement type *i* produced. The total emission reduction from the project activity shall be calculated as the sum of emission reductions for all cement types *i* produced.”

B.6.2. Data and parameters fixed ex ante

Data / Parameter:	[30]EF_{grid_BSL}
unit:	tCO_2/MWh
Description:	Baseline grid Emission factor

[30]Hence $BELE_{grid,ADD}$, $BELE_{grid,BC}$, $BELE_{grid,CLNK}$ data for the Base Year are not required for ex-ante CERs estimation

Source of data:	Calculation of the Combined margin emission factor of Ethiopia´s electric power system according the UNFCCC Methodological tool “Tool to calculate the emission factor for an electricity system”
Value(s) applied:	0.0
choice of data or measurement methods and procedures	The Ex ante Combined Margin grid emission factor for the grid calculated in year 2008 is 0.00591 tCO_2/MWh.
Purpose of data	Used in Equations 6 and 8
Any comment:	Assumption for Ex Ante CERs calculation only. It will be calculated at the Base Year using the latest version of the “Tool to calculate the emission factor for an electricity system” or will obtain latest value from DNA

Data / Parameter:	$EF_{grid\ y}$
unit:	tCO_2/MWh
Description:	Grid Emission factor in year y
Source of data:	Calculation of the Combined margin emission factor of Ethiopia´s electric power system according the UNFCCC Methodological tool “Tool to calculate the emission factor for an electricity system”
Value(s) applied:	[31]0.0
choice of data or measurement methods and procedures	The Ex ante Combined Margin grid emission factor for the grid calculated in year 2008 is 0.00591 tCO_2/MWh.
Purpose of data	Used in Equations 6 and 8
Any comment:	Assumption for Ex Ante CERs calculation only. At the Base year (Y1) PPs will calculate using latest version of grid tool or take the latest available Grid emission factor at or after the base year for Ex-Post purpose.

<table>
<tr><td>Data / Parameter:</td><td>$B_{Blend,y}$</td></tr>
<tr><td>unit:</td><td>%</td></tr>
<tr><td>Description:</td><td>Baseline benchmark of share of clinker per tonne of BC updated for year y</td></tr>
<tr><td>Source of data:</td><td>Calculated using the guidance in the methodology</td></tr>
<tr><td>Value(s) applied:</td><td><table>
<tr><td>No</td><td>Type of Blended cement</td><td>$B_{Blend,1}$</td><td>$B_{Blend,y}$</td></tr>
<tr><td>1</td><td>PPC</td><td>72.86%</td><td>Updated</td></tr>
<tr><td>2</td><td>PLC</td><td>94%</td><td>Updated</td></tr>
<tr><td>3</td><td>PC</td><td>89 %</td><td>Updated</td></tr>
</table></td></tr>
<tr><td>choice of data or measurement methods and procedures</td><td>Statistical data on other cement plants in the region prior to start date as per step 2.1 i.e for year 2008 analysed</td></tr>
<tr><td>Purpose of data</td><td>Used in equation 1</td></tr>
<tr><td>Any comment:</td><td>updated every year with 2% decline in additive share as per the formula in the guidance</td></tr>
</table>

Data / Parameter:	$EF_{CO2,f}$
unit:	g CO_2 / t km

[31]Hence $PELE_{grid,ADD}$, $PELE_{grid,BC}$, $PELE_{grid,CLNK}$ data for year “y” are not required for ex-ante CERs estimation

Description:	Default CO_2 emission factor for freight transportation activity *f* (g CO_2 / t km)
Source of data:	Default provided in the tool
Value(s) applied:	129
choice of data or measurement methods and procedures	Emission factor of Diesel. Diesel is the commonly used transport fuel in material freight trucks purchased by plant owner
Purpose of data	Calculation of Leakage using the tool
Any comment:	Fixed ex ante for the crediting period

B.6.3. Ex ante calculation of emission reductions

The complete summary of the Ex-ante calculation of emission reduction is shown in Annex 4. The calculation/estimation is also provided in reproducible spread sheet format as an annex to the PDD.

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2016	1,573,415.80	1,403,634.03	6,488.01	163,293.76
2017	1,747,089.27	1,403,634.03	6,477.26	336,977.98
2018	1,740,702.81	1,403,634.03	6,237.80	330,830.99
2019	1,734,188.63	1,388,293.76	6,579.75	339,315.11
2020	1,752,265.06	1,397,962.78	6,905.80	347,396.48
2021	1,754,922.68	1,397,748.77	7,020.40	350,153.51
2022	1,758,157.93	1,400,576.00	7,040.96	350,540.98
2023	1,756,437.34	1,397,395.65	7,101.80	351,939.89
2024	1,760,620.18	1,393,886.57	7,400.90	359,332.71
2025	1,772,243.91	1,403,634.03	7,477.87	361,132.02
Total	17,350,043.61	13,990,399.64	68,730.54	3,290,913.43
Total number of crediting years	10			
Annual average over the crediting period	1,735,004.361	1,399,039.964	6,873.054	329,091.343

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter:	Q_{rm}
Unit:	t raw materials
Description:	Quantity of clinker raw material used in the base year
Source of data:	On-site measurements in plant records
Value(s) applied	Refer CER sheet
Measurement methods and	Weight meters i.e. weigh feeder is used connected to CCR. Alternatively; the CLNK will be used to determine this value using the appropriate

procedures	Clinkerization factor.
Monitoring frequency:	Annually
QA/QC procedures:	The source of the data i.e CCR will be calibrated once in two years. Please see B7.3 for further details.
Purpose of data	Used in base year
Additional comment	In case of greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year of the CDM project activity. i.e $Q_{rm,y,1}=Q_{rm}$. This parameter is used to calculate InCaO and InMgO

Data/Parameter:	$CLNK_{BSL}$
Unit:	t clinker
Description:	Annual production of clinker in the base year
Source of data:	On-site measurements in plant records
Value(s) applied	1,848,000
Measurement methods and procedures (if any):	Weight meters i.e. weighfeeder is used connected to CCR. The sum of annual clinker tonnage utilized for producing each cement type provides the total clinker utilized to produce cement.
Monitoring frequency:	Annually
QA/QC procedures:	The source of the data i.e CCR or flow meter will be calibrated once in two years. Please see B7.3 for further details.
Purpose of data	Used in base year
Additional comment	In case of greenfield cement plants this parameter shall be determined based on the monitoring value or calculation from data in first operational year of the project activity. i.e$CLNK_{y,1}=CLNK_{BSL}$

Data/Parameter:	$FFi,_{BSL}$
Unit:	t fuel
Description:	Fossil fuel of type I consumed for production of clinker in the base year
Source of data:	On-site measurements in plant records
Value(s) applied	Coal-218,064 HFO-0
Measurement methods and procedures (if any):	Weight meters i.e. weighfeeder is used connected to CCR
Monitoring frequency:	Annually
QA/QC procedures:	The source of the data i.e CCR or weigh meter will be calibrated once in two years. Please see B7.3 for further details.
Purpose of data	Used in base year
Additional comment	In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year. i.e $FFi_{y,1}=FFi_{BSL}$

Data/Parameter:	InCaO
Unit:	tCaO
Description:	Baseline non-carbonated CaO content in the raw material in the base year
Source of data:	Limestone, marl and basalt are all carbonated materials and hence InCaO is zero. If non carbonated material is used On-site % non-carbonated CaO is measured in XRF records and InCaO calculated as the non-carbonated CaO content (%) of the raw material times total raw material used to produce clinker (Q_{rm}).
Value(s) applied	0
Measurement methods and	If non carbonated material is used in clinker production; this value will be obtained from X-ray Efflorescence connected to recording computer or using

procedures	conventional lab test
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in base year
Additional comment	Kiln is designed to utilize Limestone, marl, Basalt which are all carbonated and minor silica sand. In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year. i.e $InCaO_{y,1}$=InCaO

Data/Parameter:	InMgO
Unit:	tMgO
Description:	Baseline non-carbonated MgO content in the raw material in the base year
Source of data:	Limestone, marl and basalt are all carbonated materials and hence InMgO is zero. If non carbonated material is used On-site % non-carbonated MgO measured in XRF records and InMgO is calculated as the non-carbonated MgO content (%) of the raw material times total raw material used to produce clinker (Qrm)
Value(s) applied	0
Measurement methods and procedures (if any):	X-ray Efflorescence connected to recording computer or using conventional lab test
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in base year
Additional comment	Kiln is designed to utilize Limestone, marl, Basalt which are all carbonated and minor silica sand . In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year. i.e$InMgO_{y,1}$=InMgO

Data/Parameter:	OutCaO
Unit:	tCaO
Description:	Baseline CaO content in Clinker in the base year
Source of data:	On-site % CaO measurements in plant records and calculated as the CaO content (%) of the clinker times clinker produced [$CLNK_{BSL}$]
Value(s) applied	1,183,644
Measurement methods and procedures (if any):	X-ray Efflorescence connected to recording computer or using conventional lab test
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in base year
Additional comment	In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year of the project activity. i.e$OutCaO_{y,1}$ =OutCaO

Data/Parameter:	OutMgO
Unit:	tMgO

Description:	Baseline MgO content in Clinker in the base year
Source of data:	On-site %MgO measurements in plant records and calculated as the MgO content (%) of the clinker times clinker produced [CLNKBSL]
Value(s) applied	63,756
Measurement methods and procedures :	X-ray Efflorescence connected to recording computer or using conventional lab test
Monitoring frequency:	Annually
QA/QC procedures:	Monthly monitored values will be compared with the previous and subsequent month. Please see B7.3 for further details.
Purpose of data	Used in base year
Additional comment	In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year. i.e$OutMgO_{y,1}$ =OutMgO

Data/Parameter:	BC_{BSL}
Unit:	t BC
Description:	Blended Cement produced and sold in the domestic market in the base year (t BC)
Source of data:	On-site measurements in plant records
Value(s) applied	Production plan
Measurement methods and procedures (if any):	Weight meters and/or CCR i.e. weighfeeder is used connected to CCR and then adjusted for export record in respect of each type of cement classified as per Ethiopian standard. The total cement produced under each type/brand in a given year reduced by the total cement exported under each type/brand in a given year, will give the cement domestically sold in each crediting year. Only the quantity of blended cement sold/utilized in the domestic market will be considered. (exported cement will be excluded/reduced from total)
Monitoring frequency:	Annually
QA/QC procedures:	Weigh meters and CCR calibrated once in two years. Please see B7.3 for further details.
Purpose of data	Used in Equation 9, 10, 11 and 12, in base year.
Additional comment	In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year. This parameter would anyway be redundant since the grid emission factor is zero and there would be no self generation for additive preparation and cement grinding in base year.

Data / Parameter:	BC_y
Unit:	t BC
Description:	Blended Cement produced and sold in the domestic market in year *y* (t BC)
Source of data:	Production plan
Value(s) applied	Since CDM project activity produces three types each cement type will be monitored and values applied
Measurement methods and procedures (if any):	Use weight meter i.e. weighfeeder is used and then cross checked with domestic sales record and export in respect of each type of cement classified as per the clinker share in the Ethiopian standard. The total cement produced under each type/brand in a given year reduced by the total cement exported under each type/brand in a given year, will give the cement domestically sold in each crediting year. Only the quantity of blended cement sold in the domestic market will be considered. (exported cement will be excluded)
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in equation 13
Additional comment	Actual quantity of each type of cement (PPC, PC, PLC) will be in used Ex-post calculation. PP will cross check measurement results with records (i.e. invoices) for sold blended cement to identify and deduct export quantity.

Data / Parameter:	$P_{Blend,y}$
Unit:	t clinker/t BC
Description:	Share of clinker per tonne of BC in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	Production plan for ex-ante calculation
Measurement methods and procedures (if any):	Use weight meter i.e. weighfeeder is used
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in equation 13
Additional comment	All data from these meters will be displayed on computers in CCR. Actual values will be used in ex-post calculation

Data / Parameter:	$Q_{rm,y}$
Unit:	t raw materials
Description:	Quantity of clinker raw material used in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	
Measurement methods and procedures (if any):	Use weight meter i.e. weigh feeder connected to CCR is used. Alternatively; the CLNK value will be used to determine this value using the appropriate Clinkerization factor.

Monitoring frequency:	Annually
QA/QC procedures:	The source of the data i.e CCR will be calibrated once in two years. Please see B7.3 for further details.
Purpose of data	Parameter required to calculate $InCaO_y$ and $InMgO_y$
Additional comment	All data from these meters will be displayed on computers in CCR

Data / Parameter:	$CLNK_y$
Unit:	t clinker
Description:	Clinker production in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	1,848,000
Measurement methods and procedures (if any):	Use weight meter i.e. weighfeeder connected to CCR is used. The sum of annual clinker tonnage utilized for producing each cement type provides the total clinker utilized to produce cement.
Monitoring frequency:	Annually
QA/QC procedures:	The source of the data i.e CCR or flow meter will be calibrated once in two years. Please see B7.3 for further details.
Purpose of data	Used in equation 15,16,17,18
Additional comment	All data from these meters may be displayed on computers in CCR

Data / Parameter:	$FF_{i,y}$
Unit:	t fuel
Description:	Fossil fuel of type i consumed for clinker production in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	Coal-218,064 HFO- 0
Measurement methods and procedures (if any):	Use weight meter i.e. Weigh-feeders are used in case of solid fuels and flow meters in case of liquid fuels
Monitoring frequency:	Annually
QA/QC procedures:	Weigh-feeders used in case of solid fuels and flow meters in case of liquid fuels are calibrated once in two years. Please see B7.3 for further details.
Purpose of data	Used in Equation 16
Additional comment	All data from these meters will be displayed on computers in CCR

Data / Parameter:	$EFF_{i,}$
Unit:	tCO2/t fuel
Description:	Emission factor of Fossil fuel of type i consumed for clinker production in year *y*
Source of data:	IPCC default
Value(s) applied	Coal -98.3 tCO2/TJ HFO-77.4 tCO2/TJ
Measurement methods and procedures (if any):	IPCC default for carbon intensity of anthracite coal, HFO .
Monitoring frequency:	Annually
QA/QC	Kept constant unless IPCC default changes

procedures:	
Purpose of data	Baseline emissions and project emissions
Additional comment	Used in base year and crediting period

Data / Parameter:	$EF_{CO2,m}$
Unit:	tCO2/t fuel
Description:	Emission factor of Fossil fuel of type m consumed in self generating power source
Source of data:	IPCC default
Value(s) applied	Diesel-74.1 tCO2/TJ
Measurement methods and procedures (if any):	IPCC default for carbon intensity of Diesel.
Monitoring frequency:	Annually
QA/QC procedures:	Kept constant unless IPCC default changes
Purpose of data	Baseline emissions and project emissions
Additional comment	Used in base year and crediting period. In case of Greenfield cement plants, this parameter shall be determined based on the monitoring value of first operational year. For ex-ante calculation, project participants can use data from technology supplier information,. The only generator is a 1.7MW diesel backup/emergency generator which is not considered self/captive generation. PPs will check if there is captive power plant installed running in crediting year and is used in equation 24

Data / Parameter:	$BELE_{grid,CLNK}$
Data unit:	MWh
Description:	Grid electricity for clinker production in base year
Source of data:	On-site measurements in plant records
Value(s) applied	Not required
Measurement procedures (if any):	Use electricity meter or CCR value for average KWh/t clinker. In case of reading KWh/t clinker, it will be multiplied by the clinker tonnage used to produce Blended Cement to obtain the total electricity consumed.
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Additional comment:	This parameter doesn't need to be monitored if the GEF is approximately 0. Data will not be needed since we chose Ex-ante GEF and $EF_{grid,BSL}$ ~0 This parameter will not be monitored for the crediting period if the GEF at the base year is zero.

Data / Parameter:	$PELE_{grid,CLNK,y}$
Data unit:	MWh
Description:	Grid electricity for clinker production in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	Not required
Measurement procedures (if any):	Use electricity meter or CCR value for average KWh/t clinker. In case of reading KWh/t clinker, it will be multiplied by the clinker tonnage used to produce Blended Cement to obtain the total electricity consumed.
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Additional comment:	This parameter doesn't need to be monitored if the GEF is approximately 0. Data will not be needed since we chose Ex-ante GEF and $EF_{grid,y}$ ~0 This parameter will not be monitored for the crediting period if the GEF at the base year is zero.

Data / Parameter:	$BELE_{sg,CLNK}$
Data unit:	MWh
Description:	Self generation of electricity for clinker production in base year
Source of data:	On-site measurements in plant records
Value(s) applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Additional comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a kiln anyway. Data will not be needed since $F_{m,n,BSL}$ is not material

Data / Parameter:	$PELE_{sg,CLNK,y}$
Data unit:	MWh
Description:	Self generation of electricity for clinker production in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Additional comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a kiln anyway. Data will not be needed since $F_{k,j,y}$is not material

Data / Parameter:	$ADD_{,y}$
Unit:	tAdditives
Description:	Amount of Additives used for BC production in project plant in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	Not required
Measurement methods and procedures (if any):	Use weight meter i.e. weigh feeders sending data to CCR
Monitoring frequency:	Annually
QA/QC procedures:	Weigh feeders and CCR will be calibrated every two years. Please see B7.3 for further details.
Purpose of data	This parameter is used in calculation of α_y for Leakage estimation using equation 31.
Additional comment	This parameter will not be used as it will be a denominator of a zero numerator (i.e $ADD_{NS},_{,y}$ =0)-

Data / Parameter:	$ADD_{NS},_{,y}$
Unit:	t Additives
Description:	Amount of Additives for which the project participants could not substantiate that they are surplus in year *y*
Source of data:	National data or data collected by project participants
Value(s) applied	$ADD_{NS,y}$=0,.

Measurement methods and procedures (if any):	Demonstrate using the L1 approach in step 8. PP to demonstrate additive is surplus
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Calculation of α_y for Leakage estimation using equation 31
Additional comment	PP has additive concession so obviously surplus

Data / Parameter:	Ay
unit:	-
Description:	Penalty factor
Source of data:	Calculated
Value(s) applied:	0
Measurement methods and procedures (if any):	Pumice quarry at AlemTena, where the pumice is going to be excavated and transported from, is held under concession by plant owner. There would be no diversion of pumice from existing use. Limestone quarry at the plant site, where limestone is going to be excavated and transported from is held under concession by plant owner. There would be no diversion of Limestone.
Monitoring frequency:	Annually
QA/QC procedures:	Calculated
Purpose of data	To check if diversion from existing use exists
Any comment:	Calcaulted from $ADD_{,y}$ and $ADD_{NS,,y}$

Data / Parameter:	$BELE_{grid,BC}$
Data unit:	MWh
Description:	Grid electricity for grinding BC in base year
Source of data:	On-site measurements in plant records
Value(s) applied	Not required
Measurement procedures (if any):	Use electricity meter or CCR value for average KWh/t cement. In case of reading KWh/t cement, it will be multiplied by the Blended Cement to obtain the total electricity consumed.
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Additional comment:	Data will not be needed since we chose Ex-ante value for GEF and $EF_{grid,BSL}$ ~0. This parameter will not be monitored for the crediting period if the GEF at the base year is zero.

Data / Parameter:	$PELE_{grid,BC,y}$
Data unit:	MWh
Description:	Grid electricity for grinding BC in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	Not required
Measurement procedures (if any):	Use electricity meter or CCR value for average KWh/t cement. In case of reading KWh/t cement, it will be multiplied by the Blended Cement to obtain the total electricity consumed.
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Additional comment:	Data will not be needed since we chose Ex-ante value for GEF and $EF_{grid,y}$ ~0. This parameter will not be monitored for the crediting period if the GEF at the base year is zero.

Data / Parameter:	$BELE_{sg,BC}$
Data unit:	MWh
Description:	Self generated electricity for grinding BC in base year
Source of data:	On-site measurements in plant records
Value applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a cement mill anyway. Data will not be needed if self generated electricity is not used or if $F_{m,n,BSL}$ is not material

Data / Parameter:	$PELE_{sg,BC,y}$
Data unit:	MWh
Description:	Self generated electricity for grinding BC in year *y*
Source of data:	On-site measurements in plant records
Value applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a cement mill anyway. Data will not be needed if self generated electricity is not used or if $F_{k,j,y}$is not material

Data / Parameter:	$BELE_{grid,ADD}$
Data unit:	MWh
Description:	Grid electricity for grinding additives in base year
Source of data:	On-site measurements in plant records
Value applied	Not required
Measurement procedures (if any):	Use electricity meter or CCR value for average KWh/t additive. In case of reading KWh/t additive, it will be multiplied by the total Additive to obtain the total electricity consumed.
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	We chose Ex-ante GEF and Data will not be needed since $EF_{grid,BSL}$ ~0. This parameter will not be monitored for the crediting period if the GEF at the base year is zero.

Data / Parameter:	$PELE_{grid,ADD,y}$
Data unit:	MWh
Description:	Grid electricity for grinding additives in year *y*
Source of data:	On-site measurements in plant records
Value applied	Not required
Measurement procedures (if any):	Use electricity meter or CCR value for average KWh/t additive. In case of reading KWh/t aditive, it will be multiplied by the total Additive to obtain the total electricity consumed.
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	We chose Ex-ante GEF and Data will not be needed since $EF_{grid,y}$ ~0. This parameter will not be monitored for the crediting period if the GEF at the base year is zero.

Data / Parameter:	$BELE_{sg,ADD}$
Data unit:	MWh
Description:	Self generation electricity for grinding additives in base year
Source of data:	On-site measurements in plant records
Value applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a mill anyway. Data will not be needed if self generation electricity is not used or $F_{m,n,BSL}$ is not material

Data / Parameter:	$PELE_{sg,ADD,y}$
Data unit:	MWh
Description:	Self generation electricity for grinding additives in year *y*
Source of data:	On-site measurements in plant records
Value applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Monthly
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a mill anyway. Data will not be needed if self generation electricity is not used or $F_{k,j,y}$is not material

Data / Parameter:	$F_{k,j,y}$
Data unit:	mass or volume unit
Description:	Amount of fuel *k* consumed by relevant power sources *j* in year *y*
Source of data:	On-site measurements in plant records
Value applied	Diesel-0
Measurement procedures (if any):	Use weight or volume meter
Monitoring frequency:	Monthly
QA/QC procedures:	Crosschecked with purchase invoices.
Purpose of data	
Any comment:	This parameter is very insignificant at the moment since there would be no self generation and small backup generator cannot run a kiln anyway except for avoiding abrupt kiln stoppage to save kiln liner damage. This value therefore likely to stay zero unless captive generation is installed for purpose of running cement plant.

Data / Parameter:	$F_{m,n,BSL}$
Data unit:	mass or volume unit
Description:	Amount of fuel m consumed by relevant power sources n in base year
Source of data:	On-site measurements in plant records
Value applied	Diesel-0
Measurement procedures (if any):	Use weight or volume meter
Monitoring frequency:	Monthly
QA/QC procedures:	Crosschecked with purchase invoices.
Purpose of data	
Any comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a kiln anyway.

Data / Parameter:	NCV_k
Data unit:	GJ/mass or volume unit
Description:	Net calorific value per mass or volume unit of a fuel *k*
Source of data:	The following data sources may be used if the relevant conditions apply: <table><tr><td>Data source</td><td>Conditions for using the data source</td></tr><tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr><tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr><tr><td>c) Regional or national default values</td><td>If b) is not available These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances)</td></tr><tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If c) is not available</td></tr></table>
Value applied	Coal -6250 kCal/kg HFO-41.7 TJ/Gg Diesel-43.3 TJ/Gg
Measurement procedures (if any):	For a) and b): Measurements should be undertaken in line with national or international fuel standards
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
Purpose of data	
Any comment:	Used in base year and crediting period. IPCC default value will be used

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	Electricity generated by the source *j* in the year *y*
Source of data:	On-site measurements in plant records
Value applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a kiln or mills anyway. Data will not be needed if $F_{k,j,y}$is not material

Data / Parameter:	$EF_{sg, BSL}$
unit:	tCO_2/MWh
Description:	Grid Emission factor self generated electricity in Base Year
Source of data:	Calculated using Eq. 24
Value(s) applied:	Zero or Not required
measurement procedures	calculated
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in Equations 10, and 12
Any comment:	Assumption for Ex Ante CERs calculation only. At the Base year PPs will check if there is captive power plant installed running and calculate using equation 24

Data / Parameter:	$EF_{sg,y}$
unit:	tCO_2/MWh
Description:	Grid Emission factor self generated electricity in year y
Source of data:	Calculated using Eq. 24
Value(s) applied:	Zero or Not required
measurement procedures	Calculated
Monitoring frequency:	Annualy
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in Equations 10 and 12
Any comment:	Assumption for Ex Ante CERs calculation only. At each crediting year PPs will check if there is captive power plant installed in crediting year and calculate using equation 24

Data / Parameter:	$GEN_{n,BSL}$
Data unit:	MWh
Description:	Electricity generated by the source n in the base year y
Source of data:	On-site measurements in plant records
Value applied	Zero
Measurement procedures (if any):	Use electricity meter
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	
Any comment:	This parameter is very insignificant since there would be no self generation and small backup generator cannot run a kiln or mills anyway. Data will not be needed if $F_{m,n,BSL}$ is not material

Parameter:	OXIDm
Data unit:	-
Description:	Oxidation factor of the fuel m
Source of data:	Refer to Table 5 of the IPCC Good practice Guidelines for uncertainty management
Value(s) applied:	1
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Purpose of data	Baseline emissions
Any comment:	Ex-ante value corresponding to diesel for Ex-ante (The only generator is a 1.7MW diesel backup/emergency generator.) although not required anyway. PPs will check if there is captive power plant installed running in crediting year and is used in equation 24. Used in base year and crediting period

Data / Parameter:	$A_{PJ,blend,y}$
Unit:	t additives/t BC
Description:	Share of additives per tonne of BC in year *y*
Source of data:	On-site measurements in plant records
Value(s) applied	Production plan
Measurement methods and procedures (if any):	Use weight meter i.weigh feeders sending data to CCR
Monitoring frequency:	Calculated
QA/QC procedures:	
Purpose of data	For calculation of leakage estimation from Additive transport
Additional Comment	-

Data / Parameter:	$A_{BSL,blend,y}$
Unit:	t additives/t BC
Description:	Baseline Share of additives per tonne of BC updated for year *y*
Source of data:	Ex-ante value based on annually updated base year clinker benchmark
Value(s) applied	Benchmarks calculated, updated every year
Measurement methods and procedures (if any):	In case of Greenfield cement plants, the value of $A_{BL,blend,y}$ is 1-$B_{Blend,y}$ of equation (1)
Monitoring frequency:	Calculated
QA/QC procedures:	
Purpose of data	For calculation of leakage estimation from Additive transport
Additional comment:	

Data/Parameter:	OutCaOy
Unit:	tCaO
Description:	CaO content in Clinker in the year y
Source of data:	On-site % CaO measurements in plant records and calculated as the CaO content (%) of the clinker times clinker produced [$CLNK_y$]
Value(s) applied	Ex-ante;1,183,644

Measurement methods and procedures (if any):	X-ray Efflorescence connected to recording computer or using conventional lab test
Monitoring frequency:	%CaO monitored Annually and OutCaOy calculated
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in year y
Additional comment	

Data/Parameter:	OutMgOy
Unit:	tMgO
Description:	MgO content in Clinker in the year y
Source of data:	On-site %MgO measurements in plant records and calculated as the MgO content (%) of the clinker times clinker produced [CLNKy]
Value(s) applied	Ex-ante; 63,756
Measurement methods and procedures :	X-ray Efflorescence connected to recording computer or using conventional lab test
Monitoring frequency:	%CaO monitored Annually and OutMgOy calculated
QA/QC procedures:	Monthly monitored values will be compared with the previous and subsequent month. Please see B7.3 for further details.
Purpose of data	Used in year y
Additional comment	

Data / Parameter:	$Q_{ADD,y}$
Unit:	t additives
Description:	Quantify of additional additives transported in year *y* (t additives).
Source of data:	Calculated
Value(s) applied	Refer CER sheet
Measurement methods and procedures (if any):	
Monitoring frequency:	Calculated
QA/QC procedures:	
Purpose of data	This parameter shall be used instead of $FR_{f,m}$ in the tool "Project and leakage emissions from road transportation of freight." to calculate leakage.
Additional comment:	-

Data / Parameter:	$D_{f,m}$
Unit:	Km
Description:	Return trip road distance between the origin and destination of freight transportation activity *f* in monitoring period *m* (km)
Source of data:	Vehicle Odometer measurement
Value(s) applied	250
Measurement methods and procedures (if any):	AlemTena, where the pumice is going to be mined and transported from, is 125km from plant site.
Monitoring frequency:	Annually
QA/QC procedures:	Data monitored annually will be compared with the records of the previous year. In the absence of measurement, the ex ante value (125km) will be used as it barely changes. Please see B7.3 for further details.
Purpose of data	This parameter shall be used in the tool "Project and leakage emissions from road transportation of freight." to calculate leakage.
Additional comment:	monitored only if source changes from Alemtena reserve

Data/Parameter:	InCaOy
Unit:	tCaO
Description:	non-carbonated CaO content in the raw material in the year y
Source of data:	Limestone, marl and basalt are all carbonated materials and hence InCaO is zero. If non carbonated material is used in year y, on-site % non-carbonated CaO is measured in XRF records and InCaO calculated as the non-carbonated CaO content (%) of the raw material times total raw material used to produce clinker (Q_{rm}).
Value(s) applied	0
Measurement methods and procedures	This parameter is calculated as the CaO content (%) of the raw material in year y times the raw material quantity used in year y [Qrm,y]. Project participants can use a conservative default value of 0% for the non-carbonated CaO content of the raw material in year y
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in base year and in year y
Additional comment	Kiln is designed to utilize Limestone, marl, Basalt which are all carbonated and minor silica sand. This is not likely to change. In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year. i.e $InCaO_{y,1}$=InCaO. Zero value applied ex-post as per meth provision.

Data/Parameter:	InMgOy
Unit:	tMgO
Description:	Baseline non-carbonated MgO content in the raw material in the base year
Source of data:	Limestone, marl and basalt are all carbonated materials and hence InMgO is zero. If non carbonated material is used On-site % non-carbonated MgO measured in XRF records will be taken and InMgO is calculated as the non-carbonated MgO content (%) of the raw material times total raw material used to produce clinker (Qrm) This parameter is calculated as the MgO content (%) of the non carbonated raw material in year y times the raw material quantity in year y [Qrm,y]. This

	will be calculated and measured as part of normal operations
Value(s) applied	0
Measurement methods and procedures (if any):	X-ray Efflorescence connected to recording computer or using conventional lab test
Monitoring frequency:	Annually
QA/QC procedures:	Please see B7.3 for further details.
Purpose of data	Used in base year and in year y
Additional comment	Kiln is designed to utilize Limestone, marl, Basalt which are all carbonated and minor silica sand . In case of greenfield cement plants this parameter shall be determined based on the monitoring value of first operational year. i.e$InMgO_{y,1}$=InMgO

B.7.2. Sampling plan

The Project activity is at a stationary plant and not distributed in nature. Methodology is dependent on monitored values from plant meter at prescribed frequencies and doesn't prescribe a sampling approach. PP's have also instituted a backup plan under B.7.3 below in case of monitoring failure at specific reading hours. Yet in case where there occurred a difficult situation to acquire monitored values at the prescribed monitoring frequencies, sampling approach may be applied among other available monitored values and apply the latest sampling standards under the CDM. Since it is a large scale project, we use the 95% confidence level.

B.7.3. Other elements of monitoring plan

Monitoring arrangement

The conventional monitoring of the cement operation will continue as it is. The relevant national standard, national sectorial norm or international sectorial norm will be followed. More emphasis from the norm will be the additional QA/QC emphasis given to monitoring parameters due to CDM and the additional CDM specific monitoring manpower allocation.

- *Instruments and meters*

Monitoring instruments (weigh bridges, weigh feeders, flow meters, meters and x-ray fluorescence room) are installed and almost always kept in acceptable working condition. Weigh feeders or flow meters are instruments fixed along the material flow which measure the amount of material transferred into the next processing stage. All materials/fuel that entered into the process line will be measure by weigh feeders and the reading transferred to CCR. Weighbridges are meters installed to measure the weight of truck load of materials/products. All raw materials transported on truck from outside or products exiting the premise will be weighed by weighbridges. X-ray fluorescence room is equipped with x-ray fluorescence equipment and attached computer. It measures the % share of different constituents of clinker raw material as well as Clinker itself and sends data to the adjacent computer. Electricity consumption meters are also installed which read either in absolute KWh for a period or average specific consumption KWh/t for a period, at each stage of relevant process. Most meters read cumulative values and require information on previously recorded cumulative value. Where monitoring meter requires reading the cumulative value at the moment of reading and deducting the cumulative value obtained a day or a month or a year before; then that would be implemented to obtain the daily, monthly or annual value.

Measuring instruments will be calibrated as per the calibration frequency requirement stated on the equipment, national standard, norm or at least the CDM monitoring table. The calibration

programme will follow a combination of internal calibration and independent calibration. The former is not mandatory and may happen more frequently while the later must happen at least once in two years.

- *Reading frequency*

Most Monitoring parameters will be read from central control room (CCR) which collects all data measured by measuring instruments (weigh bridges, weigh feeders, meters and x-ray fluorescence). Parameters with default values will be obtained from the relevant source (i.e IPCC, ex ante calculated values etc). Reading will be practiced as per the reading frequency requirement of the plant norm for the conventional purpose and the CDM monitoring plan for the CDM Purpose. The CCR displays hourly, daily, monthly and annual data and cumulative values at the time of reading for almost all parameters. Most of the data are therefore recorded on industry log sheet from the CCR. However for CDM Purpose further recording will be made accordingly with the CDM monitoring frequency or aggregation and averaging of data into daily, monthly and annual values in case of missed reading session at the reading schedules stated in table 008 below; on the CDM log sheet separately as required by the monitoring tables of the PDD.

- *Monitoring and aggregation moments*

Ethiopia follows a Gregorian calendar and its own counting of clock. However the plant will adopt the European calendar and clock. The following table shows the time of monitoring/aggregation as per each monitoring frequency of parameters:

Frequency	Reading hour	Coverage	Record holder
Daily values	24:00 PM or 12:00PM	00:00 to 23:59	Conventional plant control
Monthly values	Last day of month at 24:00PM	First day of month to last day of monitoring month	Relevant CDM Parameters
Annual values	Last day of year at 24:00PM	First day of year to last day of monitoring year	Relevant (most) CDM Parameters

Table 008: Table of reading hours

When parameters are not the type that is normally obtainable from plant meters then the representative daily, monthly or annual value will be identified from the relevant source. Sum or average of hourly values give daily values while sum or average of daily or monthly values will give annual values.

- *Monitoring CDM log sheets*

In addition to the conventional Industry log sheet, CDM log sheets will be used. The log sheet for the CDM/EBF route will be comprehensive and subject to improvement based on further evolution of CDM.

Quality assurance and quality control (QA/QC) procedures;

The conventional cement project will implement the standard industry QA/QC norm in cement sector except linked to the CDM specific requirements. Where relevant to the practice, all common and domestic relevant national standards and plant norms will be employed for monitoring quality and handling data.

a. *Monitoring responsibility*

The entire monitoring of parameters, reliability check and final authentication of values for the CDM monitoring purpose will be managed by Ethan Bio-Fuels PLC (EBF). However, the detailed institutional monitoring arrangement will be harmonized with the conventional cement operation management and monitoring system of the plant operated by Derba MIDROC cement PLC and its conventional organization.

b. *The Monitoring routine and back up plans*

In principle the monitoring frequencies mandated by the CDM monitoring table are the most governing norms for monitoring our CDM project activity. For example if the parameter is required by the CDM monitoring table to be monitored annually; then one annual value monitored on the last month of the monitoring year close to the last day hour will be targeted as the relevant year end value and then discounted by the monitored value at the beginning of the monitoring year (refer table 008); to be used in the estimation of GHG emission. The same monitored value would then be used as the beginning monitored value for the next monitoring year. This approach will be mirrored for CDM Parameters monitored monthly and daily. However; we outlined a non mandatory prescription of backup plans and good practices below. Moreover; the monitoring performed by the crew of the plant owner are independent of the CDM monitoring without ruling out the possibility of data transfer to one another.

The %CaO and %MgO are the non-carbonated CaO and MgO components (if any) respectively, sourced from any non-carbonated material in the raw mix. The project kiln is designed to process Limestone, marl, Basalt and sand. Limestone, marl and Basalt are all carbonated sources (i.e CaO and MgO comes from decomposition of $CaCO_3$ and $MgCO_3$ found in the materials). The sand will not contribute any CaO or MgO. Non carbonated materials are also identified by exhibiting no loss of mass on ignition (LOI ~0). For the base year and each crediting year, in case non carbonated raw material is used; reading of %CaO and %MgO will be taken from the computer connected to the X-ray fluorescence (XRF) machine which is the equipment installed to analyse samples from raw material feeders continuously feeding into the clinker process. In case of XRF equipment failure, the average of values of XRF tests on any day in the same calendar month will be taken. If data absence or the equipment failure occurs on the first day of the calendar month, average of values of tests on any one day which is the nearest among the previous or subsequent calendar months will be taken. Alternatively, conventional laboratory tests (titration) will be used in case the XRF equipment maintenance or replacement takes more than six months. Analysed data from any number of tests conducted daily on samples will be monitored and filled daily on log sheets by data clerks assigned by plant owner. These data will again be monitored and recorded by EBF CDM monitoring records clerks based only on the relevant CDM monitoring frequency. In the absence of monitored data for any reason the default value of the methodology (2% for CaO) and the %MgO equal to that in clinker (conservative) will be applied.

The OutCaO and OutMgO are the components of CaO and MgO in the clinker produced respectively calculated from %CaO and %MgO in the Clinker. The reading for % CaO and % MgO in the clinker will be taken from the same computer connected to the X-ray fluorescence machine which is the equipment installed to analyse clinker samples from clinker weigh feeders. Analysed data from tests conducted daily on any number of samples will be monitored and filled daily on log sheets by data clerks assigned by plant owner. These data will again be monitored and recorded by EBF CDM monitoring records clerks at a frequency mandated by the CDM monitoring table. In the absence of monitored data or failure of XRF equipment, the average of values of XRF tests on the nearest day in the same calendar month or a day in the last month of the year will be taken. If data absence or the equipment failure occurs on the first day of the calendar month, average of values of tests on any one day which is the nearest among the previous or subsequent calendar months will be taken. Alternatively, conventional laboratory tests will be used in case of the XRF equipment maintenance or replacement takes more than six months.

Q_{rm} and CLNK are tonnage of raw material and clinker produced (in base year or/and crediting year). They are used to calculate InCaO, InMgO, OutCaO and OutMgO (in base year as well as crediting year). The central control room (CCR) is the room where the entire plant operating

parameters are controlled and operating parameters may be monitored. Their reading will be taken from the computer in the relevant Central Control Rooms (CCR) connected to the weigh feeders installed where raw materials flow into the clinker process and clinker exits from the kiln system. The weigh feeders transfer data to the CCRs continuously. Data from the computers in the CCRs will be monitored and filled hourly on log sheets by data clerks assigned by plant owner. These data will again be monitored and recorded by EBF CDM monitoring records clerks at a frequency mandated by CDM monitoring table. These values need to be monitored annually by the CDM monitoring plan. If an annually monitored value was not possible at the scheduled reading hour for some reason, the sum of the monthly values would be taken as a replacement. If a month end record was not possible due either to meter failure or some other reason, the sum of the available daily records will provide the monthly value. In the absence of monitored hourly data, daily data or failure of weigh feeder(s) equipment, the smallest of the daily record of the previous day or subsequent day where full hourly record exists is taken as the value for the day where hourly or daily data are missing. In case clinker quantity is not displayed, clinker conversion factor will alternatively be used to convert raw meal to clinker quantity and vice versa. The sum of the clinker tonnage used to produce each type off blended cement in the monitoring year would be used to obtain the total clinker consumed to produce the annual blended cement. This value may also be used to obtain the raw materials consumed; using the Clinkerization factor.

If daily data were needed and if such daily data are not available for more than a week in a relevant monitoring calendar month, the smallest among the weekly values of a week in the same month, previous month or subsequent month where full hourly and daily data are available for the week is taken as value for the week where data are missing. If daily data are not available for a month, the smallest among the monthly values of the previous months or subsequent months in the crediting year where full hourly and daily data are available for the month, is taken as value for the months where data are missing. In case clinker is produced in excess and stored for future cement grinding in rainy season, the relevant quantity of clinker would be estimated from the cement type produced. The relevant parameters above related to the raw materials and clinker would be taken from the most recent month when the clinker was produced.

The reading for kiln fuel consumption for clinker making (FF_i) will be taken from the computer in the Central Control Room (CCR) connected to the weigh feeders (in case of solid fuels) or flow meters (in case of liquid fuels) installed where kiln fuel flows into the clinker process. The weigh feeders/flow meters transfer data to the CCR continuously.

Data from the computers in the CCR will be monitored and filled hourly on log sheets by data clerks assigned by plant owner. These data will again be monitored and recorded by EBF CDM monitoring records clerks at a frequency mandated by the CDM monitoring table. In the absence of monitored hourly data or failure of weigh feeder (s) equipment, the smallest fuel/clinker ratio (in energy terms) taken from the daily record of the previous day or subsequent day where full hourly record exists is taken to estimate the fuel consumption value (linear extrapolation) for the day where hourly data are missing. If hourly data are not available for more than a week in a calendar month, the smallest fuel/clinker ratio (in energy terms) among the weekly values of a week in the same month, previous month or subsequent month where full hourly and daily data are available for the week is taken to estimate the fuel consumption (linear extrapolation) for the week where data are missing. If hourly data are not available for a month, the smallest fuel/clinker ratio (in energy terms) among the monthly values of the previous months or subsequent months in the crediting year where full hourly and daily data are available for the month, is taken to estimate the fuel consumption value (linear extrapolation) for the months where data are missing.

In each crediting year, each cement type produced (BC_i) and share of clinker per tonne of each type of blended cement ($P_{Blend, y}$), share of additives utilized in each type of blended cement will be obtained from the computer in the Central Control Room (CCR) connected to the weigh feeders installed where additives and/or clinker flow into the cement grinding process and cement exits from the process. Cement types will be classified and recorded as per the national cement standard taking the clinker share and type of additive into consideration. The weigh feeders transfer data to the relevant CCR continuously. Data from the computers in the CCR will be

monitored and filled hourly on log sheets by data clerks assigned by plant owner. These data will again be monitored and recorded as relevant for CDM purpose by EBF's CDM monitoring records clerks. The record of export sales on each type of blended cement will provide data on export. The total cement produced under each type reduced by the total cement exported under each type will give the cement domestically sold/consumed.

In the absence of monitored daily data or failure of weigh feeder (s) equipment, the value of the daily average of the previous day or subsequent day where full hourly record exists is taken as the value for the day where daily data are missing. If daily data are not available for more than a week in a calendar month, the weekly average of a week in the same month, previous month or subsequent month where full daily data are available for the week is taken as value for the week where data are missing. If daily data are not available for a month or months, the monthly average value of the nearest previous or subsequent month in the crediting year where full hourly or daily data are available for the month, is taken as value for the months where data are missing. Share of clinker per tonne of each type of blended cement ($P_{blend,y}$) may alternatively be obtained from Monthly production of each cement type and the monthly average share of additive per tonne of each type of blended cement.

Electricity consumption (KWh) data will be monitored / recorded or calculated from average specific electricity consumption readings monthly and annually from electricity meters. Similarly fuel consumption for self generated electricity and/or Electricity generated by any power source in the project activity boundary will be monitored annually and recorded. As of now the self generated electricity comes from emergency diesel generator of less than 2MW capacity, sufficient only for lighting and preventing damage to kiln liners from abrupt kiln stoppage in event of grid power interruption.

The total quantity of additive used for blended cement production (ADD_y) will be the sum of values for different additives consumption recorded from weigh feeders installed where additives flow to cement grinding equipment and displayed at CCR. However the additional quantity of additives transported due to the project activity and contributing to leakage ($Q_{ADD,y}$) will be obtained from calculation.

The weigh feeders transfer additive consumption data to the CCR continuously. Data from the computers in the CCR will be monitored and filled hourly on log sheets by data clerks assigned by plant owner. These data will again be monitored and recorded by EBF's CDM monitoring records clerks as per the CDM monitoring frequency. In the absence of monitored hourly data or failure of weigh feeder (s) equipment, the value of the daily average of the previous day or subsequent day where full hourly record exists is taken as the value for the day where hourly data are missing. If hourly data are not available for more than a week in a calendar month, the weekly average of a week in the same month, previous month or subsequent month where full hourly and daily data are available for the week is taken as value for the week where data are missing. If hourly data are not available for a month, the monthly average value of the nearest previous or subsequent month in the crediting year where full hourly and daily data are available for the month, is taken as value for the month where data are missing. Alternatively, the total cement considered in a calendar month reduced by the total clinker and gypsum consumed in cement production in the same calendar month will be used as the value to the monthly additive quantity used in the cement type considered.

Fuel consumption for vehicle transporting additives per kilometre (TF) will be obtained from the specification of the trucks involved in the transporting of additives in case trucks not older than 15 years from year of manufacturing. In the absence of such specification or if any of the trucks involved are older than 15 years from year of manufacturing, the fuel consumption of such truck with highest litres/ton-kilometre shall be used as a representative value for all. Such measurement will be done once in a year based on filling truck fuel tanker full level, driving and measuring the remaining fuel balance. After that the balance fuel will be divided by the distance travelled.

Baseline benchmark share of clinker per ton of blended cement type in the crediting year will be calculated from the benchmark set at the base year already calculated based on the procedure in the methodology and installed in PDD table 011. Baseline benchmark share of additives per ton of blended cement type updated for the crediting year ($A_{BSL,blend,y}$) will be calculated from total cement type in the crediting year reduced by baseline benchmark share of clinker in the blended cement type in the crediting year ($B_{Blend,y}$).

The source of Additives (Alemtena locality) is 125 km from plant as revealed in feasibility study (TEFR). Distance between the source of additive (pumice) and the project activity plant (D_{f_m}) will be measured once in every crediting year using vehicle odometer of a representative truck or ordinary vehicle. In the absence of monitored data for a crediting year, the value for the previous year will be used unless the source of additive is already changed. Alternatively, a distance of 125km will be used which is reasonably fixed and the effect of mining on the distance between plant and pumice source is insignificant. Emission factor of the transport fuel has been identified as the default value provided in the tool"Project and leakage emissions from road transportation of freight"

Under step 8 in leakage, PP chose option L1. Reduction factor (α_y), will not be measured and is zero as the source of each additive is a massive quarry held in concession agreement by plant owner and hence no diversion of additives from existing uses, as there is no other existing use. The concession licence will be made available always to the validating and verifying DOE.

The kiln fuel emission factor will be taken from the latest version of the IPCC default values available in the crediting year, for stationary combustion and type of kiln fuel.

c. Monitoring data reliability check and authentication

Internally and not for CDM justification purpose, data monitored hourly for conventional control by plant owner may be randomly compared with the hourly records of the day, the previous day and the subsequent day. The weekly total may be compared with the previous and the subsequent week. Monthly monitored values may be compared with the previous and subsequent month. Moreover the amount of clinker produced will be counterchecked on a quarterly basis with the amount of raw material input into the clinker process and the amount of clinker sent to cement production. Similarly the amount of each type of cement produced will be counterchecked on a quarterly basis with the amount of Clinker, pumice and additives input into the cement grinding process.

The CDM monitoring engineer of EBF stationed on site is responsible for such random comparison, authentication, and consolidation of hourly data into daily, weekly and monthly values in addition to also signing/approving and archiving of CDM specific log sheets at the site CDM data bank administered on site by EBF. He is responsible for overseeing or entering monitored data from hard copies to the spread sheet in the computer installed at the site CDM data bank. Additionally, he is also responsible for consolidating to monthly values (unless missing monitoring data are involved) and comparing with monthly reading (if any available). He shall then send the soft copy through email as well as weekly and monthly signed/approved hard copy log sheets (scanned or live) to the head office.

The EBF head office in Addis Ababa will be responsible for setting the relevant values as per the monitoring table and the relevant replacement values for any missing data as per the QA/QC procedure described for each or group of parameter(s) above and values (monthly and annual) relevant for calculation of emissions reduction in the crediting year. The officers at head office will cross check the amount of cement produced and monitored with the export sales invoice on quarterly basis or other means on annual basis.

d. Monitoring meter maintenance, replacement and calibration

Neither the selected methodology, nor the Board's guidance specifies any requirements for calibration frequency for measuring equipment. Hence project participants will ensure that equipment is calibrated either in accordance with the local/national standards or the plant QA/QC or as per the manufacturer's specifications. If for a specific meter local/national standards or plant QA/QC or the manufacturer's specifications are not available, Planned maintenance schedules serve as standards and may be used.

Measurement equipment or meters will be calibrated periodically as governed by the relevant industry requirement for each type of equipment. Meters already calibrated but have not been used will be calibrated after the relevant duration counted from date they were put for use. Calibration information, including date of calibration and next schedule of calibration, will be posted by the side of each instrument. Failed or underperforming meters will be replaced as quickly as possible but taking into account the timeline required for importing replacement meters into the host country. However, purchase order will be placed within a month or two of identifying the relevant supplier. While the Independent calibration schedule governs the CDM monitoring compliance, calibration of meters will be made in two tracks. The first, the voluntary internal calibration, will be made either by technicians of plant owner or supplier of specific equipment on frequency required by the industry standard or supplier standard. This internal calibration will be applied more frequently. However malfunction due to light interruption and the like may take several months to remedy. Internal calibration is not used CDM purpose and hence will not be made available to the verifying DoE.

The independent calibration will be implemented (for the purpose of CDM) by either the national quality standard or an entity accredited nationally or internationally to perform calibration. Plants normally employ the Quality and Standards Authority of Ethiopia for this. The following table shows the calibration frequency.

Meter type	Independent calibration (months)
CCR	As per manufacturer Specification or every 2 years
Weigh feeder for clinker rawmaterial	As per manufacturer Specification or every 2 years
Weigh feeder or flow meter for clinker	As per manufacturer Specification or every 2 years
Weigh feeder for cement additive	As per manufacturer Specification or every 2 years
Weigh feeder for solid kiln fuel	As per manufacturer Specification or every 2 years
Flow meter for liquid kiln fuel	As per manufacturer Specification or every 2 years
Weigh feeder for Additives	As per manufacturer Specification or every 2 years
Weighbridge at gate of factory premise	As per manufacturer Specification or every 2 years
XRF machine	As per manufacturer Specification or every 2 years
Conventional lab equipment	As per manufacturer Specification or every 2 years
Vehicle Odometer	As per manufacturer Specification or every 2 years

Table 009: calibration frequency

e. Calculation of Baseline emission, project emission, leakage and Emissions Reduction

The EBF officers at head (or project) office in Addis Ababa will be responsible for reviewing the accuracy of data between hard copy and soft copy of monitored data transferred from site, utilizing the correct data into the algorithms of the methodology, selecting default values from relevant documents and estimating the annual (or monthly) emissions reduction and preparing monitoring reports.

f. Data storage

All data collected as part of monitoring will be archived electronically and be kept at least for 2 years at head (or project) office in Addis Ababa, after the end of the crediting period (in this case only a fixed ten years)or the last issuance of CERs. All of the relevant parameters will be monitored unless otherwise substituted by default values. All measurements will be conducted with measurement equipment calibrated according to cement industry standards.

g. Monitoring organization chart

The chart annexed in Appendix 5 below shows the CDM project monitoring management structure that the project participants will implement in order to monitor emissions, emissions reduction and any leakage effects generated by the project activity. For the avoidance of overlap of responsibilities and to render specialized attention to the CDM angle of the monitoring task without interfering with the traditional activities of the production process or other value chains of the plant, a project activity monitoring organization is designed and will be overseen by the relevant participant (Ethan Bio-Fuels PLC). Since Ethan Bio-Fuels PLC has originated the project idea as a Clean Development Mechanism and designed the PDD, emissions reduction estimates and monitoring plan, it will handle the monitoring and preparation of the monitoring report as well. The entire CDM project data monitoring will be practiced in harmony with the conventional process.

The routine monitoring practice will be based on data collected from computers in CCR directly or plant log sheets. Data will be recorded both for the routine and CDM purpose but initially collected as part of the routine monitoring and QA/QC process. Office records will be maintained in three stages.

These are onsite data bank at site office, soft data at site office PC and finally at Addis Ababa (HO) CDM office in both hard and soft copy data bank. The documents and data at EBF CDM head office will be used as input for baseline, project and leakage emissions including ERs calculation. Emission Reductions calculation may be made more frequently (i.e weekly) for the first few months of operation and relaxed thereafter. Computer spread sheet will be established to calculate each sub-equation and major equations.

The routine monitoring practice will be based on data collected from plant log sheets. Data will be recorded both for the norm and CDM purpose but collected as part of the routine monitoring and QA/QC process. Office records will be maintained in three stages. These are onsite data bank at data clerk hand, soft data at site office PC and finally at Addis Ababa (HO) CDM office in both hard and soft copy data bank. The data at EBF CDM head office will be used as input for baseline, project and leakage emissions including ERs calculation. ERs calculation may be made more frequently (i.e weekly) for the first few months of operation and relaxed thereafter. Computer spread sheet will be established on site to enter daily records and at head office to calculate each sub-equation and major equations.

As for the monitoring log sheet, a specific log sheet format will be instituted for CDM specific data record (frequency) and archiving, in addition to the standard industry log sheets used by plant owner (Derba). Since the plant is Greenfield, the monitored values of the first year of operation of the project activity are essential as per the relevant guidance under the methodology for establishing emission intensity of clinker in base year. In this regard the monitored values of one

year counted from the date of the registration of the CDM project activity will be used to establish the parameters of the base year i.e first operational year of the project activity.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

Date PDD Version 2 is completed: 08/01/ 2016

Entity responsible for application of the methodology: Ethan Bio-Fuels PLC

Contact Person: Ambachew F. Admassie; ethanbiofuelsltd@gmail.com, Tel: 00251-911-218626

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

The starting date of the project activity is 14/08/2009. This date reflects the date when the "point of no return" was reached following the placement of equity contribution of the plant owner in the hope of fulfilment of precondition for starting to receive debt finance disbursement.

C.1.2. Expected operational lifetime of project activity

[32]20 (twenty) years from the date of registration of the project activity

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Fixed ten years crediting period

C.2.2. Start date of crediting period

The starting date of the crediting period is the latest of either 29/01/2016 or date of registration of the project activity.

C.2.3. Length of crediting period

Ten years non renewable

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

Environmental clearance letter from Federal EPA is required to enter site for construction. The EIA process followed procedures mandatorily enforced under the host country and also other financing requirement of the project.

[32]Letters from plant design consultant and plant maintenance contractor

Environmental impact assessment study and corresponding recommendation of mitigation measures for anticipated impacts, was performed by hiring a consultant capable of harmonizing the EIA findings with the turnkey design exercise of the plant.

D.2. Environmental impact assessment

According to the Environmental Impact Assessment Report, environmental impacts possibly caused by the Project activity and mitigation measures to be adopted by the project owner are analyzed as follows:

Air pollution

The air pollutants of the project activity are mainly dust and soot. In order to reduce SO_2, NO_X, dust emission, and associated adverse impacts on local environment, the project focused on mitigating the emissions by means of closed transporting raw materials, sprinkling and increasing humidity, etc. Two stages of de-dusting are proposed with 25mg/NM3 dust emission control efficiency. The following table shows level of some of the major pollutants in comparison of national environmental requirement versus that project technology and operation targets to achieve.

Pollutant type	**[33]National standard**	**Project design**
Dust Emission, mg/NM3	50	20-50
SOx Emission, mg/NM3	400	200-400
NOx Emission, mg/NM3	800	600-800
Waste (BOD@25 degree c), mg/l	25	15-25
Noise (dB), Industrial	Day:75 and night: 70	60
Discharge water quality, TSS (mg/l)	50	10

Table 010: comparison between regulation and project design for some of the pollutants

Noise

The noise influence of the project activity comes from some operating equipments. In order to reduce the negative impact on passing by local residents or their pack animals, equipment with low noise will be used and measures to control the noise sources will be adopted. These countermeasures to reducing noise pollution are mainly including furnishing muffler, vibration absorption targeting the base of fans, and building closed sound insulation room.

Therefore, the project activity almost does not lead to any changes on the current noise level in the boundary of the project activity.

Waste water

Waste water will be generated by production and living activities during the construction and operation period. As pollutants in the waste water resulting from production activities are primarily inorganic suspending particulates, the waste water will be discharged after collectively removing the suspending particulates by means of sedimentation tank. Waste water resulting from living activities will not be discharged until being treated by septic tank. Therefore, the project activity will not have any significant impact upon water environment.

[33] EPA national draft standard of the FDRE

Waste solids

The solid wastes generated in clinker/cement production are mainly dust collected by the dust collectors in various sections of the production processes. Such dust will be all returned to the production process without release to the environment. The wrapping packages will be sent to the reclamation company for recovery, and the municipal domestic refuse will be treated by sanitary department. Therefore, the treated solid wastes will not have any obvious impact on soil environment. Therefore there would be no trans-boundary impacts.

Greening

Derba Midroc plans to sponsor the planting of non CDM one million trees progressively around the project area over which local communities could participate as planting service givers. After finishing construction, the area surrounding clinker/cement production line will be greened and greening ratio targeted is about 20% of total areas.

In conclusion, any potential negative environmental impacts arising from the Project activity are small and are actively addressed by the project.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

The Constitution of FDRE highlights the importance of Public Consultation over Development projects. The national policy principles specifies: "People have the right to full consultation and to the expression of their views in the planning and implementation of environmental policies and projects that affect them directly." The Environment Impact Assessment of the project which was being conducted during the local consultation period states in chapter 6.2.1.1 that blending CDM project will be pursued and Carbon finance will be sought. Hence substantial stakeholder was conducted regarding all aspects of the development project including the CDM. The full stakeholder consultation process, participants and photographs are documented under Chapter 7 of the EIA report has been annexed to the validating DOE.

In accordance with the same invitations were made to various stakeholder groups and consultations made as follows;

- Consecutive field trips were taken in month of August 2007 to these project and the neighbouring areas in order to assess the views and comments of the community and concerned administrative units within and around the project areas. The details of stakeholders, actual dates of consultation and minutes of consultation are provided in table 7.1 and 7.2 of the stakeholder consultation report.

- Meetings were held on 11 and 12 July 2007 with the two Ministries.

- EIA was subsequently completed in December 2007 and TEFR completed in

The consultation included a total of about 1,250 stakeholders, including members of affected households and communities, local administration officials, and peasant association (village) leaders from the project-affected area. Discussions were held in two main languages: Amharic, the national language, and Oromiffa, the local dialect spoken in the Mugher Valley area and in Oromia Region. [34]Based on the information in the EIA report and meetings with resettled households, village leaders, and local administration officials during a debt finance appraisal mission, the appraisal team believes that the project has achieved broad community support.

[34]http://www.ifc.org/ifcext/spiwebsite1.nsf/0/E3F4305FC37F09AE852576BA000E2B4A

The stakeholder consultation has been conducted and is still being run as a holistic process running from the TEFR/ESIA study till this date in the commissioning process. The expropriation of the limestone site, the pumice site, the features of the plant itself and the products (which are all main features of the CDM project) were all discussed with local stakeholders as in the submitted stakeholder consultation document.

Comments from Local Stakeholders have been collected from the grass root local administrative area to the national scale as part of an examination of the entire investment's feasibility. Related documents open for validation show stakeholder consultation records. The following were considered Local Stakeholders:

- Federal Environment Protection Authority
- Regional Environment Protection Authority
- Ministry of water Resources, Ministry of Agriculture& Ministry of Mines
- Regional Government
- Woreda (grass root) administrative offices
- Local community comprising Elders, Women, children , Farmers and youth

In order to assess the communities' awareness and perception as well as attitudes about the project and its potential impacts, several meetings and discussions were held with a large number of community members and their leaders in the project area and from various Woreda sector offices. A number of household individuals (including gender represented) were consulted conveniently so that the people were given chance to express their views freely.

In General 40Woreda officials, 28 kebele peasant association council members, 223 community members consulted through community discussions, 956 individual household heads have been consulted.

E.2. Summary of comments received

Sufficient stakeholder comments were entertained through various consultations engaging participants over several stages. Just few pages of the entire process including collecting stakeholder comment are attached here below while the rest is available for the validating DOE. The following were among comments received from local stakeholders and perceived impacts.

Positive Impacts	**Negative Impacts**
Creation of jobs	Early employment, farm decline,
Access roads developed	Dust pollution, deforestation, wild disturbance
Development opportunity following access roads	Contagious diseases like HIV expansion
Opportunity of resource utilization for development	Sustainable utilization & landslides
Indirect assistance to local people	development of dependence by Local people
Cement for local development	Cement related pollution

Table 011: summary of EIA comments

E.3. Report on consideration of comments received

All comments were addressed in the EIA, plant design and operation plans as follows:

- Measures were taken to include in the factory manual denial of all requests for child labour and encouragement of education prior to employment. In addition on job training in no hazardous areas will be made until age when they can legally apply for job.
- Plant design and technology transfer included dust removal systems, to enable extremely low levels of dust pollution by global standards
- Access roads will to the most practical extent be built with tarmac or the best pavement structure to avoid recurrent excavation, dust pollution and resource utilization. Measures will be taken to avoid forest land and wild life areas.
- HIV awareness, worker discipline and medical preparedness were included in the colony establishment guideline
- Quarries were identified with caution to avoid landslide suspect zones and local administration members were involved in stakeholder discussions regarding the procedure of opening quarries
- Project development included packages of water well development, electrical supply, school and health centres for the community. The community will be empowered to manage the utilities and avoid dependence on the factory.
- Cement plant's design parameters included consideration of all environmental and climatic hazards.

SECTION F. Approval and authorization

Letter of Approval and Authorization for the project activity and participation in respect of both Project Participants obtained from DNA of host country (Ethiopia) has been uploaded on the UNFCCC site as part of the previous request for registration.

- - - - -

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	■ Project participant ■ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Ethan Bio-Fuels Pvt Ltd Co (Authorized representative)
Street/P.O. Box	*Registered business address* :; **Bole** Sub-City, Woreda **14**; House Number **new**;
Building	MAG International Building
City	Addis Ababa
State/Region	Addis Ababa (Capital)
Postcode	81210
Country	Ethiopia
Telephone	00251911218626
Fax	
E-mail	ethanbiofuelsltd@gmail.com,
Website	
Contact person	Ambachew F. Admassie
Title	Chairman, Sustainability Engineer
Salutation	Engineer
Last name	Admassie
Middle name	Fekadeneh
First name	Ambachew
Department	Green Growth and Sustainability investments
Mobile	00251-911-218626
Direct fax	
Direct tel.	00251-911-220538
Personal e-mail	Ambachew.admassie@gmail.com

Project participant and/or responsible person/ entity	■ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	[35]Derba MIDROC Cement Pvt Ltd Co
Street/P.O. Box	Ras Desta Damtew street
Building	Nani Building
City	Addis Ababa; Kirkos Subcity, woreda 07, Kebele 14/15
State/Region	Addis Ababa (Capital)
Postcode	23202/1000
Country	Ethiopia
Telephone	00251-115-549888 ; Extension CEO
Fax	00251-115-549808
E-mail	
Website	
Contact person	Ato Haile Assegde
Title	Executive Director
Salutation	Engineer
Last name	Haile
Middle name	Assegde
First name	Haile
Department	Executives
Mobile	00251-911-252627
Direct fax	
Direct tel.	00251-115-549810
Personal e-mail	ahaileahailew@yahoo.com, ahaileahailew@gmail.com

[35]Private Limited Company can be stated in short as Pvt Ltd Co or PLC in Ethiopia

Appendix 2. Affirmation regarding public funding

N/A (PO undertaking letter)

Appendix 3. Applicability of methodology and standardized baseline

Number	All applicability Criteria in methodology
1	The Methodology is Applicable where there is National Cement standard
2	This methodology is applicable to project activities that produce blended cement (BC) beyond current practices in the host country either: (i) in Greenfield cement plant or (ii) in existing cement production plant by increasing the share of additives (i.e. reduce the share of clinker)."
3	The project activity plant is Greenfield.
4	This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement (if any);
5	The methodology is not applicable if blending of cement outside the cement production plants is a common practice in the host country (ex: localized blending in construction sites).
6	All clinker used in the project activity shall be produced by the cement plant that is included within the project boundary, hence, cement grinding only plants cannot use this methodology (e.g. plants with no clinker manufacturing facility)
7	Adequate data are available on cement types in the market

Appendix 4. Further background information on ex ante calculation of emission reductions

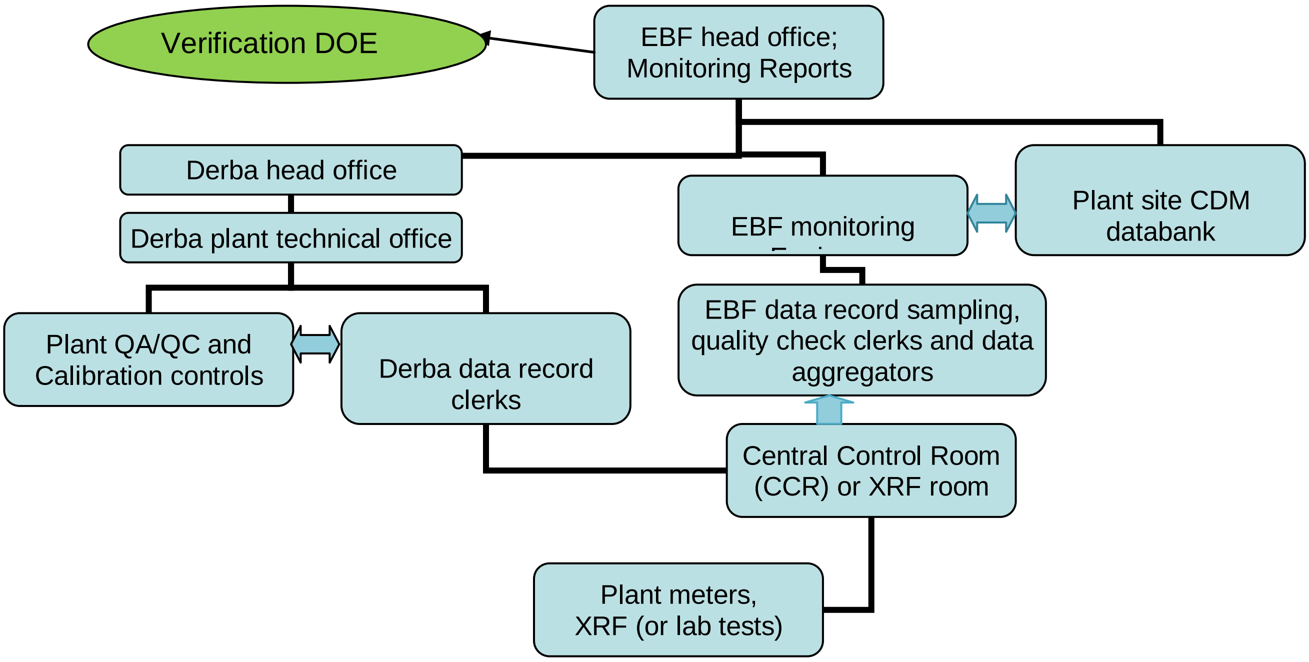
The following data sources were utilized

- Official Letter from QSAE, (Government quality Authority);shows cement plants in host country and types of cement they produce and the confirmation letter regarding restriction of producing blended cement outside cement plants.
- Official Letter from Ministry of trade and Industry; shows cement plants operating in host country during 2006, 2007 & 2008 and types of cement they produce
- 2007, 2008, 2009 production and plant data from all plants in the region obtained from EPA: shows cement plants and annual volume and types of cement they produce for three previous years. Three years data is taken for penetration % check and one Year 2008 data is taken for calculation as per the guidance on benchmark for base year in the methodology.
- Host country clinker/Cement standard (QSAE, formerly ESA); shows specifications for 27 cement types allowable under the standards, default ceiling clinker share and allowable lowest clinker share for each
- The TEFR & EIA studies of the project plant
- Recent tentative production plan
- Most recent IPCC Default values
- Grid emission factor calculation document for year ending December 2008, done through assistance of the Government of by Austria to the DNA Ethiopia:
- Statistics on Annually imported cement obtained from Government Authority

- Calculation tables are shown in next page

Appendix 5. Further background information on monitoring plan

A complete monitoring background has been provided in the relevant section above. Moreover the following monitoring organizational and intra- organizational set up has been envisaged while it may be improvised by EBF upon lessons learned from implementation.



EBF: Ethan Bio-Fuels PLC
Derba: Derba MIDROC Cement PLC
DOE: Designated Operational Entity to be employed for Verification

Appendix 6. Summary of post registration changes

N/A

- - - - -

Document information

Version	*Date*	*Description*
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: project activities, project design document