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:

>>
GACL Blended cement projects at:

- Maratha Cement plant
- Gujarat Unit
- Himachal Unit
- Ropar Unit
- Bhatinda Unit
- Rabriyawas Unit

Version 10, 16/06/2006

A.2. Description of the project activity:

>>
The project activity consists of an increase in the blending of fly ash in the PPC cement produced by Gujarat Ambuja Cements Ltd. (GACL). The current average percentage blend of fly-ash produced by GACL is 25%, and the project activity is expected to enable GACL to increase this to 32% and above.

The current fly ash blend level represents a plateau for GACL and to increase the blend above this level requires significant investment and involves a number of barriers. To help overcome these barriers GACL are utilising the CDM.

The project activity will displace clinker with fly ash in the production of PPC. This will reduce clinker production and the associated CO_2 emissions per tonne of cement produced.

The project contributes to sustainable development in a number of ways. In terms of social well being, the cement plants undertaking the project activities are important local employers. The project activities will directly increase employment in research and marketing personnel. In terms of economic well being, the project activity has resulted in additional investment in research and marketing, as well as in fly ash handling facilities. A major impact of the project activity is in terms of environmental well being – limestone is a finite resource, and the (open cast) mining of limestone can have adverse environmental effects. Fly ash is a by-product of electricity generation, and is a product for which disposal can be difficult. Replacing limestone-derived clinker with fly ash therefore provides two benefits. Moreover, clinker production is highly energy intensive. Reducing clinker production will therefore conserve energy and given the power shortages that are prevalent in many parts of India, will assist India's overall development process. The projects will also reduce emissions of greenhouse gases. Finally, in terms of technological well being, the project activities involve the development of specific technologies to increase the fly ash content of PPC. The technology involved in blending fly ash has been developed indigenously by GACL, and GACL have referred of a number of scientific studies that have been carried out in Annex 1 countries on options available for increasing the blending of fly ash and on the properties of PPC.

A.3. Project participants:

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Name of Party involved	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant
India (host)	Private entity: Gujarat Ambuja Cements Ltd. Public entity: Ministry of Environment and Forests	No
United Kingdom	Private entity: Agrinergy Ltd. Public entity: Department of Environment, Food and Rural Affairs	No

Mr A V Rao of Gujurat Ambuja Cements Ltd will be responsible for the registration of the project activity.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>> The projects take place at six of the cement plants owned and run by GACL. The location of each cement plant is outlined below:

Maratha Cement plant Upparwahi – 442 908 Korpana (Taluk) Chandrapur Maharashtra	**Ropar Unit P.O. Lodhimajara Dist. Ropar Punjab – 140 113**
Gujarat Unit P.O Ambujanagar Taluk Kodinar Dist. Junagadh Gujarat - 362715	**Bhatinda Unit Near G.N.D.T.E. Bhatinda Punjab**
Himachal Unit P.O. Darlaghat – 171 102 Dist. Solan Himachal Pradesh	**Rabriyawas Unit P.O. Rabriyawas Dist. Pali Rajasthan 306 709**

A.4.1.1. Host Party(ies):

>> India

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

>>

Maratha Cement plant **Maharashtra State**	**Ropar Unit** **Punjab State**
Gujarat Unit **Gujarat State**	**Bhatinda Unit** **Punjab State**
Himachal Unit **Himachal Pradesh State**	**Rabriyawas Unit** **Rajasthan State**

A.4.1.3. City/Town/Community etc:

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Maratha Cement plant **Upparwahi** **Korpana (Taluk)** **Chandrapur**	**Ropar Unit** **Dist. Ropar**
Gujarat Unit **Taluk Kodinar** **Dist. Junagadh**	**Bhatinda Unit** **Bhatinda**
Himachal Unit **Dist. Solan**	**Rabriyawas Unit** **Dist. Pali**

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

>>

The details of plant locations are outlined above. The cement plants are easily visible and uniquely identifiable. The map below illustrates the location of plant within India and also shows the individual states of India each plant is situated in.

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

>> Manufacturing industries

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

>>
The cement plants undertaking the CDM project activities range in annual capacity from 0.5 million tonnes to 4.5 million tonnes.

The technology involved in blending fly ash has been developed indigenously by GACL. However, GACL have referred of a number of scientific studies that have been carried out in Annex 1 countries on options available for increasing the blending of fly ash and on the properties of PPC.

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 activities consist of increasing the blending of fly ash in PPC produced at the project sites. This will reduce clinker production and associated GHG emissions. As outlined in the methodology, these emissions arise from the calcination of limestone, fossil kiln fuel combustion and consumption of electrical energy.

The proposed projects will take the additive blend to a level that is not common practice and which will require a number of barriers to be overcome. A considerable research effort has been and will continue to be made to enable the increase in fly-ash blending associated with the project activity, whilst crucially maintaining the quality and brand reputation of Gujarat Ambuja PPC. At the same time, considerable marketing and educational effort must be undertaken to ensure that customers are aware that the quality and properties of the brand remains the same, despite the increased fly ash content.

In the absence of the project activity, these actions would not be undertaken, and the fly ash blend of PPC produced by the GACL cement plants would remain at the current level. Under this (baseline) scenario, clinker production per tonne of cement and hence GHG emissions would also be higher.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e					
	Maratha	**Gujarat**	**Himachal**	**Ropar**	**Bhatinda**	**Rabriyawas**
Year 1	4924	41548	10004	10696	0	0
Year 2	7033	40048	27323	30475	0	0
Year 3	210510	452174	26430	51233	4479	0
Year 4	270511	433856	20275	39302	3234	33
Year 5	310495	415172	13997	27132	336	2087
Year 6	291167	396114	7593	14719	1938	640
Year 7	271453	376676	1062	2058	0	0
Year 8	251344	356848	0	0	0	0
Year 9	230832	336623	0	0	0	0
Year 10	209911	315995	0	0	0	0
Total estimated reductions (tonnes of CO_2e)	**2058180**	**3165055**	**106683**	**175615**	**9989**	**2760**
Total number of crediting years	**10**	**10**	**10**	**10**	**10**	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**205818**	**316506**	**10668**	**17562**	**999**	**276**

A.4.5. Public funding of the project activity:

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The project activity has received no public funding.

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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ACM0005
"Consolidated Baseline Methodology for increasing the Blend in Cement Production"

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:
>>
The methodology used has been specifically designed for project activities of this kind. In terms of the specific applicability conditions:

- There is no shortage of additives to prevent leakage related to the lack of blending materials – The project activity will result in an increase in the percentage of fly ash blended in PPC produced at the specified GACL cement plants. The GACL plants are situated in India. Fly ash production in India is estimated at around 90 million tonnes per year, whilst annual utilisation is estimated at 13 million tonnes[1]. Disposal of fly ash in India is considered an environmental problem. We can therefore conclude that there is sufficient supply of fly ash that the project activity will not lead other PPC producers to reduce their fly ash blend rate.
- The methodology is applicable to domestically sold output of the project activity sold plant and excludes export of blended cement types – This is the case.
- Adequate data are available on cement types in the market – This is the case. A database has been obtained from the Cement Manufacturers Association of India.

B.2. Description of how the methodology is applied in the context of the project activity:
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Baseline Scenarios
The first element of the methodology is to identify the baseline scenario. Production of fly ash based PPC in India is subject to the Bureau of Indian Standards specification IS: 1489 (Part 1). This specifies that the percentage of pozzolana material (i.e. fly ash) in PPC must fall between the ranges of 15% to 35%. The current blend level varies between 16% and 27%. This is an optimum level that has been reached based on the clinker and fly ash quality at each plant, and taking into account the views of PPC users. These levels all fall within the range specified by IS: 1489 (Part 1) and there is no requirement or need for these levels to be increased. The likely baseline scenario is the continuation of the current blend level, although in Section B.3 we also evaluate the project activity as a potential baseline scenario.

In addition to the project activity and maintenance of the current blend level, other theoretically possible baseline scenarios consist of:

- A reduction in the blend level
- A switch to production of Ordinary Portland Cement (OPC)
- A switch to production of another type of cement (e.g. Portland Blast Furnace Slag Cement)

[1] Source: http://www.tifac.org.in/news/flymgm.htm. TIFAC is an autonomous organisation under the Indian Department of Science and Technology

Given the barriers to increasing the blend of fly ash in PPC, and the continued prevalence of customer resistance to high fly-ash blended cements, there is a possibility that GACL would reduce the fly-ash blend. However, demonstrating that this would occur is difficult. We can exclude this course of action as doing so is a conservative assumption. A switch to OPC can also be excluded as doing so adds conservativeness. A switch to PBFS is a potential possibility. However, PBFS production is limited to areas where there is availability of slag from steel plants. This is not the case at any of the project activities cement plants, and this option can therefore also be ruled out.

The realistic and credible alternatives can therefore be restricted to two – the existing practice of cement production and the proposed project activity – and therefore the tool for demonstration of additionality is used to determine the most likely baseline scenario (see Section B.3.).

Baselines Emissions
The first element in the calculation of baseline emissions is the baseline benchmark share of clinker in PPC. In line with the applied methodology this is calculated as the lowest value among the following:

(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 first step is to define the relevant region for each project. As outlined in the methodology:

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

We choose not to define the region as the national market. This can be justified because India is a large country – the key elements which define the extent of additive blending (fly ash and clinker quality and market perceptions) vary greatly within the country. Moreover, the cost and time of moving cement around the country make this unfeasible. For these reasons, a state based approach is deemed most appropriate. For all plants, the state in which the plant is located is also the state where most of the cement output of the plant is sold. Where required, we then extend the region to adjacent states that purchase the next most cement from the plant. We do this for each plant until the region accounts for at least 75% of the cement plant's sales (as required by ACM0005).

This approach is accurate and follows the requirements and spirit of ACM0005. Each region contains the state within which the plant is situated – other plants in this state will be subject to the same limestone and fly ash qualities. The region also contains other states where the plant sells at least 75% of its output – other plants in the region will therefore also be faced with a similar demand situation.

For clarity, the following map shows the location in India of each state.

The states making up each region defined are outlined below, and we also show the population of each region (this illustrates that the regions are large – indeed larger than many countries). After the table an explanation of how these region definitions meet the three criteria outlined in ACM0005 is provided:

Applicable Region for Each Cement Plant:

Cement Plant	States Making up the Region	Population of Region (millions)
Maratha	Maharashtra, Madhya Pradesh	157
Gujurat	Maharashtra, Gujarat	154
Himachal	Haryana, Punjab, Himachal Pradesh	52
Ropar	Haryana, Punjab, Uttar Pradesh, Himachal Pradesh	218
Bhatinda	Haryana, Punjab, Uttar Pradesh, Rajasthan	268
Rabriyawas	Rajasthan, Delhi, Haryana	92

Population Source: http://www.censusindia.net/Projection_Report.pdf (Table 1)

The sales data used to establish the regions is highlighted below. The **first region definition condition** is that it is the area within which at least 75% of the project activity plant's cement production is sold (domestic sales only). The final row of the below table outlines the percentage of domestic sales occurring within the defined Region.

GACL - Plantwise Despatches to States - 2003-2004 (Lakh tonnes)

State	**Maratha**	**Gujarat**	**Himachal**	**Ropar**	**Bathinda**	**Rabriyawas**
Utranchal	-	-	0.02	1.45	-	-
Haryana	-	-	1.62	1.25	0.92	2.48
Punjab	-	-	1.31	10.43	2.99	-
Rajsthan	-	-	-	-	-	8.34
HP	-	-	6.02	0.01	-	-
Delhi	-	-	-	0.62	-	3.61
J&K	-	-	1.41	1.51	-	-
AP	2.87	-	-	-	-	-
Gujarat	-	18.3	-	-	-	-
Maharshtra	18.47	9.39	-	-	-	-
UP	0.02	-	0.01	3.62	-	0.82
MP	2.15	-	-	-	-	-
Total Sales	**23.51**	**27.69**	**10.39**	**18.89**	**3.91**	**15.25**
% of Total Domestic Sales in Region	**88%**	**100%**	**86%**	**81%**	**100%**	**95%**

Source: GACL

The **second region definition condition** is that the Region includes at least 5 other plants with the required published data. The table outlined below shows the cements plant in each Region with the required data, and also shows the percentage of additives blended in PPC at each of these cement plants. As required, there are at least 5 plants in each region with the required data.

Maratha		Gujarat		Himachal		Ropar		Bathinda		Rabriyawas	
Manikgarh	80%	Sikka	89%	CCI Ltd.	85%	CCI	85%	Mangalam	81%	Mangalam	81%
Satna	79%	Rajashree	82%	ACC Tikaria	75%	ACC Tikaria	75%	JK	77%	Shriram	71%
Prism	79%	L&T	82%	Grasim	75%	Grasim	75%	Aditya	75%	JK	77%
Rajashree	82%	Manikgarh	80%	Diamond	74%	Diamond	74%	ACC Tikaria	75%	Aditya	75%
Jaypee	76%	L&T Magdalla	78%	ACC Gagal	73%	ACC Gagal	73%	Grasim	75%	ACC Ltd.	74%
Birla Vikas	76%	Orient	75%	Birla	67%	GACL Himachal	69%	ACC Lakheri	74%	Lakshmi	70%
Vikram	76%	ACC Chanda	74%	GACL Ropar	67%	Birla	67%	Diamond	74%	Neer Shree	70%
ACC Satna	74%			GACL Bhatinda	66%	GACL Bhatinda	66%	GACL Rab.	71%	Binani	67%
ACC Wadi	74%							Shriram	71%	Chittor	66%
Orient	75%							Lakshmi	70%	Birla	65%
Diamond	73%							Neer Shree	70%		
Jaypee	73%							Birla	67%		
Maihar	72%							Binani	67%		
								GACL Ropar	67%		
								Chittor	66%		
								Birla	65%		

Source: CMA

The **third** and final **region definition condition** is that cement production in the region is at least four times the project activity plant's output. The table below shows the cement production of each region and of each project activity cement plant. As can be seen, the share of each project activity plant's output is well below 25% of the applicable Region's production.

	Maratha	Gujarat	Himachal	Ropar	Bathinda	Rabriyawas
Cement plant output	2363970	2930660	1033430	1889900	387940	1516950
Cement Production of Region	25649340	19321050	7324000	10782450	6336090	17781020
% of total	9%	21%	10%	18%	6%	9%

Source: CMA

Determination of benchmark

Having established the regions, the next step is to determine the benchmark clinker and additive content of PPC in each region. As outlined in the applied methodology, *"the benchmark for baseline emissions is defined as the lowest among the following:*

(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."

To determine (i) and (ii) above, the methodology stipulates either statistically significant random sampling or the use of reliable and up to date annual data from a reputable and verifiable source. Data on OPC and PPC production and on clinker production and grinding at cement plants in India is provided by the Cement Manufacturers Association of India (CMA). This data, which is from a reputable source and is verifiable, is used to derive the clinker content as required. For consistency, the same data is used to determine (i). The table below outlines the three calculated applicable benchmarks for each region:

Project activity plant	Region	Benchmark clinker content, 2003-4	
Maratha	Maharashtra, Madhya Pradesh	(i)	73.0%
		(ii)	72.7%
		(iii)	80.0%
Gujurat	Maharashtra, Gujarat	(i)	77.6%
		(ii)	74.5%
		(iii)	79.2%
Himachal	Haryana, Punjab, Himachal Pradesh	(i)	70.0%
		(ii)	66.8%
		(iii)	68.6%
Ropar	Haryana, Punjab, Uttar Pradesh, Himachal Pradesh	(i)	70.0%
		(ii)	66.8%
		(iii)	66.9%
Bhatinda	Haryana, Punjab, Uttar Pradesh, Rajasthan	(i)	66.5%
		(ii)	66.3%
		(iii)	65.6%
Rabriyawas	Rajasthan, Delhi	(i)	67.8%
		(ii)	66.2%
		(iii)	70.7%

Source: CMA data

The methodology stipulates that the lowest value among the three options be selected as the benchmark baseline for the base year (2003-4). These are illustrated below:

Plant	**Selected benchmark baseline for base year**
Maratha	72.7% (option ii)
Gujurat	74.5% (option ii)
Himachal	66.8% (option ii)
Ropar	66.8% (option ii)
Bhatinda	65.6% (option iii)
Rabriyawas	66.2% (option ii)

Trend increase in additive blend

As outlined in the methodology, we have selected to specify **ex-ante** an annual increase in the additive blend. The reason for this is to alleviate the monitoring burden and importantly to increase the certainty of CER volumes.

The large scale production of PPC in India is a recent phenomenon. PPC production has increased from 15.57 million tonnes in 1998-99 to 60.23 million tones in 2004-5. For this reason, the historical data on the blending of fly-ash is neither detailed nor reliable enough to base a trend analysis upon. Moreover, the level of fly-ash blending being considered as part of the project activity is qualitatively different to levels previously blended and therefore analysis of previous blending levels, even if feasible, would not provide a meaningful basis for estimating baseline emissions. For these reasons, we select the minimum annual 2% increase in additives as outlined in the methodology. Incorporation of this trend increase is conservative as the likely baseline scenario is a continuation of the current blend level.

Baseline Emissions Factors
Having determined the benchmark for baseline emissions, specific baseline emissions factors must be calculated. As outlined in the methodology, baseline emissions per tonne of blended cement type are:

$$BE_{BC,y} = \left\lfloor BE_{clinker} * B_{Blend,y} \right\rfloor + BE_{ele\_ADD\_BC}$$

where
$BE_{BC,y}$ = Baseline CO_2 emissions per tonne of blended cement type (BC) (tCO_2/tonne BC)
$BE_{clinker}$ = CO_2 emissions per tonne of clinker in the baseline in the project activity plant (tCO_2/tonne clinker)
$BE_{Blend,y}$ = Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne BC)
$BE_{ele\_ADD\_BC}$ = Baseline electricity emissions for BC grinding and preparation of additives (tCO_2/tonne of BC)

Calculation of $BE_{clinker}$*:*

$$BE_{clinker} = BE_{calcin} + BE_{fossil\_fuel} + BE_{ele\_grid\_CLNK} + BE_{ele\_sg\_CLNK}$$

BE_{calcin} is the baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (tCO_2/tonne clinker). The table below outlines BE_{calcin} for each project activity plant for the year 2003-4, calculated from actual company data.

Plant	BE_{calcin} **(tCO_2/tonne clinker)**
Maratha	0.531
Gujurat	0.532
Himachal	0.527
Ropar	0.527
Bhatinda	0.527
Rabriyawas	0.527

Figures for Ropar and Bhatinda are the same as Himachal and Rabriyawas respectively, as this is the source of clinker for these plants

BE_{fossil_fuel} is the baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (tCO_2/tonne clinker). The table below outlines BE_{fossil_fuel} for each project activity plant for the year 2003-4, calculated from actual company data.

Plant	BE_{fossil_fuel} (tCO_2/tonne clinker)
Maratha	0.310
Gujurat	0.227
Himachal	0.235
Ropar	0.235
Bhatinda	0.243
Rabriyawas	0.243

Figures for Ropar and Bhatinda are the same as Himachal and Rabriyawas respectively, as this is the source of clinker for these plants.

$BE_{ele\_grid\_CLNK}$ are the baseline grid electricity emissions for clinker production per tonne of clinker (tCO_2/tonne clinker). The table below outlines $BE_{ele\_grid\_CLNK}$ for each project activity plant for the year 2003-4, calculated from actual company data.

Plant	$BE_{ele\_grid\_CLNK}$ (tCO_2/tonne clinker)
Maratha	0.00000
Gujurat	0.00057
Himachal	0.03578
Ropar	0.03578
Bhatinda	0.00476
Rabriyawas	0.00476

Figures for Ropar and Bhatinda are the same as Himachal and Rabriyawas respectively, as this is the source of clinker for these plants.

$BE_{ele\_sg\_CLNK}$ are the baseline emissions from self generated electricity for clinker production per tonne of clinker (tCO_2/tonne clinker). The table below outlines $BE_{ele\_sg\_CLNK}$ for each project activity plant for the year 2003-4, calculated from actual company data.

Plant	$BE_{ele\_sg\_CLNK}$ (tCO_2/tonne clinker)
Maratha	0.08989
Gujurat	0.03125
Himachal	0.00367
Ropar	0.00367
Bhatinda	0.08068
Rabriyawas	0.08068

Figures for Ropar and Bhatinda are the same as Himachal and Rabriyawas respectively, as this is the source of clinker for these plants.

Calculation of $BE_{ele\_ADD\_BC}$:

$$BE_{ele\_ADD\_BC} = BE_{ele\_grid\_BC} + BE_{ele\_sg\_BC} + BE_{ele\_grid\_ADD} + BE_{ele\_sg\_ADD}$$

$BE_{ele\_grid\_BC}$ are the baseline grid electricity emissions for BC grinding (tCO_2/tonne of BC). The table below outlines $BE_{ele\_grid\_BC}$ for each project activity plant for the year 2003-4, calculated from actual company data.

Plant	$BE_{ele\_grid\_BC}$ **(tCO_2/tonne BC)**
Maratha	0.00000
Gujurat	0.00041
Himachal	0.02564
Ropar	0.01364
Bhatinda	0.03462
Rabriyawas	0.00316

$BE_{ele\_sg\_BC}$ are baseline self generated emissions for BC grinding (tCO_2/tonne of BC). The table below outlines $BE_{ele\_sg\_BC}$ for each project activity plant for the year 2003-4, calculated from actual company data.

Plant	$BE_{ele\_sg\_BC}$ **(tCO_2/tonne BC)**
Maratha	0.07247
Gujurat	0.02264
Himachal	0.00263
Ropar	0.00000
Bhatinda	0.00000
Rabriyawas	0.05359

GACL do not carry out separate grinding of preparation of fly ash and hence $BE_{ele\_grid\_ADD}$ (baseline grid emissions for additive preparation) and $BE_{ele\_sg\_ADD}$ (baseline self generated electricity emissions for additive preparation) are zero. Whilst increasing the blend of fly ash requires additional processing to increase the reactivity of fly-ash, this is carried out on the final blended cement mix and is hence captured in $BE_{ele\_grid\_BC}$ and $BE_{ele\_sg\_BC}$.

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 outlined in the methodology, we use the additionality tool developed by the EB, modified for the specifics of the project type, to evaluate additionality of the project activity.

Step 0: Preliminary screening of projects started after 1 January 2000 and prior to December 2005

The project activity started (i.e. real action began) in November 2003. This falls between 1 January 2000 and the first registration of a CDM project activity (18th November 2004). There is a wealth of evidence demonstrating that GACL seriously considered the CDM at the time it was taken to proceed with the project activity. Specifically:

- A proposal was submitted by consultants to the GACL in July 2002. This was titled "Harnessing Opportunities CDM/Carbon Credits".
- GACL Officials attended a Workshop on Opportunities of CDM Projects organised by the Environmental Protection Training & Research Institute in December 2002.
- GACL Officials participated in the Workshop organised in Oct.2003 by the British High Commission on Indian Industrial Sector: CDM Capacity Building Project-Cement. A PIN was submitted subsequent to this workshop.
- PIN Produced in November 2003
- GACL Officials attended the South Asian Forum organised by TERI in Feb. 2004 covering CDM
- Under the Indo German technical collaboration GACL submitted a PIN to CDM-India Jan.2004

In addition to the above, extensive discussions were held between GACL and Agrinergy Ltd prior to the start of the project activity, and Agrinergy proceeded with the CDM aspects of the project activity alongside the ACC blended cement project (which is one of the methodology submissions upon which the consolidated methodology is based).

We can therefore provide evidence that the CDM was seriously considered at the time the decision was taken to proceed with the project activity and may move to additionality Step 1.

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

As outlined in the methodology and confirmed in Section B.2., the available alternatives are restricted to:

- The project activity not carried out as a CDM project activity
- The continuation of current practice

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

Production of fly ash based PPC in India is subject to the Bureau of Indian Standards specification IS: 1489 (Part 1). This specifies that the percentage of pozzolana material (i.e. fly ash) in PPC must fall between the ranges of 15% to 35%. Both of the above alternatives will meet this requirement.

The Ministry of Environment and Forests requires coal and lignite power plants subject to environmental clearance conditions to submit an action plan showing how they will achieve full utilisation of fly ash. However there are no regulatory requirements on cement plants to assist in accomplishing this.

From the above discussion, we conclude that both alternatives are in compliance with applicable laws and regulations.

Step 2. Investment analysis OR

Step 3. Barrier analysis.

Step 3, Barrier analysis is selected.

As has been highlighted, the increase in fly ash blending that will occur as a result of the project activities will take the blend to a level that exceeds that which represents the best common practice within each project activity plant's region.

Blending targets for each GACL cement plant producing PPC are set at a central level, based on marketing and research advice and taking account of plant specific factors, including limestone, clinker and additive quality. As a result of the project activity, GACL has increased the target blend rate at the plants where the CDM project activities will be undertaken. However there are a number of important barriers preventing implementation of the target rate. These barriers can be characterised as:

1. Technical barriers

It is very difficult to increase the percentage of fly ash in PPC to the levels anticipated as part of the project activity whilst maintaining the quality of the cement. Early strength at 1st and 3rd days is a very important element of cement quality, and increasing the fly-ash content will *a priori* reduce early strength. This is the key barrier to increasing the share of fly ash (it should be noted that as the blend level increases, incremental increases in the fly ash content are harder to obtain).

The quality and hydraulic potential of clinker acts as a barrier to increasing the fly ash blend as does the fineness of high fly ash PPC and the distribution of fly ash components in coarse fractions of cement.

It is absolutely vital that the quality of GACL PPC is maintained as otherwise its reputation and hence sales will suffer. Maintaining the quality of the cement, whilst increasing the blending of fly ash additives represents a major technical barrier to implementation of the project activity.

There are also technical barriers relating to the use of high fly ash PPC. Builders must be educated on the use of high fly ash PPC as well as reassured as to its quality (see below).

2. Market resistance to high fly ash blended cement.

It is crucial that the increased blending of fly ash neither reduces the quality of the GACL PPC produced, nor results in a customer perception that the cement is of a lower quality.

In India there is still a general perception that the quality of blended cements is inferior to that of OPC, and therefore that PPC with a higher fly ash blend is undesirable. PPC acceptance is in particular low in some government agencies – the Central Public Works Department has imposed a ban on the use of blended cements in bridges and other concrete works and constructions. Moreover, there is a general perception that fly ash reduces cement strength and increases setting time. Early strength at first and third days is particularly important to the customers of GACL and the ability to increase the blend whilst maintaining early strength, and then convincing customers this is the case, represent major barriers to implementation of the project activity. The a-priori assumption of customers is that a high fly ash PPC is of an inferior quality and therefore they will tend not to purchase such cement. Moreover, there is the potential that the brand name could be negatively impacted by the blend increase.

There is documented evidence that customers raise questions and have concerns with high fly ash PPC. Concerns raised include complaints that: the compressive strength of high fly ash cement is low, it requires more water and the corrosion protection of concrete with high fly ash cement is low.

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

The alternative to the project activity is the continuation of current practice. This would face none of the barriers outlined above.

Implementation of the alternative of the project activity not carried out as a CDM project activity is prevented by the identified barriers.

Step 4. Common Practice Analysis
As outlined in Section B.2., the additive content that the project activities will increase the fly ash blend in PPC to exceeds common practice in the relevant system boundaries.

Step 5. Impact of CDM Registration
The CDM will allow GACL to overcome the barriers to increased fly ash absorption. CDM status provides two key benefits to GACL; the first is the prospect of CDM revenue. The second benefit, which should not be underestimated, is a desire to gain experience in the CDM and to provide demonstrable evidence that the company is making serious and concerted efforts to reduce GHG emissions. The cement industry is acutely aware of the high emissions associated with cement production and is keen to utilise the CDM to reduce these.

Both of the above factors crucially have and will continue to allow the company to dedicate research and marketing effort to overcoming the barriers outlined in Step 2. It is the prospect of the CDM that allows these actions to be undertaken. In the absence of the CDM, GACL would not undertake these activities and thus the project activity not carried out as a CDM project activity is not a realistic scenario – without substantial research and marketing effort the additive content cannot be increased.

The Marketing Division and Technical Services Division are responsible for overcoming the technical and market related barriers to the blend increase.

Research
Research is carried out at the Research Centre located in Ambujanagar. This is part of the Technical Services Department, which is based in Ahmenabad. The Research Centre has had to utilise sophisticated equipment and techniques to allow for an increase in the fly ash blend. These include Microscopy, use of a Particle Size Analyser, an Atomic Absorption Spectrometer, a High Temperature Furnace and Laboratory separator and Ball mills for characterization of fly ash, clinker, raw mix design and gypsum.

Key elements of Research and process:

- Hydration of OPC liberates lime - Ca(OH)2
- Active silica in Ambuja PPC reacts with liberated Ca(OH)2
- The reaction makes silicate gel
- This blocks voids and capillary pores and thus, lowers permeability and increases durability.
- Improving the reactivity of fly-ash

The following studies have been undertaken by the Technical Services Department:

- Evaluation of fly ash from captive TPS of Nirma Chemicals, Bhavanagar
- Fly ash study from TPS Gandhinagar
- Quality and Optimisation of OPC fineness for producing PPC by Blending with fly ash from TPS, Ukai
- Report on Dadri Fly ash

In addition to these studies, a global fly ash supply and clinker compatibility study has been undertaken.

A team of 15 are working at the Research Centre on how to increase the fly ash blend. These personnel are complemented by staff from each individual plant's laboratory. Approximately 3,800 samples of concrete and mortar have been analysed as part of the process of increasing the blend.

Marketing

The Technical Services Division works closely with marketing teams. In each state Technical Services has employed engineers to deal with customer concerns over the quality and usability of PPC. A total of 145 engineers are employed by Technical Services across the country. Since the inception of the CDM project activity, these personnel have had to be rained in the benefits and use of high fly ash PPC.

Technical Services have run a series of workshops, seminars and programs for customers on a town-to-town basis advising on the use of PPC and convincing users that high fly-ash PPC is of an acceptable quality.

A key target of the marketing and technical advice is cement dealers. The marketing department is in constant contact with cement dealers and are able to call in Technical Services when dealers have concerns over the use and quality of high fly-ash PPC.

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

>>

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

Emissions from the following emission sources are accounted for:

- Direct emissions at the cement plant due to fuel combustion for:
  - Firing the kiln (including supplemental fuels used in the precalciner);
  - Processing (including drying) of solid fuels, raw materials, and additives;
  - On-site generation of electricity (if applicable).

- 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.

The (regional) power grids or plants from which the cement plant purchases electricity and its losses are considered in determining indirect emissions. Transport related emissions from the delivery of additional additives are 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.

Gases included: CO_2 only. Changes in CH_4 and N_2O emissions from combustion processes are considered to be negligible and excluded because the differences in the baseline and project activity are not substantial. This assumption simplifies the methodology and is conservative.

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:

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22/12/2005
Ben Atkinson, Agrinergy Ltd

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:

>>
1 November 2003

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

>>
10 years

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

The project activity has chosen a fixed ten-year crediting period.

C.2.1. Renewable crediting period

Not applicable

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:

>>
1 January 2004

C.2.2.2. Length:

>>
10 years

SECTION D. Application of a monitoring methodology and plan

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

>>
ACM0005
"Consolidated Monitoring Methodology for Increasing the Blend in Cement Production"

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

>>

The monitoring methodology is applicable to projects using the allied baseline methodology. In terms of the applicability conditions:

- There is no shortage of additives to prevent leakage related to the lack of blending materials – The project activity will result in an increase in the percentage of fly ash blended in PPC produced at the specified GACL cement plants. The GACL plants are situated in India. Fly ash production in India is estimated at around 90 million tonnes per year, whilst annual utilisation is estimated at 13 million tonnes[2]. Disposal of fly ash in India is considered an environmental problem. We can therefore conclude that there is sufficient supply of fly ash that the project activity will not lead other PPC producers to reduce their fly ash blend rate.
- The methodology is applicable to domestically sold output of the project activity sold plant and excludes export of blended cement types – This is the case.
- Adequate data are available on cement types in the market – This is the case. A database has been obtained from the Cement Manufacturers Association of India.

[2] Source: http://www.tifac.org.in/news/flymgm.htm. TIFAC is an autonomous organisation under the Indian Department of Science and Technology

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

This option is selected and is specified in the monitoring methodology followed.

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

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	$InCaO_y$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
2	$OutCaO_y$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
3	$InMgO_y$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
4	$OutMgO_y$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
5	*Quantity of clinker raw material*	*Plant records*	*Kilo tonnes*	*M*	*Annually*	*100%*	*Paper & Electronic*	
6	*CLNKy*	*Plant records*	*Kilo tonnes of clinker*	*M*	*Annually*	*100%*	*Paper & Electronic*	
7	FF_{i_y}	*Plant records*	*Tonnes of fuel i*	*M*	*Monthly*	*100%*	*Paper & Electronic*	
8	EFF_i	*IPCC/ Plant records*	*tCO2/tonne of fuel i*	*C/M*	*Annually*	*100%*	*Electronic*	
9	$PELE_{grid\_CLNK,y}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Paper & Electronic*	*Metered*
10	$EF_{grid,BSL}$	*Calculated ex-ante*	tCO_2/MWh	*N/a*	*N/a*	*100%*	*Electronic*	*Calculated ex-ante as per ACM0002*
11	$PELE_{sg\_CLNK,y}$	*Plant*	*MWh*	*M*	*Monthly*	*100%*	*Paper &*	*Metered*

		records					Electronic	
12	$EF_{sg,y}$	Plant records	tCO_2/MWh	C	Monthly	100%	Electronic	IPCC factors
13	ADDy	Plant records	Kilo tonnes	M	Monthly	100%	Paper & Electronic	Weighbridge records
14	$PELE_{grid,BC,y}$	Plant records	MWh	M	Monthly	100%	Paper & Electronic	Metered
15	$PELE_{sg,BC,y}$	Plant records	MWh	M	Monthly	100%	Paper & Electronic	Metered
16	$PELE_{grid,ADD,y}$	Plant records	MWh	M	Monthly	100%	Paper & Electronic	Metered
17	$PELE_{sg,ADD,y}$	Plant records	MWh	M	Monthly	100%	Paper & Electronic	Metered
18	$F_{i,j,y}$	Plant records	Tonnes of fuel i	M	Monthly	100%	Paper & Electronic	
19	$COEF_{i,j,y}$	IPCC/ Plant records	tCO_2/tonne of fuel i	C/M	Annually	100%	Electronic	
20	$GEN_{j,y}$	Plant records	MWh	M	Annually	100%	Paper & Electronic	
21	$PE_{calcin,y}$	Plant records	tCO_2/tonne clinker	C	Annually	100%	Electronic	
22	$PE_{fossil\_fuel,y}$	Plant records	tCO_2/tonne clinker	C	Annually	100%	Electronic	
23	$PE_{ele\_grid\_CLNK,y}$	Plant records	tCO_2/tonne clinker	C	Annually	100%	Electronic	
24	$PE_{ele\_sg\_CLNK,y}$	Plant records	tCO_2/tonne clinker	C	Annually	100%	Electronic	
25	$PE_{ele\_grid\_BC,y}$	Plant records	tCO_2/tonne blended cement	C	Annually	100%	Electronic	
26	$PE_{ele\_sg\_BC,y}$	Plant records	tCO_2/tonne blended cement	C	Annually	100%	Electronic	
27	$PE_{ele\_grid\_ADD,y}$	Plant records	tCO_2/tonne blended cement	C	Annually	100%	Electronic	

28	$PE_{ele\_sg\_ADD,y}$	*Plant records*	*tCO_2/tonne blended cement*	*C*	*Annually*	*100%*	*Electronic*	
29	$P_{blend,y}$	*Plant records*	*Tonne of clinker/ tonne 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

(i) Emissions from calcinations of limestone;
(ii) Emissions from combustion of fossil fuel and electricity for clinker production and processing of raw material;
(iii) Emissions from electricity used for additives preparation and grinding of cement.

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 ($PE_{Clinker,y} > BE_{Clinker}$).

In case (i), the baseline value is substituted by the project activity value. That is, if emissions per tonne of clinker are lower during the crediting period, then the lower value is taken for the baseline.

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 overall negative 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, 0 CERs are issued for year t and only 70 CERs are issued for the year t+1.)

$PE_{BC,y} = [PE_{clinker,y} * P_{Blend,y}] + PE_{ele\_ADD\_BC,y}$

where:

$PE_{BC,y}$ = CO_2 emissions per tonne of BC in the project activity plant in year y(tCO_2/tonne BC)
$PE_{clinker,y}$ = CO_2 emissions per tonne of clinker in the project activity plant in year y (t CO_2/tonne clinker) and defined below
$P_{Blend,y}$ = Share of clinker per tonne of BC in year y (tonne of clinker/tonne of BC)

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

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

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

where:

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

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

where:

$PE_{calcin,y}$ = 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)
$InCaO_{,y}$ = 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)

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

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 (tCO2/tonne of fuel)
$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

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

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

$PE_{ele\_ADD\_BC,y} = PE_{ele\_grid\_BC,y} + PE_{ele\_sg\_BC,y} + PE_{ele\_grid\_ADD,y} + PE_{ele\_sg\_ADD,y}$
where:

$PE_{ele\_grid\_BC} =$ Grid electricity emissions for BC grinding in year y (tCO2/tonne of 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)

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

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

$PE_{elec\_sg\_BC,y} = [PELE_{sg\_BC,y} * EF_{sg\_y}] / [BC_y * 1000]$

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

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

$BELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)
EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)
BC_y = Annual production of BC in year y (kilotonnes of BC)

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

$PELE_{sg\_ADD,y}$ = Baseline self generation electricity for grinding additives (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)
BC_y = Annual production of BC in year y (kilotonnes of BC)

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
30	$InCaO_{BSL}$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
31	$OutCaO_{BSL}$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
32	$InMgO_{BSL}$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
33	$OutMgO_{BSL}$	*Plant records*	*%*	*M,C*	*Daily*	*100%*	*Paper & Electronic*	*Will be calculated/measured as part of normal operations via lab test*
34	*Quantity of clinker raw material*	*Plant records*	*Kilo tonnes*	*M*	*Annually*	*100%*	*Paper & Electronic*	*Weighbridge records*
35	$CLNK_{BSL}$	*Plant records*	*Kilo tonnes of clinker*	*M*	*Annually*	*100%*	*Paper & Electronic*	
36	FF_{iBSLy}	*Plant records*	*Tonnes of fuel i*	*M*	*Monthly*	*100%*	*Paper & Electronic*	
37	EFF_i	*IPCC/ Plant records*	*tCO2/tonne of fuel i*	*C/M*	*Annually*	*100%*	*Electronic*	
38	$BELE_{grid\_CLNK,BSL}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Paper & Electronic*	*Metered*
39	$EF_{grid,BSL}$	*Calculated ex-ante*	tCO_2/MWh	*N/a*	*N/a*	*100%*	*Electronic*	*Calculated ex-ante as per ACM0002*
40	$BELE_{sg\_CLNK,BSL}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Paper & Electronic*	
41	$EF_{sg,BSL}$	*Plant records*	tCO_2/MWh	*C*	*Monthly*	*100%*	*Electronic*	*IPCC factors*

42	ADD_{BSL}	*Plant records*	*Kilo tonnes*	*M*	*Monthly*	*100%*	*Paper & Electronic*	*Weighbridge records*
43	$BELE_{grid,BC,BSL}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Paper & Electronic*	*Metered*
44	$BELE_{sg,BC,BSL}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Paper & Electronic*	*Metered*
45	$BELE_{grid,ADD}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Paper & Electronic*	*Metered*
46	$BELE_{sg,ADD,BSL}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Paper & Electronic*	*Metered*
47	$F_{i,j,BSL}$	*Plant records*	*Tonnes of fuel i*	*M*	*Monthly*	*100%*	*Paper & Electronic*	
48	$COEF_{i,j,BSL}$	*IPCC/ Plant records*	tCO_2*/tonne of fuel i*	*C/M*	*Annually*	*100%*	*Electronic*	
49	$GEN_{j,BSL}$	*Plant records*	*MWh*	*M*	*Annually*	*100%*	*Paper & Electronic*	
50	$BE_{calcin,BSL}$	*Plant records*	tCO_2*/tonne clinker*	*C*	*Annually*	*100%*	*Electronic*	
51	$BE_{fossil\_fuel,BSL}$	*Plant records*	tCO_2*/tonne clinker*	*C*	*Annually*	*100%*	*Electronic*	
52	$BE_{ele\_grid\_CLNK,BSL}$	*Plant records*	tCO_2*/tonne clinker*	*C*	*Annually*	*100%*	*Electronic*	
53	$BE_{ele\_sg\_CLNK,BSL}$	*Plant records*	tCO_2*/tonne clinker*	*C*	*Annually*	*100%*	*Electronic*	
54	$BE_{ele\_grid\_BC,BSL}$	*Plant records*	tCO_2*/tonne blended cement*	*C*	*Annually*	*100%*	*Electronic*	
55	$BE_{ele\_sg\_BC,BSL}$	*Plant records*	tCO_2*/tonne blended cement*	*C*	*Annually*	*100%*	*Electronic*	
56	$PE_{ele\_grid\_ADD,BSL}$	*Plant records*	tCO_2*/tonne*	*C*	*Annually*	*100%*	*Electronic*	

			blended cement					
57	$BE_{ele\_sg\_ADD,BSL}$	*Plant records*	*tCO_2/tonne blended cement*	*C*	*Annually*	*100%*	*Electronic*	
58	$B_{blend,y}$	*Plant records*	*Tonne of clinker/tonne blended cement*	*C*	*Annually*	*100%*	*Electronic*	

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

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

where:

$BE_{BC,y}$ = Baseline CO_2 emissions per tonne of blended cement type (BC) (tCO_2/tonne BC)
$BE_{clinker}$ = CO_2 emissions per tonne of clinker in the baseline in the project activity plant (t CO_2/tonne clinker) and defined below
$B_{Blend,y}$ = Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne of BC)
$BE_{ele\_ADD\_BC}$ = Baseline electricity emissions for BC grinding and preparation of additives (tCO2/tonne of BC)

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

$BE_{clinker} = BE_{calcin} + BE_{fossil\_fuel} + BE_{ele\_grid\_CLNK} + BE_{ele\_sg\_CLNK}$

where:

$BE_{clinker}$ = Baseline emissions of CO_2 per tonne of clinker in the project activity plant (t CO_2/tonne clinker)
BE_{calcin} = Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (t CO_2/tonne clinker)
BE_{fossil_fuel} = Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (t CO_2/tonne clinker)
$BE_{ele\_grid\_CLNK}$ = Baseline grid electricity emissions for clinker production per tonne of clinker (t CO_2/tonne clinker)
$BE_{ele\_sg\_CLNK}$ = Baseline emissions from self generated electricity for clinker production per tonne of clinker (t CO_2/tonne clinker)

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

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)

$BE_{fossil\_fuel} = [\sum FF_{i\_BSL} * EFF_i] / [CLNK_{BSL} * 1000]$
FF_{i_BSL} = Fossil fuel of type i consumed for clinker production in the baseline (tonnes of fuel i)
EFF_i = Emission factor for fossil fuel i (t CO_2/tonne of fuel)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{ele\_grid\_CLNK} = [BELE_{grid\_CLNK} * EF_{grid\_BSL}] / CLNK_{BSL} * 1000$
$BELE_{grid\_CLNK}$ = Baseline grid electricity for clinker production (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{elec\_sg\_CLNK} = [BELE_{sg\_CLNK} * EF_{sg\_BSL}] / [CLNK_{BSL} * 1000]$

$BELE_{sg\_CLNK}$ = Baseline self generation of electricity for clinker production (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{ele\_ADD\_BC} = BE_{ele\_grid\_BC} + BE_{ele\_sg\_BC} + BE_{ele\_grid\_ADD} + BE_{ele\_sg\_ADD}$

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)

$BE_{ele\_grid\_BC} = [BELE_{grid\_BC} * EF_{grid\_BSL}] / [BC_{BSL} * 1000]$
$BELE_{grid\_BC}$ = Baseline grid electricity for grinding BC (MWh)

EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$BE_{elec\_sg\_BC} = [BELE_{sg\_BC} * EF_{sg\_BSL}] / [BC_{BSL} * 1000]$
$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding BC (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$BE_{ele\_grid\_ADD} = [BELE_{grid\_ADD} * EF_{grid\_BSL}] /[BC_{BSL} * 1000]$

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

$BE_{elec\_sg\_ADD} = [BELE_{sg\_ADD} * EF_{sg\_BSL}] / [BC_{BSL} * 1000]$

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

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

This section is left blank on purpose

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

Leakage is restricted to any transport emissions that arise from the increased use of additive. The methodology does require consideration of whether additives used are surplus. As outlined in Sections B.1.1 and D.2., fly ash utilisation in India is at best 14%. Disposal of fly ash is an environmental problem, with the vast majority of fly ash disposed of via land filling. Some 65,000 acres of land is devoted to ash ponds in the country. As highlighted, annual fly ash production in India is currently 90 million tonnes of which only 13 million tonnes are used. Fly ash production in India is forecast to increase to 180 million tonnes by 2015. GACL (across six plants of one of the largest cement producers in India) will utilise 1.3 million tonnes of fly ash in 2005, rising to 4.9 million tonnes in 2014. This is well below availability. It should be noted that these tonnages reflect the total fly ash usage at the project activity cement plants, not just that additional fly ash that will be utilised as a result of the CDM project activity increase in blending. The project activity will thus use 100% surplus additives and no discounting is required (α = 0).

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

ID number	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
59	TF_{cons}	*Plant records*	*Kg of fuel/kilometre*	*C*	*Annually*	*100%*	*Electronic*	
60	D_{add_source}	*IPCC*	*Km*	*M*	*Per trip*	*100%*	*Electronic*	*Will not vary greatly. Source can be verified by additive receipt data.*
61	*TEF*	*Plant records*	*Kg CO2/kg of fuel*	*E*	*Annually*	*100%*	*Electronic*	
62	Q_{add}	*Plant records*	*Tonnes of additive/vehicle*	*M*	*Per trip*	*100%*	*Electronic*	*Vehicle types will not vary. Can be readily verified by transporter records.*
63	$ELE_{conveyor\_ADD}$	*Plant records*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	
64	EF_{grid}	*Ex-ante grid factor or on-site fuel*	*Tonnes of CO2/MWh*	*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.)

>>

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

where:

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

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

$L_y = L_{add\_trans} * [A_{blend,y} – P_{blend,y}] * BC_y$

where:

L_y = Leakage emissions for transport of additives (kilotonnes of CO_2)
BC_y = 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 additives per tonne of BC in year y (tonne of additives/tonne of BC)

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

>>

The project activity mainly reduces CO_2 emissions through substitution of clinker in cement by blending materials. Emissions reductions in year y are the difference in the CO_2 emissions per tonne of BC in the baseline and in the project activity multiplied by the production of BC in year y.

There is no need to discount for the percentage of additives for which surplus availability is not substantiated as there exists in India a clear surplus of fly ash.

$ER_y = [BE_{BC,y} – PE_{BC,y}] * BC_y + L_y$

where:

ER_y = Emissions reductions in year y due to project activity (thousand tonnes of CO_2)
$BE_{BC,y}$ = Baseline emissions per tonne of BC (t CO_2/tonnes of BC)
$PE_{BC,y}$ = Project emissions per tonne of BC in year y (t CO_2/tonnes of BC)
BC_y = BC production in year y (thousand tonnes)
L_y = Transport related leakage emissions (t CO_{2e})

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.
TableD.2.1.1, ID numbers 1-29	*Low-Medium*	*These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross – checking these with other internal company reports. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.* *With the exception of Maratha, all units have ISO9001 certification. Maratha is in the process of obtaining ISO9001 certification and the systems outlined below will be put in place. The GACL ISO9001 systems include procedures for:* - *Training and monitoring of personnel* - *Calibration and maintenance of monitoring equipment* - *Emergency procedures* - *Record and data handling* - *Uncertainty data adjustment* - *Internal Audit* *Grid electricity meters are provided by electricity authorities and cannot be tampered with. Internal electricity meters will be subject to calibration. Laboratory test equipment for MgO and CaO contents is subject to regular calibration*

TableD.2.1.3, ID numbers 30-58	*Low-Medium*	*These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross – checking these with other internal company reports. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.* *With the exception of Maratha, all units have ISO9001 certification. Maratha is in the process of obtaining ISO9001 certification and the systems outlined below will be put in place. The GACL ISO9001 systems include procedures for:* - *Training and monitoring of personnel* - *Calibration and maintenance of monitoring equipment* - *Emergency procedures* - *Record and data handling* - *Uncertainty data adjustment* - *Internal Audit* *Grid electricity meters are provided by electricity authorities and cannot be tampered with. Internal electricity meters will be subject to calibration. Laboratory test equipment for MgO and CaO contents is subject to regular calibration*
TableD.2.3, ID numbers 59-64	*Low*	*Round trip distance will be cross-checked with evidence of origin and map references. Truck capacity and Fuel consumption data will originate from vehicle manufacturers and transporters.*

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

>>

The Energy Manager/Head of the Environmental Management Division at each plant will be responsible for the monitoring, measurement and reporting of the data required to undertake the CDM project. All data required is collected as part of normal operations. Records will be archived at each plant for 12 years and will be available at the time of verification. Project management at each site will fall under the responsibility of the designated employee, whilst central management and coordination of the project activities will fall under the responsibility of Mr. K.M. Kavadia, General Manager (Environment).

Data required to monitor leakage will also be archived at each plant for 12 years as well as at the coordinating agency at Mumbai.

The collated data will be transmitted in electronic format to the central GACL head office (Mr. K.M. Kavadia). A specific spreadsheet has been designed for this purpose. Mr Kavadia and Ben Atkinson of Agrinergy Ltd. will then perform the data calculations and transformations as required as part of the monitoring methodology.

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

>>
Ben Atkinson, Agrinergy Ltd.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

Project emissions per tonne of blended cement are calculated as:

$PE_{BC,y} = [PE_{clinker,y} * P_{Blend,y}] + PE_{ele\_ADD\_BC,y}$

where:

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

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

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

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

The following table outlines the projected decrease in the clinker content at the cement plants carrying out the project activity over the crediting period:

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	69.6%	68.0%	66.0%	64.0%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Gujarat	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Himachal	64.5%	63.0%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Ropar	65.3%	63.0%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%
Bhatinda	66.0%	64.0%	62.5%	62.5%	62.5%	61.5%	62.0%	62.5%	62.5%	62.5%
Rabriyawas	68.0%	65.0%	63.5%	63.5%	63.0%	62.5%	62.5%	62.5%	62.5%	62.5%

The gypsum content of the PPC produced by GACL will remain fixed at 5% throughout the crediting period. Thus the fly ash content can be calculated as 100% minus 5% minus the clinker content. Based on a these additive blend projections, we forecast the following values for $PE_{BC,y}$ over the crediting period (whilst project emission factors will be monitored as per the methodology, for the purposes of the following, the baseline figures for Eclinker and E elec_ADD_BC are taken):

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	0.721	0.706	0.687	0.668	0.654	0.654	0.654	0.654	0.654	0.654
Gujarat	0.517	0.517	0.517	0.517	0.517	0.517	0.517	0.517	0.517	0.517
Himachal	0.546	0.534	0.530	0.530	0.530	0.530	0.530	0.530	0.530	0.530
Ropar	0.537	0.519	0.515	0.515	0.515	0.515	0.515	0.515	0.515	0.515
Bhatinda	0.599	0.582	0.569	0.569	0.569	0.561	0.565	0.569	0.569	0.569
Rabriyawas	0.638	0.613	0.600	0.600	0.595	0.591	0.591	0.591	0.591	0.591

E.2. Estimated leakage:

>>
Leakage is calculated as:

$L_{add\_trans} =$ $[(TF_{cons} * D_{add\_source} * TEF) + (ELE_{conveyor\_ADD} * EF_{grid})]* 1/Q_{add} * 1/1000$
where:
$L_{add\_trans} =$ Transport related emissions per tonne of additives (t CO_2/tonne of additive)
$TF_{cons} =$ Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre)
$D_{add\_source} =$ Distance between the source of additive and the project activity plant (km)
$TEF =$ Emission factor for transport fuel (kg CO_2/kg of fuel)
$ELE_{conveyor\_ADD} =$ Electricity consumption for conveyor system for additives (MWh)
$EF_{grid} =$ Grid electricity emission factor (tonnes of CO_2/MWh)
$Q_{add} =$ Quantity of additive carried in one trip per vehicle (tonnes of additive)

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

$L_y = L_{add\_trans} * [B_{blend,y} – P_{blend,y}] * BC_y$

where:
$L_y =$ Leakage emissions for transport of additives (kilotonnes of CO_2)
$BC_y =$ Production of BC in year y (kilotonnes of BC)
$P_{blend,y} =$ Share of clinker per tonne of BC in year y (tonne of clinker/tonne of BC)

Leakage over the crediting period at each project activity plant is estimated as follows (tCO2e):

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	59	85	2535	3257	3739	3506	3269	3027	2780	2528
Gujarat	591	569	6427	6167	5901	5630	5354	5072	4785	4491
Himachal	140	383	370	284	196	106	15	0	0	0
Ropar	150	427	718	551	380	206	29	0	0	0
Bhatinda	0	18	80	42	4	25	0	0	0	0
Rabriyawas	0	2	130	45	27	8	0	0	0	0

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

>>
The following table shows project figures for BCy (blended cement production in year y, kt):

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	200	200	4270	4270	4270	4270	4270	4270	4270	4270
Gujarat	460	460	5400	5400	5400	5400	5400	5400	5400	5400
Himachal	730	1300	1300	1300	1300	1300	1300	1300	1300	1300
Ropar	1450	1450	2520	2520	2520	2520	2520	2520	2520	2520
Bhatinda	360	360	540	540	540	540	540	540	540	540
Rabriyawas	660	660	1260	1260	1260	1260	1260	1260	1260	1260

And based on this project activity emissions are calculated as (million tonnes CO_2):

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14

Maratha	0.144	0.141	2.936	2.857	2.798	2.798	2.798	2.798	2.797	2.797
Gujarat	0.239	0.238	2.799	2.799	2.799	2.799	2.798	2.798	2.798	2.797
Himachal	0.398	0.694	0.689	0.689	0.689	0.688	0.688	0.688	0.688	0.688
Ropar	0.779	0.753	1.298	1.298	1.298	1.298	1.298	1.298	1.298	1.298
Bhatinda	0.216	0.210	0.307	0.307	0.307	0.303	0.305	0.307	0.307	0.307
Rabriyawas	0.421	0.404	0.756	0.756	0.750	0.745	0.745	0.745	0.745	0.745

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

>>

Baseline emissions per tonne of blended cement are calculated as:

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

where:

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

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

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

$BE_{ele\_ADD\_BC}$ = Baseline electricity emissions for BC grinding and preparation of additives (tCO2/tonne of BC)

The following table outlines the baseline clinker content for the project activity cement plants over the crediting period:

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	72.3%	71.8%	71.4%	70.9%	70.4%	69.9%	69.4%	68.9%	68.4%	67.8%
Gujarat	74.1%	73.7%	73.2%	72.8%	72.4%	71.9%	71.4%	71.0%	70.5%	70.0%
Himachal	66.2%	65.7%	65.1%	64.5%	63.9%	63.2%	62.6%	62.0%	61.3%	60.6%
Ropar	66.2%	65.7%	65.1%	64.5%	63.9%	63.2%	62.6%	62.0%	61.3%	60.6%
Bhatinda	65.0%	64.4%	63.8%	63.2%	62.6%	61.9%	61.3%	60.6%	59.9%	59.2%
Rabriyawas	65.6%	65.0%	64.4%	63.8%	63.2%	62.6%	61.9%	61.2%	60.6%	59.9%

Based on a these baseline clinker contents, the following values for $BE_{BC,y}$ are arrived at over the crediting period:

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	0.746	0.741	0.737	0.733	0.728	0.723	0.719	0.714	0.709	0.704
Gujarat	0.609	0.606	0.602	0.599	0.595	0.592	0.588	0.584	0.580	0.577
Himachal	0.559	0.555	0.550	0.545	0.540	0.535	0.530	0.525	0.520	0.514
Ropar	0.545	0.540	0.536	0.531	0.526	0.521	0.516	0.511	0.505	0.500
Bhatinda	0.591	0.586	0.580	0.575	0.570	0.564	0.558	0.553	0.547	0.541
Rabriyawas	0.618	0.613	0.608	0.602	0.597	0.592	0.586	0.581	0.575	0.569

And based on this baseline emissions are calculated as (million tonnes CO_2):

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	0.149	0.148	3.147	3.128	3.109	3.089	3.069	3.049	3.028	3.007
Gujarat	0.279	3.252	3.233	3.214	3.195	3.175	3.155	3.134	3.113	0.279
Himachal	0.408	0.721	0.715	0.709	0.703	0.696	0.689	0.683	0.676	0.669

Ropar	0.790	0.783	1.350	1.337	1.325	1.312	1.300	1.287	1.273	1.260
Bhatinda	0.213	0.211	0.313	0.311	0.308	0.305	0.302	0.298	0.295	0.292
Rabriyawas	0.408	0.404	0.766	0.759	0.752	0.746	0.739	0.731	0.724	0.717

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

>>

kt CO_2

	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14
Maratha	4.9	7.0	210.5	270.5	310.5	291.2	271.5	251.3	230.8	209.9
Gujarat	41.5	40.0	452.2	433.9	415.2	396.1	376.7	356.9	336.6	316.0
Himachal	10.0	27.3	26.4	20.3	14.0	7.6	1.1	0.0	0.0	0.0
Ropar	10.7	30.5	51.2	39.3	27.1	14.7	2.1	0.0	0.0	0.0
Bhatinda	0.0	0.0	0.5	3.2	0.3	1.9	0.0	0.0	0.0	0.0
Rabriyawas	0.0	0.0	0.0	0.0	2.1	0.6	0.0	0.0	0.0	0.0

The risks to successful implementation of the project activities are not great. Ample fly ash is available, as highlighted in Sections B.1.1 and D2. GACL is using it full research and marketing effort to achieve the increase in the additive blend in PPC.

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

>>

Maratha

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2004-5	144117	149101	59	4924
2005-6	141137	148255	85	7033
2006-7	2933759	3146804	2535	210510
2007-8	2854235	3128003	3257	270511
2008-9	2794591	3108825	3739	310495
2009-10	2794591	3089265	3506	291167
2010-11	2794591	3069312	3269	271453
2011-12	2794591	3048961	3027	251344
2012-13	2794591	3028203	2780	230832
2013-14	2794591	3007030	2528	209911
Total	**22840796**	**24923760**	**24784**	**2058180**

Gujarat

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2004-5	237904	280043	591	41548
2005-6	237904	278522	569	40048
2006-7	2792789	3251390	6427	452174
2007-8	2792789	3232812	6167	433856
2008-9	2792789	3213862	5901	415172
2009-10	2792789	3194533	5630	396114
2010-11	2792789	3174818	5354	376676
2011-12	2792789	3154708	5072	356848
2012-13	2792789	3134197	4785	336623
2013-14	2792789	3113275	4491	315995
Total	**22818117**	**26028160**	**44987**	**3165055**

Himachal

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2004-5	398267	408411	140	10004
2005-6	693603	721308	383	27323
2006-7	688390	715190	370	26430
2007-8	688390	708948	284	20275
2008-9	688390	702583	196	13997
2009-10	688390	696089	106	7593
2010-11	688390	689466	15	1062
2011-12	688390	682711	0	0
2012-13	688390	675820	0	0
2013-14	688390	668791	0	0
Total	**6598987**	**6669317**	**1494**	**106683**

Ropar

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2004-5	779171	790017	150	10696
2005-6	752424	783326	427	30475
2006-7	1297555	1349506	718	51233
2007-8	1297555	1337408	551	39302
2008-9	1297555	1325068	380	27132
2009-10	1297555	1312481	206	14719
2010-11	1297555	1299642	29	2058
2011-12	1297555	1286547	0	0
2012-13	1297555	1273189	0	0
2013-14	1297555	1259565	0	0
Total	**11912039**	**12016749**	**2460**	**175615**

Bhatinda

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2004-5	215640	212694	0	0
2005-6	209483	210850	0	0
2006-7	307298	313453	80	4479
2007-8	307298	310575	42	3234
2008-9	307298	307639	4	336
2009-10	302680	304644	25	1938
2010-11	304989	301590	0	0
2011-12	307298	298474	0	0
2012-13	307298	295296	0	0
2013-14	307298	292054	0	0
Total	**2876580**	**2847270**	**152**	**9989**

Rabriyawas

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2004-5	421231	407789	0	0
2005-6	404300	404473	0	0
2006-7	755684	765717	0	0
2007-8	755684	759130	45	33
2008-9	750296	752411	27	2087
2009-10	744909	745557	8	640
2010-11	744909	738567	0	0
2011-12	744909	731436	0	0
2012-13	744909	724163	0	0
2013-14	744909	716745	0	0
Total	**6811740**	**6745988**	**80**	**2760**

SECTION F. Environmental impacts

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

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The environmental impacts of the project are minimal – the project activity represents an increase in a current activity rather than an entirely new activity. Increased fly ash consumption will result in additional transportation which may involve some environmental impact (the GHG emissions from this transportation are deducted from the amount of CERs generated by the project activity). Increased dust from the fly ash blending operation is also a potential environmental impact. However, GACL has taken measures to minimise these adverse environmental effects:

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

- The fly-ash is transported in closed bulkers so as to eliminate fugitive emissions.

- All the unloading points are covered and provided with dust collection systems for maintaining the AAQ as per norms.

- Fly ash is pneumatically conveyed with flow control system with “dedusting systems” installed to remove fugitive emissions.

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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As per MoEF guidelines, environmental clearance and an environmental impact assessment is not required for the specific project activity (increase in the % of fly ash).

Matarha, Gujarat, Himachal and Rabriyawas units all have obtained environmental clearance (EC) from the MoEF. As part of obtaining this Environmental Clearance they have undertaken EIAs and public hearings. The grinding units (Ropar and Bhatinda) do not need environmental clearance as outlined in MoEF circular dated 04-03-1999.

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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Stakeholder comments have been obtained through five routes:

- National stakeholder: The project has applied for approval from the Ministry of Environment and Forests. As part of this application, the PDD and PCN have been submitted to the MoEF and a presentation on the project provided. The MoEF has approved the project activities.

- The projects have also received stakeholder approval through the application and obtaining of consents to operate from the state pollution control boards.

- Cement customers are key stakeholders in the project activity. Through its outreach and information activities on the benefits of PPC, these stakeholders have been informed of the project activity.

- The PDD will be posted on the UNFCCC website for 30 days and comments from international stakeholders invited.

- There is no change to the local environment from the project activities, and the project activities provide wider environmental benefits – conserving limestone and utilising an industrial waste product. However as part of its local relationship activities, GACL has placed notices in the local language in local papers outlining the project activity and inviting comments.

G.2. Summary of the comments received:

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All questions from the MoEF were answered at the presentation. No comments have been received from the state pollution control board with respect to the blending of fly ash. No comments have been received from the 30 day international stakeholder assessment and no negative comments have been received in response to the local language notices. The local consultations and responses have been supplied to the validator.

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

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Given no issues were raised no action was required. As highlighted in Section F, GACL have carried out measures to mitigate any negative environmental effects of blending fly ash. Moreover the project activity provides substantial positive environmental effects through the disposal of fly ash and conservation of limestone.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Gujarat Ambuja Cements Ltd
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First Name:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project activity has received no public funding.

Annex 3

BASELINE INFORMATION

Data type	Source
Data on cement plant locations, capacities and productions	CMA
Additive blend of cement plants in region	Calculated from CMA statements: "Varietywise Cement Production Companywise 2003-4" and "Performance of Cement Companies Companywise 2003-4"
NCV for Indian hard coal	Table 1.2 1996 Revised IPCC Guidelines
Emission coefficient for other bituminous coal	Table 1.1 1996 Revised IPCC Guidelines
Fraction of carbon oxidised in coal	Table 1.6 (page 1.28) 1996 Revised IPCC Guidelines
NCV for fuel oil	Table 1.3 1996 Revised IPCC Guidelines
Emission coefficient for fuel oil	Table 1.1 1996 Revised IPCC Guidelines
Fraction of carbon oxidised in fuel oil	http://www.epa.ie/Licensing/EmissionsTrading/HowtoApply/FileUpload,3426,en.pdf

Baseline Calcination Emission Factor Calculation

	InCaO%	InMgO%	OutCaO%	OutMgO%	Clinker	InCaO	InMgO	OutCaO	OutMgO	tCO2/t clinker
Maratha	0	0	65.13%	1.81%	2232555	0	0	1454063	40409	0.531
Kodinar	0	0	65.73%	1.44%	4225440	0	0	2777382	60846	0.532
Himachal	0	0	65.05%	1.53%	2323860	0	0	1511671	35555	0.527
Rabriyawas	0	0	64.68%	1.73%	1463220	0	0	946411	25314	0.527

Fossil Fuel Clinker Emission Factor Calculation

CEF primary data, India	CO2 EF	EF, tCO2/TJ	NCV, TJ/kt	Oxidation	C to CO2
Coal	1852.30584	94.6	19.98	0.98	3.666666667

	2003-4				
		t/yr	tCO2/yr	t clinker/yr	tCO2/t clinker
Maratha		373975	692,716	2232555	0.310
Gujarat	5.18	518000	959,494	4225440	0.227
Himachal	2.95	295111	546,636	2323860	0.235
Rabriyawas	1.92	192000	355,643	1463220	0.243

Electricity Baseline Emission Factor Calculations

				Electricity Supply (kWh)		
	Clinker Prod	Cement Production	Fly Ash Used	Total	From CPP	From Grid
Maratha	2232555	2363970	72677	259265000	259265000	0
Gujarat	4225440	4511880	0	382300000	378171160	4128840
Himachal	2323860	1033430	193629	183673000	23282000	160391000
Ropar	0	1889900	407395	83880000	0	83880000
Bhatinda	0	387940	106793	15400000	0	15400000
Rabiriyawas	1463220	1516950	159983	149900000	134385350	15514650

	Electricity Consumption in Clinkerisation (kWh)			Electricity Consumption in BC Grinding (kWh)			Electricity Consumption in Fly Ash Grinding & Preparation (kWh)		
	Total	From CPP	From grid	Total	From CPP	From grid	Total	From CPP	From grid
Maratha	113730597	113730597	0	97088248	97088248	0	0	0	0
Gujarat	217066547	214722228	2344319	167932174	166118506	1813667	0	0	0
Himachal	106688413	13523597	93164816	33996000	4309261	29686739	0	0	0
Ropar	0	0	0	28880000	0	28880000	0	0	0
Bhatinda	0	0	0	15048193	0	15048193	0	0	0
Rabiriyawas	75346907	67548502	7798405	51879690	46510142	5369548	0	0	0

	Grid Emissions (kgCO2)			CPP Emissions (kgCO2)		
	Clinkerisation	BC Grinding	FA Grinding	Clinkerisation	BC Grinding	FA Grinding
Maratha	0	0	0	200680138	171314348	0.00
Gujarat	2416993	1869891	0	132045909	102156490	0.00
Himachal	83144381	26493752	0	8524622	2716350	0.00
Ropar	0	25773783	0	0	0	0.00
Bhatinda	0	13429669	0	0	0	0.00
Rabiriyawas	6959640	4792021	0	118057156	81287593	0.00

	Grid	Grid CEF	CPP Fuel Consumption	CPP Emissions	CPP EF
Maratha	Western	1.03	246978	457478792	1.76
Gujarat	Western	1.03	86300000	232560714	0.61
Himachal	Northern	0.89	5446000	14675848	0.63
Ropar	Northern	0.89	0	0	
Bhatinda	Northern	0.89	0	0	
Rabiriyawas	Northern	0.89	126799	234870528	1.75

	PE elec_grid_clinker	PE elec_sg_clinker	BE elec_grid_BC	BE elec_sg_BC	BE elec_grid_ADD	BE elec_sg_ADD
Maratha	0.00000	0.08989	0.00000	0.07247	0.00000	0.00000
Gujarat	0.00057	0.03125	0.00041	0.02264	0.00000	0.00000
Himachal	0.03578	0.00367	0.02564	0.00263	0.00000	0.00000
Ropar	0.00000	0.00000	0.01364	0.00000	0.00000	0.00000
Bhatinda	0.00000	0.00000	0.03462	0.00000	0.00000	0.00000
Rabiriyawas	0.00476	0.08068	0.00316	0.05359	0.00000	0.00000

Annex 4

MONITORING PLAN

GACL have delegated a key contact in the central operations department who will co-ordinate the collection of plant and company level data required for monitoring. Agrinergy Ltd have been contracted to collate the data and carry out the calculations required to update emissions factors and to estimate baseline and project emissions. Agrinergy Ltd will produce on an annual basis a formatted report outlining the data, sources and calculations underlying emission reduction generation. This will be presented to the DOE carrying out verification.

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