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:

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"Optimal Utilization of Clinker" project at Dalmia Cement (Bharat) Limited (DCBL), Dalmiapuram , Tamilnadu.

Version 01

Date: 21 October 2005

A.2. Description of the project activity:

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DCBL as a responsible global corporate and committed citizen realizes sustainable development is key to success for future businesses. DCBL always gives relevance to social, economic, environmental aspects and commitments. DCBL's project on "Optimal utilization of clinker" initiative is one of such step towards sustainable development.

The project activity entails a reduction of the clinker content of Portland Pozzolanic Cement (PPC) by increasing additive (Fly ash) percent, thereby replacing an equivalent amount of clinker at DCBL's cement manufacturing unit at Dalmiapuram, Tamilnadu state in southern India.

Clinker is one of the most important raw materials for cement production. Clinker manufacturing includes:

1. Pre-processing (grinding) and
2. Pyro-processing of the raw meal

The clinker manufacturing process is an energy intensive process. The project activity aims to optimally utilize the clinker in PPC cement manufacturing. The reduction of clinker percent, by adding fly ash in the PPC would conserve natural resources like limestone and depleting fossil fuels like coal which is used to meet the thermal and electrical energy requirements of pre-processing and pyro-processing of cement manufacturing process. The project activity would therefore reduce direct onsite emissions from clinkerisation and direct off-site emissions due to reduced consumption of electricity per unit of cement produced.

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. Project activity leads to reduction of clinker percent in cement production by use of fly ash (alternative waste materials) and would therefore result in direct and indirect GHG emission reductions.

Industrial waste utilization

Project activity uses fly ash for the PPC manufacturing, which is an industrial waste from power plants. Disposal of fly ash is a serious environmental issue at coal based thermal power plants. The project activity facilitates fly ash utilization and reduces the cost of waste handling and disposal on the part of coal fired thermal power plants.

Fly ash utilisation in PPC manufacturing also reduces:

Land pollution: As a regular practice fly ash is disposed into landfills, which creates land pollution in long run. Project activity reduces the burden of the ever-increasing volume of waste in landfills as well as facilitates its environment – friendly utilisation.

Water contamination: Project activity reduces problems arising from landfill leaching and ground water contamination, by reducing the quantity of fly ash in the landfill sites.

Further, the project indirectly encourages development of waste management infrastructure and associated value chain between two different types of industries (e.g., power / utility and cement) mutually benefiting each other's operation. Thus, the external activities of the project links two sectors of industries and expedites similar proactive action from industries to find avenues and opportunities for economical exchange of waste products and reduction in cost of waste management.

Thermal and electrical energy conservation

The project activity reduces specific thermal and electrical energy consumption for PPC production and conserves energy. Indian economy is significantly dependent on Coal as a fuel, which is a "finite natural resource" to generate power and heat for production processes. Since the project activity reduces electrical energy and thermal demand of coal based thermal power plant, it positively contributes towards conservation of coal, a non-renewable natural resource and making coal available for other important applications. The savings in electrical energy demand would also means savings in transmission and distribution losses.

Resource Conservation

The project activity conserves the resources in following way:

1. Reduces the quantum of limestone required per unit of PPC produced
2. Reduces the coal used per unit of PPC production, both in terms of thermal and electrical energy

This resource conservation helps in sustainable development by the ways of:

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

Therefore, the project activity has excellent environmental benefits in terms of reduction of GHG emissions, limestone and coal resource conservation, coal conservation, decreased environmental destruction and enhanced restoration, economical and social prosperity by opening avenues for investment in waste management.

A.3. Project participants:

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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	Dalmia Cement (Bharat) Ltd (Private entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>> India

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

>> State: Tamilnadu

A.4.1.3. City/Town/Community etc:

>> City: Dalmiapuram

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

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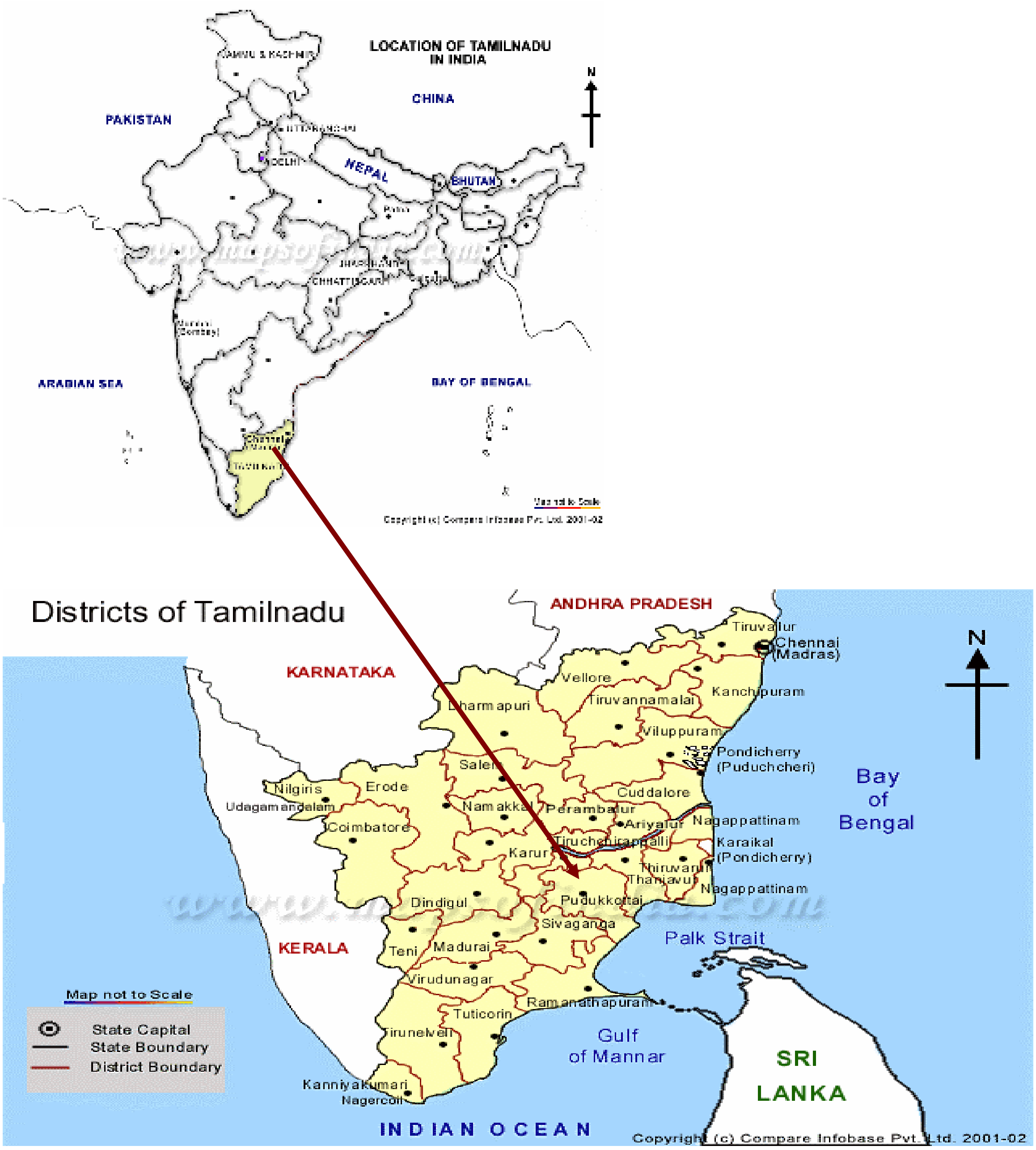
DCBL is located at Perambalur district, Tamilnadu State in southern India. DCBL is situated at latitude of $10^0$58' N and longitude of $78^0$57' E. The nearest highway is Trichy –Chidambaram state highway SH-24. The nearest railway station is Kallakudi-Palanganatham, which is about 0.5 km to the east of plant

The detailed physical location of site is shown in the map below:


LOCATION OF TAMILNADU IN INDIA
CHINA
PAKISTAN
NEPAL
BHUTAN
ARABIAN SEA
BAY OF BENGAL
Districts of Tamilnadu
ANDHRA PRADESH
KARNATAKA
KERALA
Tiruvallur
Chennai (Madras)
Vellore
Kanchipuram
Dharmapuri
Tiruvannamalai
Viluppuram
Pondicherry (Puduchcheri)
Salem
Nilgiris
Erode
Udagamandalam
Namakkal
Perambalur
Cuddalore
Coimbatore
Ariyalur
Nagappattinam
Karaikal (Pondicherry)
Karur
Tiruchchirappalli
Thiruvarur
Thanjavur
Nagappattinam
Dindigul
Pudukkottai
Sivaganga
Teni
Madurai
Virudunagar
Ramanathapuram
Tuticorin
Tirunelveli
Kanniyakumari
Nagercoil
Bay of Bengal
Palk Strait
Gulf of Mannar
SRI LANKA
INDIAN OCEAN
N
Map not to Scale
State Capital
State Boundary
District Boundary
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A.4.2. Category (ies) of project activity:

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The project activity is a cement sector specific project activity. The project activity may principally be categorized in scope 4: Manufacturing Industries as per the scope of the project activities enlisted in the 'list of sectoral scopes with approved methodologies' (Version 02/ 28-11-2003) for accreditation of operational entities.

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

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The project activity includes the following sub-systems:

1. Transportation of fly ash from power plant to DCBL
2. Transfer of fly ash from tanker to fly ash silo
3. Fly ash handling and feeding system to cement mill
4. Fly ash mixing and transfer of Portland Pozzolana Cement (PPC) to storage silo

1. Transportation of fly ash from power plant to DCBL: Fly ash is transported from power plant to DCBL through Bouser tankers or Lorries. DCBL is using the fly ash from Mettur thermal power station and Neyveli Lignite Power Station, which are located at distances of 220 km and 130 km respectively.

2. Transfer of fly ash from tanker to fly ash silo: The transported fly ash from the tankers is stored in fly ash silo and storage yards. The in-built pneumatic arrangement evacuates fly ash from tanker to fly ash storage yard.

3. Fly ash handling and feeding system to cement mill: Based on production requirement dry fly ash from fly ash storage yard is transported to fly ash/slag hopper by installed pneumatic arrangement (Blower) . Fly ash hopper is directly connected to cement mill and Fly ash flows by gravity from hopper to cement mills.

4. Fly ash mixing and transfer of Portland Pozzolana Cement (PPC) to storage silo: Mixing of fly ash, clinker and gypsum takes place simultaneously with grinding and PPC is transported to bag filter after cement mill, then eventually transferred to storage silo.

The technology adopted is simple and environmentally safe. Baghouse (dust collectors) are provided at top of the fly-ash silo to vent out transport air during unloading of fly-ash from tankers and also aeration air, which is provided at bottom of the silo.

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 percent in PPC produced by increasing additive percent. The project activity would thereby bring about a reduction in direct on-site emissions from reduced calcination and reduced thermal energy consumption and direct off-site emissions at the thermal power plants due to reduced electrical energy consumption.

Ministry of Environment and Forests (MoEF), Ministry of Power (MoP) and Ministry of Non-Conventional Energy Sources (MNES) in India encourages GHG reduction and energy conservation activities, on voluntary basis their specific energy consumption to a prescribed standard. Further till date the Department of Industries/ the Bureau of Indian Standards/ Cement Manufacturers Association (CMA)/ National Council for Building Materials also have not imposed any directives towards reduction in clinker content in cement manufacturing and or in specific energy consumption. The project proponent has implemented the project activity voluntarily, over and above the national or sectoral requirements. The GHG reductions 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. DCBL has developed the infrastructure and marketing strategy for the use of higher additive (fly ash) % taking into consideration the financial assistance, which would be made available under CDM. The financial assistance would help DCBL to overcome the associated barriers like market related barriers like 'poor market acceptability' to project activity implementation. However, in absence of the project activity, DCBL would have continued to manufacture PPC with additive of 23.6 %(baseline) and would lead higher GHG emissions.

By implementing the project activity, DCBL proposes to reduce the 599,822 tons of CO_2 in the crediting period of 10 years.

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

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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
2006-2007	30753
2007-2008	66094
2008-2009	65655
2009-2010	106393
2010-2011	92238
2011-2012	77799
2012-2013	63072
2013-2014	48050
2014-2015	32728
2015-2016	17100
Total estimated reductions (tonnes of CO_2 e)	599882
Total number of crediting years	10
Annual average over the crediting period of estimated reductions ((tonnes of CO_2 e)	59,988.2

A.4.5. Public funding of the project activity:

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No public funding from parties included in Annex – I are 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:

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TITLE**: Consolidated Baseline methodology for increasing the Blend in cement production (ACM0005)**

Reference: UNFCCC website

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

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

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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. DCBL project activity increases the share of additive in PPC beyond current practices in the country and DCBL's project activity meets all the applicability conditions of the consolidated methodology. Hence the consolidated baseline methodology for increasing the blend in cement production is appropriate for DCBL's project activity.

The applicability of methodology is justified as following

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. DCBL takes fly ash from Mettur and Neyveli thermal power plant where surplus fly ash is available. (Sufficient information is available on surplus availability of fly ash which may be shown to DOE during validation).

This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement types

DCBL does not export PPC and all the PPC produced by the project activity are sold in domestic market only.

Adequate data are available on cement types in the market

Adequate data on cement types is available in the market through reports published by Cement Manufacturers Association, India

The project activity fulfils all the applicability conditions described in the consolidated methodology.

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

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The approved methodology is applied to project activity in following manner.

Applicability

DCBL has implemented the CDM project activity in order to increase the proportion of additive (fly ash), resulting in an equivalent reduction of clinker consumed per ton of PPC produced. The project activity increases the proportion of additive from 23.6 % to 25.9 %, which is higher than the blending practices of Tamilnadu + Kerala region. (Please refer selection of region further in this section).

The reduction in clinker percent in cement would reduce GHG emissions related to clinker production.
Hence, consolidated baseline methodology for project activities that increases the blend in cement production is most appropriate for the project activity at DCBL.

Selection of the region for the project activity hosting plant

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.

According to CMA, the cement plants in India are classified under various regions – Northern, Southern, Eastern, Western and Central region. Since DCBL plant is situated in Tamilnadu, it falls under Southern Region category. According to the methodology, project proponent is also required to take into consideration the market domain of the project activity hosting plant.

As per the methodology, national market can be chosen by default but project proponents can also define a specific geographic region. Since the geographic boundary of India is 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 market circumstances. Therefore the project proponent has considered geographic extent of the states where the project plant cater their cement production in order to determine the "region" for the project activity hosting plant.

The cement output of DCBL plant is sold in Tamilnadu + Kerala region. The following table depicts the state-wise statistics of sales of the project activity hosting plant in the year prior to the start of the project activity (i.e. 1999-2000) and determines the market domain where the project activity hosting plant cater their cement production.

Table B-1: Selection of market for the project activity hosting plant considering their sales		
Parameters	**Base Year (1999-2000)**	**Remarks**
DCBL		
Total Cement Despatch (MT)	945000 (100%)	Only domestically sold cement is considered as required by the methodology.
Sales in states		
Tamilnadu	578000 (61.2%)	
Kerala	367000 (38.8%)	

The above table establishes that primarily the project activity hosting plant cater their cement production to Tamilnadu + Kerala region (100 %). Tamilnadu+ Kerala region is selected for DCBL's project activity because it meets the following conditions for selecting a geographic region (according to consolidated methodology):

(i) At least 75% of project activity plant's cement production is sold (percentage of domestic sales only) in that region

During the year 1999-2000, 100 % of total cement produced by DCBL was sold in the states of Tamilnadu and Kerala.

(ii) Includes atleast 5 other plants with the required published data

Tamilnadu + Kerala region consists of 10 plants (excluding DCBL) with required published data's in the year 1999-2000.

(iii) The production in the region is at least four times the project activity plant's output. Only domestically sold output is considered and any export of cement produced by the project activity plant are excluded in the estimation of emission reductions.

The total cement production of Tamilnadu + Kerala region was 82, 96,170 tonnes, which was 8.77 times of total cement production of DCBL (9,45,000 tonnes) in the year 1999-2000.

The below Table – B-2 gives details of cement plant of Tamil nadu + Kerala Region.

Sl. No	State/Plant	Type of cement process	OPC (Tonnes)	PPC (Tonnes)	Other cements – PBFS , SRC , IRST40, Oilwell (Tonnes)	Total Cement Production (Tonnes)
Tamilnadu						
1	Madukkarai	Dry process	120650	705550	-	826200
2	Sankarnagar	Dry process	921020	219970	-	1140990
3	Sankaridurg	Wet Process	184810	341510	-	526320
4	Dalavoi	Dry process	1044640	-	1040	1045680
5	Alangulam	Wet Process	109280	176280	-	285560
6	Ariyalur	Dry process	280410	165500	-	445910
7	Ramasamy Raja Nagar	Dry process	-	790650	-	790650
8	Alathiyur works	Dry process	151910	815020	151910	1118840
9	Chettinad Cements	Dry process	337780	462170	27600	827550
10	Dalmia Cements	Dry and Semi Dry process	559500	335200	131740	1026440
Kerala						
11	Malabar Cements	Dry process	123100	313340	0	1474260

Source : Cement Statistics Hand book 1999-2000

Therefore by considering both the aspects of location and primary market of the project activity hosting plant, the geographic boundary of the Tamil nadu + Kerala Region has been considered as the "region" for the project activity hosting plant.

Define alternative scenarios for project activity

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.

DCBL has identified the following alternatives to the project activity:

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

In absence of the project activity, DCBL 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.

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

DCBL 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 financial burdens associated with the R&D and promotional activities of the PPC produced, this alternative would not be a feasible option for DCBL.

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, DCBL may produce PPC with a clinker percentage, which was the common prevailing practice in other cement manufacturing plants in the Tamil nadu + Kerala region using similar input/raw materials, and facing similar economic, market and technical circumstances.

The methodology requires the project proponent to determine the common prevailing clinker percentage in PPC in other cement manufacturing plants in Tamil nadu + Kerala region "using similar input/raw materials, and facing similar economic, market and technical circumstances."

Each of these considerations has been dealt below:

Similar input/raw materials

The project activity entails an increase in additive blending in PPC production in the cement manufacturing unit of DCBL. The basic raw materials for PPC production are limestone and different calcareous materials (like clay, shale, sand and iron ore containing calcium, silica, alumina and iron oxides) along with gypsum and other pozzolanic additives (like fly ash). The primary raw materials used in PPC production are same for all the cement manufacturing units producing PPC.

Therefore all the cement manufacturing units in the region (listed in Table B-2 above) use similar input/raw materials.

Similar market circumstances

Indian cement market is divided in 22 major markets. The DCBL cement plant is in Tamil nadu + Kerala Region and caters to Chennai, Trivandrum , Cochin markets.

Table B.3 Main markets of different cluster

Sr. No.	Cluster / Market	Satna	Bilaspur	Gulbarga	Chandrapu	Chanderia	Nalgonda	Yerraguntl	Gujarat	HP + Punjab	Orissa	North Rajasthan.	TN + Kerala	Others
1.	Ahmedabad								M			M		
2.	Mumbai			M	O				M					
3.	Pune			M	O		O							
4.	Surat								M			M		
5.	Nagpur		M		M									
6.	Hyderabad			O	O		M							
7.	Bangalore			M	O		O	M						
8.	Chennai						O	M					M	
9.	Cochin						M	O					M	
10.	Vizag		O				M							
11.	Trivandrum							O					M	
12.	Raipur		M											
13.	Patna	M	O								O			M
14.	Calcutta		M								O			M
15.	Guwahati	M	M								O			M
16.	Bhubaneshwar		O								M			O
17.	Jamshedpur		M								O			M
18.	Bhopal	M	O											
19.	Lucknow	M												M
20.	Delhi	O				M						M		
21.	Jaipur					M						M		
22.	Amritsar					M				M				

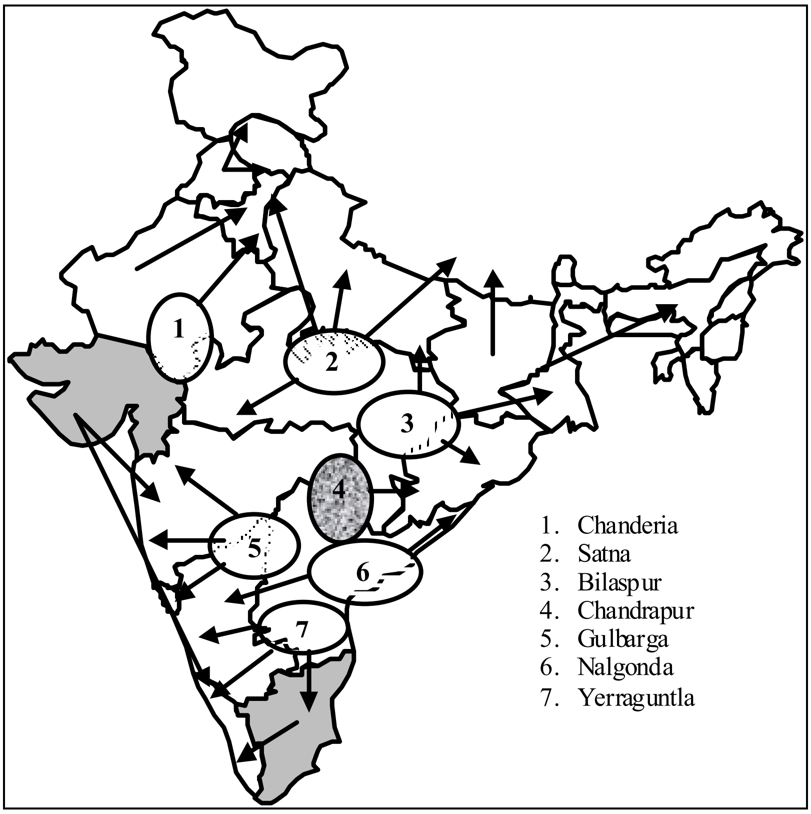
The cement manufacturing plants in the Yerranguntla, Nalagonda cluster also cater to the Chennai , Cochin markets . Therefore the market circumstances of all the plants in Yerranguntla, Nalagonda cluster and Tamilnadu and Kerala region are similar including that of the project activity hosting plant.

Similar economic circumstances

Since all the plants in the Nalagonda, Yerraguntla cluster and Tamilnadu and Kerala region have similar market circumstances, the project proponent is now required to conduct a comparison in the ‘economic circumstances’ amongst the cement plants of Nalagonda, Tamilnadu and Kerala and Yerraguntla cluster based on the parameters like cost of raw material (lime), energy (fuel and electricity) and fly ash (which would include transportation/ purchase/ handling costs).

The availability and cost of the limestone is one of the most important factors among all the other factors, which influence the economical considerations. This factor has played a major role in the cement plant locations and has resulted in geographical aggregation or clusterisation of the cement plants in and around the limestone reserves of India. The cement industries have been classified into seven clusters taking into consideration this geographical aggregation of the cement plants in India.

Figure B-1: Map of India illustrates the geographic location of the seven cement clusters[1]



The project activity has been undertaken at the manufacturing unit of DCBL, which falls under the Tamil nadu + Kerala Region.

The cement plants in the same cluster will have similar economic circumstances due to similar proximities to the required quality of limestone, coal reserves, gypsum and fly ash and similar locational advantages whereas the cement plants in different clusters will differ with respect to the above parameters and therefore would have varied economic circumstances. The Table B-4 provides a comparison of the economic circumstances of the Nalagonda, Yerraguntla clusters and Tamilnadu and Kerala region.

[1] From Cement Manufacturing Association of India

Table B-4: Operating Costs of producing clinker on 'Average Cost' Basis			
Cluster / Parameter	**Nalagonda**	**Tamilnadu and Kerala**	**Yerraguntla**
Limestone Cost	Distance of the cement manufacturing units from the limestone quarry plays a significant role in determining the economic circumstances of the cement plants since transportation of limestone across varied distances will result in different transportation cost of limestone for the cement plants. The cost of limestone per bag of clinker produced in the above clusters is provided below.		
Cost of Limestone (Rs. per bag of Clinker)	**4.6**	**9.8**	**4.7**
Coal Cost	Coal cost is another parameter which has a significant impact on the economic circumstances of the cement plants. The quality of coal available and its associated cost in different regions of the country vary significantly. The coal transportation cost also governs the coal cost per unit of clinker production. Further coal, being a light material, transportation cost comprises a significant proportion of the landed costs. The cost of coal per bag of clinker produced in the above clusters is provided below.		
Cost of Coal (Rs. per bag of Clinker)	**14.8**	**15**	**13**
Other Costs	Apart from limestone and coal, the process of clinkerisation involves electrical energy consumption which also contributes significantly to the cost of clinker and hence to the cost of PPC. All these cost associated with clinkerisation in the above clusters are provided below under respective heads.		
Electricity Cost (Rs. per bag of Clinker)	**12.4**	**11.4**	**12.4**
Cost for Stores and Spares (Rs. per bag of Clinker)	**2.8**	**2.8**	**2.8**
Cost for Salaries and Wages (Rs. per bag of Clinker)	**1.1**	**1.1**	**1.1**

Cost for Factory Overheads (Rs. per bag of Clinker)	**4.0**	**4.0**	**4.0**
Clinker Cost	The production cost of PPC is primarily governed by the cost of clinker production which is determined on the basis of all the above parameters. The clinker cost is provided below for all the above clusters.		
Total Clinker Cost (Rs. per bag of Clinker)	**39.7**	**44.2**	**38.0**
Source: Module 1: Estimation of fair Price of Cement, May 2001 (Report published by "The Credit Rating Information Services of India Limited") page 41			

The above table clearly establishes that the clinker cost (which constitutes the major portion of the production cost of PPC) in Tamilnadu and Kerala region is widely different than that for the other two clusters namely Yerraguntla, and Nalagonda. However while considering the overall economy of PPC production, the project proponent is required to consider the cost of additives also.

Additives Cost Consideration

PPC is produced by blending clinker with additives like gypsum and fly ash with fly ash as the major additive. The cement plants in India mainly source their fly ash from thermal power plants. Variance in the 'fly ash additive cost' incurred depends mainly on the distance of the thermal power plants from the cement-manufacturing units. However the distance of thermal power plants from cement manufacturing units in Tamil nadu + kerala region do not vary largely and therefore the effect of additive cost on the overall cost of PPC production would be same for all the cement plants in these clusters.

Thus considering all the above mentioned key economic parameters, it is established that the cement plants in the Tamil nadu + Kerala region would have similar economic circumstances.

Similar technical circumstances

The project proponent is required to compare the 'technical circumstances' of the cement plants in Tamil nadu + Kerala region as regards the availability and use of the basic technology for the three distinct phases of the cement manufacturing process viz.- Raw material preparation, Clinker production (including clinker grinding) and Cement manufacturing. DCBL is the only plant in Tamil nadu + Kerala region to produce cement by using both Dry and Semi – Dry process, no other plant in Tamil nadu +

Kerala region produces cement using both technologies.

It can be inferred from the above discussions that the DCBL is only plant in Tamil Nadu + Kerala region to produce PPC with 'similar input/ raw materials' under 'similar market, economic and technical circumstances' and no other similar plant in the region exists to compare. Therefore alternative 3 does not exist for DCBL project activity.

Hence, Alternative – 1 - Continuation of the existing practice of cement (PPC) production is selected as baseline scenario for DCBL project activity.

Baseline emission calculations:

After selecting the region, benchmark for baseline emissions is to be determined. The lowest value among the following is to be selected as benchmark for baseline emissions:

I. The average (weighted by production) mass percentage of clinker for the 5 highest blend cement brands for the relevant cement type in the region; or
II. The production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region; or
III. The mass percentage of clinker in the relevant cement type produced in the proposed project activity plant before the implementation of the CDM project activity.

The mass percentage of clinker in PPC has been calculated for Alternative 1 and Alternative 3 and is tabulated below in Table B. 5.

Sl. No	**Conditions**	**Mass percentage of clinker in PPC (Tonne of clinker / Tonne of PPC)**	**As per the consolidated baseline methodology 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 Tamil nadu + Kerala Region	Not applicable	
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 Tamil nadu + Kerala Region	Not applicable	
	Alternative 1:		
3	The mass percentage of clinker in PPC produced in DCBL before the implementation of the CDM project activity during the year 1999-2000. (Please refer enclosure -1 of Emission reduction calculation sheet)	0.7061	✓

The mass percentage of clinker in PPC produced in DCBL before implementation of the project activity is selected as benchmark for baseline emissions. 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.

For determining baseline grid emission factor, Southern grid is chosen and grid emission factor is calculated according to consolidated methodology ACM0002. For detailed calculations of baseline emission estimation of Southern grid please refer to Enclosure 7 of Emission reduction calculation excel sheet.

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 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' Annex-1 to EB 16 Report.

Step 0. Preliminary Screening based on the starting date of the project activity

Not applicable to DCBL project activity since crediting period would start after registration

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

Define realistic and credible alternative scenarios to the CDM project activity that can be (part of) the baseline scenario through the following sub-steps:

Sub-step 1a. Define alternatives to the project activity

Sub-step 1b. Enforcement of applicable laws and regulations

DCBL 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.

All these Alternatives are in compliance with all applicable legal and regulatory requirements. There is no legal binding on DCBL to implement the any of the alternatives or the CDM 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

Step 2. Investment analysis OR

Step 3. Barrier analysis.

DCBL proceeds to establish project additionality by conducting the Step 3: Barrier Analysis.

DCBL is required to determine whether the project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives

through the following sub-steps:

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

Technological Barrier

The project activity has technical barriers related to use of PPC with higher additive%. In order to optimise and further reduce the clinker quantum per ton of PPC, DCBL conducted meticulous Research and Development (R & D) and numerous trials and experiments with varying percentage of fly ash 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. DCBL also carried out numerous trials with varying fineness of PPC cement with numerous permutation- combinations of different fly ash percentage additions and different clinker qualities.

By conducting such intensive tests, DCBL has finally developed its own product mix based on the quality of raw material used for the manufacture of fly ash based PPC upto 28 % addition of fly ash sourced from thermal power plants in the near vicinity and plans to increase the additive percentage to 32 % and above during the crediting period.

The increase in additive percent in PPC demands for good quality fly ash and limestone. Since DCBL plans to increase additive percent in PPC over the years, DCBL continuously carries out testing of quality of fly ash at various thermal power plants and also testing of quality of lime stone continuously.

An increase in the additive % in 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, DCBL had taken some initiatives in this direction to conduct awareness and training programmes as measures under the project activity implementation.

Other Barriers

Market barrier:

The barrier due to market uncertainties or customer's resistance is the major prohibitive barrier to project activity implementation.

The Indian market is dominated by OPC production. One of the prime reasons for the high OPC market share is attributed to the fact that Indian consumers have been mainly exposed to OPC only over the last two decades. The 'market's acceptability' of PPC with a higher additive percent is one of the major barriers due to prevailing practice as stated above. After implementation of the project activity, DCBL received many comments, queries on PPC with higher additive percentage from consumers, masons, dealers, handling agents. The various perceptions of the consumers, masons on higher additive based PPC are given below.

- The strength of PPC with higher additive percent is doubted.
- Some of the masons felt burning sensation in their hands while using higher additive based PPC, hence they doubt on quality of the blended material used for manufacturing PPC.
- The darker colour of PPC and the colour variations in them especially the floating carbon particles during mortar preparation are mistakenly attributed to impurity.
- Consumers feel that more the additive percent lesser will be the strength and quality of PPC.
- Consumers are apprehensive about setting time of higher additive based PPC.
- All the problems in construction faced due to poor operational practice is correlated to poor quality and strength of PPC.

As per the regulatory norms cement cannot be manufactured, stored or sold in India without it being tested and certified by Bureau of Indian Standards (BIS) carrying the BIS certification mark. PPC too had to be manufactured under strict quality control and meet international standards. This quality assurance of product alone could not overcome the market acceptability barrier.

These 'market acceptability' and 'customer resistance' barriers due to current prevailing practice in the Tamilnadu + Kerala region would have led to implementation of a project activity with PPC manufacture with lower additive percent (baseline) resulting in higher emissions;

As mentioned earlier DCBL took up several marketing and promotional activities in order to promote PPC with higher fly ash additive% in the consumer market. Some of the promotional activities are

1) Conducting regular training / educational programmes for engineers, architects, contractors, builders, masons, retailers, dealers and end users to discuss merits of PPC to boost their confidence level for this product.

   - Mason meets: DCBL conducts regularly mason meets in different cities and villages. In this programme DCBL invites masons of the near by area and conducts training on the benefits of PPC with higher additive percentage as well as other good construction practices. DCBL is the first plant in India to publish a separate magazine for masons. The mason magazine highlights benefits of PPC, good operational practices of PPC usage, queries of masons and the reply for them and details of masons meets.

   - The magazine forms a platform for interaction between masons. In same manner, DCBL is also only plant in Tamilnadu + Kerela region to form a large network system for about 50 000 masons. Each mason is given a unique identity number and letters and communication are addressed through this unique identity number. DCBL has formed this big network system to appraise its masons about advantages of higher additive based PPC and reply to queries raised by masons on PPC.

- Kerb Meets – About 20 –25 masons are invited on the shop of the dealer and briefed about PPC with higher additive percent. It ends with some refreshment and a gift to the participants.

- Architects / Engineers meets – DCBL invites architects/ engineers of the town at the venue commensuration to their status and brief about the use of PPC by experienced engineers.

- Plant Visit – DCBL also organize visits for the consumers, architects, engineers, contractors, builders and dealers to the cement plant to show them the process of manufacturing of PPC testing of the cement and its results in our equipped laboratory to enhance the confidence in PPC.

2) Mass distribution of handbills / leaflets / brochures amongst different segment of consumers. Awareness through advertisement/ media / literatures - creating awareness through advertisements in different news papers, magazines, souvenir, T.V. signboards, hoarding, literatures, leaflets, brochures, gift articles, calendars, dairies etc.

The total number of promotional activities conducted between the period: Year 2000-2003 (Table -3) in order to increase the market acceptability of the PPC product with higher additive percent is tabulated below. These promotional activities are a part of the project activity implementation and operation and would be conducted throughout the 10 year crediting period.

Activities	2000-01		2001-02		2002 - 03	
	Meets	Participants	Meets	Participants	Meets	Participants
Mason Meet	15	1500	16	1736	20	1979
Engnr./ Arch. Meet			3	185	4	211
Dealers/Retailer Meet			15	1280	13	853
Total Participants		1500		3201		3043

From the assessment of the current prevailing practices and the feedbacks received from the consumers PPC with 28 % fly ash additives it is evident that a strong market resistance to the product exists. This market acceptability barrier is further increased with further increase in the additive percent due to technical aspects related to use of PPC with higher additive%. However as per project under discussion and the cement production plan of DCBL, they will increase the fly ash additive% and the cost incurred to overcome this major barrier to the project activity implementation would be borne by the financial assistance to be made available under the CDM.

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

DCBL's alternative to project activity is producing of PPC with lower additive percent (continuing the current practice). This scenario does not face any Investment, Market and Technological barriers.

From the Step 1 and Step 2 we may conclude that the alternative – continuing of current practice does not have impediment. Please refer section B.2 for further details. However the project activity faces barriers, which would prevent DCBL from implementing the project activity as elaborated in the 'Barrier Analysis.

Step 4-a. Common Practice Analysis

The use of higher additive percent in PPC manufacturing in Tamilnadu + Kerala region is not a common practice .The blending percentage in the project activity is more than the baseline scenario and it is additional. It is not a common practice in the region.

Step 5. Impact of CDM registration

As stated above DCBL project activity has barriers associated to R&D activities, 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 DCBL's management took a corporate decision to invest

- in overcoming the barriers facing project implementation
- in the CDM project activity 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 DCBL 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:

Project Boundary

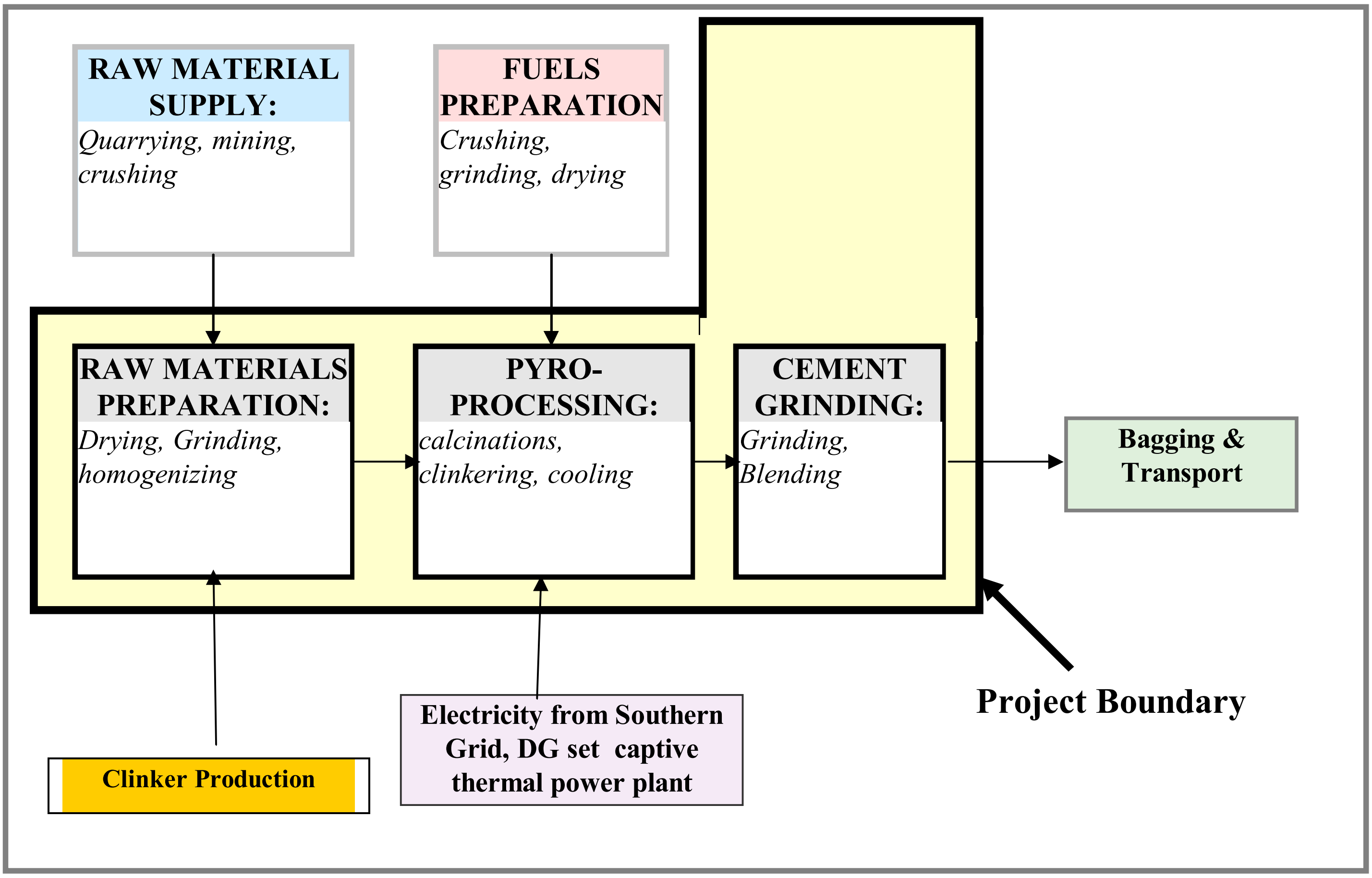
The project activity would affect the GHG emissions at all the three distinct stages of cement manufacturing. Therefore the project boundary includes
- the clinker and cement production plant at DCBL
- Onsite power generation which includes DG set based Power plant at DCBL

According the methodology, project boundary includes the cement production plant, onsite power generation and the power generation in the grid.

- Direct emissions at the cement plant due to fuel combustion for:
  - ✓ Firing the kiln
  - ✓ Processing (including drying) of solid fuels, raw materials, and additives;
  - ✓ On-site generation of electricity.
- Direct emissions due to calcination of limestone
- 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.

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.

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.



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: 21 October 2005

DCBL and its associated 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:

>> 01/06/2000

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

>> 25 years 0 months

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

Not Applicable

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:

>> 01/04/2006

C.2.2.2. Length:

>> 10 years 0 months

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)**

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 country. DCBL project activity increases the share of additives in PPC beyond current practices in the country and DCBL'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 DCBL's project activity.

The applicability of methodology is justified as following

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 abundant in the thermal power plants. DCBL takes fly ash from Mettur and Neyveli Thermal power plant where surplus fly ash is available. (Sufficient information is available on surplus availability of fly ash which may be shown to DOE during validation)

This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement types.

DCBL does not export PPC and all the PPC produced from the project activity are sold in domestic market only.

Adequate data are available on cement types in the market

Adequate data on cement types is available in the market through reports published by Cement Manufacturers Association, India

The DCBL's project activity fulfils all the applicability conditions described in the consolidated methodology.

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 no	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
1.1	$InCao_y$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated / measured as part of normal operations
1.2	$OutCao_y$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated /measured as part of normal operations
1.3	$InMgo_y$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated/ measured as part of normal operations
1.4	$OutMgo_y$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated/ measured as part of normal operations
1.5	Quantity of clinker raw material	Plant Records	Kilo Tonnes	M	Annually	100%	Electronic	

ID no	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
1.6	$CLNK_y$	Plant Records	Kilo Tonnes of clinker	M	Annually	100%	Electronic	
1.7	FF_{i_y}	Plant Records	tonnes of fuel i	M	Annually	100%	Electronic	
1.8	EFF_i	IPCC	tCO2/tonne of fuel i	C/M	Annually	100%	Electronic	
1.9	$PELE_{grid\_CLNK,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	
1.10	EF_{grid_BSL}	-	tCO2/MWh	C	Annually	100%	Electronic	ACM002 would be used to determine electricity emission
1.11	$PELE_{sg\_CLNK,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	
1.12	EF_{sg_y}	Plant Records/IPCC	tCO2/MWh	C	Monthly	100%	Electronic	
1.13	$ADD_{,y}$ Quantity of additives	Plant Records	Kilo Tonnes	M	Monthly	100%	Electronic	
1.14	$PELE_{gird\_BC,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	
1.15	$PELE_{sg\_BC,y}$	Plant Records	MWh	M	Monthly	100%	Electronic	
1.16	$PELE_{gird\_ADD,}$	Plant Records	MWh	M	Monthly	100%	Electronic	
1.17	$PELE_{sg\_ADD,BS L}$	Plant Records	MWh	M	Monthly	100%	Electronic	
1.18	$F_{i,j,y}$	Plant records	tonnes of fuel i	M	Monthly	100%	Electronic	

ID no	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
1.19	$COEF_{I,j,,y}$	IPCC / Plant Records	tCO2/tonne of fuel i	C/M	Annually	100%	Electronic	
1.20	$GEN_{I,y}$	Plant Records	MWh	M	Annually	100%	Electronic	
1.21	$PE_{calcin,y}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
1.22	$PE_{fossil\_fuel,y}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
1.23	$PE_{ele\_grid\_CLNK,y}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
1.24	$PE_{ele\_sg\_CLNK,y}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
1.25	$PE_{ele\_grid\_BC,y}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
1.26	$PE_{ele\_sg\_BC,y}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
1.27	$PE_{ele\_grid\_ADD,y}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
1.28	$PE_{ele\_sg\_ADD,y}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
1.29	$PE_{blend,y}$	Plant Records	Tonne of clinker/ tonne of blended cement	C	Annually	100%	Electronic	

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. (For example: if negative emission reductions of 30 tCO_2e occur in the year t and positive emission reductions of 100 tCO_2e occur in the year t+1, only 70 CERs are issued for the year t+1.)

$PE_{BC,y} = [PE_{clinker,y} * P_{Blend,y}] + PE_{ele\_ADD\_BC,y}$ ----------**(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 (tCO_2/tonne of BC)
CO_2 per tonne of clinker in the project activity plant in year y is calculated as below:

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

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

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

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

$PE_{elec\_sg\_CLNK,y}$ = [$PELE_{sg\_CLNK\ ,y}$* EF_{sg_y}] /[$CLNK_y$ * 1000] ---------**(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)

$PE_{ele\_ADD\_BC,y}$ = $PE_{ele\_grid\_BC,y}$ + $PE_{ele\_sg\_BC,y}$ + $PE_{ele\_grid\_ADD,y}$ + $PE_{ele\_sg\_ADD,y}$ ------------**(1.2)**

where:
$PE_{ele\_grid\_BC}$ = Grid electricity emissions for BC grinding in year y (tCO2/tonneof BC)
$PE_{ele\_sg\_BC}$ = Emissions from self generated electricity for BC grinding in year y (tCO2/tonne of BC)
$PE_{ele\_grid\_ADD}$ = Grid electricity emissions for additive preparation in year y (tCO2/tonne of BC)
$PE_{ele\_sg\_ADD}$ = Emissions from self generated electricity additive preparation in year y (tCO2/tonne of BC)

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

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

$PE_{elec\_sg\_BC,y}$ = [$PELE_{sg\_BC,y}$ * EF_{sg_y}] / [BC_y* 1000]--------------- **(1.2.2)**

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

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

$PELE_{grid\_ADD}$ = Grid electricity for grinding additives (MWh)
EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)

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

$PELE_{sg\_ADD,y}$ = Self generation electricity for grinding additives (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)

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 no	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
2.1	$InCao_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated / measured as part of normal operations
2.2	$OutCao_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated /measured as part of normal operations
2.3	$InMgo_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated/ measured as part of normal operations
2.4	$OutMgo_{BSL}$	Plant Records	%	M,C	Daily	100%	Electronic	Will be calculated/ measured as part of normal operations
2.5	Quantity of	Plant	Kilo Tonnes	M	Annually	100%	Electronic	

	clinker raw material	Records						

ID no	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
2.6	$CLNK_{BSL}$	Plant Records	Kilo Tonnes of clinker	M	Annually	100%	Electronic	
2.7	$FF_{i\ BSL}$	Plant Records	tonnes of fuel i	M	Annually	100%	Electronic	
2.8	EFF_i	IPCC	tCO2/tonne of fuel i	C/M	Annually	100%	Electronic	
2.9	$BELE_{grid\_CLNK,BSL}$	Plant Records	MWh	M	Annually	100%	Electronic	
2.10	EF_{grid_BSL}	-	tCO2/MWh	C	Annually	100%	Electronic	ACM002 would be used to determine electricity emission
2.11	$BELE_{sg\ CLNK,BS\ L}$	Plant Records	MWh	M	Annually	100%	Electronic	
2.12	EF_{sg_BSL}	Plant Records/IPCC	tCO2/MWh	C	Annually	100%	Electronic	
2.13	$ADD_{,BS\ L}$ Quantity of additives	Plant Records	Kilo Tonnes	M	Annually	100%	Electronic	
2.14	$BELE_{gird\ BC,BS\ L}$	Plant Records	MWh	M	Annually	100%	Electronic	
2.15	$BELE_{sg\ BC,BS\ L}$	Plant Records	MWh	M	Annually	100%	Electronic	
2.16	$BELE_{gird\ ADD,}$	Plant Records	MWh	M	Annually	100%	Electronic	
2.17	$BELE_{sg\ ADD,BS\ L}$	Plant Records	MWh	M	Annually	100%	Electronic	
2.18	$F_{i,j,BSL}$	Plant records	tonnes of fuel i	M	Annually	100%	Electronic	

ID no	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
2.19	COEF $_{I,j,BSL}$	IPCC / Plant Records	tCO2/tonne of fuel i	C/M	Annually	100%	Electronic	
2.20	GEN $_{I,BSL}$	Plant Records	MWh	M	Annually	100%	Electronic	
2.21	BE $_{calcin,BS\ L}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
2.22	BE $_{fossil\_fuel,BS\ L}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
2.23	BE $_{ele\_grid\_CLNK,BS\ L}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
2.24	BE $_{ele\_sg\_CLNK,BS\ L}$	Plant Records	tCO2/tonne of clinker	C	Annually	100%	Electronic	
2.25	BE $_{ele\_grid\_BC,BS\ L}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
2.26	BE $_{ele\_sg\_BC,BS\ L}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
2.27	BE $_{ele\_grid\_ADD,BS\ L}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
2.28	BE $_{ele\_sg\_ADD,BS\ L}$	Plant Records	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
2.29	A $_{blend,y}$	Plant Records	Tonne of Additives/ tonne of blended cement	C	Annually	100%	Electronic	
ID	Data variable	Source of data	Data unit	Measured	Recording	Proportion	How will the data be	Comment

no				(m), calculated (c) or estimated (e)	Frequency	of data to be monitored	archived? (electronic/ paper)	
2.30	EF_{grid_BSL}	TNEB, CEA reports	tCO2/MWh	C	Once at the beginning of the crediting period	100%	Electronic,	Calculated as weighted sum of OM and BM emission factors as per Step 3 of ACM0002
2.31	$EF_{OM, y}$	TNEB, CEA reports	tCO2/MWh	C	Once at the beginning of the crediting period	100%	Electronic	Calculated as Step 1 of ACM0002
2.32	$EF_{BM, y}$	TNEB, CEA reports	tCO2/MWh	C	Once at the beginning of the crediting period	100%	Electronic	Calculated as Step 2 of ACM0002
2.33	$F_{i,y}$	TNEB, CEA reports	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 Station Heat Rate data of power plants of Southern grid
2.34	$COEF_i$	IPCC/local	tCO2/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 Southern grid
2.35	$GEN_{j,y}$	TNEB, CEA reports	MWh / annum	M	Once at the beginning of the	100%	Electronic	Obtained from authentic and latest local statistics

					crediting period			

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 baseline emissions are a function of two factors:

- the percentage of additives and the related electricity consumption that is taken as the baseline benchmark; and
- the CO2 emissions per tonne of clinker in the project activity plant, which in turn

depends on

- ✓ Quantity and carbon intensity of the fuels used in clinker making;
- ✓ Quantity and carbon intensity of electricity;
- ✓ CO2 emissions from calcinations.

The formulae used for estimation of the anthropogenic emissions by sources of greenhouse gases of the baseline scenario are as under as in Equation 1
$BE_{BC,y} = [BE_{clinker} * B_{Blend,y}] + BE_{ele\_ADD\_BC}$ **------(2)**
where:
$BE_{BC,y}$ = Baseline CO2 emissions per tonne of blended cement type (BC) (tCO2/tonne BC)
$BE_{clinker}$ = CO2 emissions per tonne of clinker in the baseline in the project activity plant (t CO2/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 (tCO2/tonne of BC)

CO2 per tonne of clinker in the project activity plant in the baseline is calculated as below:
$BE_{clinker} = BE_{calcin} + BE_{fossil\_fuel} + BE_{ele\_grid\_CLNK} + BE_{ele\_sg\_CLNK}$ …………**(2.1)**
where:
$BE_{clinker}$ = Baseline emissions of CO2 per tonne of clinker in the project activity plant (t CO2/tonne clinker)
BE_{calcin} = Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (t CO2/tonne clinker)
BE_{fossil_fuel} = Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (t CO2/tonne clinker)

$BE_{ele\_grid\_CLNK}$ = Baseline grid electricity emissions for clinker production per tonne of clinker (t CO2/tonne clinker)
$BE_{ele\_sg\_CLNK}$ = Baseline emissions from self generated electricity for clinker production per tonne of clinker (t CO2/tonne clinker)

BE_{calcin} = [0.785*(OutCaO - InCaO) + 1.092*(OutMgO - InMgO)] / [$CLNK_{BSL}$ * 1000]-------**(2.1.1)**
where:
BE_{calcin} = Emissions from the calcinations of limestone (tCO2/tonne clinker)
0.785 = Stoichiometric emission factor for CaO (tCO2/t CaO)
1.092 = Stoichiometric emission factor for MgO (tCO2/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)**
FF_{i_BSL} = Fossil fuel of type i consumed for clinker production in the baseline (tones of fuel i)
EFF_i = Emission factor for fossil fuel i (t CO2/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)**
$BELE_{grid\_CLNK}$ = Baseline grid electricity for clinker production (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO2/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 Southern grid mix. Simple OM factor is calculated as under.

$EF_{OM, simple, y}$ is calculated as the average of the most recent three years (2002-2003, 2003-2004 and 2004-2005)

$$EF_{OM,simple,y} = \sum_{i,j} F_{i,j,y} \times COEF_{i,j} / \sum_{j} GEN_{j,y}$$

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

$$\sum_{i} F_{i,j,y} = \left(\sum_{j} GEN_{j,y} \times 860 \Big/ NCV_{i} \times E_{i,j} \right)$$

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

$$COEF_i = NCV_i \times EF_{CO_2,i} \times OXID_i$$

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:

$$EF_{BM,y} = \sum_{i,m} F_{i,m,y} \times COEF_{i,m} / \sum_{m} GEN_{m,y}$$

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 Southern 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. (Please refer to Enclosure 7 Emission reduction calculation excel sheet)

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 ($EF_{BM, y}$):

$$EF_y = W_{OM} \times EF_{OM,Simple,y} + W_{BM} \times EF_{BM,y}$$

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.

$$BE_y = EF_y \times EG_y$$

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.

$BE_{elec\_sg\_CLNK}$ = [$BELE_{sg\_CLNK}$ * EF_{sg_BSL}] /[$CLNK_{BSL}$ * 1000]--------- **(2.1.4)**
$BELE_{sg\_CLNK}$ = Baseline self generation of electricity for clinker production (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{ele\_ADD\_BC}$ = $BE_{ele\_grid\_BC}$ + $BE_{ele\_sg\_BC}$ + $BE_{ele\_grid\_ADD}$ + $BE_{ele\_sg\_ADD}$ --------**(2.2)**
where:
$BE_{ele\_grid\_BC}$ = Baseline grid electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele\_sg\_BC}$ = Baseline self generated electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele\_grid\_ADD}$ = Baseline grid electricity emissions for additive preparation (tCO2/tonne of BC)
$BE_{ele\_sg\_ADD}$ = Baseline self generated electricity emissions for additive preparation (tCO2/tonne of BC)

$BE_{ele\_grid\_BC}$ = [$BELE_{grid\_BC}$ * EF_{grid_BSL}] /[BC_{BSL}* 1000]-------------- **(2.2.1)**

$BELE_{grid\_BC}$ = Baseline grid electricity for grinding BC (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$BE_{elec\_sg\_BC}$ = [$BELE_{sg\_BC}$ * EF_{sg_BSL}] / [BC_{BSL} * 1000]------------**(2.2.2)**

$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding BC (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$BE_{ele\_grid\_ADD}$ = [$BELE_{grid\_ADD}$ * EF_{grid_BSL}] /[BC_{BSL}* 1000]---------- **(2.2.3)**

$BELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO2/MWh)

$BE_{elec\_sg\_ADD}$ = [$BELE_{sg\_ADD}$ * EF_{sg_BSL}] / [BC_{BSL}* 1000]------- **(2.2.4)**

$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding additives (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO2/MWh)

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.):

>>

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 no	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
3.1	Fuel consumption for the vehicle per kilometre	Plant Records	Kg of fuel/ Kilometer	C	Annually	100%	Electronic	
3.2	Distance between the source of additive and project activity plant	Plant Records	km	M	Per Trip	100%	Electronic	
3.3	Quantity of additive carried in one trip per vehicle	Plant Records	Tonnes of addtive/ vehicle	M	Per Trip	100%	Electronic	
3.4	Emission factor for transport fuel	IPCC	Kg CO2/Kg of fuel	E	Annually	100%	Electronic	
3.5	Electricity consumption for	Plant Records	MWh	M	Monthly	100%	Electronic	

	conveyor system for additives							
3.6	Grid electricity emission factor	National Grid / Plant Data	tonnes of CO2/MWh	C	Annually	100%	Electronic	
3.7	Tonnes of additives in year y / total additional additives used in year	Plant Records	Tonnes of fly ash	M/C	Annually	100%	Electronic	

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.

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

where:

L_{add_trans} = Transport related emissions per tonne of additives (t CO2/tonne of additive)

TFcons = Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre)

Dadd_source = Distance between the source of additive and the project activity plant (km)

TEF = Emission factor for transport fuel (kg CO2/kg of fuel)

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

EF_{grid} = Grid electricity emission factor (tonnes of CO2/MWh)

ADD_y = Annual consumption of additives in year y. (t of additives)

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

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

$Ly = L_{add\_trans} * [A_{blend,y} – P_{blend,y}] * BCy$ -----------------(3.1)

where:

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

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

$A_{blend,y}$ = Baseline benchmark share of additives per tonne of BC updated for year y (tonne of additives/tonne of BC)

$P_{blend,y}$ = Share of clinker 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:
αy = x tonnes of additives in year y / total additional additives used in year y ----------------**(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 CO2 emissions through substitution of clinker in cement by blending materials. Emissions reductions in year y are the difference in the CO2 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

ERy = { [BEBC,y – PEBC,y] * BCy + Ly } * (1 – αy) ---------------**(5)**

ERy = Emissions reductions in year y due to project activity (thousand tonnes of CO2)
BEBC,y = Baseline emissions per tonne of BC (t CO2/tonnes of BC)
PEBC,y = Project emissions per tonne of BC in year y (t CO2/tonnes of BC)
BCy = BC production in year y (thousand tonnes)
Ly = Leakage emissions for transport of additives (kilotonnes of CO2)
αy = 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.
1.1	Low	ISO 9001

1.2	Low	-Do-
1.3	Low	-Do-
1.4	Low	-Do-
1.5	Low	-Do-
1.6	Low	-Do-
1.7	Low	-Do-
1.8	Low	IPCC values would be used
1.9	Low	ISO 9001
1.11	Low	ISO 9001
1.12	Low	IPCC values would be used
1.13	Low	ISO 9001
1.14	Low	-Do-
1.15	Low	-Do-
1.16	Low	-Do-
1.17	Low	-Do-
1.18	Low	-Do-
1.19	Low	IPCC values would be used
1.20	Low	ISO 9001
1.21	Low	-Do-
1.22	Low	-Do-
1.23	Low	-Do-
1.24	Low	-Do-
1.25	Low	-Do-
1.26	Low	-Do-
1.27	Low	-Do-
1.28	Low	-Do-
1.29	Low	-Do-
2.1	Low	ISO 9001
2.2	Low	-Do-
2.3	Low	-Do-
2.4	Low	-Do-

2.5	Low	-Do-
2.6	Low	-Do-
2.7	Low	-Do-
2.8	Low	IPCC values would be used
2.9	Low	ISO 9001
2.11	Low	ISO 9001
2.12	Low	IPCC values would be used
2.13	Low	ISO 9001
2.14	Low	-Do-
2.15	Low	-Do-
2.16	Low	-Do-
2.17	Low	-Do-
2.18	Low	-Do-
2.19	Low	IPCC values would be used
2.20	Low	ISO 9001
2.21	Low	-Do-
2.22	Low	-Do-
2.23	Low	-Do-
2.24	Low	-Do-
2.25	Low	-Do-
2.26	Low	-Do-
2.27	Low	-Do-
2.28	Low	-Do-
2.29	Low	-Do-
3.1	Medium	-Do-
3.2	Medium	-Do-
3.3	Low	IPCC values would be used
3.4	Low	ISO 9001

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

>>

DCBL has implemented an operational and management structure in order to monitor emission reductions and any leakage effects, generated by the project activity.

DCBL has formed a CDM team/committee comprising of persons from relevant departments, which will be responsible for monitoring of all the parameters mentioned in this section. The CDM team also comprises of a special group of operators who are assigned the responsibility of monitoring of different parameters and record keeping. On a weekly basis, the monitoring reports are checked and discussed by the seniors CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it is informed to the concerned person for necessary actions. On monthly basis, these reports are forwarded at the management level.

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

>>

DCBL along with guidance from their consultants

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>> Please refer to Enclosure 3 ,6 of Emission reduction calculation excel sheet for detailed calculations.

Sl. No.	Operating Years	Project Emission Factor (tones of CO_2 / tPPC)	Project Emission (tones of CO_2)
1.	2006-2007	0.596	1041238
2.	2007-2008	0.578	1251150
3.	2008-2009	0.578	1480788
4.	2009-2010	0.561	1553171
5.	2010-2011	0.561	1553171
6.	2011-2012	0.561	1553171
7.	2012-2013	0.561	1553171
8.	2013-2014	0.561	1553171
9.	2014-2015	0.561	1553171
10.	2015-2016	0.561	1553171
	Total		**14645373**

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 to Enclosure 5 of Emission reduction calculation excel sheet for detailed calculations.

Sl. No.	Operating Years	Leakage (tones of CO_2)
1.	2006-2007	318
2.	2007-2008	657
3.	2008-2009	660
4.	2009-2010	1045
5.	2010-2011	913
6.	2011-2012	777
7.	2012-2013	639
8.	2013-2014	498
9.	2014-2015	355
10.	2015-2016	208
	Total	**6070**

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. Please refer to Enclosure 6 of Emission reduction calculation excel sheet for detailed calculations.

Sl. No.	Operating Years	Total Project Activity emissions (tones of CO_2)
1.	2006-2007	1041556
2.	2007-2008	1251807
3.	2008-2009	1481447
4.	2009-2010	1554216
5.	2010-2011	1554084
6.	2011-2012	1553948
7.	2012-2013	1553810
8.	2013-2014	1553669
9.	2014-2015	1553526
10.	2015-2016	1553379
	Total	**14651442**

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:
>>
Please refer to Enclosure 2,4,6 of Emission reduction calculation excel sheet for detailed calculations.

Sl. No.	Operating Years	Baseline Emission Factor (tones of CO_2 / tPPC)	Baseline Emissions (tones of CO_2)
1.	2006-2007	0.614	1072309
2.	2007-2008	0.609	1317900
3.	2008-2009	0.604	1547102
4.	2009-2010	0.599	1660609
5.	2010-2011	0.594	1646321
6.	2011-2012	0.589	1631748
7.	2012-2013	0.584	1616882
8.	2013-2014	0.578	1601720
9.	2014-2015	0.572	1586254
10.	2015-2016	0.567	1570479
	Total		**15251324**

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

Please refer to Enclosure 6 of Emission reduction calculation excel sheet for detailed calculations.

Sl. No.	Operating Years	CO_2 Emission Reductions (tones of CO_2)
1.	2006-2007	30753
2.	2007-2008	66094
3.	2008-2009	65655
4.	2009-2010	106393
5.	2010-2011	92238
6.	2011-2012	77799
7.	2012-2013	63072
8.	2013-2014	48050
9.	2014-2015	32728
10.	2015-2016	17100
	Total	**599882**

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

Year	Estimation of Project activity Emission reductions (tonnes of CO2 e)	Estimation of baseline Emission reductions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of emission reductions (tonnes of CO2 e)
2000-2001	1041556	1072309	318	30753
2001-2002	1251807	1317900	657	66094
2002-2003	1481447	1547102	660	65655
2003-2004	1554216	1660609	1045	106393
2004-2005	1554084	1646321	913	92238
2005-2006	1553948	1631748	777	77799
2006-2007	1553810	1616882	639	63072
2007-2008	1553669	1601720	498	48050
2008-2009	1553526	1586254	355	32728
2009-2010	1553379	1570479	208	17100
Total **(tonnes of CO2 e)**	**14651442**	**15251324**	**6070**	**599882**

SECTION F. Environmental impacts

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

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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[2] 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 that is fly ash blending 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 DCBL ensures maximum global and local benefits with respect to certain environmental and social issues and contributes marginally towards sustainable development. The project activity - to utilize pollutant - 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 and 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.

DCBL being an ISO 14001 organization has specialized environmental management systems and 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 nature of the impacts that are evident during the operational phase is discussed in detail given below. The environmental impact during the construction phase is regarded as temporary or short term and hence does not affect the environment significantly.

The DCBL'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.

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

SL. NO.	ENVIRONMENTAL IMPACTS and 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 , Lignite , Petcoke conservation.
2	**Coal , Lignite , Petcoke conservation:** The project activity reduces specific electrical and 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/ lignite, 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.	
SL. NO.	**ENVIRONMENTAL IMPACTS and BENEFITS**	**MITIGATION MEASURES/ REMARKS**
	CATEGORY: ENVIRONMENTAL – AIR QUALITY	

	Global By reducing the clinker content of the cement, the project activity reduces CO_2 emissions due to 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. **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 and handling of fly ash where there are chances of fugitive dust emission at unloading and feeding points.	The project activity reduces emission of CO_2 -a global entity. According to Central Pollution Control Board, the plant is required to meet the legal stack emission limit of 150 mg/Nm^3 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 Mettur and Neyveli power plant in bouser tankers to avoid any spillage.

SL. NO.	ENVIRONMENTAL IMPACTS and BENEFITS	MITIGATION MEASURES / REMARKS
C	CATEGORY: ENVIRONMENTAL –WATER	
1	The project activity utilizes industrial waste -fly ash and negates 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	
12	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.

SL. NO.	ENVIRONMENTAL IMPACTS and BENEFITS	MITIGATION MEASURES / REMARKS
E	CATEGORY: ENVIRONMENTAL – NOISE GENERATION	
1	**The project activity does not contribute to noise pollution.**	-
F	CATEGORY: SOCIAL	
1 2	**Mining Risks:** Limestone quarry mining experiences landslides and destruction in the history of mining. Reduction in clinker production consecutively reduces consumption of limestone which would indirectly reduce chances of landslides and landscape destruction at the 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- semi-skilled, unskilled, and 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.

SL. NO.	ENVIRONMENTAL IMPACTS and BENEFITS	MITIGATION MEASURES / REMARKS
3	**Capacity Building** The project activity indirectly promotes development of waste management infrastructure and associated value chain between two different types of industries mutually befitting each other's operation. Thus the external activities of the project link 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 types 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.	-

Thus above analysis clearly purports that the project activity has excellent environmental benefits in terms of reduction of carbon emissions, limestone resource conservation, coal /lignite, petcoke conservation, decreased environmental destruction and enhanced restoration, economical and social prosperity by opening avenues for investment in waste, etc

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:

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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 needn't conduct the EIA.

SECTION G. Stakeholders' comments

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

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The stakeholders identified for the project are as under:

- Elected body of representatives administering the local area
- Thermal power plant (s) supplying Fly ash
- Tamilnadu Pollution Control Board (TNPCB)
- Project Consultants

The project activity aims to reduce clinker content in cement by fly ash blending and would result in simultaneous benefits like industrial waste minimization, conservation of natural resources and manufacture of high quality PPC with optimum use of clinker content.

The stakeholders for the project activity have been identified on the basis of their involvement at various stages of project activity. The list of relevant stakeholders includes all governmental and non-governmental organization, which were involved in the project at various stages.

DCBL invited local villagers, elected representatives for stakeholders meeting through printed invitation letter. During the meeting DCBL officials apprised local villagers, elected representatives about the various activities carried out by DCBL in field of power and environment. DCBL informed about the project activity and its associated benefits.

Project consultants were involved in the project to take care of various pre contract and post contract project activities like preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, successful commissioning and trial runs.

G.2. Summary of the comments received:

>>

- Elected body of representatives administering the local area

The village *Panchayat* / local elected body of representatives administering the local area is a true representative of the local population in a democracy like India. Hence, their appraisal / permission to use fly ash and operate the plant are very necessary. As stated in section G.1, a stakeholders meeting was conducted and DCBL project activity was very well appreciated by the local villagers.

- Thermal power plant (s) supplying Fly ash

Thermal power plants (Mettur and Neyveli) that supply fly ash to DCBL are benefited by the project because fly ash disposal problem and its associated hazards gets reduced, so the thermal power plants supplying fly ash has positive opinions about the project.

- Tamilnadu Pollution Control Board (TNPCB)

TNPCB 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 TNPCB during the commissioning of the plant. The project activity abates the environmental impacts on the local ambient air quality and meets all the statutory requirements. DCBL submits an annual Environmental Statement to TNPCB and also describes the Environmental aspects of the plant in its annual report. .As discussed in earlier in chapter F, the project activity has many positive environmental impacts and does not violate the environmental norms.

- Project Consultants/Equipment Suppliers

Project Consultants/ Equipment suppliers have supplied the equipments as per the specifications finalized for the project and successfully erected & commissioned of the same at the site and for performance.

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

>>

During stakeholders meeting, local villagers appreciated DCBL for undertaking Environmental friendly project activity. No other adverse comments were received from the stakeholders

As per UNFCCC requirement the PDD will be published at the validator's web site for public comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Dalmia Cement Bharat Limited
Street/P.O.Box:	Dalmiapuram
Building:	
City:	Dalmiapuram
State/Region:	Tamilnadu
Postfix/ZIP:	621 651
Country:	India
Telephone:	91-11-2371 4094
FAX:	91-11-2601 1329
E-Mail:	
URL:	
Represented by:	
Title:	Executive Director (Tech dev)
Salutation:	Dr. Narang
Last Name:	Narang
Middle Name:	C
First Name:	K
Department:	-
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	kcnarang@dalmiacement.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding received for the project activity till date.

Annex 3
Baseline Data

Please refer Enclosure 1-6 of Emission reduction calculation excel sheet.

Annex-4

Monitoring plan

DCBL'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 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, DCBL 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 state of art monitoring and control equipment that will measure, record, report, monitor and control various key parameters like total cement and clinker produced, 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, DCBL has designed adequate and apt instruments for the project activity, to control and monitor various operating parameters for safe, effective and efficient operations like raw material processing, kiln, grinding and mixing.

The instrumentation system comprises of microprocessor-based instruments like weigh feeders etc. (of reputed makes) that adheres the required specifications and of best accuracy levels. The instruments are calibrated (by reputed third parties) 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

DCBL 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. The project system comprising of the raw material transportation system, Pre Calcination, Kiln, Grinding, Electrostatic precipitator and the ash disposal system.

The project boundary covers the point of supply of raw material to the point of finished goods dispatch where the project proponent has a full control. Hence, project boundary is considered within these terminal points.

GHG emissions sources of the project

Direct on-site emissions

In the project activity, clinker is substituted by additives (like fly ash) and therefore itself does-not emits no direct GHG.

Indirect on-site emissions

The indirect on site GHG source is the consumption of energy and the emission of GHGs involved in the construction of the cement blending equipment. Considering the life cycle assessment of the total power generated and the emissions to be avoided in the life span of 25 years, emissions from the above-mentioned source is too small and hence neglected.

Direct off site emissions

Direct off site emission is due to the fly ash transportation from thermal power plants to the facility site and have been considered in the leakage due to transportation.

In-Direct off-site emissions

This includes emissions during the manufacturing process of parts, supplies and machinery required for building the project (i.e. electromechanical equipment, etc.). But these emissions are outside the control of the project and excluded;

Project parameters affecting emission reduction claims

Monitoring

The CDM mechanism stands on the quantification of emission reduction and keeping the track of the emissions reduced. The project activity reduces the carbon dioxide whereas an apt monitoring system ensures this reduction is quantified and helps maintaining the required level. The monitoring system brings about the flaws (if any are identified) in the system and opens up always, opportunities for amelioration.

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(in effect as of: July 1, 2004)
5.	UNFCCC document: Annex B to attachment 3 Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories ver 05, February 25, 2005.
	Baseline Related
6.	Report of the working group on cement industry, X-Five year Plan (2002-2007), Government of India, Planning Commission, February, 2000.
7.	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
8.	Cement Industry Data, by Cement Manufacturers' Association, Annual report 1999,2000,2001,2002,2003-March 2004
9.	Module – 1:Estimation of Fair Prices of Cement, May 2001; by The credit rating information services of India Limited.
10.	Module – 2:Current Demand Supply Scenario, May 2001; by The credit rating information services of India Limited
11.	Module – 3:Trends in Cement Prices, May 2001; by The credit rating information services of India Limited
12.	www.infraline.com
13.	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.
14.	'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
15.	IPCC-Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (There is no year for this document)

Sr.No	Particulars of the references
	- 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
16.	'Anthropogenic Emissions from Energy Activities in India: Generation and Source Characterization' by Moti L. Mittal and C. Sharma
17	http://mnes.nic.in/baselinepdfs/annexure2a.pdf
18	Report on Indian Cement Industry, ICRA, March 2004
	Project Related
19.	Various project related information / documents / data received from DCBL 's cement manufacturing units, Dalmiapuram , Tamilnadu
20.	Various project related information / documents / data on Environmental Impacts received from DCBL's cement manufacturing units, Dalmiapuram , Tamilnadu
21.	Various project related information / documents on Stakeholders comments received from DCBL s cement manufacturing units, Dalmiapuram , Tamilnadu

Appendix 2

ABBREIVIATIONS

BAU	Business As Usual
BE	Baseline Emissions
BM	Build Margin
CaCO3	Calcium Carbonate
CaO	Calcium Oxide
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CM	Combined Margin
CMA	Cement Manufacturer Association of India
CO2	Carbon di-oxide
CPWD	Central Public Works Department
DCBL	Dalmia Cement (Bharat) Limited
EB	Executive Board
equ	Equivalent
GHG	Greenhouse Gas
IPCC	Intra-governmental Panel for Climate Change
INR	Indian Rupee
kg	kilo gram
km	kilo meter
MoEF	Ministry of Environment and Forests
MoP	Ministry of Power
OM	Operating Margin
OPC	Ordinary Portland Cement
PE	Project Emissions
PPC	Portland Pozzolonic Cement
tCO2	ton of Carbon Di Oxide
TJ	Trillion Joules
UNFCCC	United Nations Framework Convention on Climate Change

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