CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

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SECTION A. General description of project activity

A.1 Title of the project activity:

>> Optimum utilisation of clinker for Pozzolana Portland Cement (PPC) production at Birla Plus Cement in Bathinda, Punjab, India.

Version: 06

Date: 15/01/2007

A.2. Description of the project activity:

>> The project activity involves reduction of the clinker content in the production of Pozzolana Portland Cement (PPC) by increasing the percentage of fly ash and thus replacing an equivalent amount of clinker at Birla Plus Cement (BPC) manufacturing unit of Grasim Industries at Bathinda in the state of Punjab, India. The project activity therefore aims at optimal utilization of clinker in PPC manufacturing.

The project activity started (increase in fly ash blending percentage) in the year 2005-06 with 24.32 % fly ash in the PPC production. In the pre-project scenario the project proponent was using 20% of fly ash in the manufacturing of PPC. The project activity started gradually with the addition of grinding aids to increase the fly ash blending percentage without compromising on quality of cement. The future action plan of BPC is given in the table no A.1 below.

Table A.1: Action Plan to improve % utlisation of additives

Sr. No.	Year	% additives (Year average)	Remarks
2	2004-05	25.6	BASE LINE YEAR
3	2005-06	30.3	a) Lab Trial taken of Grinding Aid in July'04 Industrial Trial of Grinding Aid in July'05
4.	2006-07	30.5	a) Vibrating Mill will be commissioned by 31.01.2007 b) Roller Press will be commissioned by 31.03.2007
5	2007-08	32.5	a) Vibrating mill stabilisation of operation by 31.07.2007 b) Roller Press operation optimisation by 30.09.2007
6	2008-09	35.00	With Optimisation of Roller Press
7	2009-10	36.00	O-Sepa and Mill discharge Bucket Elevator replacement with an investment Rs 100 lakhs
8	2010-11	36.5	Increase will be possible with consistency in quality of fly ash with >3400 cm^2/gm fineness & C3S in clinker >50 and
9	2011-12	37.0	
10	2012-14	37.0	
11	2014-15	37.0	

12	2015-16	37.0	optimisation of quality at this level
14	2016-17	37.0	

In the present projection upto 32% fly ash blending (37% additive percentage) is considered conservatively. The project activity contributes to sustainable development at the local, regional and global levels in the following ways:

Direct and indirect reduction of GHG emissions: Clinker production from raw meal is the main source of CO_2 emission in cement production. The project activity reduces the clinker percent in cement production by use of fly ash and results in direct and indirect GHG emission reductions.

Industrial waste utilization: Disposal of fly ash is one of the major environmental problems of coal based thermal power plants. The project activity facilitates fly ash utilization and reduces the environmental degradation due to coal fired thermal power plants. Fly ash utilisation in PPC manufacturing also reduces land pollution and water contamination.

Further, the project indirectly encourages development of waste management infrastructure and associated value chains between two different types of industries that mutually support each other's operation.

Thermal and electrical energy conservation: The project activity reduces specific thermal and electrical energy consumption for PPC production and conserves the thermal and electrical energy. The savings in electrical energy demand would also means savings in electricity lost during transmission and distribution.

Resource Conservation: The project activity reduces the coal and limestone used per unit of PPC production. This resource conservation helps in sustainable development by the ways of

1. Reducing quarry mining for lime extraction
2. Reducing associated fugitive dust emissions
3. Reducing land destruction and erosions arising from such activities.
4. Reducing adverse health impacts caused from quarrying of materials on the mining persons, nearby habitats and ecosystems.

Therefore, the project activity contributes to sustainable development in the area and its surrounding regions.

A.3. Project participants:

>>

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants(as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	***Private entity:*** Birla Plus Cement Behind G.H.T.P P.O. Lehra Mohabat, 151 111, District : Bathinda,	No

	Punjab, India	

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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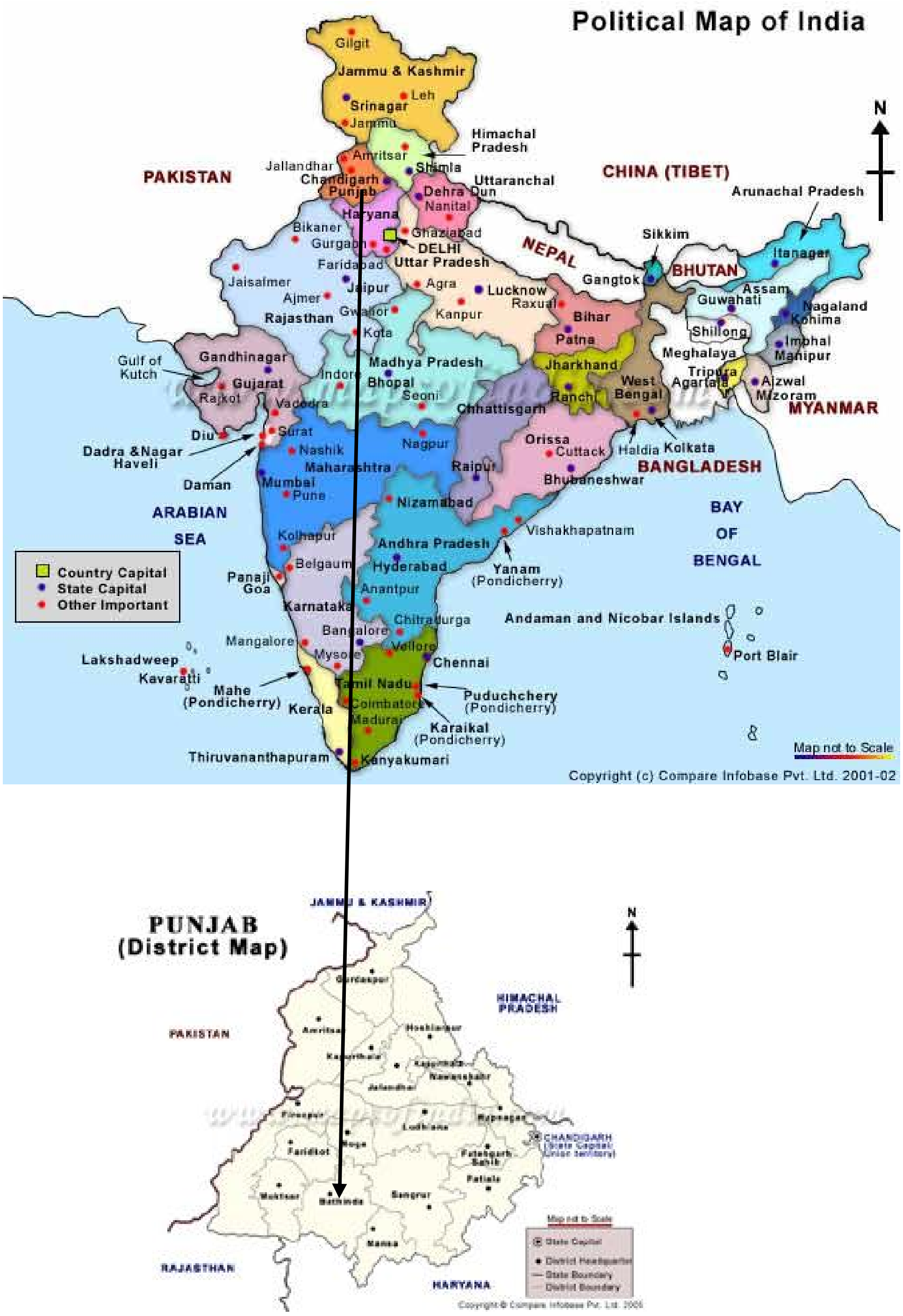
The project activity location is shown in the map below:



Reference: **www.mapsofindia.com**

A.4.1.1. Host Party(ies):

>> India

A.4.1.2. Region/State/Province etc.:

>> Punjab

A.4.1.3. City/Town/Community etc:

>> Lehra Mohabat, District: Bathinda

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

>> The project proponent in this project is Birla Plus Cement which is located in district: Bathinda of State: Punjab, India. The plant is placed near to industry developed district Patiala and Ludhiana. The project site is well connected by road and the nearest air port located at Chandigarh.

The coordinates of the site are as follows:
Latitude: 30.16 N
Longitude: 75.11 E

A.4.2. Category(ies) of project activity:

>> The project activity is a cement sector specific project activity.
The project activity is categorized under sector scope 4: ***"Manufacturing Industries***" as per the scope of the project activities enlisted in the 'list of sector scopes with approved methodologies' for accreditation of operational entities.

A.4.3. Technology to be employed by the project activity:

>> The project activity at Birla Plus Cement is to utilize fly-ash, a by-product of coal fired thermal power plant, in the manufacturing of PPC. Technology used in this project facilitates proportional mixing of flyash with clinker after fine grinding of both products.

In BPC manufacturing site clinker out sourced is ground and mixed proportionally with fly-ash, Gypsum and other additives to produce PPC. Technology implemented at Birla Plus Cement helps in reducing GHG emissions and thermal and electrical energy required to produce the final product. The project activity plant has installed a capital intensive roller press for fine grinding of the clinker. Details of the roller press are as below:

Details of Roller Press Installed at BPC – Bathinda

Roller Press is a highly energy efficient productivity tool, which works as a pre-grinder for fine cement grinding. In Roller Press system, clinker is pressed and pre-crushed to fineness of 2500-3000 Blaine which goes for further grinding in Ball Mill to 4000 Blaine. By installing the roller press which work as a pre-grinder, capacity

of cement will increase by 30-40% while at the same time energy requirement is reduced by 5-6 KWH/MT of cement. With this we will be able to increase the consumption of flyash from 24.32% to 30%. Since fine material is fed to Ball Mill, the noise level is also reduced considerably.

Technical data

Description	Value
Type	RP13-140/140
Roller diameter	1400 mm
Roller width	1400 mm
Roller speed	1.6 m/s
Throughput	720 TPH
Motor with GRR for speed control	2 x 1000 kW
RPM	900 -1500

Fly ash is transported from Guru Har Gobind Thermal power plant (GHTP) silos in the project boundary to BPC through pipe line having modudense pneumatic system to transport fly-ash to BPC silo and silo extraction system.

The quantity of fly ash feed to mill is controlled by the flow meter at the silo outlet. Fly ash is mixed with clinker and transported through elevator and fed to O - Sepa separator for required fineness. The accuracy of weighing and feeding system is ± 3 %. Bag dust collectors are installed for arresting dust. The technology adopted is simple and environmentally safe. Bag dust collectors are provided at top of the fly-ash silo to vent out transport air during feeding of fly-ash from pipe line and also aeration air, which is provided at bottom of the silo.

One more advantage of using efficient Roller press is that the operational noise is reduced significantly, making the plant operations friendly and the environmental benefit of using this high-end technology is that it provides substantial savings in thermal and electrical energy. The technology has thus helped in reducing GHG emissions.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

>> The project activity would reduce the clinker percentage in PPC produced. Cement manufactured at the project site is produced after grinding and blending of clinker with additives. As the project activity reduces clinker utilization with addition of substances fly-ash and gypsum for cement production, it helps in reducing process emissions and emissions related to thermal and electrical energy consumption.

Though the Ministry of Environment and Forest (MoEF), Ministry of Power (MoP) and Ministry of Non conventional Energy Sources (MNES) in India encourages energy conservation, there is no compulsion for cement industries to reduce their specific energy consumption to a prescribed standard. Nor do the

Department of Industries/ the Bureau of Indian Standards/ Cement Manufacturers Association/ National Council for Building Materials have imposed any directives towards reduction in clinker content in cement manufacturing. The project proponent has implemented the project activity over and above the national or sectoral requirements. The GHG reductions to be achieved by the project activity are additional to those directed by the governmental policies and regulations. The other "additionality" criteria of the project activity are dealt-with in section B.

The GHG performance of BPC in absence of the CDM project activity would be in line with PPC production and low blending percentage, which was the case in base year. The baseline carbon emission factor of the system boundary as per the proposed baseline methodology was estimated as ***0.733 tCO_2/t PPC. 7246688 t CO_2*** emissions over a crediting period of 10 years (details have been provided in Section B and E).

However, Birla Plus Cement has decided to produce PPC cement with low blending percentage and market it by making additional efforts in the direction of overcoming the stiff competition. With CDM project activity implementation the GHG performance of BPC over 10 years of crediting period would be of the order of ***6703888 t CO_2*** emissions and the emission reductions would amount to ***542800 t CO_2***.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

>>

Crediting period of 10 years has been chosen for the project activity

Table 1: Emission reductions of the project activity

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2007-2008	44435
2008-2009	63651
2009-2010	68456
2010-2011	67254
2011-2012	66053
2012-2013	60042
2013-2014	54037
2014-2015	46832
2015-2016	39622
2016-2017	32418
Total estimated reductions (tonnes of CO_2 e)	**542800**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**54280**

A.4.5. Public funding of the project activity:

>>

No public funding from parties included in Annex – I countries is available to the project.

SECTION B. Application of a baseline methodology

B.1. Title and reference of the approved baseline methodology applied to the project activity:

>> **Title**: Consolidated Baseline methodology for increasing the Blend in cement production. (ACM0005) – Version 03

Approach: Existing actual or historical emissions, as applicable; [as per 48 (a) of CP 7/17]

Reference: UNFCCC website

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

>> This methodology is applicable to projects that increase the share of additives (i.e. reduce the share of clinker) in the production of cement types beyond current practices in the country. BPC project activity increases the share of additive in PPC beyond current practices in the region and the project activity meets all the applicability conditions of the consolidated methodology. The same has been discussed herein.

The applicability of methodology is illustrated in a tabular format:

S.No	Applicability Criteria	Explanation
1.	There is no shortage of additives to prevent leakage related to the lack of blending materials. Project participants should demonstrate that there is no alternative allocation or use for the additional amount of additives used in the project activity. If the surplus availability of additives is not substantiated the project emissions reductions (ERs) will be discounted.	The project activity uses fly ash (as additive) a waste generated in thermal power plants. Fly ash is available abundantly in the thermal power plants. BPC takes fly ash from Guru Har Gobind thermal power plant, Bathinda which is 1 km from the project activity. The thermal power plant produces the flyash in surplus and has readily agreed to supply it to the cement plant considering improvement to the environment.
2	This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement types.	BPC does not export PPC. Cement types besides PPC are sold in domestic market alone.
3	Adequate data are available on cement types in the market.	Adequate data on cement types in the market is available through reports published by Cement Manufacturers Association, India.

The project activity fulfils all the applicability conditions described in the consolidated methodology. Hence the consolidated baseline methodology for increasing the blend in cement production will be appropriate for Birla Plus Cement project activity.

B.2. Description of how the methodology is applied in the context of the project activity:

>> The methodology is based on a systematic, step-wise approach that is applied as under for selecting an appropriate region for the project activity hosting plant, identifying the alternatives available to the project proponent, determining the benchmark for baseline emissions, establishing additionality of the project activity and estimating the emission reductions resulting from the project activity:

Selection of the region for the project activity hosting plants

The methodology requires the project proponent to determine the region for the project activity hosting plant by selecting an appropriate geographic boundary where the project plant is physically situated and catering their PPC production.

The project proponent is required to select the region for the baseline calculation in which the project activity plant is supplying at least 90% of their blended cement production. As per the methodology, the national market can be chosen by default; however the geographic boundary of India being very large, the key parameters affecting the percentage of additive blending vary widely in cement manufacturing units across the country depending on the local scenarios (like fly ash availability, customers' perception and market acceptability etc). As a result, measures like increased additive blending in cement production, undertaken in different cement manufacturing units all over India are not exposed to similar economic and market circumstances. Therefore the project proponent has considered the geographic extent of the states where the project plant caters their cement production in order to arrive at the region for the project activity hosting plant. The project activity is installed in grinding plant therefore the region selected is covering all the grinding units in Central, Western, Northern and southern region as described by cement manufacturers' association[1](CMA).

The sale of PPC from the project activity is mainly in the states of Punjab, Haryana, Himachal Pradesh and J & K. This PPC sale of BPC is more than 90 % in region.
Following plants come under the region of project activity cement plant.

Table B-2: Other cement manufacturing plants catering to the market including Birla Plus Cement

Name of unit	Products
Grinding Units-Northern Region	
Punjab	
Grasim Cement – Bathinda	OPC, PPC
GACL- Bhantida	OPC, PPC

[1] www.cmaindia.org

GACL- Ropar	OPC, PPC
Delhi	
CCI Ltd	OPC, PPC
Grinding Units-Southern Region	
Andhra Pradesh	
Andhra vijaywada	NIL
Andhra vizag	PBFS
Tamilnadu	
Ultratech – ARCW	OPC, PPC
Kerala	
Malabar Cements	PPC, PBFS
Grinding Units-Western Region	
Gujarat	
Narmada, Magdalla	OPC, PPC
Maharashtra	
Rajshree Hotgi	OPC, PPC
Narmda, Ratnagiri	OPC,
Indo Rama, Raigad	PBFS
Orient, Jalgaon	OPC, PPC
Grinding Units-Central Region	
Uttar Pradesh	
ACC, Tikaria	PPC
Birla cement- Raibareilly	PPC
Dimond cement, Jhansi	PPC
Chunar	NIL
Jaypee-Sadva Khurd	PPC
Jaypee Ayodhya, Tanda	PPC

The eastern region is not considered in the project region because of the blended cement is dominant in that market. According to cement manufacturing association the percentage of different types of cement in different markets are as below:

Region/State/Plant	**OPC %**	**Blended Cement (%)**
Eastern	**11.87**	**88.13**

Northern	48.89	51.11
Central	23.86	76.14
Southern	47.63	52.37
Western	75.83	24.17

It is clear from above table that the blended cement is 88% in the eastern region and it is penetrated well. As the methodology region should have similar marketing conditions. Considering this the eastern region is not considered.

As per the methodology, the region selected for the project activity hosting plant needs to satisfy the following conditions:

i) "at least 75% of project activity plant's cement production is sold (percentage of domestic sales only)"

In the year 2004-2005, Birla Plus Cement sold 954.01 MT of PPC in the domestic market; which is (>75%) of the cement of BPC was sold in the selected region in the year 2004-2005.

Therefore the region selected for the BPC satisfies the above condition.

ii) ***"includes at least 5 other plants with the required published data"***

The region selected for Birla Plus Cement plant includes twenty three (19>5) plants.

Therefore the region selected for BPC satisfies the above condition.

iii) ***"the production in the region is at least four times the project activity plant's output"***

The total production in the region is 5360110 MT; which is greater than (5.2>4) times of the cement production of the project activity plant.

Therefore the region selected for the project activity hosting plant is justified.

Identification of the alternatives

As per the methodology, the project proponent is required to identify all the realistic and credible alternatives or production scenarios for the relevant cement type (i.e. PPC) that were available to them in absence of the project activity and that are consistent with current rules and regulations. These alternatives would provide output or services comparable with the project activity.

BPC has identified the following alternatives to the project activity:

Alternative 1: Continuation of the existing practice of cement (PPC) production

Alternative 2: Implementation of the project activity not undertaken as a CDM project activity
Alternative 3: Implementation of cement (PPC) production practice as in other manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances.

Alternative 1: Continuation of the existing practice of cement (PPC) production
In absence of the project activity, BPC may propose to continue the PPC production with "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."
Alternative-1 is in compliance with all applicable legal and regulatory compliances and may be the baseline alternative. Since the Alternative-1 is the status quo and does not face barriers that would prevent its implementation (as per Step 3: Barrier Analysis of the "Tool for the demonstration and assessment of additionality") it is considered as one of the most probable baseline scenario.
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 has been determined as per the guidance provided in point (iii) of the 'Baseline emissions' section of the consolidated baseline methodology. Please refer to Benchmark determination and Baseline emission calculations given below.

Alternative 2: Implementation of the project activity not undertaken as a CDM project activity
BPC may propose to produce PPC with a lower clinker percentage as in the project activity scenario.
Alternative-2 is also in compliance with all applicable legal and regulatory compliances and may be the baseline alternative.
However this alternative would have faced the barriers as that of the project activity under consideration (all these barriers are detailed in "Barrier Analysis" in Section-B.3 given below). Hence without the CDM revenue which would actually supplement the additional financial burdens associated with the R&D and promotional activities of the PPC produced, this alternative would not be a feasible option for Birla Plus Cement.

Alternative 3: Implementation of cement (PPC) production practice as in other manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances.
In absence of the project activity, BPC may produce PPC with a clinker percentage, which is the common prevailing practice in other cement manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances.
The region for the project activity hosting plant has already been determined above and all the plants supplying PPC in the region have been identified.
The methodology requires the project proponent to determine the common prevailing clinker percentage in PPC in other cement manufacturing plants in the region ***"using similar input/raw materials, and facing***

similar economic, market and technical circumstances.” The Cement plants which are having registered CDM project activity on blending is not considered in calculation[2].

Since the Alternative-3 is the prevailing practice and does not face barriers that would prevent its implementation (as per Step 3: Barrier Analysis of the “Tool for the demonstration and assessment of additionality”) it is considered as one of the most probable baseline scenario.

The mass percentage of clinker in the PPC produced in the proposed project activity plant as per the practices in other manufacturing plants in the region has been determined as per the guidance provided in point (i) and point (ii) of the ‘Baseline emissions’ section of the consolidated baseline methodology. Please refer to Benchmark determination and Baseline emission calculations given below.

Benchmark determination and Baseline emission calculations:

The mass percentage of clinker in PPC has been calculated for Alternative 1 and Alternative 3 as per the guidance provided in the consolidated baseline methodology and is tabulated below in Table.

Sl. No	**Condition**	**Mass percentage of clinker in PPC (Tonne of clinker / Tonne of PPC)**	**The lowest value among the following is to be selected as benchmark for baseline emissions.**
	Alternative 3:		
1	The average (weighted by production) mass percentage of clinker for the 5 highest blend cement brands for PPC in the region	0.737	✘
2	The production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the PPC in the region	0.733	✔
	Alternative 1:		
3	The mass percentage of clinker in PPC produced in BPC before the implementation of the CDM project activity during the year 2004-2005.	0.744	✘

It is reflected from the above table that the baseline option 2 has the lowest mass percentage of clinker in cement, so this will be the benchmark baseline scenario. Since the baseline is dynamic, an increasing endogenous trend of 2% increase in additive over the percentage of additive at the start of the project activity has been incorporated.

Estimating the emission reduction resulting from the project activity

[2] ACM004, para 4, line 6

The emission reduction resulting from the project activity is estimated as a difference between the baseline emissions, project emissions and leakage.

Baseline Emissions

As per the methodology,

"The baseline emissions are a function of two factors:

i. *the percentage of additives and the related electricity consumption that is taken as the baseline benchmark; and*
ii. *the CO_2 emissions per tonne of clinker in the Birla Plus Cement project activity plants, which in turn depends on*
   (a) *Quantity and carbon intensity of the fuels used in clinker making;*
   (b) *Quantity and carbon intensity of electricity;*
   (c) *CO_2 emissions from calcinations."*

For detailed calculations of baseline emissions in the base year 2004-2005, please refer to Enclosure 3: Calculation of Baseline Emission Factor and Enclosure 4: Emission Reductions.

Since Birla Plus cement plant meets its electricity requirement from the Punjab state grid, which has substantial electricity imports from the state grids in the Northern Region, the baseline grid emission factor is determined for the Northern Regional grid according to Approved Consolidated Methodology ACM0002.

Since this methodology is restricted to increase in percentage of blend only and not to efficiency improvements or fuel switching, in case

(i) the emissions per tonne of clinker during the crediting period are less than baseline, the baseline value is substituted by the project activity value
(ii) the emissions per tonne of clinker are higher during the crediting period than the baseline, it could be due to declining efficiency or fuel switch or some other reason. Under such circumstances the baseline value is used and in case negative emission reductions arise in a year, ERs are not issue until emission reductions from subsequent years have compensated the negative quantum.

Project Emissions

The project emissions resulting after the implementation of the project activity is also calculated as per the guidance provided in ACM0005 for each of the years of the proposed crediting period.

For detailed calculations of project activity emission factors and the project activity emissions in the crediting period, please refer to Enclosure 1: Calculation of Project activity Emission Factor and Enclosure 4: Emission Reductions.

Leakage

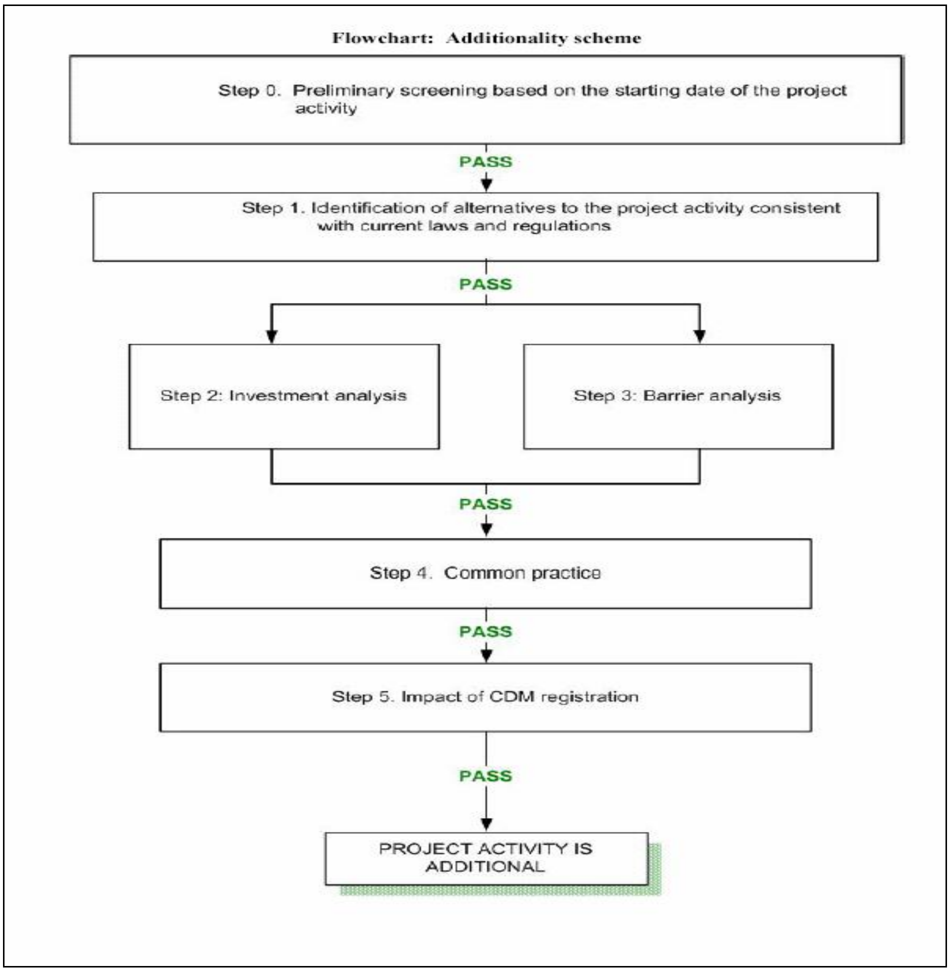
The project proponent is also required to account for any leakage which may be attributed to the project activity. Any transport related emissions for the delivery of additional additives would be included in the emissions related to the project activity as leakage. Reduction of clinker percentage in PPC results in reduced limestone and coal consumption per ton of PPC produced. Therefore there is a decrease in transportation of limestone and coal required per ton of PPC produced due to the implementation of the project activity, leading to a reduction in associated transportation emissions. However as conservative simplification, emission reductions from transport of raw materials for clinker production are not taken into consideration.

For detailed calculations of emissions due to leakage in the crediting period, please refer to Enclosure 2: Leakage

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

>> As per the decision 17/cp.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in absence of the registered CDM project activity. The methodology requires the project proponent to determine its additionality based on the "Tool for the demonstration and assessment of additionality", agreed by the CDM Executive Board at its sixteenth meeting.

The flowchart presented in below provides a step-by-step approach to establish additionality of the project activity.



The additionality of the project activity has been described below:

As per the selected methodology, the project proponent is required to establish that the GHG reductions due to project activity are additional to those that would have occurred in absence of the project activity as per the 'Tool for the demonstration and assessment of additionality'.

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

In sub-step 1a and 1b, BPC is required to identify the realistic and credible alternative(s) that were available to them and that would provide output or services comparable with the project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

Sub-step1a- Define alternatives to the project activity

BPC identified the following alternatives to the project activity:

Alternative 1: Continuation of the existing practice of cement (PPC) production

Alternative 2: Implementation of the project activity not undertaken as a CDM project activity

Alternative 3: Implementation of cement (PPC) production practice as in other manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances

Please refer to Section B.2 for details on the alternatives.

Sub-step1b- Enforcement of applicable laws and regulations

In India, PPC product is required to satisfy the specifications of the Bureau of Indian Standards as laid down in IS: 1489 (Part 1). As per this specification, the percentage of pozzolanic material (i.e. fly ash) in PPC must fall between the ranges of 15% to 35%. All the above alternatives would meet this requirement.

Fly ash is being used as the major additive in the production of PPC. The quantum of fly ash generated in thermal power plants is huge and fly ash disposal has always been a matter of environmental concern. In absence of the project activity, the fly ash would have been dumped in landfill or low land.

There is no legal binding on Birla Plus Cement to implement the project activity. In India it is not mandatory for to use higher additives in cement manufacturing. There is no policy, which promotes use of higher percentage of additives and would be adequate to stimulate implementation of the project activity in absence of CDM. The implementation of the project activity was a voluntary step undertaken by BPC with no direct or indirect mandate by law or promotional policies to foster development of widespread CDM projects like optimal utilization of clinker.

The project proponent is required to conduct

Step 2. Investment analysis: Investment analysis is not used for the project activity.
OR
Step 3. Barrier analysis

Birla Plus Cement proceeds to establish the project activity additionality by conducting Step 3: Barrier Analysis.
The project proponent is required to determine whether the project activity faces barriers that:

(a) Prevent the implementation of this type of project activity; and
(b) Do not prevent the implementation of at least one of the alternatives through the following sub-steps

All the barriers that prevail for the project activity are detailed in Sub-step 3a.

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

BPC's initiative of reducing the clinker consumption in the PPC produced by using a higher additive percentage has been facing several barriers as outlined below:

Technological Barrier

There are technical barriers related to use of PPC with higher additive %. An increase in the additive % in the PPC produced results in a change in the product mix. The masons and builders require special training

and guidance in order to use PPC as building material. The training and guidance include measures to be adopted to ensure equal durability and workability of OPC and PPC. Due to poor awareness levels on use and preparation of PPC for building and other benefits, the product acceptability levels of PPC with higher additive % are also very low. These technical barriers related to use of PPC with higher additive % further heightens the poor market acceptability of the product. It may however be noted that the PPC with a higher additive% would be providing an equivalent service to that of PPC with lower additive % as per the BIS standards, Birla Plus Cement had taken some initiatives in this direction to conduct awareness and training programmes as measures under the project activity implementation.

Generally PPC manufacturers use low percentage of additive in manufacturing of blended cement. In the project activity, Birla Plus Cement uses high percentage of additives and proposes to increase it further in years to come. It is noted that the use of fly ash for the manufacture of PPC depends on the quality of fly ash, clinker and by adding high flyash percent (the CDM project activity) in PPC increases the efforts to adhere to the required quality standards of PPC by manifold. Any higher addition of fly-ash would cause fall in strength properties on 1 day, 3 day and 28 day basis.

In order to optimise the clinker quantity per ton of PPC, Birla Plus Cement conducted Research & Development (R&D) and numerous trials & experiments with varying percentage of flyash addition and with varying clinker qualities to examine and has ascertained their impact on each other as well as their combined final impact on the strength properties of PPC manufactured. Birla Plus Cement also carried out numerous trials with varying fineness of PPC with numerous permutations and combinations of different flyash percentage additions and different clinker qualities.
The roller used in the project activity is first of its kind in cement industry in India. Operation and maintenance of the same without sufficient experience is a major barrier for project proponent.

Market barrier due to poor acceptance of the PPC produced
The resistance in the acceptability of the PPC produced is the major barrier of the project activity at Birla Plus Cement. The reasons behind this non-acceptability are furnished below:
Consumer perception of PPC

The various consumer perceptions were as follows:

a) Non-acceptance of PPC in Government Departments and Projects - The Central Public Works Department (CPWD) imposed a ban on use of blended cement for bridges and other prestigious concrete works/constructions
b) "PPC is flyash mixed cement" propagated by the competitors and perceived by general public
c) Serious doubts about strength and durability in the mind of technocrats, builders and entire hierarchy of consumers
d) The darker colour of PPC and the colour variations in them are mistakenly attributed to impurity. For example, PPC is generally of darker colour as compared with OPC because of the carbon

present in flyash. Dissatisfaction due to blackish material leaching and floating on the surface of concrete / mortar

All these misconceptions have resulted in a lower market share of PPC thereby discouraging the cement manufacturing units all over India to produce more PPC. In spite of all such prevailing market resistances, Birla Plus cement continued the production of PPC and has put their whole-hearted efforts to further increase the additive percentage in the PPC in order to improve the GHG performance during cement production.

Resistance from utilisation of higher percentage of additives in PPC production

With such a background of 'consumer resistances' resulting in 'poor market acceptability of PPC' as discussed above, a higher percentage of additives in PPC worsened the scenario. However with the objective of increasing the additive percentage in PPC production, Birla Plus Cement has implemented the project activity.

Indian cement market, being controlled by a number of players, is highly susceptible to the negative propaganda by the competitors against the launching of a new kind of product mix. With various misconceptions created by the competitors in the mind of the consumers, only quality assurance of the product mix cannot get the confidence of the consumers. However, instead of succumbing to such market resistances by producing PPC with lower additive percentage, Birla Plus Cement has put their consistent efforts in designing a product mix which would optimise the clinker percentage in PPC by addition of higher additives and enhance market acceptability. A lot of Research & Development (R&D) activities have been carried out by an in-house team of technical experts in order to produce PPC with a higher additive percentage that would satisfy the code requirements as per the relevant Indian Standard (IS 1489(Part 1):1991) and get the confidence of its consumers.

Sub-step 3 b. Show that the identified barriers would not prevent a wide spread implementation of at least one of the alternatives (excepted the proposed project activity):

It has been observed in Sub-step 3a that the project activity has its associated barriers to successful implementation. In a broader sense, these barriers can be categorised as below:

- Technological barrier and
- Market barrier

The other realistic alternatives available with Birla Plus cement in absence of the project activity are evaluated with respect to these barriers.

So far as market and technological barriers are concerned, Alternative 1 and Alternative 3 would not have faced all the market related resistances and technological awareness problems that are evident for the project activity (i.e. Alternative 2). No upfront investment would be required for the Alternative options 1 and 3. No expenses would need to be incurred in order to train the masons and the builders for using the product mix manufactured as per Alternative 1 and 3. Hence BPC would not have faced any obstacles in adopting either of the Alternatives 1 and 3.

Step 4. Common practice analysis

The project proponent is further required to conduct the common practice analysis as a credibility check to complement the barrier analysis (Step 3). The project proponent is required to identify and discuss the existing common practice through the following sub-steps:

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Sub-step 4b. Discuss any similar options that are occurring:

From Step 3: Barrier Analysis it may be concluded that Alternative 1 and Alternative 3 would not have faced obstacles to implementation. However Alternative 2 faced all the barriers to implementation as detailed in Sub-step 3a. The common practice scenario discussed below further substantiates that Alternative 2 faces barriers to implementation and is therefore not a widespread proposition for cement plants under similar socio-economic environment in India.

All the cement plants in the region selected for the project activity hosting plant were producing the similar cement with mass percent of clinker below that of project activity plant before implementation of the project activity.

This further proves that the risk associated with the project activity is so high that the cement plants in the included in the region are reluctant to take up an initiative like this. Hence BPC's initiative is a pioneering effort which would not have occurred in absence of the CDM project activity.

Step 5. Impact of CDM registration

The benefits and incentives expected due to approval and registration of the project activity as a CDM activity will certainly improve the sustainability of the project activity and thus its consideration before implementation helps to overcome the identified barriers, which enables the project activity to be undertaken. Each of them especially barriers associated to market uncertainties and customer resistance could result in project failure resulting in financial losses. However, with goal of obtaining the proposed carbon financing for the project BPC's management took a corporate decision to invest

- in overcoming the barriers facing project implementation
- in the other CDM project activities through equity
- in additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfil CDM requirements.

It is ascertained that the project activity would not have occurred in the absence of the CDM simply because no sufficient financial, policy, or other incentives exist locally to foster its development in India and without the proposed carbon financing for the project the Birla Plus Cement would not have taken the investment risks in order to implement the project activity. In such an event the BAU baseline option is continued with release of carbon dioxide emissions.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

>> The project activity would affect the GHG emissions at all the three distinct stages of cement manufacturing. Therefore *the project boundary includes*

- the clinker & cement production plant

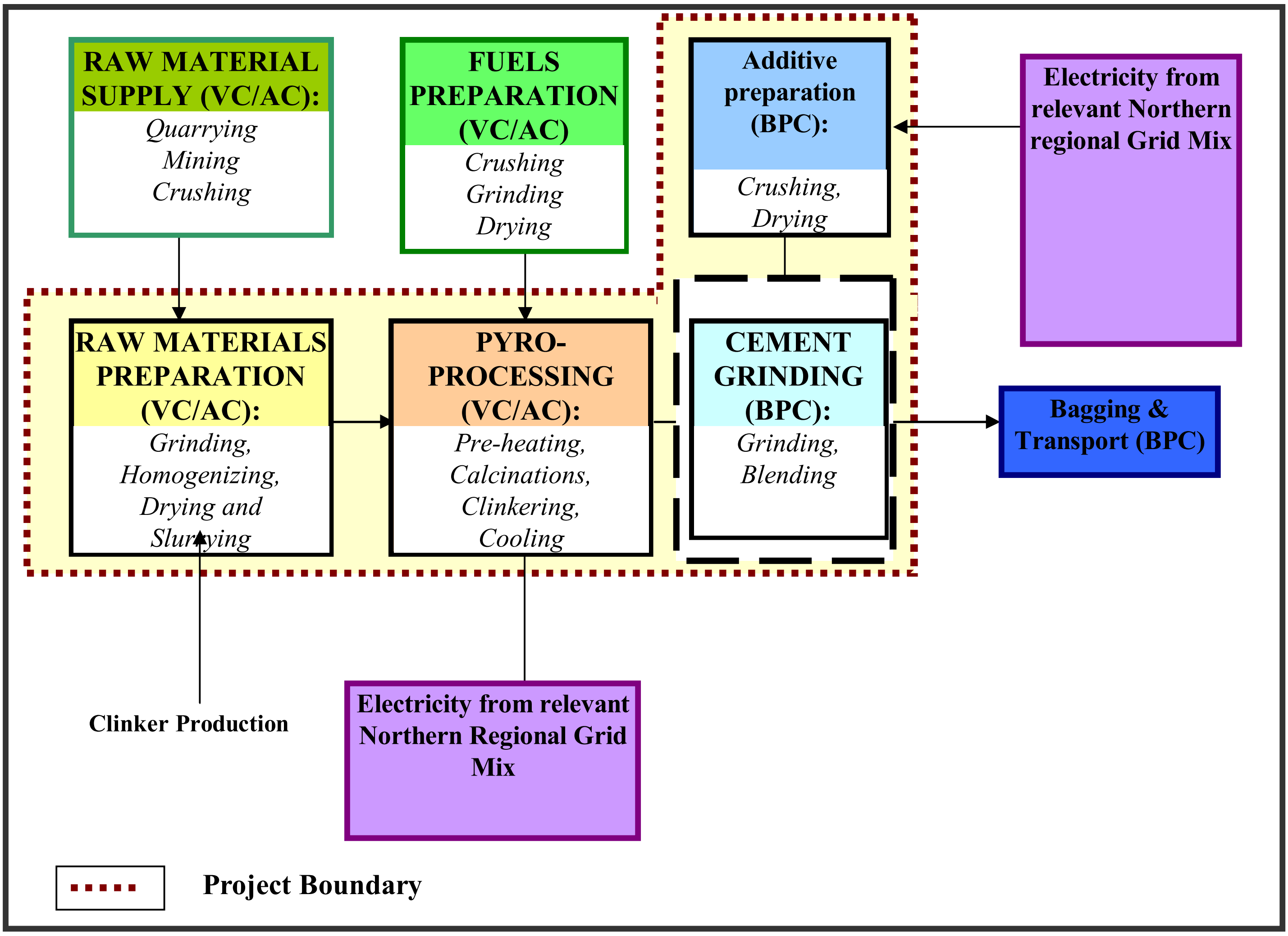
- Power generation in the grid connected to Birla Plus Cement

- Onsite power generation which includes Captive coal based Thermal Power plant at Birla Plus cement

The project boundary defined above takes into account the following emission sources

- *Direct emissions at the cement plant due to fuel combustion for:*
  - *Firing the kiln (including supplemental fuels used in the precalciner);*
  - *Processing (including drying) of solid fuels, raw materials, and additives;*
  - *On-site generation of electricity from captive coal based thermal power plant.*
- *Direct emissions due to calcination of limestone (i.e. calcium carbonate and magnesium carbonate, if present in the raw meal).*
- *Indirect emissions from fossil fuel combustion in power plants in the grid due to electricity use at the cement plant, including electricity consumption for:*
  - *Crushing and grinding the raw materials used for clinker production;*
  - *Driving the kiln and kiln fans;*
  - *Finish grinding of cement;*
  - *Processing of additives."*

The project activity installed in BPC, Bhatinda; which is the grinding unit of the Grasim Industries Limited. The BPC Bhantida is receiving clinker from the Vikram Cement (VC) and Aditya Cement (AC); cement plant of same group of industry and are considered in the project boundary. The diagrammatic representation of the cement process and the project boundary is illustrated below which includes all anthropogenic emissions by sources of GHG under control of the project proponent which are significant and reasonably attributable to the project activity.



Transport related emissions for the delivery of additional additives have been included in the emissions related to the project activity as leakage. Emissions reductions from transport of raw materials for clinker production are not taken into account as a conservative simplification.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

>>

Date of completing the final draft of this baseline selection: 12/05/2006

Name of person/entity determining the baseline: BPC along with guidance from their consultants

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>> 01/07/2005

C.1.2. Expected operational lifetime of the project activity:

>> 25 y 0 m

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>> The crediting period will start from the date of registration of the project activity. For the estimation of emission reductions the 01/04/2007 is taken as the starting date of project activity.

C.2.2.2. Length:

>> 10 y 0 m

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

>> **Title:** Consolidated monitoring methodology for increasing the Blend in cement production (ACM0005)-ver 03

Approach: Existing actual or historical emissions, as applicable; [as per 48 (a) of CP 7/17]

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

>> This methodology is applicable to projects that increase the share of additives (i.e. reduce the share of clinker) in the production of cement types beyond current practices in the region/country. BPC's project activity increases the share of additives in PPC beyond current practices in the region and BPC's project activity meets all the applicability conditions of the consolidated methodology, Hence the consolidated monitoring methodology for increasing the blend in cement production is appropriate for BPC's project activity.

The applicability conditions of methodology are already discussed in Section B.1.1.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	$InCao_y$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/- 3%. Calibration and monitoring Procedure: As per ISO 9001 Data archived: Crediting period + 2 years*
2	$OutCao_y$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/- 3%. Calibration and monitoring Procedure: As per ISO 9001 Data archived: Crediting period + 2 years*

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
3	$InMgo_y$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/- 3%.* *Calibration and monitoring Procedure: As per ISO 9001* *Data archived: Crediting period + 2 years*
4	$OutMgo_y$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/- 3%.* *Calibration and monitoring Procedure: As per ISO 9001* *Data archived: Crediting period + 2 years*
5	Quantity of clinker raw material	Plant Records	Kilo Tonnes	M	Annually	100%	Electronic	*Measured from the kiln feed counter.* *Instrument: Weigh bridge* *Accuracy: +/- 3%* *Calibration: As per ISO-9001 procedure* *Data archived: Crediting period + 2 years*
6	$CLNK_y$	Plant Records	Kilo	M	Annually	100%	Electronic	*Measured from weigh bridge.*

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
			Tonnes of clinker					*Accuracy: +/- 2%* *Calibration: As per ISO-9001 procedure* *Data archived: Crediting period + 2 years*
7	FF_{i_y}	Plant Records	tonnes of fuel i	M	Annually	100%	Electronic	*Instrument: Weigh bridge* *Accuracy: +/- 2%* *Calibration: As per ISO procedure* *Data archived: Crediting period + 2 year*
8	EFF_i	IPCC	tCO_2/tonne of fuel i	C/M	Annually	100%	Electronic	*IPCC default values* *Uncertainty: Low*
9	$PELE_{grid\_CLNK,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
10	EF_{grid_BSL}	-	tCO2/MWh	C	Annually	100%	Electronic	*Calculated as per latest version of consolidated methodology ACM002.*
11	$PELE_{sg\_CLNK,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration*

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
								procedure with the calibrated electrical meter. *Data archived: Crediting period + 2 year*
12	EF_{sg_y}	Plant Records/IPCC	tCO2/MWh	C	Monthly	100%	Electronic	*IPCC default values used for emission factors.* *Uncertainty: Low* *Data archived: Crediting period + 2 year*
13	$ADD_{,y}$ Quantity of additives	Plant Records	Kilo Tonnes	M	Monthly	100%	Electronic	*Instrument: Weigh bridge* *Accuracy: +/- 2%* *Calibration: As per ISO procedure* *Data archived: Crediting period + 2 year*
14	$PELE_{grid\_BC,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
15	$PELE_{sg\_BC,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical*

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
								meter. *Data archived: Crediting period + 2 year*
16	$PELE_{grid\_ADD,}$	Plant Records	MWh	M	Monthly	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
17	$PELE_{sg\_ADD,BS L}$	Plant Records	MWh	M	Monthly	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
18	$F_{i,j,y}$	Plant records	tonnes of fuel I	M	Monthly	100%	Electronic	*Instrument: Weigh bridge* *Accuracy: +/- 2%* *Calibration: As per ISO procedure* *Data archived: Crediting period + 2 year*
19	$COEF_{I,j,,y}$	IPCC / Plant Records	tCO_2/tonne of fuel i	C/M	Annually	100%	Electronic	*IPCC default values* *Uncertainty: Low*
20	$GEN_{I,y}$	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter*

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
								Accuracy: +/- 1% *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
21	$PE_{calcin,y}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*
22	$PE_{fossil\_fuel,y}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*
23	$PE_{ele\_grid\_CLNK,y}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*
24	$PE_{ele\_sg\_CLNK,y}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*
25	$PE_{ele\_grid\_BC,y}$	Plant Records	tCO_2/tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
26	$PE_{ele\_sg\_BC,y}$	Plant Records	tCO_2/tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
27	PE	Plant Records	tCO_2/tonne	C	Annually	100%	Electronic	*Calculated*

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	ele_grid_ADD,y		of blended cement					
28	PE ele_sg_ADD,y	Plant Records	tCO_2/tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
29	$P_{blend,y}$	Plant Records	Tonne of clinker/ tonne of blended cement	C	Annually	100%	Electronic	*Calculated*

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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

- Emissions from calcinations of limestone;
- Emissions from combustion of fossil fuel and electricity for clinker production and processing of raw material;
- Emissions from electricity used for additives preparation and grinding of cement.

In determining the emissions reduction there are 3 possibilities:

(i) Emissions per tonne of clinker during the crediting period are less than baseline emissions per tonne of clinker ($PE_{Clinker,y} < BE_{Clinker}$); or

(ii) Baseline and year y emissions per tonne of clinker are equal ($PE_{Clinker,y} = BE_{Clinker}$); or

(iii) Emissions per tonne of clinker in year y are greater than the baseline emissions per tonne of clinker ($PE_{Clinker,y} > BE_{Clinker}$).

As this methodology is restricted to increase in percentage of blend only and not to efficiency improvements, in case (i), the baseline value is substituted for the project activity value. That is, if emissions per tonne of clinker are lower during the crediting period, then the lower value is taken. The choice of the lower value aims at avoiding potential perverse incentives for project participants to increase the energy intensity of clinker production as a result of the project activity (e.g. by switching from less carbon-intensive energy sources to more carbon intensive energy sources).

In case (iii) the emissions per tonne of clinker are higher during the crediting period than the baseline. This could be due to declining efficiency or a fuel switch or some other reason. In this case, there is a possibility that project activity emissions exceed the baseline emissions for some years in the crediting period. In this case, the project does not get new credits for emissions reduction till the net balance for the project is positive. In the case that negative overall emission reductions arise in a year, ERs 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.

$$\mathbf{PE_{BC,y} = [PE_{clinker,y} * P_{Blend,y}] + PE_{ele\_ADD\_BC,y}} \quad (1)$$

Where:

$PE_{BC,y}$ = CO_2 emissions per tonne of BC in the project activity plant in year y (tCO_2/tonne BC)

$PE_{clinker,y}$ = CO_2 emissions per tonne of clinker in the project activity plant in year y (t CO_2/tonne clinker) and defined below

$P_{Blend,y}$ = Share of clinker per tonne of BC in year y (tonne of clinker/tonne of BC)

$PE_{ele\_AD,D\_BC,y}$ = Electricity emissions for BC grinding and preparation of additives in year y (tCO2/tonne of BC)

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

$$\mathbf{PE_{clinker,y} = PE_{calcin,y} + PE_{fossil\_fuel,y} + PE_{ele\_grid\_CLNK,y} + PE_{ele\_sg\_CLNK,y}} \quad (1.1)$$

Where:

$PE_{clinker,y}$ = Emissions of CO_2 per tonne of clinker in the project activity plant in year y (t CO_2/tonne clinker)

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

$PE_{ele\_grid\_CLNK,y}$ = Grid electricity emissions for clinker production per tonne of clinker in year y (t CO_2/tonne clinker)

$PE_{ele\_sg\_CLNK,y}$ = Emissions from self-generated electricity per tonne of clinker production in year y (t CO_2/tonne clinker)

$$\mathbf{PE_{calcin,y} = 0.785*(OutCaO_y - InCaO_y) + 1.092*(OutMgO_y - InMgO_y) / [CLNK_y * 1000]} \quad \mathbf{(1.1.1)}$$

Where:

$PE_{calcin,y}$ = Emissions from the calcinations of limestone (tCO_2/tonne clinker)

0.785 = Stoichiometric emission factor for CaO (tCO_2/t CaO)

1.092 = Stoichiometric emission factor for MgO (tCO_2/t MgO)

$InCaO_{,y}$ = CaO content (%) of the raw material * raw material quantity (tonnes)

$OutCaO_{,y}$ = CaO content (%) of the clinker * clinker produced (tonnes)

$InMgO_{,y}$ = MgO content (%) of the raw material * raw material quantity (tonnes)

$OutMgO_{,y}$ = MgO content (%) of the clinker * clinker produced (tonnes)

$$\mathbf{PE_{fossil\_fuel,y} = [\sum FF_{i\_,y} * EFF_i] / CLNK_{,y} * 1000} \quad \mathbf{(1.1.2)}$$

Where:

$FF_{i\_,y}$ = Fossil fuel of type i consumed for clinker production in year y (tonnes of fuel i)

EFF_i = Emission factor for fossil fuel i (tCO_2/tonne of fuel)

$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

$$\mathbf{PE_{ele\_grid\_CLNK,y} = [\ PELE_{grid\_CLNK,y} * EF_{grid\_y}] / [CLNK_y * 1000]} \quad \textbf{(1.1.3)}$$

Where:

$PELE_{grid\_CLNK,y}$ = 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)

$$\mathbf{PE_{elec\_sg\_CLNK,y} = [PELE_{sg\_CLNK\ ,y} * EF_{sg\_y}] /[CLNK_y * 1000]} \quad \textbf{(1.1.4)}$$

Where:

$PELE_{sg\_CLNK,y}$ = 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)

$$\mathbf{PE_{ele\_ADD\_BC,y} = PE_{ele\_grid\_BC,y} + PE_{ele\_sg\_BC,y} + PE_{ele\_grid\_ADD,y} + PE_{ele\_sg\_ADD,y}} \quad \textbf{(1.2)}$$

Where:

$PE_{ele\_grid\_BC}$ = Grid electricity emissions for BC grinding in year y (tCO_2/tonneof BC)

$PE_{ele\_sg\_BC}$ = Emissions from self generated electricity for BC grinding in year y (tCO_2/tonne of BC)

$PE_{ele\_grid\_ADD}$ = Grid electricity emissions for additive preparation in year y (tCO_2/tonne of BC)

$PE_{ele\_sg\_ADD}$ = Emissions from self generated electricity additive preparation in year y (tCO_2/tonne of BC)

$$\mathbf{PE_{ele\_grid\_BC,y} = [\ PELE_{grid\_BC,y} * EF_{grid\_BSL,y}] /[BC_y * 1000]} \quad \textbf{(1.2.1)}$$

Where :

$PELE_{grid\_BC,y}$ = Baseline grid electricity for grinding BC (MWh)

EF_{grid_y} = Grid emission factor in year y (t CO_2/MWh)

BC_y = Annual production of BC in year y (kilotonnes of BC)

$$\mathbf{PE_{elec\_sg\_BC,y} = [PELE_{sg\_BC,y} * EF_{sg\_y}] / [BC_y * 1000]} \quad \textbf{(1.2.2)}$$

Where:

$PELE_{sg\_BC,y}$ = 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 = Annual production of BC in year y (kilotonnes of BC)

$$\mathbf{PE_{ele\_grid\_ADD} = [\ PELE_{grid\_ADD} * EF_{grid\_y}] / [BC_y * 1000]} \quad \textbf{(1.2.3)}$$

Where:

$PELE_{grid\_ADD}$ = Grid electricity for grinding additives (MWh)

EF_{grid_y} = Grid emission factor in year y (t CO_2/MWh)

BC_y = Annual production of BC in year y (kilotonnes of BC)

$$\mathbf{PE_{elec\_sg\_ADD,y} = [PELE_{sg\_ADD,y} * EF_{sg\_y}] / [BC_y * 1000]} \quad \textbf{(1.2.4)}$$

Where :

$PELE_{sg\_ADD,y}$ = 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 = Annual production of BC in year y (kilotonnes of BC)

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project

boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	$InCaO_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/-3%. Calibration and monitoring Procedure: As per ISO 9001 Data archived: Crediting period + 2 years*
2	$OutCaO_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/-3%. Calibration and monitoring Procedure: As per ISO 9001 Data archived: Crediting period + 2 years*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
3	$InMgO_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/-3%. Calibration and monitoring Procedure: As per ISO 9001 Data archived: Crediting period + 2 years*
4	$OutMgO_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	*Estimated from lab experiment of average daily sample. The accuracy of meter is +/-3%. Calibration and monitoring Procedure: As per ISO 9001 Data archived: Crediting period + 2 years*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
5	Quantity of clinker raw material	Plant Records	Kilo Tonnes	M	Annually	100%	Electronic	*Measured from the kiln feed counter.* *Instrument: Weigh bridge* *Accuracy: +/- 3%* *Calibration: As per ISO-9001 procedure* *Data archived: Crediting period + 2 years*
6	$CLNK_{BSL}$	Plant Records	Kilo Tonnes of clinker	M	Annually	100%	Electronic	*Measured from weigh bridge.* *Accuracy: +/- 2%* *Calibration: As per ISO-9001 procedure* *Data archived: Crediting period + 2 years*
7	FF_{i_BSL}	Plant Records	tonnes of fuel i	M	Annually	100%	Electronic	*Instrument: Weigh bridge* *Accuracy: +/- 2%* *Calibration: As per ISO procedure* *Data archived: Crediting period + 2 year*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
8	EFF_i	IPCC	tCO_2/tonne of fuel i	C/M	Annually	100%	Electronic	*IPCC default values* *Uncertainty: Low*
9	$BELE_{grid\_CLNK,BS L}$	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
10	EF_{grid_BSL}	-	tCO_2/MWh	C	Once at the beginning of the crediting period	100%	Electronic	*Calculated as per latest version of consolidated methodology ACM002.*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
11	$BELE_{sg\_CLNK,BSL}$	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
12	EF_{sg_BSL}	Plant Records/IPCC	tCO_2/MWh	C	Annually	100%	Electronic	*IPCC default values for emission factors* *Uncertainty: Low* *Data archived: Crediting period + 2 year*
13	$ADD_{,BSL}$ Quantity of additives	Plant Records	Kilo Tonnes	M	Annually	100%	Electronic	*Instrument: Weigh bridge* *Accuracy: +/- 2%* *Calibration: As per ISO procedure* *Data archived: Crediting period + 2 year*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
14	BELE grid_BC,BS L	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
15	BELE sg_BC,BS L	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
16	$BELE_{grid\_ADD,}$	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
17	$BELE_{sg\_ADD,BS L}$	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
18	$F_{i,j,BSL}$	Plant records	tonnes of fuel i	M	Annually	100%	Electronic	*Instrument: Weigh bridge* *Accuracy: +/- 2%* *Calibration: As per ISO procedure* *Data archived: Crediting period + 2 year*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
19	$COEF_{I,j,BSL}$	IPCC / Plant Records	tCO_2/tonne of fuel i	C/M	Annually	100%	Electronic	*IPCC default values* *Uncertainty: Low*
20	$GEN_{I,BSL}$	Plant Records	MWh	M	Annually	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2 year*
21	$BE_{calcin,BS L}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*
22	$BE_{fossil\_fuel,BS L}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*
23	$BE_{ele\_grid\_CLNK,BS L}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*
24	$BE_{ele\_sg\_CLNK,BS L}$	Plant Records	tCO_2/tonne of clinker	C	Annually	100%	Electronic	*Calculated*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
25	$BE_{ele\_grid\_BC,BSL}$	Plant Records	tCO_2/tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
26	$BE_{ele\_sg\_BC,BSL}$	Plant Records	tCO_2/tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
27	$BE_{ele\_grid\_ADD,BSL}$	Plant Records	tCO_2/tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
28	$BE_{ele\_sg\_ADD,BSL}$	Plant Records	tCO_2/tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
29	$B_{blend,y}$	Plant Records	Tonne of clinker/ tonne of blended cement	C	Annually	100%	Electronic	*Calculated*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
30	$A_{blend,y}$	Plant Records	Tonne of additive/ tonne of blended cement	C	Annually	100%	Electronic	*Calculated*
EF_{grid_BSL}								
31	$EF_{OM,\ y}$	Published data from electricity board	tCO_2/MWh	C	Once at the beginning of the crediting period	100%	Electronic	Calculated as Step 1 of ACM0002
32	$EF_{\ BM,\ y}$	Published data from electricity board	tCO_2/MWh	C	Once at the beginning of the crediting period	100%	Electronic	Calculated as Step 2 of ACM0002

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
33	$F_{i,y}$	Published data from electricity board	Tonnes	C	Once at the beginning of the crediting period	100%	Electronic	Calculated based on the Total power generation, Average Net Calorific Value of the fuel used and the Designed
34	$COEF_i$	IPCC/local	tCO_2/ton of fuel	Standard / calculated	Once at the beginning of the crediting period	100%	Electronic	Calculated based on the IPCC default value of the Emission Factor, Net Calorific Value and Oxidation Factor of the Fuel used by the power plants of the state grid
35	$GEN_{j,y}$	Published data from electricity board	MWh / annum	M	Once at the beginning of the crediting period	100%	Electronic	Obtained from authentic and latest local statistics

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>> The formulae used for estimation of the anthropogenic emissions by sources of greenhouse gases of the baseline scenario are as under

$$BE_{BC,y} = [BE_{clinker} * B_{Blend,y}] + BE_{ele\_ADD\_BC} \quad (2)$$

Where:

$BE_{BC,y}$ = Baseline CO_2 emissions per tonne of blended cement type (BC) (tCO_2/tonne BC)

$BE_{clinker}$ = CO_2 emissions per tonne of clinker in the baseline in the project activity plant (t CO_2/tonne clinker) and defined below

$B_{Blend,y}$ = Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne of BC)

$BE_{ele\_ADD\_BC}$ = Baseline electricity emissions for BC grinding and preparation of additives (tCO_2/tonne of BC)

CO_2 per tonne of clinker in the project activity plant in the baseline is calculated as below:

$$BE_{clinker} = BE_{calcin} + BE_{fossil\_fuel} + BE_{ele\_grid\_CLNK} + BE_{ele\_sg\_CLNK} \quad (2.1)$$

Where:

$BE_{clinker}$ = Baseline emissions of CO_2 per tonne of clinker in the project activity plant (tCO_2/tonne clinker)

BE_{calcin} = Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (t CO_2/tonne clinker)

BE_{fossil_fuel} = Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (t CO_2/tonne clinker)

$BE_{ele\_grid\_CLNK}$ = Baseline grid electricity emissions for clinker production per tonne of clinker (t CO_2/tonne clinker)

$BE_{ele\_sg\_CLNK}$ = Baseline emissions from self generated electricity for clinker production per tonne of clinker (t CO_2/tonne clinker)

$$BE_{calcin} = [0.785*(OutCaO - InCaO) + 1.092*(OutMgO - InMgO)] / [CLNK_{BSL} * 1000] \quad (2.1.1)$$

Where:

BE_{calcin} = Emissions from the calcinations of limestone (tCO_2/tonne clinker)

0.785 = Stoichiometric emission factor for CaO (tCO_2/t CaO)

1.092 = Stoichiometric emission factor for MgO (tCO_2/t MgO)

InCaO = CaO content (%) of the raw material * raw material quantity (tonnes)

OutCaO = CaO content (%) of the clinker * clinker produced (tonnes)

InMgO = MgO content (%) of the raw material * raw material quantity (tonnes)

OutMgO = MgO content (%) of the clinker * clinker produced (tonnes)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{fossil\_fuel} = [\sum FF_{i\_BSL} * EFF_i] / [CLNK_{BSL} * 1000]$ **(2.1.2)**

Where:
FF_{i_BSL} = Fossil fuel of type i consumed for clinker production in the baseline (tonnes of fuel i)
EFF_i = Emission factor for fossil fuel i (t CO_2/tonne of fuel)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{ele\_grid\_CLNK} = [BELE_{grid\_CLNK} * EF_{grid\_BSL}] / CLNK_{BSL} * 1000$ **(2.1.3)**

Where:
$BELE_{grid\_CLNK}$ = Baseline grid electricity for clinker production (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)
With reference to ACM0002 baseline emissions are estimated as under

Calculation of electricity baseline emission factor

The electricity baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source (where available) and made publicly available.

Step 1: Calculate the Operating Margin emission factor(s)

Out of the four methods mentioned in ACM0002, simple OM approach has been chosen for calculations since the low-cost/must run resources constitute less than 50% of the total grid generation in the state grid mix. Simple OM factor is calculated as under.

$EF_{OM, simple, y}$ is calculated as the average of the most recent three years

$$EF_{OM,simple,y} = \sum_{i,j} F_{i,j,y} \times COEF_{i,j} / \sum_{j} GEN_{j,y} \qquad \textbf{E.1}$$

Where

$COEF_{i,j}$ - is the CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), calculated as given below and

$GEN_{j,y}$ - is the electricity (MWh) delivered to the grid by source j

$F_{i,j,y}$ - is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y, calculated as given below

j - refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid

The Fuel Consumption $F_{i,j,y}$ is obtained as

$$\sum_{i} F_{i,j,y} = \left(\sum_{j} GEN_{j,y} \times 860 \Big/ NCV_i \times E_{i,j} \right) \qquad \textbf{E.2}$$

Where

$GEN_{j,y}$ - is the electricity (MWh) delivered to the grid by source j

NCV_i - is the net calorific value (energy content) per mass or volume unit of a fuel i

$E_{i,j}$ - is the efficiency (%) of the power plants by source j

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i \qquad \textbf{E.3}$$

Where

NCV_i -is the net calorific value (energy content) per mass or volume unit of a fuel i

$EFCO_{2,i}$ -is the CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ -is the oxidation factor of the fuel

Step 2: Calculation of the Build Margin emission factor ($EF_{BM,y}$)

It is calculated as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of grid, as follows:

$$EF_{BM,y} = \sum_{i,m} F_{i,m,y} \times COEF_{i,m} / \sum_{m} GEN_{m,y} \qquad \textbf{E.4}$$

Where

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ - are analogous to the variables described for the simple OM method above for plants m.

Considered calculations for the Build Margin emission factor $EF_{BM,y}$ as ex ante based on the most recent information available on plants already built for sample group m of state grid at the time of PDD submission. The sample group m consists of the 20 % of power plants supplying electricity to grid that have been built most recently, since it comprises of larger annual power generation. (Refer Enclosure- 5.3)

Further, none of the power plant capacity additions in the sample group have been registered as CDM project activities.

Step 3: Calculate the electricity baseline emission factor (EF_y)

It is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM, simple, y}$) and the Build Margin emission factor ($EF_{BM, y}$):

$$EF_y = W_{OM} \times EF_{OM,Simple,y} + W_{BM} \times EF_{BM,y} \qquad \textbf{E.5}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $W_{OM} = W_{BM} = 0.5$), and $EF_{OM, Simple, y}$ and $EF_{BM, y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.

$$BE_y = EF_y \times EG_y \qquad \textbf{E.6}$$

Where

BE_y - are the baseline emissions due to displacement of electricity during the year y in tons of CO_2

EG_y- is the net quantity of electricity generated by the project activity during the year y in MWh, and

EF_y- is the CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh.

$$\mathbf{BE_{elec\_sg\_CLNK} = [BELE_{sg\_CLNK} * EF_{sg\_BSL}] / [CLNK_{BSL} * 1000]} \qquad \textbf{(2.1.4)}$$

Where:

$BELE_{sg\_CLNK}$ = Baseline self generation of electricity for clinker production (MWh)

EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)

$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$$\mathbf{BE_{ele\_ADD\_BC} = BE_{ele\_grid\_BC} + BE_{ele\_sg\_BC} + BE_{ele\_grid\_ADD} + BE_{ele\_sg\_ADD}} \qquad \textbf{(2.2)}$$

Where:

$BE_{ele\_grid\_BC}$ = Baseline grid electricity emissions for BC grinding (tCO_2/tonne of BC)

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

$$\mathbf{BE_{ele\_grid\_BC} = [\, BELE_{grid\_BC} * EF_{grid\_BSL}] / [BC_{BSL} * 1000]} \qquad \textbf{(2.2.1)}$$

Where:
$BELE_{grid\_BC}$ = Baseline grid electricity for grinding BC (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$$\mathbf{BE_{elec\_sg\_BC} = [BELE_{sg\_BC} * EF_{sg\_BSL}] / [BC_{BSL} * 1000]} \qquad \textbf{(2.2.2)}$$

Where:
$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding BC (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$$\mathbf{BE_{ele\_grid\_ADD} = [\, BELE_{grid\_ADD} * EF_{grid\_BSL}] / [BC_{BSL} * 1000]} \qquad \textbf{(2.2.3)}$$

Where:
$BELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$$\mathbf{BE_{elec\_sg\_ADD} = [BELE_{sg\_ADD} * EF_{sg\_BSL}] / [BC_{BSL} * 1000]} \qquad \textbf{(2.2.4)}$$

Where:
$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding additives (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Not applicable.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>> Not applicable

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	Fuel consumption for the vehicle per kilometre (TF_{cons})	Plant Records	Kg of fuel / Kilometer	C	Annually	100%	Electronic	*Data will be provided by transporters and verified by manufacturer data.*
2	Distance between the source of additive and project activity plant (D_{add_source})	Plant Records	Km	M	Per Trip	100%	Electronic	*Distance between the power plant and the BPC. Will not change greatly. Source can be verified by additive receipt data.*
3	Quantity of additive carried in one trip per vehicle (Q_{add})	Plant Records	Tonnes of additive / Vehicle	M	Per Trip	100%	Electronic	*Presently the fly ash transportation is in pipeline. If vehicle will e used then Vehicle types will not vary. Can be readily verified by transporter records.*
4	Emission factor for transport fuel (TEF)	IPCC	Kg CO_2/Kg of fuel	E	Annually	100%	Electronic	IPCC default values will be used.
5	Electricity consumption for conveyor system for additives ($ELE_{conveyor\_ADD}$)	Plant Records	MWh	M	Monthly	100%	Electronic	*Instrument: Electrical meter* *Accuracy: +/- 1%* *Calibration: Internal calibration procedure with the calibrated electrical meter.* *Data archived: Crediting period + 2*

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
								year
6	Grid electricity emission factor (EF_{grid})	National Grid / Plant Data	tonnes of CO_2/MWh	C	Annually	100%	Electronic	Calculated AS per ACM002 for the regional grid.
7	Tonnes of additives in year y / total additional additives used in year (α_y)	Plant Records	Tonnes of fly ash	M/C	Annually	100%	Electronic	Can be verified from the signed contracts between the power plant and BPC.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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

$$L_{add\_trans} = [(TF_{cons} * D_{add\_source} * TEF) * 1/Q_{add} * 1/1000 + (ELE_{conveyor\_ADD} * EF_{grid}) * 1/ADD_y] \quad (3)$$

Where:

L_{add_trans} = Transport related emissions per tonne of additives (t CO_2/tonne of additive)

TF_{cons} = Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre)

D_{add_source} = Distance between the source of additive and the project activity plant (km)

TEF = Emission factor for transport fuel (kg CO_2/kg of fuel)

$ELE_{conveyor\_ADD}$ = Annual Electricity consumption for conveyor system for additives (MWh)

EF_{grid} = Grid electricity emission factor (tonnes of CO_2/MWh)

Q_{add} = Quantity of additive carried in one trip per vehicle (tonnes of additive)

ADD_y = Annual consumption of additives in year y. (t of additives)
And leakage emissions per tonne of BC due to additional additives are determined by

$$L_y = L_{add\_trans} * [A_{blend,y} - P_{blend,y}] * BC_y \quad \textbf{(3.1)}$$

Where:

Ly = Leakage emissions for transport of additives (kilotonnes of CO2)

BCy = Production of BC in year y (kilotonnes of BC)

Ablend,y = Baseline benchmark share of additives per tonne of BC updated for year y (tonne of additives/tonne of BC)

Pblend,y = Share of additives per tonne of BC in year y (tonne of additives/tonne of BC)

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

$$\alpha_y = \text{x tonnes of additives in year y / total additional additives used in year y} \quad \textbf{(4)}$$

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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

Emission reductions by the project activity

$$ER_y = \{ [BE_{BC,y} – PE_{BC,y}] * BC_y + L_y \} * (1 – \alpha_y) \quad (5)$$

ER_y = Emissions reductions in year y due to project activity (thousand tonnes of CO_2)

$BE_{BC,y}$ = Baseline emissions per tonne of BC (t CO_2/tonnes of BC)

$PE_{BC,y}$ = Project emissions per tonne of BC in year y (t CO_2/tonnes of BC)

BC_y = BC production in year y (thousand tonnes)

L_y = Leakage emissions for transport of additives (kilotonnes of CO_2)

α_y = x tonnes of additives in year y / total additional additives used in year y

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
TableD.2.1.1, ID numbers 1-29	Low-medium	*These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross – checking local plant data with other internal company reports. Local data and where applicable IPCC data will be used for the calculations. Independent agency verification will also be used.* *All units (AC/VC/BPC) have ISO 9001/ISO 14001 certification. The ISO9001/ISO 14001 systems include procedures for:* *- Training and monitoring of personnel* *- Calibration and maintenance of monitoring equipment* *- Emergency procedures* *- Record and data handling* *- Uncertainty data adjustment* *- Internal Audit* *Grid electricity meters are provided by electricity authorities and cannot be tampered with. Internal electricity meters will be subject to calibration.* *Laboratory test equipment for MgO and CaO contents is subject to regular calibration* *No data is expected to require adjustment. There is no way of measuring the separate grid and captive supply to the different parts of the plant. (Consumption in Clinkerisation and BC grinding). However the total supply of electricity to the kiln and grinding units is metered as is total grid and captive supply. Therefore it will be taken that the share of grid and captive electricity to all elements is equal. This is reasonable.* *The accuracy of weighbridge, electricity meters and CaO and MgO laboratory is ensured through calibration undertaken as part of ISO 9001/ISO14001 requirements. The CaO and MgO meter has an accuracy+/-3%. The weighbridge has an accuracy of +/- 2%. The electricity meters have an accuracy of +/- 1%..*

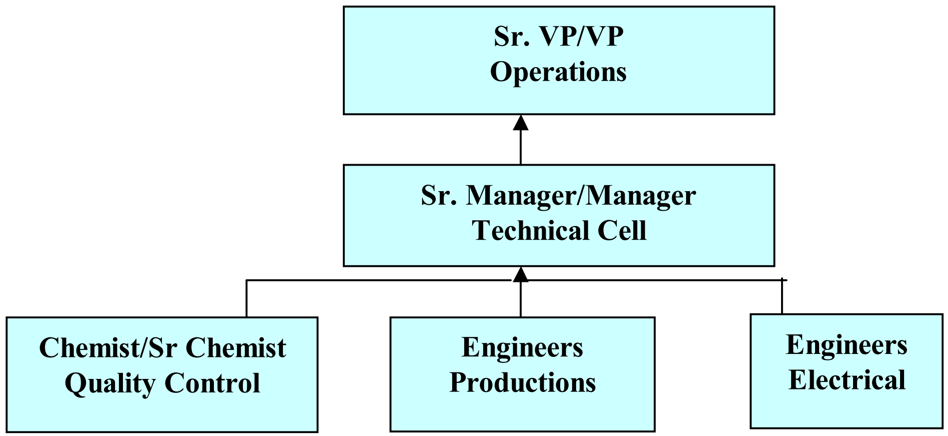
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
TableD.2.1.3, ID numbers 1-34	Low-medium	*These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross – checking local plant data with other internal company reports. Local data and where applicable IPCC data will be used for the calculations. Independent agency verification will also be used.* *All units (AC/VC/BPC) have ISO 9001/ISO 14001 certification. The ISO9001/ISO 14001 systems include procedures for:* *- Training and monitoring of personnel* *- Calibration and maintenance of monitoring equipment* *- Emergency procedures* *- Record and data handling* *- Uncertainty data adjustment* *- Internal Audit* *Grid electricity meters are provided by electricity authorities and cannot be tampered with. Internal electricity meters will be subject to calibration.* *Laboratory test equipment for MgO and CaO contents is subject to regular calibration* *No data is expected to require adjustment. There is no way of measuring the separate grid and captive supply to the different parts of the plant. (Consumption in Clinkerisation and BC grinding). However the total supply of electricity to the kiln and grinding units is metered as is total grid and captive supply. Therefore it will be taken that the share of grid and captive electricity to all elements is equal. This is reasonable.* *The accuracy of weighbridge, electricity meters and CaO and MgO laboratory is ensured through calibration undertaken as part of ISO 9001/ISO14001 requirements. The CaO and MgO meter has an accuracy+/-3%. The weighbridge has an accuracy of +/- 2%. The electricity meters have an accuracy of +/- 1%.. The date for grid electricity emission factor is taken from the published sources of government/electricity boardt and the emission factors for the fuel used is taken from theI PCC.*

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
TableD.2.3, ID	*Numbers 1-6*	*Round trip distance will be cross-checked with evidence of origin and map references. Truck capacity and Fuel consumption data will originate from vehicle manufacturers and transporters.*

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>> BPC has implemented an operational and management structure in order to monitor emission reductions and any leakage effects, generated by the project activity. Emission monitoring and calculation procedure will follow the following organisational structure. All data and calculation formula required to proceed is given in the section D in PDD.

Organisational structure for monitoring plan



Monitoring and calculation activities and responsibility

Monitoring and calculation activities	Procedure and responsibility
Data source and collection	Data is taken from the purchase, materials and accounting system. Most of the data is available in ISO 9001 quality management system.
Frequency	Monitoring frequency should be as per section D of PDD.
Review	All received data is reviewed by respective departments. Electrical data from engineers of electrical department, Lab data from chemist/sr chemist of quality control department and related with clinker production etc from the production engineers.
Data compilation	All the data is compiled and stored in production department.
Emission calculation	Emission reduction calculations will be done annual based on the data collected. Engineers of production department will do the calculations

Review	Sr. Manager/ Manager, Production will review the calculation.
Emission data review	Final calculations is reviewed and approved by VP/EVP Operations.
Record keeping	All calculation and data record will be kept with the Production.

The senior VP/VP will be responsible for the monitoring and measurement of the data required to undertake the CDM project. The production department at each plant will be responsible for archiving and reporting of the data required to undertake the CDM project.

Data required to monitor leakage will also be archived at each plant for 12 years. The collated data will be transmitted in electronic format to the corporate office in MUmbai.

D.5 Name of person/entity determining the monitoring methodology:

>> Birla Plus cement along with guidance from their consultants

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>
Please refer Annex-3 of PDD for detailed calculations.

Sl. No.	Operating Years	Project Emission (tonnes of CO_2)
1.	2007-2008	708811
2.	2008-2009	683582
3.	2009-2010	672769
4.	2010-2011	666762
5.	2011-2012	661957
6.	2012-2013	661957
7.	2013-2014	661957
8.	2014-2015	661957
9.	2015-2016	661957
10.	2016-2017	661957
	Total	**6703666**

E.2. Estimated leakage:

>> The emission due to fuel use for the transport of Fly ash additive from offsite locations (Thermal power plants) to the project plant has been considered. There is no conveying system for additive transportation at offsite location. Please refer Annex-3 of PDD for detailed calculations.

Sl. No.	Operating Years	Leakage (tonnes of CO_2)
1.	2007-2008	15
2.	2008-2009	22
3.	2009-2010	23
4.	2010-2011	23
5.	2011-2012	23
6.	2012-2013	27
7.	2013-2014	25
8.	2014-2015	22
9.	2015-2016	23
10.	2016-2017	19
	Total	**222**

E.3. The sum of E.1 and E.2 representing the project activity emissions:

>> Net emissions by project activity (E1+E2) are over the 10-year crediting period.

Sl. No.	Operating Years	Total Project Activity emissions (tonnes of CO_2)
1.	2007-2008	708826
2.	2008-2009	683604
3.	2009-2010	672792
4.	2010-2011	666785
5.	2011-2012	661980
6.	2012-2013	661984
7.	2013-2014	661982
8.	2014-2015	661979
9.	2015-2016	661980
10.	2016-2017	657173
	Total	**6654644**

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

>>

Sl. No.	Operating Years	Baseline Emissions (tonnes of CO_2)
1.	2007-2008	753261
2.	2008-2009	747255
3.	2009-2010	741248
4.	2010-2011	734039
5.	2011-2012	728033
6.	2012-2013	722026
7.	2013-2014	716019
8.	2014-2015	708811
9.	2015-2016	701602
10.	2016-2017	694394
	Total	**7246688**

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

>>

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2007-2008	44435
2008-2009	63651
2009-2010	68456
2010-2011	67254
2011-2012	66053
2012-2013	60042
2013-2014	54037
2014-2015	46832
2015-2016	39622
2016-2017	32418
Total estimated reductions (tonnes of CO_2 e)	**542800**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions ((tonnes of CO_2 e)	**54280**

E.6. Table providing values obtained when applying formulae above:

>>

Years	Estimation of Project activity Emission reductions (tonnes of CO_2 e)	Estimation of baseline emission reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions in tonnes of CO_2 e
2007-2008	708811	753261	15	44435
2008-2009	683582	747255	22	63651
2009-2010	672769	741248	23	68456
2010-2011	666762	734039	23	67254
2011-2012	661957	728033	23	66053
2012-2013	661957	722026	27	60042
2013-2014	661957	716019	25	54037
2014-2015	661957	708811	22	46832

Years	Estimation of Project activity Emission reductions (tonnes of CO_2 e)	Estimation of baseline emission reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions in tonnes of CO_2 e
2015-2016	661957	701602	23	39622
2016-2017	661957	694394	19	32418
Total estimated reductions (tonnes of CO_2 e)	**6703666**	**7246688**	**222**	**542800**

Please refer to Enclosure – 4 of PDD for detailed calculations.

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>> The Ministry of Environment and Forests (MoEF), Government of India, under the Environment Impact Assessment Notification vide S.O. 60(E) dated 27/01/94 has listed a set of industrial activities in Schedule I[3] of the notification which for setting up new projects or modernization/ expansion will require environmental clearance and will have to conduct an Environment Impact Assessment (EIA) study. However, the project under consideration does not require any EIA to be conducted, as the activity is not included in Schedule I.

Article 12 of the Kyoto Protocol requires that a CDM project activity contribute to the sustainable development of the host country. Assessing the project activity's positive and negative impacts on the local environment and on society is thus a key element for each CDM project.

The CDM project activity developed by BPC's ensures maximum global and local benefits with respect to certain environmental & social issues and contributes marginally towards sustainable development. The project activity to utilize fly ash in cement manufacturing and thereby reducing clinker content per tonne of cement produced leads to many positive Environmental Impacts.

The reduction in clinker content per tonne of cement reduces environmental impacts related to clinkerisation, fly ash disposal and also conserves natural resources like limestone & non-renewable coal. The GHG emission reductions from project activity benefits the global environment and the local environment is benefited (due to the project activity) by natural resource conservation, good ambient quality maintenance etc.

Birla Plus Cement being an ISO 9001, ISO 14001, OHSAS 18001 certified organization has specialized environmental management systems & consistent evaluation of the impacts, key parameters have ensured that the company meets the environmental targets. The project activity is one such voluntary measure, which has positive long-term environmental impact. The environmental impact during the construction phase is regarded as temporary or short term and hence does not affect the environment significantly.

BPC has taken measures to minimise these adverse environmental effects:

• Air pollution control systems are in operation efficiently and the stack/ambient air quality norms are better than the standards laid down by Pollution Control Boards.

• The fly-ash is transported in closed pipe line to eliminate fugitive emissions in transportation.

• All the dry fly ash unloading points are covered and provided with dust collection systems for maintaining the Ambient Air Quality as per norms.

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[3] http://envfor.nic.in/legis/legis.html#H

The BPC's CDM project activity ensures maximum global and local benefits in relation to certain environmental and social issues and is a small step towards sustainable development. The project activity does not have any significant negative environmental impact at the site. The GHG emission reductions from project activity benefit the global environment.

The project activity has excellent environmental benefits in terms of reduction of carbon emissions, limestone resource conservation, coal / petcoke conservation, decreased environmental destruction and enhanced restoration, economical and social prosperity by opening avenues for investment in waste, etc.

The environmental benefits from the project activity are discussed in the table below:

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	REMARKS
A	CATEGORY: ENVIRONMENTAL – RESOURCE CONSERVATION	
1	**Limestone conservation:** The project activity reduces the quantum of limestone required per unit of cement produced.	The project activity is a step towards limestone and coal/ petcoke conservation.
2	**Coal / Petcoke conservation:** The project activity reduces specific electrical & thermal energy consumption for cement production and conserves the energy. By reducing the specific thermal energy, the project activity reduces an equivalent amount of coal / petcoke consumption per unit of cement produced that would have been required to cater to the baseline project option. By reducing the specific electrical energy, the project activity reduces an equivalent amount of coal consumption at the thermal power plants that would have been required in absence of project activity. The reduced electrical energy demand would also include the electricity loss during transmission and distribution. "Coal is a finite natural resource" used as fuel to generate power and for production processes. Since this project activity reduces its thermal energy demand it positively contributes towards conservation of coal and making coal available for other important applications.	
B	CATEGORY: ENVIRONMENTAL – AIR QUALITY	

1	**Global** By reducing the clinker content of the cement, the project activity reduces CO_2 emissions due to reduced manufacture of clinker required per unit of cement produced in the baseline. The CO_2 emissions reductions include emissions from the calcinations process, fuel combustion in clinkerisation at Vikram and Aditya cements.	The project activity reduces emission of CO_2 -a global entity.
2	**Local (Ambient)** Fly ash utilization by the project activity eliminates all the negative environmental impacts like air pollution caused due to fugitive emissions from fly ash dumped in the vicinity of the thermal power plants. Reduction in thermal energy consumption invariably reduces air pollution (caused by the SPM emissions from fuel combustion in the Pyro-processing). The project involves transportation & handling of fly ash where there are chances of fugitive dust emission at unloading and feeding points.	To control air pollution, the plant is equipped with Electro Static Precipitator (ESP) attached to kiln, raw grinding mill and also has bag filters installed to upkeep a clean environment. According to Central Pollution Control Board, the plant is required to meet the legal stack emission limit and the plant's stack emission levels are well under the limit. All care is taken to minimize fugitive emissions from fly ash handling through effective environmental programme like installing dust collectors at fly ash handling area, providing nose mask to the workers etc. The fly ash is brought from power plant in closed pipelines to avoid any spillage.

C	CATEGORY: ENVIRONMENTAL –WATER	
1	The project activity utilizes fly ash and eliminates all the negative environmental impacts like water pollution caused due to sanitary landfill leaching and fly ash dumping in the vicinity of the thermal power plants. **The project activity does not contribute to water pollution.**	The project activity contributes positive impacts to the water environment.

D	CATEGORY: ENVIRONMENTAL – LAND	
1 2	Reduction in specific limestone and coal consumption/ demand further reduces quarry/coal mining; raw material extraction, which leads to loss of biodiversity, land destruction and erosions arising from such activities. Fly ash disposal is one of the major environmental aspect of the thermal power plants in India. By utilizing large volumes of thermal power plant's fly-ash waste, the project activity eliminates all the negative environmental impacts related to fly ash disposal on soil/land. Land requirement for fly ash disposal is minimized. **There is no possible soil or land pollution arising due to project activity.**	The project activity leads to positive impact on Land environment.
E	CATEGORY: ENVIRONMENTAL – NOISE GENERATION	
1	**The project activity does not contribute to noise pollution.**	-
F	CATEGORY: SOCIAL	
1 2	**Mining Risks:** Quarry mining of limestone experiences landslides and destruction in the history of mining. Thus by less consumption of limestone with reduced clinker production the project activity would indirectly reduce chances of landslides and landscape destruction at mining sites. The adverse heath impacts caused from quarrying of materials on the mining persons, nearby habitats and ecosystem, would therefore be avoided. **Employment:** The project activity creates opportunity for employment of semi-skilled, unskilled, engaged in various activities. The project activity site is within the premises and there is no human displacement. Therefore no rehabilitation programme was needed.	The project is expected to bring positive changes in the life style and quality of life and reduce mining risks.

3	**Capacity Building** The project activity indirectly encourages development of waste management infrastructure and associated value chain between two different types of industries mutually befitting each other's operation. Thus the external activity of the project links two sectors of industries and expedites similar proactive actions from industries to find avenues and opportunities for economical exchange of waste products and decrease cost of waste management.	The project is expected to bridge two type of industries for mutual benefiting.
G	CATEGORY: ECOLOGY	
1	By fly ash utilization, the project activity has a beneficial impact on the flora, fauna in the vicinity of the thermal power plants.	-

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>> Project activity does not lead to any significant negative impact. Neither does the host country require EIA study to be conducted for this kind of projects. As stated above project activities not included under Schedule I of Environment Impact Assessment Notification of MoEF for environmental clearance of new projects or modification of old ones need not conduct the EIA.

SECTION G. Stakeholders' comments

>>

G.1. Brief description how comments by local stakeholders have been invited and compiled:

>> Stakeholder consultation is a important matter for an esteemed organisation, where comments on the project activity are invited from identified stakeholders with a view to maintain transparency in the activities of the project promoter and also assist to comply with applicable regulations. Representatives of BPC have already identified the relevant stakeholders and they have been consulting with them looking for their comments and approvals for the project activity. The necessary consultation is in the form of the oral and written documents. BPC has communicated to identified stakeholders about the project activity and asked for comments on the activity. This is a continuous process from the project proponent.

The project activity occurred at BPC's cement plant in Punjab. The project activity will reduce the use of thermal energy *i.e.* fossil fuel.

The various stakeholders identified for the project are as under.

- Elected body of representatives administering the local area (village Panchayat)
- Central & State Pollution Control Board
- Ministry of Environment & Forest (MoEF), Government of India
- PPC cement users/consumers
- Local population
- Equipment Suppliers

Stakeholders list includes both government and non-government parties, which are involved in the project at various stages. At the appropriate stage of the project development, stakeholders/ relevant bodies were involved to get the project clearance.

Stakeholders Involvement

The success of the project activity depends upon the acceptance and usage level of PPC by consumers, masons, engineers, architects, dealers and builders. Hence they form the key stakeholders of the project activity. Birla Plus Cement also plans to increase the PPC production during the credit period, hence the importance of these stakeholders is further increased. Birla Plus cement appraises the consumers, masons, dealers, architects about its PPC product- benefits, technical reliability, and the latest developments in the PPC scenario by conducting various seminars, training / awareness programmes, on-field testing & experiments and most importantly having one to one meeting.

Local population comprises of the local people in and around the project area and also people around thermal power plant, which provides fly ash. The roles of the local people are as a beneficiary of the project. The project activity also includes creates employment opportunity to local manpower near the plant site. Since, the project has environmental benefits at the project area and the thermal power plant's locality and has provided good direct employment opportunities the local populace has positive opinions about the project

PPCB has prescribed standards of environmental compliance and monitors the adherence to the standards. The cement plant received the Consent to Establish (or No Objection Certificate (NOC)) and the Consent to Operate from PPCB during the commissioning of the plant. The project activity reduces the environmental impacts on the local ambient quality and meets all the statutory requirements. BPC submits an annual Environmental Statement to PPCB and also describes the Environmental aspects of the plant in its annual report. As discussed in chapter F, the project activity has many positive environmental impacts and does not violate the environmental norms.

The project is being implemented at existing facility of BPC and thus the project does not require any displacement of the local population. This implies that the project will not cause any adverse social impacts on the local population rather it would help in improving the quality of life for them.

Further the adverse health impacts caused from quarrying of materials on the mining persons, nearby habitats and ecosystem, would therefore be avoided. Hence, with minimization of natural resources depletion the project activity achieves environmental conservation for future generation as well as improved health and prosperity of present generation.

The Government of India, through Ministry of Environment and Forests (MoEF), has been promoting waste minimization projects like "Fly Ash Utilization" and "Energy Conservation" to reduce much increasing burden of industrial waste on the society as a whole. The project activity is in line with their promotional activities with regard to environmental improvements.

G.2. Summary of the comments received:

>> The project activity is environmental friendly and facilitates reductions in CO_2 emissions. The project proponent has received positive comments from the stakeholders. The summary of comments is as below:

By utilising fly ash emitting from the power plant, Birla Plus Cement, has reduced the CO_2 quantity emitting from Pozzolona Cement (PPC) manufacturing. In this way company is saving limestone and coal quantity indirectly.

We are happy that the plant is not only reducing the adverse affects with the effective utilisation of waste materials like fly ash in cement manufacturing but in the process also generating employment opportunities for local people.

BPC needs to take care of the strength of the PPC cement by adding adequate quantity of fly ash.

G.3. Report on how due account was taken of any comments received:

>> The comment is received about the adequate quantity of fly ash addition on the PPC. The project proponent discussed about the BIS norms and will ensure the strength of the PPC by adding adequate quantity of Fly ash.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Birla Plus Cement
Street/P.O.Box:	Behind G.H.T.P P.O. Lehra Mohabat,
Building:	
City:	Bathinda,
State/Region:	Pujab
Postfix/ZIP:	151 111
Country:	India
Telephone:	91 164 2756340/825
FAX:	91 164 2756316
E-Mail:	rmgupta@adityabirla.com
URL:	www.adityabirla.com
Represented by:	
Title:	Sr. Executive President
Salutation:	Mr.
Last Name:	Gupta
Middle Name:	M
First Name:	R
Department:	Finance
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	rmgupta@adityabirla.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding for the project is available.

Annex 3

BASELINE INFORMATION

Please see enclosure 1- 4 in the project design document.

Annex 4

MONITORING PLAN

BPC's project activity is of clinker content reduction in PPC production. The monitoring and verification system mainly comprise of Raw material, PPC production along with fly ash, Gypsum and clinker used for this purpose. Key parameters related to quality of cement are also monitored to ensure 'equivalence of service'. The key parameters related to quality of the product delivered are governed by country's specifications and standards, Birla Plus Cement too has a monitoring plan to ensure the product meets the 'Indian Standard – Portland-Pozzolana Cement – Specification (IS 1489(Part 1): 1991;

Further, the project activity has employed the monitoring and control equipment that will measure, record, report, monitor and control various key parameters like total cement produced & clinker procured , material flow rate, operating conditions and parameters of the material movement and conversion processes.

The instrumentation and control system is the key aspect for salubrious functioning of any monitoring and verification system of a CDM project activity. Taking these issues into considerations, BPC has designed adequate and apt instruments for the project activity, to control and monitor various operating parameters for safe, effective & efficient operations like raw material processing, kiln, grinding and mixing.

The instrumentation system comprises of microprocessor-based instruments like weigh feeders, flowmeters etc. (of reputed makes) that adheres the required specifications and of best accuracy levels. The instruments are calibrated and marked at regular intervals ensuring the accuracy of measurements always. The calibration frequency too is a part of the monitoring and verification parameters.

Project boundary and GHG sources

Birla Plus Cement has state-of- the-art Central Control Room (CCR) which monitors various process parameters (including the parameters required to be monitored for the project activity) continuously.

APPENDIX 1

Sr.No	Particulars of the references
	Kyoto Protocol / UNFCCC Related
1.	Kyoto Protocol to the United Nations Framework Convention on Climate Change
2.	Website of United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int
3.	UNFCCC Decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol.
4.	UNFCCC document, Clean Development Mechanism-Project Design Document (CDM-PDD) version 02
5.	ACM002, www.unfccc.int
6.	Further Clarification on Methodological Issues, EB 10 Report, Annex 1, http://unfccc.int
7.	Annex 2: Amendment to Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, EB 12 Report. http://unfccc.int
	Baseline Related
8.	Report of the working group on cement industry, X-Five year Plan (2002-2007), Government of India, Planning Comission, February, 2000.
9.	India Cement Sector - The Untold Story Part II ; by India Infoline - Overview of the industry; 15th July, 2003 - Annexure 9 – Types of cement; 12th August, 2003
10.	Cement Industry Data, by Cement Manufacturers' Association, Annual report 2004, 2005
11.	Module – 1: Estimation of Fair Prices of Cement, May 2001; by The credit rating information services of India Limited.
12.	Module – 2:Current Demand Supply Scenario, May 2001; by The credit rating information services of India Limited
13.	Module – 3:Trends in Cement Prices, May 2001; by The credit rating information services of India Limited
14.	Map of India: Annual Rainfall -

Sr.No	Particulars of the references
	http://education.vsnl.com/rmcguwahati/normalannual.gif
15.	An initial view on methodologies for Emission Baselines: Cement Case Study; June 2000, OECD and IEA Information Paper; by Jane Ellis, Organisation for Economic Co-operation and Development, Paris.
16.	'India's cement Industry: Productivity, Energy Efficiency and Carbon Emissions, July 1999 by Katja Schumacher and Jayant Sathaye, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory
17.	IPCC-Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (There is no year for this document) - CO_2 Emissions From Industry; Cement production; Figure 3.1:Decision Tree for Estimation of CO_2emissions from cement production - CO_2 Emissions From Stationary Combustion of Fossil Fuels
18.	Website of Department of Energy, Government of Punjab - **http://www.rajenergy.com**
19.	'Anthropogenic Emissions from Energy Activities in India: Generation and Source Characterization' by Moti L. Mittal and C. Sharma
20.	Cement Production, Conversion Factor Data, Energy Consumption Data of cement plants in region 2002-2003, NCCBM
21	http://mnes.nic.in/baselinepdfs/annexure2a.pdf
22.	Report on Indian Cement Industry, ICRA, March 2004
	Project Related
23.	Various project related information / documents / data received from BPC's cement manufacturing unit
24.	Various project related information / documents / data on Environmental Impacts received from BPC's cement manufacturing unit
25.	Various project related information / documents on Stakeholders comments received from BPC' cement manufacturing unit

APPENDIX 2

ABBREVIATIONS

%	Percentage
BAU	Business As Usual
BPC	Birla Plus Cement
BM	Build Margin
$CaCO_3$	Calcium Carbonate
CaO	Calcium Oxide
CAS	Country Assistance Strategy
CCR	Central Control Room
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CM	Combined Margin
CMA	Cement Manufacturer Association of India
CO_2	Carbon di-oxide
COP	Cost of production
CPWD	Central Public Works Department
EF_{Coal}	Emission Factor of Coal
EF_{Diesel}	Emission Factor of Diesel
EF_{Fuel}	Emission Factor of Fuel
Equ	Equivalent
GHG	Greenhouse Gas
HP	Himachal Pradesh
IPCC	Intra-governmental Panel for Climate Change
IS	Indian Standards
Kg	Kilo Gram
Km	Kilo meter
kWh	Kilo Watt Hour
M	Major Proportion of Supply in Clusters
M^3	Cubic Meter
$MgCO_3$	Magnesium Carbonate

MgO	Magnesium Oxide
MoEF	Ministry of Environment & Forest
MoP	Ministry of Power
MU	Million Units
MVP	Monitoring Verification and Protocol
MW	Mega Watts
NCBM	National Council for Building and Materials
O	Other Clusters supplying to the Market
OM	Operating Margin
OPC	Ordinary Portland Cement
PFC	Portland Blast Furnace Slag Cement
PFD	Process Flow Diagrams
PPC	Portland Pozzolona Cement
SPM	Suspended Particulate Matter
STEC	Specific Thermal Energy Consumption in kcal/t clinker
tCO_2	Tonnes of Carbon Di Oxide
TJ	Trillion Joules
TPH	Tonnes Per Hour
UNFCCC	United Nations Framework Convention on Climate Change

Enclosure 1

Project Activity Emissions Factor

Parameter	Unit	Vikram Cement (2005-06)	Aditya Cement (2005-06)
Emissions of CO_2 per tonne of clinker in the project activity plant (tCO_2/tonne clinker)-PE $_{clinker,y}$			
Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y (tCO2/tonne clinker)- PE calcin,y			
Quantity of raw mix	Tonnes	4873852	2430463
Quantity of clinker produced	Tonnes	3293143	1642123
CaO content (%) of raw mix	%	0	0
MgO content (%) of raw mix	%	0	0
CaO content (%) of Clinker	%	64.7	64.9
MgO content (%) of Clinker	%	1.2	0.97
Emissions from the calcinations of limestone(tCO2/tonne clinker) PE $_{calcin,y}$	tCO2/tclinker	0.52100	0.52006
Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year y (tCO2/tonne clinker)-PE fossil_fuel,y			
Quantity of petcoke consumed-FF_,y	Tonnes	252876.00	140735.00
Net calorific value of petcoke Fuel(IPCC)	TJ/KiloTonnes	33.28	32.98
Carbon Emission factor of petcoke (IPCC)	tCO2/TJ	97.50	97.50
Emission factor of petcoke- EFF	tCO2/Ton of fuel	3.24	3.22
Quantity of imported coal consumed-FF_,y	Tonnes	57534.00	23832.54
Net calorific value of imported Fuel(IPCC)	TJ/KiloTonnes	29.82	26.30
Carbon Emission factor of imported coal (IPCC)	tCO2/TJ	94.60	94.60
Emission factor of petcoke- EFF	tCO2/Ton of fuel	2.82	2.49
Emissions per tonne of clinker due to combustion of fossil fuels for clinker production-PE $_{fossil\_fuel,y}$	tCO2/tclinker	0.298434	0.311710
Grid electricity emissions for clinker production per tonnne of clinker in year y - PE ele_grid_CLNK, y (tCO2/tonne clinker)			
Grid Electricity for clinker production in year y -PELE$_{grid_CLNK,y}$	MWh	109602.5	4528.0

Grid Emission Factor in year y- EFgrid_y	tCO2/MWh	0.723	0.723
Grid electricity emissions for clinker production per tonnne of clinker PE ele_grid_CLNK,y	tCO2/tonne clinker	0.0241	0.0020
Emissions from self generated electricity per tonne of clinker production in year y -PE ele_sg_CLNK,y-(tCO2/tonne clinker)			
Generation of Electricity by Thermal captive power plant for clinker production in year y-PELEsg_CLNK_CPP,y	MWh	92243.70243	98380.56137
CPP Emission Factor in year y - EFsg_CPP_y	tCO2/MWh	0.79	1.57
Self generated electricity emissions for clinker production per tonnne of clinker PE ele_sg_CLNK,y	tCO2/tonne of clinker	0.02204	0.09414
Emissions of CO2 per tonne of clinker in the project activity in year y (tCO2/tonne clinker)-PE clinker,y	**tCO2/tonne of clinker**	**0.865549**	**0.927906**
Percent clinker		**0.90**	**0.10**
Project activity emission factor		**0.871784919**	
State electricity share of electricity	%	54.3	4.4
DG set share of electricity	%	45.7	95.6
DG electricity generation	Unit/lt	4.08	0
HSD/FO emission factor	kgCO2/kg	3.21	0
Electricity generation from CPP in Aditya Cement	Units	0	156130837
Quantity of coal consumed	tons	0	165526
Emission factor of coal	tCO2/TJ	0	94.60
Calorific value of coal used	TJ/KiloTonnes	0	15.67
Emission factor per unit of electricity	kg CO2/kWh	0	1.571

Electricity Emissions for BC grinding and preparation of additives in year y (tCO_2/tonne BC)-PE ele_ADD_BC,y		
Annual production of BC in year y -BCy	kilotonnes of BC	1092.158
Grid electricity emissions for BC grinding in a year y PE ele_grid_BC,y -(tCO2/tonne of BC)		
Northern Grid Electricity for grinding BC in year y -PELEgrid_BC,y	MWh	2856.03
Northern Grid Emission Factor in year y- EFgrid_y	tCO2/MWh	0.723
Northern grid electricity emissions for BC grinding in year y (tCO2/tonne of BC) PE ele_grid_BC,y	tCO2/tonne of BC	0.001892

Emissions from self generated electricity for BC grinding in year y PE ele_sg_BC,y		
Generation of Electricity by CPP for BC grinding in year y-PELEsg_BC,y	MWh	0.00
Self generated electricity emissions for BC grinding in year y (tCO2/tonne of BC) PE ele_sg_BC,y	tCO2/tonne of BC	0.000000
Grid electricity emissions for additive preparation in year y PE ele_grid_ADD,y		
Grid electricity emissions for additive preparation in year y PE ele_grid_ADD,y	tCO2/tonne of BC	0
Emissions from Self generated electricity additive preparation in year y PE ele_sg_ADD,y		
Emissions from Self generated electricity additive preparation in year y PE ele_sg_ADD,y	tCO2 / tonne of BC	0
Electricity Emissions for BC grinding and preparation of additives in year y PE ele_ADD_BC,y	**tCO2 / tonne of BC**	**0.001892**

Enclosure 2

Leakage Emissions

Parameter	Unit	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-2012	2012-2013	2013-14	2014-15	2015-16	2016-17
Quantity of Additive transported (Qadd)	tons/annum	330487	366419	390446	420481	432495	438501	444508	444508	444508	444508	444508	444508
Electricity consumption for the conveyor system for additives-ELEconveyor_ADD	MWh	123.37	128.84	136.60	155.08	170.59	187.65	206.42	227.06	249.76	274.74	302.21	332.43
Grid electricity emission factor EFgrid	tCO2/MWh	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723	0.723

Transport related emissions per tonne of additives-Ladd_trans	tCO2/tonne of additive	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004	0.0005	0.0005
Production of BC in year y - BCy	kilotonnes of BC	1092.16	1201.37	1201.37	1201.37	1201.37	1201.37	1201.37	1201.37	1201.37	1201.37	1201.37	1201.37
Baseline benchmark of share of clinker per tonne of BC updated for year y -B blend,y	tonne of clinker /tonne of BC	0.728	0.722	0.717	0.711	0.705	0.699	0.693	0.687	0.681	0.675	0.668	0.661
Share of clinker per tonne of BC in year y -P blend,y	tonne of clinker /tonne of BC	0.697	0.695	0.675	0.650	0.640	0.635	0.630	0.630	0.630	0.630	0.630	0.630
Leakage emissions for transport of additives-Ly	kilotonnes of CO2	0.010	0.010	0.015	0.022	0.023	0.023	0.023	0.027	0.025	0.022	0.023	0.019

Enclosure 3

Baseline emissions

Parameter	Unit	2004-05 (Vikram Cement)	2004-05 (Aditya Cement)
Baseline Emissions of CO_2 per tonne of clinker in the project activity (tCO_2/tonne clinker)-BE clinker			
Baseline Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (tCO2/tonne clinker)- BE calcin			
Quantity of raw mix	Tonnes	4617320	2345456

Quantity of clinker produced	Tonnes	3120411	1584668
CaO content (%) of raw mix	%	0	0
MgO content (%) of raw mix	%	0	0
CaO content (%) of Clinker	%	64.6	64.9
MgO content (%) of Clinker	%	1.3	0.98
Baseline Emissions from the calcinations of limestone(tCO2/tonne clinker) BE calcin	tCO2/tclinker	0.52131	0.52017
Baseline Emissions per tonne of clinker due to combustion of fossil fuels for clinker production (tCO2/tonne clinker)-BE fossil_fuel			
Quantity of petcoke consumed-$FF_{,BSL}$	Tonnes	286922.00	141410.83
Net calorific value of petcoke Fuel(IPCC)	TJ/KiloTonnes	33.28	32.48
Carbon Emission factor of petcoke(IPCC)	tCO2/TJ	97.50	97.50
Emission factor of petcoke - EFF	tCO2/Ton of fuel	3.24	3.17
Quantity of imported coal consumed-$FF_{,BSL}$	Tonnes	20716.00	16759.00
Net calorific value of imported coal Fuel(IPCC)	TJ/KiloTonnes	31.51	26.95
Carbon Emission factor of imported coal(IPCC)	tCO2/TJ	94.60	94.60
Emission factor of imported coal - EFF	tCO2/Ton of fuel	2.98	2.55
Baseline Emissions per tonne of clinker due to combustion of fossil fuels for clinker production-BE_{fossil_fuel}	tCO2/tclinker	0.318136	0.309591
Baseline grid electricity emissions for clinker production per tonnne of clinker- BE ele_grid_CLNK -(tCO2/tonne clinker)			
Baseline grid electricity for clinker production - $BELE_{grid\_CLNK}$	MWh	70834.92	5730.16
Baseline grid emission Factor for state grid - EF_{grid_BSL}	tCO_2/MWh	0.723	0.723
Baseline grid electricity emissions for clinker production per tonnne of clinker $BE_{ele\_grid\_CLNK}$	tCO_2/tonne clinker	0.016423	0.002616
Baseline Emissions from Self generated electricity for clinker production per tonne of clinker -BE ele_sg_CLNK-(tCO2/tonne clinker)			
Baseline generation of Electricity byDG captive power plant for clinker production -$BELE_{sg\_CLNK\_CPP}$	MWh	117555.82	93065.64
CPP Emission Factor in year y - $EF_{sg\_CPP\_BSL}$	tCO_2/MWh	0.79	1.68
Self generated electricity emissions for clinker production per tonnne of clinker BE ele_sg_CLNK,y	tCO_2/tonne of clinker	0.029786	0.098487

Baseline Emissions of CO_2 per tonne of clinker in the project activity (tCO_2/tonne clinker)-BE clinker	**tCO_2/tonne of clinker**	**0.885651**	**0.930860**
Percent clinker		**0.90**	**0.10**
Baseline emission factor- BE clinker		**0.890172**	
State electricity share of electricity	%	37.6	5.8
DG set/CPP share of electricity	%	62.4	94.2
DG electricity generation	Unit/lt	4.06	0
HSD/FO emission factor	kgCO2/kg	3.21	0
Electricity generation from CPP in Aditya Cement	Units	0	137465874
Quantity of coal consumed	tons	0	162656
Emission factor of coal	tCO2/TJ	0	94.60
Calorific value of coal used	TJ/KiloTonnes	0	14.98
Emission factor per unit of electricity	kg CO2/kWh	0	1.677
Baseline Electricity Emissions for BC grinding and preparation of additives (tCO_2/tonne BC)-BE ele_ADD_BC			
Annual production of BC in base year -BCBSL	kilotonnes of BC	954.006	
Baseline grid electricity emissions for BC grinding in	**BE ele_grid_BC -(tCO2/tonne of BC)**		
Baseline Grid Electricity for grinding BC -BELEgrid_BC	MWh	2592.95	
Baseline Grid Emission Factor for northern grid - EFgrid_BSL	tCO2/MWh	0.723	
Baseline Grid electricity emissions for BC grinding (tCO2/tonne of BC) BE ele_grid_BC	tCO2/tonne of BC	0.001966	
Baseline self generated electricity emissions for BC grinding BE ele_sg_BC			
Baseline generation of Electricity by CPP (Thermal power) for BC grinding -BELEsg_CPP_BC	MWh	0.00	
Baseline Self generated electricity emissions for BC grinding (tCO2/tonne of BC) BE ele_sg_BC	tCO2/tonne of BC	0.000000	
Baseline Grid electricity emissions for additive preparation BE ele_grid_ADD			
Baseline grid electricity emissions for additive preparation BE ele_grid_ADD	tCO2/tonne of BC	0	No grinding of additive

Baseline emissions from Self generated electricity additive preparation BE ele_sg_ADD			
Emissions from Self generated electricity additive preparation BE $_{ele\_sg\_ADD}$	tCO2 / tonne of BC	0	No grinding of additive
Baseline electricity Emissions for BC grinding and preparation of additives BE ele_ADD_BC			
Baseline electricity Emissions for BC grinding and preparation of additives BE $_{ele\_ADD\_BC}$	**tCO2 / tonne of BC**	**0.0020**	

Enclosure 4

EMISSION REDUCTION CALCULATIONS

Emission Reduction Calculations														
Parameters	**Unit**	**2004-2005 Baseline year**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**
Production of BC in year y	Tonnes	954006	1092158	1201374	1201374	1201374	1201374	1201374	1201374	1201374	1201374	1201374	1201374	1201374
Baseline benchmark of share of clinker per tonne of BC updated for year y -B blend,y	tonne of clinker /tonne of BC	0.733	0.728	0.722	0.717	0.711	0.705	0.699	0.693	0.687	0.681	0.675	0.668	0.661
Share of clinker per tonne of BC in year y -P blend,y	tonne of clinker /tonne	-	0.697	0.695	0.675	0.65	0.64	0.635	0.63	0.63	0.63	0.63	0.63	0.63

	of BC														
Baseline Emissions of CO2 per tonne of clinker in the project activity -BE clinker	tCO2/tonne of clinker	0.8902	-	-	-	-	-	-	-	-		-	-		
Emissions of CO2 per tonne of clinker in the project activity in year y- PE clinker,y	tCO2/tonne of clinker	-	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	
Conservative Baseline Emissions of CO2 per tonne of clinker in the project activity -BE clinker			0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	0.8718	
Baseline electricity Emissions for BC grinding and preparation of additives BE ele_ADD_BC	tCO2 / tonne of BC	0.0020			-	-	-	-	-	-		-	-		
Electricity Emissions for BC grinding and preparation of additives in year y PE ele_ADD_BC,y	tCO2 / tonne of BC	-	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	
Conservative Baseline electricity Emissions for BC grinding and preparation of Additives Beele_ADD_BC			0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	0.0019	

Baseline CO2 emissions per tonne of BC type- BE BC,y	tCO2 / tonne of BC	-	0.637	0.631	0.627	0.622	0.617	0.611	0.606	0.601	0.596	0.590	0.584	0.578	
CO2 emissions per tonne of BC in the project activity plant in year y PE BC,y	tCO2 / tonne of BC	-	0.610	0.608	0.590	0.569	0.560	0.555	0.551	0.551	0.551	0.551	0.551	0.551	
Emissions reductions in year y due to project activity	**tCO2**		29478	27622	44436	63651	68455	67254	66053	60041	54037	46832	39623	32418	
Baseline emissions	tCO2		695705	758067	753261	747255	741248	734039	728033	722026	716019	708811	701602	694394	
Project emissions	tCO2		666216	730435	708811	683582	672769	666762	661957	661957	661957	661957	661957	661957	
Leakage	tCO2		10	10	15	22	23	23	23	27	25	22	23	19	
			666226	730445	708826	683604	672792	666785	661980	661984	661982	661979	661980	661976	
			29479	27622	44435	63651	68456	67254	66053	60042	54037	46832	39622	32418	
Baseline Emissions in Crediting period					753261	747255	741248	734039	728033	722026	716019	708811	701602	694394	**7246688**
Project emissions in Crediting period					708811	683582	672769	666762	661957	661957	661957	661957	661957	661957	**6703666**
Leakage					15	22	23	23	23	27	25	22	23	19	**222**
Emission Reduction					**44435**	**63651**	**68456**	**67254**	**66053**	**60042**	**54037**	**46832**	**39622**	**32418**	**542800**
Total project emissions					708826	683604	672792	666785	661980	661984	661982	661979	661980	661976	**6703888**

Enclosure -5

Grid Emission Factor

	Generation Details (2003-2004)					
	Name	**Type**	**Fuel**	**Installed Capacity (MW)**	**Generation (GWh)**	**Coal Consumption (000' tonnes)**
1	Badarpur TPS	Thermal	Coal	720	5428.96	3605
2	Singrauli STPS	Thermal	Coal	2000	15643.40	9742
3	Rihand STPS	Thermal	Coal	1500	7949.26	4742
4	Dadri NCTPS	Thermal	Coal	840	6181.12	4136
5	Unchahar-I TPS	Thermal	Coal	420	3252.14	
6	Unchahar-II TPS	Thermal	Coal	420	3187.93	4396
7	Tanda TPS	Thermal	Coal	440	2872.81	2331
8	Anta GPS	Thermal	Gas	413	2775.92	
9	Auriya GPS	Thermal	Gas	652	4247.41	
10	Dadri GPS	Thermal	Gas	817	5058.66	
11	Faridabad GPS	Thermal	Gas	430	2792.58	
12	Bairasiul	Hydro	Hydel	198	687.79	
13	Salal	Hydro	Hydel	690	3477.42	
14	Tanakpur HPS	Hydro	Hydel	120	510.99	
15	Chamera HPS	Hydro	Hydel	840	2648.32	
16	Uri HPS	Hydro	Hydel	480	2873.54	
17	RAPS-A	Nuclear	Nuclear	300	1293.37	
18	RAPS-B	Nuclear	Nuclear	440	2904.68	
19	NAPS	Nuclear	Nuclear	440	2959.44	
20	Bhakra Complex	Hydro	Hydel	1479.5	6956.90	
21	Dehar	Hydro	Hydel	990	3299.29	
22	Pong	Hydro	Hydel	396	1178.93	
23	SJVNL HEP	Hydro	Hydel	1500	1164.11	-
24	Delhi	Thermal	Coal	382.5	1537.92	1268

25	Delhi	Thermal	Gas	612.4	5159.77	-
26	Haryana	Thermal	Coal	1540	6849.26	5213
27	Haryana	Hydro	Hydel	48	251.73	-
28	H.P.	Hydro	Hydel	709	3666.39	-
29	J&K	Hydro	Hydel	309.15	851.03	-
30	J&K	Thermal	Gas	175	15.41	-
31	Punjab	Thermal	Coal	2130	14118.96	9461
32	Punjab	Hydro	Hydel	1148.3	4420.43	-
33	Rajasthan	Thermal	Coal	2295	15044.48	9461
34	Rajasthan	Thermal	Gas	113.8	201.37	-
35	Rajasthan	Hydro	Hydel	432	494.07	-
36	U.P.	Thermal	Coal	4102	20638.05	16042
37	U.P.	Hydro	Hydel	518.6	2063.04	-
38	Uttaranchal	Hydro	Hydel	986.85	3452.96	-
	TOTAL				**168109.84**	**70397.00**

Source: Annual energy generation for 2003-04 has been taken as given in NREB Annual Report 2003-04 (http://www.nreb.nic.in/Reports/ar03-04/chap10/a10.1.3.pdf)
Source: Coal consumption has been taken from Performance Review of Thermal Power Station 2003-04; Section 9 (http://cea.nic.in/opm/0304/sec9psfinn0304a1.pdf)

	Generation Details (2004-2005)					
	Name	**Type**	**Fuel**	**Installed Capacity (MW)**	**Generation (GWh)**	**Coal Consumption (000' tonnes)**
1	Badarpur TPS	Thermal	Coal	720	5462.78	3732
2	Singrauli STPS	Thermal	Coal	2000	15803.34	10336
3	Rihand STPS	Thermal	Coal	1500	7988.06	4768
4	Dadri NCTPS	Thermal	Coal	840	6842.52	4432
5	Unchahar-I TPS	Thermal	Coal	420	3342.83	4604
6	Unchahar-II TPS	Thermal	Coal	420	3438.28	
7	Tanda TPS	Thermal	Coal	440	3254.67	2596

8	Anta GPS	Thermal	Gas	413	2595.77	
9	Auriya GPS	Thermal	Gas	652	4119.47	
10	Dadri GPS	Thermal	Gas	817	5527.71	
11	Faridabad GPS	Thermal	Gas	430	3172.01	
12	Bairasiul	Hydro	Hydel	198	689.67	
13	Salal	Hydro	Hydel	690	3443.29	
14	Tanakpur HPS	Hydro	Hydel	120	495.17	
15	Chamera HPS	Hydro	Hydel	840	3452.25	
16	Uri HPS	Hydro	Hydel	480	2206.71	
17	RAPS-A	Nuclear	Nuclear	300	1355.20	
18	RAPS-B	Nuclear	Nuclear	440	2954.43	
19	NAPS	Nuclear	Nuclear	440	2760.01	
20	Bhakra Complex	Hydro	Hydel	1479.5	4546.01	
21	Dehar	Hydro	Hydel	990	3150.52	
22	Pong	Hydro	Hydel	396	882.57	
23	SJVNL HEP	Hydro	Hydel	1500	5203.80	-
24	Delhi	Thermal	Coal	382.5	1617.45	1330
25	Delhi	Thermal	Gas	612.4	4091.37	-
26	Haryana	Thermal	Coal	1540	7192.41	5269
27	Haryana	Hydro	Hydel	48	251.73	-
28	H.P.	Hydro	Hydel	709	3666.39	-
29	J&K	Hydro	Hydel	309.15	851.03	-
30	J&K	Thermal	Gas	175	23.51	-
31	Punjab	Thermal	Coal	2130	14390.42	9520
32	Punjab	Hydro	Hydel	1148.3	4420.43	-
33	Rajasthan	Thermal	Coal	2295	17330.79	11133
34	Rajasthan	Thermal	Gas	113.8	360.70	-
35	Rajasthan	Hydro	Hydel	432	494.07	-
36	U.P.	Thermal	Coal	4102	19788.21	15559
37	U.P.	Hydro	Hydel	518.6	2063.04	-
38	Uttaranchal	Hydro	Hydel	986.85	3452.96	-
	TOTAL				**172681.58**	**73279.00**

Source: Annual energy generation for 2004-05 has been taken as given in NREB Annual Report 2004-05 (http://www.nreb.nic.in/Reports/ar04-05/chapter2/annx2.7.pdf)
Source: Coal consumption has been taken from Performance Review of Thermal Power Station 2004-05 (http://www.cea.nic.in/opm/0405/CEA_Thermal%20Performance%20Review0405/SECTION-9.pdf)

	Generation Details (2005-2006)					
	Name	**Type**	**Fuel**	**Installed Capacity (MW)**	**Generation (GWh)**	**Coal Consumption (000' tonnes)**
1	Badarpur TPS	Thermal	Coal	720	5380.54	3768
2	Singrauli STPS	Thermal	Coal	2000	15502.80	10394
3	Rihand STPS	Thermal	Coal	2000	10554.73	6696
4	Dadri NCTPS	Thermal	Coal	840	6768.09	4288
5	Unchahar-I TPS	Thermal	Coal	420	3544.89	4736
6	Unchahar-II TPS	Thermal	Coal	420	3501.21	
7	Tanda TPS	Thermal	Coal	440	3329.89	2567
8	Anta GPS	Thermal	Gas	413	2806.84	-
9	Auriya GPS	Thermal	Gas	652	4281.67	-
10	Dadri GPS	Thermal	Gas	817	5399.34	-
11	Faridabad GPS	Thermal	Gas	430	2954.64	-
12	Bairasiul	Hydro	Hydel	198	790.97	-
13	Salal	Hydro	Hydel	690	3480.87	-
14	Tanakpur HPS	Hydro	Hydel	120	483.26	-
15	Chamera HPS	Hydro	Hydel	840	3833.66	-
16	Uri HPS	Hydro	Hydel	480	2724.81	-
17	Dhauliganga	Hydro	Hydel	280	312.46	
18	RAPS-A	Nuclear	Nuclear	300	1267.50	-
19	RAPS-B	Nuclear	Nuclear	440	2815.73	-
20	NAPS	Nuclear	Nuclear	440	2138.45	-
21	Bhakra Complex	Hydro	Hydel	1479.5	6838.78	-
22	Dehar	Hydro	Hydel	990	3122.68	-
23	Pong	Hydro	Hydel	396	1730.70	-

24	SJVNL HEP	Hydro	Hydel	1500	3867.12	-
25	Delhi	Thermal	Coal	320	1559.10	1437
26	Delhi	Thermal	Gas	612.4	4046.11	-
27	Haryana	Thermal	Coal	1602.5	8352.58	6626
28	Haryana	Hydro	Hydel	62.4	258.30	-
29	H.P.	Hydro	Hydel	709	2870.48	-
30	J&K	Hydro	Hydel	309.15	1133.41	-
31	J&K	Thermal	Gas	175	28.31	-
32	Punjab	Thermal	Coal	2130	14848.73	9776
33	Punjab	Hydro	Hydel	1148.3	4999.36	-
34	Rajasthan	Thermal	Coal	2420	19903.79	11430
35	Rajasthan	Thermal	Gas	113.8	432.58	-
36	Rajasthan	Hydro	Hydel	354	921.33	-
37	U.P.	Thermal	Coal	4280	19326.44	15403
38	U.P.	Hydro	Hydel	518.6	1244.92	-
39	Uttaranchal	Hydro	Hydel	986.93	3496.87	-
40	**TOTAL**				**180853.94**	**77121.00**

Source: http://www.nreb.nic.in/Reports/ar05-06/Chapter2/Annex2.7.pdf
Source: Coal consumption has been taken from Performance Review of Thermal Power Station 2005-06

Power generation Mix of Northern Region for five years					
Energy Source	**2001-02**	**2002-03**	**2003-04**	**2004-05**	**2005-06**
Total Power Generation (GWh)	150935	154544	168110	172682	180854
Total Thermal Power Generation	113817	115986	122955	126342	132522
Total Low Cost Power Generation	37117	38559	45154	46339	48332

Thermal % of Total grid generation	75.41	75.05	73.14	73.16	73.28
Low Cost % of Total grid generation	**24.59**	**24.95**	**26.86**	**26.84**	**26.72**
% of Low Cost generation out of Total grid generation - Average of the five most recent years					**25.99**

Build Margin

List of plants supplying power to Northern grid arranged in descending order of date of commissioning						
Total generation		**180853.94**				
20 % of total generation		**36170.79**				
S. No.	**Plant**	**Date of commissioning**	**MW**	**Generation of the unit in 2005-2006 (GWh)**	**Fuel Type**	**Coal Consumption (000' tonnes)**
1	Dhauliganga unit-I	2005-2006	70	78.61	Hydro	-
2	Dhauliganga unit-II	2005-2006	70	78.61	Hydro	-
3	Dhauliganga unit-III	2005-2006	70	78.61	Hydro	-
4	Dhauliganga unit-IV	2005-2006	70	78.61	Hydro	-
5	Rihand Stage - II unit I	2004-2005	500	2593.70	Coal	1674.00
6	Panipat # 7	2004-2005	250	921.46	Coal	1071.51
7	Panipat # 8	2004-2005	250	1613.95	Coal	1071.51
8	Chamera HEP-II (Unit 1)	2003-2004	100	567.67	Hydro	
9	Chamera HEP-II (Unit 2)	2003-2004	100	567.67	Hydro	-
10	Chamera HEP-II (Unit 3)	2002-2003	100	567.67	Hydro	-
11	SJVPNL	2003-2004	1500	4104.25	Hydro	-

12	Baspa-II (Unit 3)	2003-2004	100	389.87	Hydro	-
13	Suratgarh-III (Unit-5)	2003-2004	250	2033.40	Coal	1217.6
14	Kota TPS-IV (Unit-6)	2003-2004	195	1695.70	Coal	996.83
15	Baspa-II (Unit 1 & 2)	2002-2003	200	779.74	Hydro	-
16	Pragati CCGT (Unit II)	2002-2003	104.6	728.29	Gas	-
17	Pragati CCGT (Unit III)	2002-2003	121.2	843.86	Gas	-
18	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.5	146.80	Gas	-
19	Ramgarh CCGT Stage -II (GT-2)	2002-2003	37.8	147.97	Gas	-
20	Upper Sindh Extn (HPS)(1)	2001-2002	35	68.52	Hydro	-
21	Suratgarh stage-II (3 & 4)	2001-2002	500	3844.81	Coal	2435.2
22	Upper Sindh Stage II (2)	2001-2002	35	68.52	Hydro	-
23	Malana-1 & 2	2001-2002	86	337.79	Hydro	-
24	Panipat TPS Stage 4 (Unit-6)	2000-2001	210	1688.29	Coal	900.07
25	Chenani Stage III (1,2,3)	2000-2001	7.5	3.88	Hydro	-
26	Ghanvi HPS (2)	2000-2001	22.5	69.71	Hydro	-
27	RAPP (Unit-4)	2000-2001	220	1432.17	Nuclear	-
28	Ranjit Sagar (Unit-1,2,3,4)	2000-2001	600	2012.84	Hydro	-
29	Gumma HPS	2000-2001	3	6.59	Hydro	-
30	Faridabad CCGT (Unit 1) (NTPC)	2000-2001	144	986.70	Gas	-
31	Suratgarh TPS 2	1999-2000	250	2112.17	Coal	1217.6
32	RAPS-B (2)	1999-2000	220	1432.17	Nuclear	-
33	Uppersindh-2 HPS #1	1999-2000	35	68.52	Hydro	-
34	Faridabad GPS 1 & 2 (NTPC)	1999-2000	286	1959.71	Gas	-
35	Unchahar-II TPS #2	1999-2000	210	1732.60	Coal	1184
36	Unchahar-II TPS #1	1998-1999	210	1767.20	Coal	1184
Total				**37608.63**		**12952**
20% of Generation				**36170.79**		

Source: Annual energy generation for 2005-06 has been taken as given in NRLDC Annual Report 2005-2006
Source: Coal consumption has been taken from Performance Review of Thermal Power Station 2005-06
Source: Overall Performance & Plant Load Factor, Section-2, Performance Review of Thermal Power Stations 2005-06

Coal	20003.28
Gas	4813.33
Hydro	9927.69
Nuclear	2864.33

Emission Factor Calculation

CALCULATION OF BASELINE EMISSION FACTORS-NORTHERN GRID						
-	2003-04		2004-05		2005-06	
	GWh		GWh		GWh	
Generation by Coal out of Total Generation	102704.29		106451.00		112572.8	
Generation by Gas out of Total Generation	20251.12		19890.00		19949.49	
Imports from others						
Imports from WREB	282.02		1602.84		2153.23	
Imports from EREB	2334.76		3600.58		4112.67	
Fuel 1 : Coal						
Avg. Calorific Value of Coal used (kcal/kg)		3755		3755		3755
Coal consumption (tons/yr)		70,397,000		73,279,000		77121000
Emission Factor for Coal (tonne CO_2/TJ)		92.5		92.5		92.5
Oxidation Factor of Coal-IPCC standard value		0.98		0.98		0.98
COEF of Coal (tonneCO_2/ton of coal)		1.425		1.425		1.425
Fuel 2 : Gas						
Avg. Efficiency of power generation with gas as a fuel, %		45		45		45
Avg. Calorific Value of Gas used (kcal/kg)		11465		11465		11465
Estimated Gas consumption (tons/yr)		3,375,794		3,315,597		3325513.485
Emission Factor for Gas- IPCC standard value(tonne CO_2/TJ)		56.1		56.1		56.1
Oxidation Factor of Gas-IPCC standard value		1.000		1.000		1.000
COEF of Gas(tonneCO_2/ton of gas)		2.693		2.693		2.693
EF (WREB), tCO2/GWh		880.00		890.00		890.00

EF (EREB), $tCO2/GWh$		1070.00		1050.00		1050.00
EF (OM Simple), tCO_2/GWh		893.22		901.36		901.37
Average EF (OM Simple), tCO_2/GWh						**898.65**

Considering 20% of Gross Generation				
Sector				
Thermal Coal Based			20003.28	
Thermal Gas Based			4813.33	
Hydro			9927.69	
Nuclear			2864.33	
Total			37608.63	
<u>Built Margin</u>	-	-	-	-
Fuel 1 : Coal				
Avg. calorific value of coal used in Northern Grid, kcal/kg				3755
Coal consumption, tons/yr				12952313
Emission factor for Coal,tonne CO_2/TJ				92.5
Oxidation factor of coal (IPCC standard value)				0.98
COEF of coal (tonneCO_2/ton of coal)				1.425
Fuel 2 : Gas				
Avg. efficiency of power generation with gas as a fuel, %				45
Avg. calorific value of gas used, kcal/kg				11465
Estimated gas consumption, tons/yr				802367
Emission factor for Gas (as per standard IPCC value)				56.1
Oxidation factor of gas (IPCC standard value)				1.000
COEF of gas(tonneCO_2/ton of gas)				2.693
EF (BM), tCO_2/GWh				548.29
Combined Margin Factor (Avg of OM & BM)				723.47
Baseline Emissions Factor (tCO_2/GWh)				**723.47**