CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:

>> GHG emission reduction by energy efficiency improvement of clinker cooler in cement manufacturing at Rajashree cement at District Gulbarga,Karnataka India.
Version 03
28th December 2006

A.2. Description of the small-scale project activity:

>> Rajashree Cement (RC) is the progressive Cement Manufacturing Company of India, operating since 1984. Rajashree cement belongs to well known Grasim Industries Ltd of Aditya Birla group of companies. RC is manufacturing cement {ordinary portland cement (OPC), portland pozzolana cement (PPC)} & clinker. The present capacity of plant is 4.2 Million TPA. The project activity is applied to line I and III of RC out of three lines of clinker production.

The project activity is performed in two phases for line I:

1. Up-gradation of pre-heater section from (5th stage to 6th stage) as a part of phase one which was completed in year 2001-02
2. Up-gradation of clinker cooler in phase two completed in year 2002-03

The project activity upgrades clinker cooler for energy efficiency in the cement manufacturing process. Cement process Line-I and III of the plant were commissioned with the best available technology by the KHD, Germany. A reciprocating grate cooler was used for clinker cooling.

The project is the redesigning and retrofitting of the grate system with Omega plate type system, which will increase the cooler recuperation efficiency i.e. utilise more heat in clinker cooler. In this project activity new clinker inlet distribution system is used to distribute the clinker on the reciprocating grate. Due to the benefits of the inlet grate system in clinker cooler, the proper cooling of inlet is taking place with additional benefit of high temperature tertiary air ducts.

The project activity contributes to sustainable development at the local, regional and global levels in the following ways:

Social Well Being:

The project activity has reduced the GHG emissions to the atmosphere associated with the production of cement, by reducing the consumption of fossil fuels. The project activity has also resulted in providing better 'Occupational Health & Safety' (OHS) conditions at the work place. The project activity reduces the consumption of coal, a key energy resource in India, thereby making it available for other purposes.

Economical well being:

The project activity has resulted in reducing the operational costs involved with the manufacture of cement and conservation of natural resources.

Environmental well being:

A) Thermal energy conservation

The project activity reduces specific thermal consumption for cement production and conserves the energy. Indian economy is highly dependent on "Coal – a finite natural resource" as fuel to generate power and heat for production processes. Since, this project activity reduces its specific thermal energy consumption it has positively contributed towards conservation of coal, a non-renewable natural resource and making coal available for other important applications.

B) GHG emission reduction

The project activity is helping in the CO_2 emission reduction. Due to saving in coal the amount of emission from per unit of clinker is also reduced.

Technological Well Being:

The project promotes better usage of energy in the cement industry, by implementing the latest technology available.

This way this project activity is helping in sustainable development.

A.3. Project participants:

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Name of Party involved	Private and/or public entity (ies) proj ect participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/ No)
India (Host Country)	Rajashree Cement Adityanagar, Malkhed Road, District: Gulbarga Karnataka, PIN 585292 India	No

A.4. Technical description of the small-scale project activity:

>>

A.4.1. Location of the small-scale project activity:

>> RC is located at P.O. Adityanagar, district Gulbarga (Karnataka). Adityanagar lies between the parallels of latitude 17^0 5' - 17^0 10', and between the meridians of longitude 77^0 10' - 77^0 15'. The location of proposed project activity is at Rajashree Cement. The plant is well connected by railway and road transport.

A.4.1.1. Host Party(ies):

>> India

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

>> Karnataka

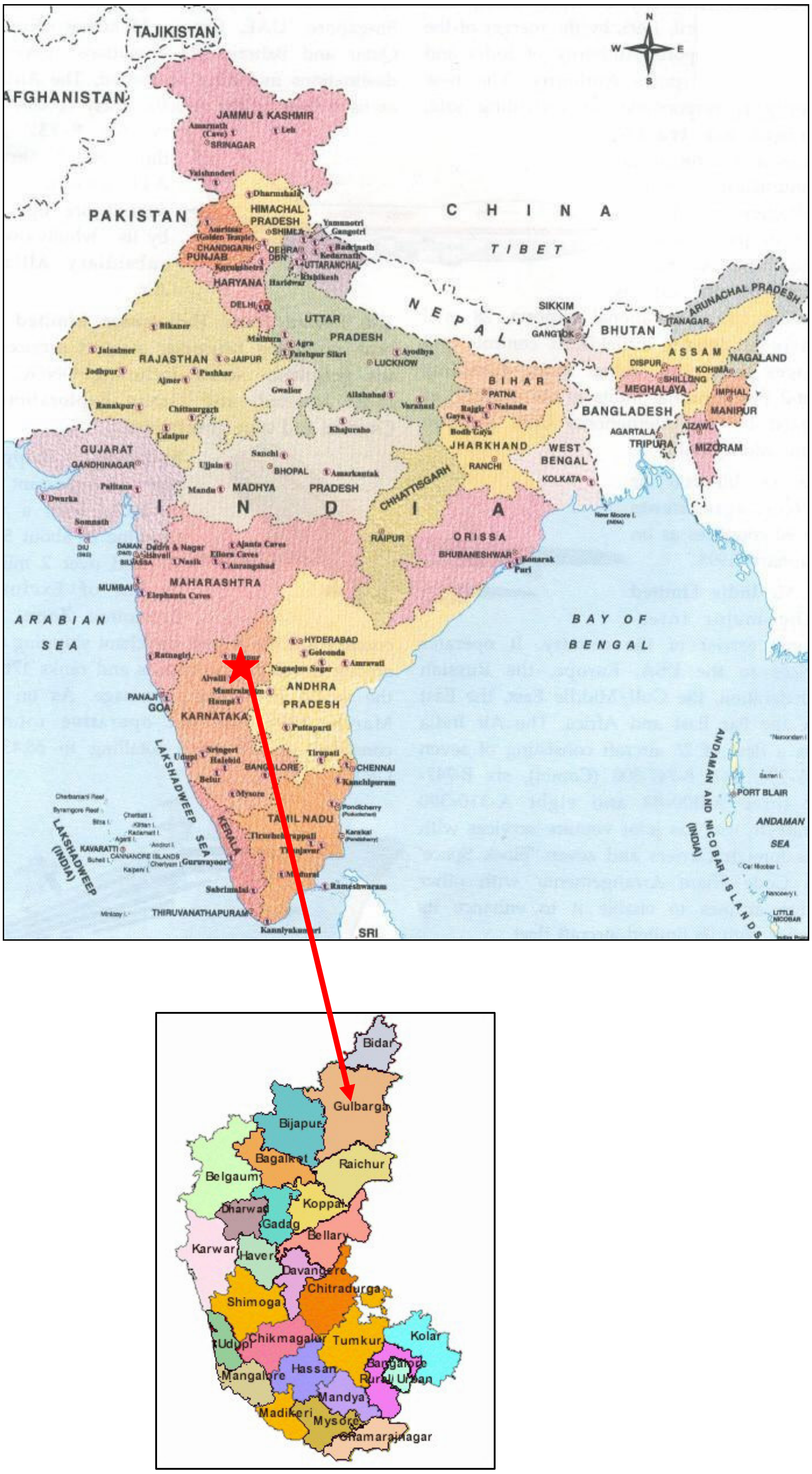
A.4.1.3. City/Town/Community etc:

>> P. O. Adityanagar, Dist: Gulbarga

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):

>> The physical location of project is shown in the map below:

Fig 1 : Location of activity site



A.4.2. Type and category(ies) and technology of the small-scale project activity:

>> Type and Category of Project Activity

The project meets the applicability criteria of the small-scale CDM project activity category, Type-II: energy efficiency improvement projects (D: Energy efficiency and fuel switching measures for industrial facilities) of the 'Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories'.

Main Category: Type II – Energy efficiency improvement project

Sub Category: D. Energy efficiency and fuel switching measures for industrial facilities

As per the provisions of appendix B of simplified modalities and procedures for small scale CDM project activities (version 07), Type II D "Comprises any energy efficiency and fuel switching measure implemented at a single industrial facility. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B. Examples include energy efficiency measures (such as efficient motors), fuel switching measures (such as switching from steam or compressed air to electricity) and efficiency measures for specific industrial processes (such as steel furnaces, paper drying, tobacco curing, etc.). The measures may replace existing equipment or be installed in a new facility. The aggregate energy savings of a single project may not exceed the equivalent of 15 GWh_e per year. A total saving of 15 GWh_e per year is equivalent to a maximal saving of 45 GWh_{th} per year in fuel input."

As per paragraph 1 of II. D. of appendix B of the UNFCCC defined simplified modalities and procedures for small-scale CDM project activities, 'The aggregate energy savings of a single project may not exceed the equivalent of 15 GWh_e per year. A total saving of 15 GWh_e per year is equivalent to a maximal saving of 45 GWh_{th} per year in fuel input'. The project activity is energy efficiency project and saving depends on the cooler efficiency and clinker production. The efficiency increase will be almost constant and the production may vary within the limit.

The baseline and emission reduction calculations from the project would be based on paragraphs 3 and 4 of appendix B (version 07, dated 28^{th} November 2005) and the monitoring methodology would be based on guidance provided in paragraph 6, 7 and 8 of II D of the same appendix B.

Technology to be applied to the project activity:

Line 1: Preheater up-gradation

Preheater consists of number of cyclones to transfer heat from gases to the material entering at the top stage. It is a counter current flow. Material comes in contact with gas and gets heated up. At the entry point material temperature is approx.70°C, but when it comes to Kiln inlet, its temperature increases upto 1000°C.The gas which flows from kiln is at 1100°C and when it passes out of pre-heater 5th stage, it is approx.300°c and in 6^{th} stage preheater, it is around 260-270°C. A secondary firing is also done in

calciner to increase gas temperature and increase calcination of material and it is around 60% of the total coal required for clinkerisation.

In cyclone of preheater there are two parts. The upper part called riser duct is meant for heat transfer. Where as the cone and cylindrical part acts as a separator. Material falls down and is transferred to another cyclone where as gases are sucked by means of preheater fan.

By this project activity pre heater exist gas temperature reduces to 260°C from 300°C. This 40°C temperature drop gives further reduction in specific fuel consumption. In practice, addition of one stage, raw feed, which enters the pre heater tower, has sufficient time to absorb temperature from gas and cool down pre heater exist gas temperature. By this retrofit measure, it is possible to achieve fossil fuel saving. The project activity reduces specific thermal energy consumption to a great extent and slight increase in specific electrical energy consumption.

Line 1 and 3: Cooler up gradation:

The technology provider was KHD, Germany at inception of the lines. They supplied reciprocating grate cooler for clinker cooling with original plant. The reciprocating grate system comprises rows of alternately fixed and movable grate plates, secured by means of T-bolts to grate support girders. The plates of various grades of steel are used along with the cooler corresponding to the different thermal and mechanical loading conditions. The holes in the rear part of the plate's acts as nozzles, directing the cooling air flow vertically upwards. Air is forced horizontally into the bed of clinker through the gaps between the fixed and the movable plate rows and through the holes in the end faces of the plates. The cooling stream and the continual agitation of the clinker by the grate movements ensure that the clinker particles come into intimate contact with the air.

The project is the redesigning of the grate system with Omega plate type system, which will increase the cooler recuperation efficiency. This Omega type system works due to the design of Omega plates (Row aerated & Chamber aerated). The cooling of clinker takes place faster due to concentrated flow of air to the clinker bed through the row aerated and beam aerated omega plates.

The technology employed is Omega plate type grate cooler system. This technology is the retrofitting of the existing system. It uses the new clinker inlet distribution system to distribute the clinker on the grate. The inlet area consists of 7 fixed rows. The omega grate system consisting of fixed and moving beams. The omega plates are of row aerated and chamber aerated type. Row aerated plates are provided with cooling air for each row of plates through dedicated flexible cooling air lines and chamber aerated rows are provided cooling air through pressurised chamber. The combined effect of row and chamber aerated plates helps in faster cooling of clinker and better heat recuperation through tertiary air duct (TAD) and also reduction clinker temp.

The clinker is transported by inclination of the inlet and by the cooling air.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

>> The project activity would reduce the specific heat consumption in the clinker cooler section in the cement production. The project activity would thereby bring about a reduction in direct on-site emissions from reduced thermal energy consumption.

Though the Ministry of Environment and Forest (MoEF), Ministry of Power (MoP) and Ministry of Non conventional Energy Sources (MNES) in India encourage energy conservation on voluntary basis but do not compel cement industries to reduce their specific energy consumption to a prescribed standard. Further, the Department of Industries/ the Bureau of Indian Standards/ Cement Manufacturers Association/ National Council for Building Materials also have not imposed any directives towards specific energy consumption in specific section in cement manufacturing. The project proponent has implemented the project activity 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

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

>>

Line 1:

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2007	14112
2008	14112
2009	14112
2010	14112
2011	14112
2012	14112
2013	14112
2014	14112
2015	14112
2016	14112
Total estimated reductions (tones of CO_2 e)	**141120**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**14112**

Line 3:

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2007	13281
2008	13281
2009	13281
2010	13281
2011	13281
2012	13281
2013	13281
2014	13281
2015	13281
2016	13281
Total estimated reductions (tones of CO_2 e)	**132810**

Year	Annual estimation of emission reductions in tonnes of CO_2 e
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**13281**

A.4.4. Public funding of the small-scale project activity:

>> No public funding for the project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

>>

According to appendix C of simplified modalities and procedures for small-scale CDM project activities, '***debundling'*** is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities.

According to para 2 of appendix C[i]

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point

In view of above-mentioned points of de-bundling, Rajashree Cement's project activity is not a part of any of the above, therefore, considered as small scale CDM project activity.

[i] Appendix C to the simplified M&P for the small-scale CDM project activities, http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

SECTION B. Application of a baseline methodology:

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

>> Main Category: **Type II – Energy efficiency improvement projects**

Sub Category: **II. D-Energy efficiency and fuel switching measures for industrial facilities**

The reference has been taken from the list of the small-scale CDM project activity categories contained in 'Appendix B of the simplified M&P for small-scale CDM project activities-Version 7 (28^{th} November 2005)'.

B.2 Project category applicable to the small-scale project activity:

>> The project activity fits under Type II.D – Energy efficiency and fuel switching measures for industrial facilities under Appendix B. The project activity is the retrofit in cooler for energy efficiency. The project activity is reducing the use of energy in cement manufacturing and will fall under the category II. D. of the appendix B.

The EB 21 meeting report, Annex 21 - 'General Principles of Bundling', states that 'project activities within a bundle can be arranged into one or more sub-bundles, with each project activity retaining its distinctive characteristics which includes technology/ measure; location; application of simplified baseline methodology. The project activities within the sub-bundle belong to the same type and the output capacity of project activities within a sub-bundle shall not exceed the maximum output capacity limit for its type'.

The application of the efficient clinker cooler is at two different places in the different line of clinker production. The saving in thermal energy from the project activity is in the tune of 43 $GWh_{thermal}$ from line 1 and 40 $GWh_{thermal}$ from line 3.

Based on above calculation it is clear that the project activity is well within the range of small scale project activity II.D.

The project activity is applied in a part of clinker manufacturing process i.e. cooler. The cooler used for cooling the clinker and waste heat recovery to the clinker manufacturing process. Since the cooler is not a direct energy user; it takes heat from the fuel applied to the preheater and kiln, efficiency before and after project activity is used for the estimation of heat saving.

All types of fuel use in the cement manufacturing will be monitored and the average emission factor will be calculated based on the fuel mix for the emission reduction calculations. The information regarding baseline and project data are presented in the table below:

Table 2: Baseline and project activity data requirement and data source

S. No.	Parameter	Data source
Baseline Scenario		
1	Cooler efficiency	Plant
2	Fuel used in clinker manufacturing	Plant
3	Calorific value of the fuel used	Plant
Project Scenario		
4	Cooler efficiency	Plant
5	Fuel used in clinker manufacturing	Plant
6	Calorific value of the fuel used	Plant
7	Emission factor of the fuel used	Default emission factor from IPCC

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 small-scale CDM project activity:

>> In accordance with paragraph 3 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in Appendix B may be used for a small-scale CDM project activity if project participants are able to demonstrate to a designated operational entity that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in Attachment A of Appendix. B. These barriers are:

- Investment barrier
- Technological barrier
- Barrier due to prevailing practice
- Other barriers

The implementation of the energy efficiency project activity in cooler is a voluntary step undertaken by no direct or indirect mandate by law.

The main driving force to this 'Climate change initiative' is:

- GHG reduction
- Fossil fuel conservation

However, the project proponent was aware of the various barriers associated to project implementation. But it is felt that the availability of carbon financing against a sale consideration of carbon credits generated due to project activity would help to overcome these barriers. Some of the key barriers are discussed below:

Investment Barrier

The project activity is energy efficiency in clinker cooler. The project is saving the fossil fuel heat input in the clinker manufacturing. The project activity is a retrofit measure in the clinker manufacturing. The project activity involves a huge capital investment and low returns. The IRR calculation of the project is below minimum required rate of return (9.2%) that can be achieved without CDM funds. The minimum required rate of return for the Grasim industries was lower than the real prime lending rate (9.2%) of bank during that time[ii].

The financial analysis- internal rate of return (IRR) is calculated for the project. The summary of IRR is given in PDD.

IRR (%) figures with and without CDM funds

	IRR (%) without CDM fund	IRR (%) with CDM funds
IRR of cooler up-gradation project (Line 1)	7.1%	15.6%
IRR of cooler up-gradation project (Line 3)	4.5%	11%

Following are the assumptions while conducting IRR analysis of the project.

1. The average fuel price is Rs. 2268/MT when the project was conceived..
2. Operation and Maintenance cost (1% of capital cost)
3. Administrative cost is 2.5% of capital investment
4. Cost of insurance is 2%of the capital investment.
5. Life of project is considered as 15 years.
6. CDM funds are available at the rate of 7 $/CER.

Technological barriers

The project activity is first of its kind in cooler section of clinker manufacturing. The cement manufacturing is an integrated process and the design of any specific equipment depends on the peculiarity of operation. For making any standardized product the plant trails are performed. The project activity is first installation of such type of the cooler technology. The letter from technology supplier is attached in the PDD. The project being first installation faces the barriers of technology unfamiliarity in the installation of technology. Skilled and experienced engineers/ operators to operate and maintain the technology were not available, which could have lead to equipment disrepair and malfunctioning.

[ii] http://indiabudget.nic.in/ES2000-01/chap33.pdf

Unfamiliarity with technology: The project proponent was not aware with the technology used in cooler retrofitting. Operational problems with the unfamiliarity of technology lead to reluctance of operators working in the section.

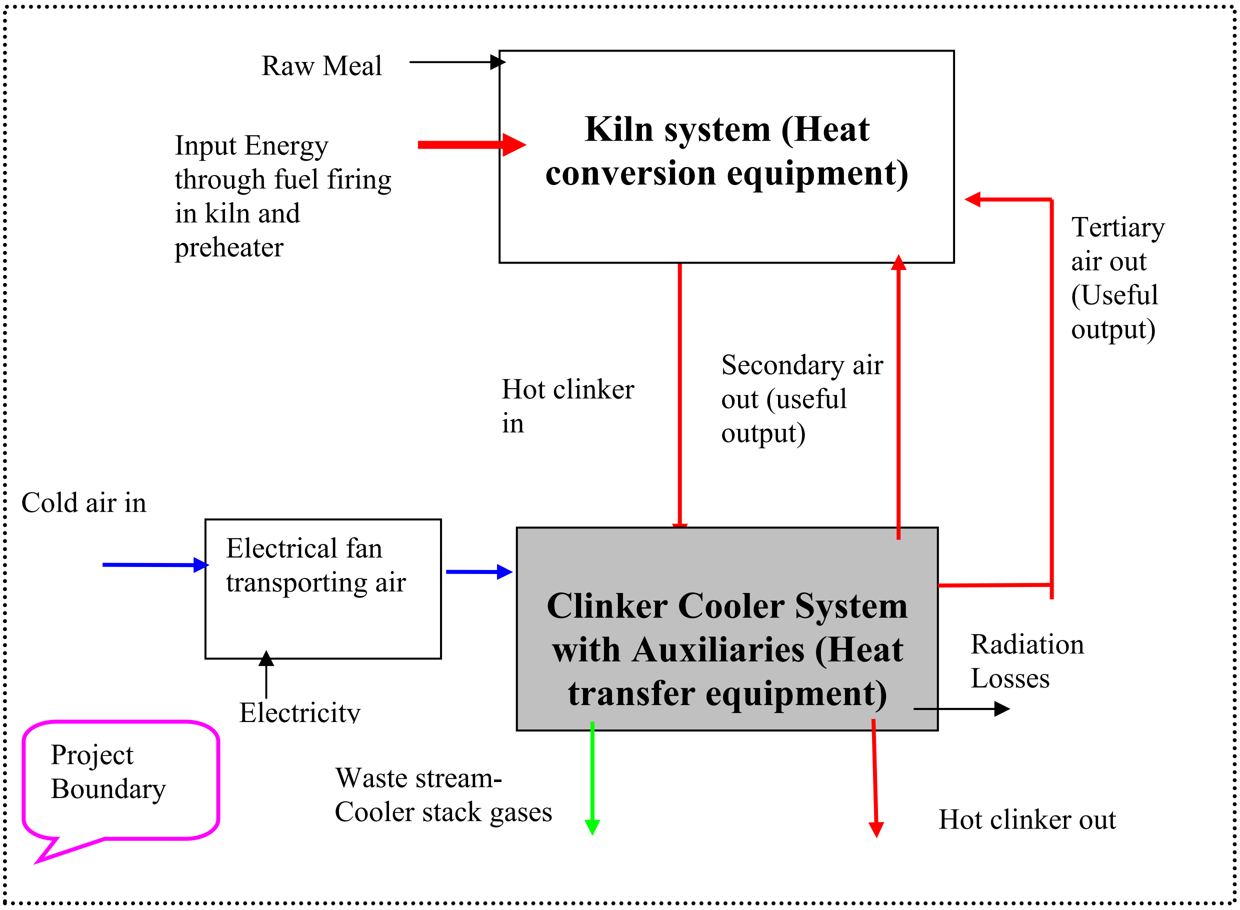
Barriers due to prevailing practice

The 'cooler energy efficiency project', when implemented as ***retrofit measure***, was "one of the first of a kind" project, due to low penetration of this technology, in Indian cement industries. Cooler is very critical part of the cement process, and general belief in Indian cement industry is that 'tempering with it may lead to production stoppages and quality problems'. Therefore, this technology, due to its 'state-of-the-art' features, risk potential and complexity, is still scarcely implemented in Indian cement industry.

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

>> Based on baseline methodology, 'the project boundary is the physical, geographical site of the industrial facility, processes or equipment that is affected by the project activity'. The project boundary selected is the clinker cooler (heat transfer equipment directly associated with heat conversion equipment *i.e.* kiln) and kiln system (heat conversion equipment), including preheater section because these all equipments are effecting from the project activity. The pictorial presentation of the project boundary is given below:

Figure B 4: Project Boundary



B.5. Details of the baseline and its development:

>>

Date of baseline development: 11/12/2005

Rajashree cement and associated consultants

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

>>

C.1.1. Starting date of the small-scale project activity:

>>

18/01/2001 (CDM consideration date)

C.1.2. Expected operational lifetime of the small-scale project activity:

>> 20 Years 0 months

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

>> Fixed

C.2.1. Renewable crediting period:

>> Not Applicable

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

>> Not Applicable

C.2.1.2. Length of the first crediting period:

>> Not Applicable

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>> The crediting period will start from the date of registration. For calculation purposes 01/01/2007 is mentioned as crediting period.

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 small-scale project activity:

>> **Title:** Monitoring Methodology for the category II D – Energy efficiency and fuel switching measures for industrial facilities.

Reference: 'Paragraph 6 to 8' as provided in Type II.D. of Appendix B of the simplified modalities and procedures for small-scale CDM project activities - Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories.

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

>> As established in Section B.2 the project activity falls under Category II.D. Energy efficiency in clinker cooler leads to mitigation of GHG emissions that would have been produced by the inefficient operation. In order to monitor the mitigation of GHG due to the project activity, the fuel used and efficiency need to be measured. The project activity is the retrofit to cooler for energy efficiency. In the monitoring all the parameters related with fuel use and efficiency of cooler is monitored.

In the monitoring plan mainly these data is monitored:

1. Fuel used in clinker manufacturing
2. Calorific value of the fuel
3. Parameters related with the cooler efficiency

Based on the monitored data and the IPCC emission factors the baseline emissions and project activity emissions are calculated.

There is no technology transfer in the project activity therefore the project activity doesn't lead to any leakage emissions. The difference between the baseline and project emissions is reported as emission reductions from the project activity.

D.3 Data to be monitored:

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

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
P.1	Clinker production (Clk)	Plant	Tons/day	Measured and calculated	Recorded continuously	100%	Electronic	The clinker production will be calculated from the raw meal consumption and the raw meal to clinker conversion factor. Raw meal consumption: Raw meal supplied at Kiln inlet is measured by Solid Flow Meter. Conversion factor: The conversion factor is given by the government agency national council for concrete and building materials.(NCCBM). Calibration: Annual calibration from equipment supplier. Loss in weight of kiln feed system is checked through "intecont plus" controller and the procedure is inbuilt and the programmed in the chip. Frequency : Annual Data retention period: Crediting period + 2 years
P.2	Quantity of fuel	Plant	Tons/month	Measured and calculated	Recorded continuousl	100%	Electronic	Instrument used: Transweigh make loss in weight equipment

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	consumed (Q_{Fuel})				y and reported monthly			Calibration: Internal calibration with standard calibrated weights. Frequency: Annual Data retention period: Crediting period + 2 years
P.3	Emission factor of fuel (EF_{Fuel})	IPCC	TCO_2/TJ	Fixed	Fixed	100%	Electronic	IPCC 2006 default values, Fixed
P.4	Calorific value of fuel consumed (CV_{Fuel})	Plant	Kcal/kg	Measured	Recorded continuously and reported monthly	100%	Electronic	By Bomb Calorimeter with standard procedure as given by the OEM is done in the plant lab. Calibration: By Benzoic acid powder/ tablet test for the bomb calorimeter. Data retention period: Crediting period + 2 years
P.5	Average emission factor ($EF_{average}$)	Plant	TCO_2/TJ	Calculated	Monthly	100%	Electronic	Calculated as per the equation 15.
Clinker cooler Efficiency calculations								
P.6	Inlet temperature of clinker in cooler ($T_{Clk In}$)	Plant	°C	Estimated	Fixed	100%	Electronic	The inlet temperature of clinker in cooler is estimated constant in pre and post project scenario, based on the data given by technology supplier. Data retention period: Crediting period + 2

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
								years
P.7	Specific heat of clinker ($S_{Clk\ In}$)	Formulae provided by technology suppler	Kcal/kg°C	Calculated	Weekly	100%	Electronic	Calculated as per eq 2 of calculation. Data retention period: Crediting period + 2 years
P.8	Inlet temperature of cooling air in cooler ($T_{Cooling\ Air}$)	Plant	°C	Measured	Daily	100%	Electronic	Average temperature of minimum and maximum ambient temperature. The mercury thermometer (Dry and wet bulb thermometer) is used for the same. Data retention period: Crediting period + 2 years
P.9	Density of air (D_a)	Data book	Kg/m^3	Calculated	Weekly	100%	Electronic	Calculated as per eq 3 in the project calculation section. Data retention period: Crediting period + 2 years
P.10	Volume flow rate of cooling air in cooler ($M_{Cooling\ Air}$)	Plant	M^3/hr	Measured & Calculated	Weekly	100%	Electronic	Measured as per the piezeometer reading in the control room and cross checked with the anemometer readings from individual cooler fans. Data retention period: Crediting period + 2 years
P.11	Specific heat of	Formulae provided by	Kcal/ kg/°C	Calculated	Fixed	100%	Electronic	Calculated as per eq 2 in the project calculation section.

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	cooling air ($S_{Cooling Air}$)	technology suppler						Data retention period: Crediting period + 2 years
P.12	Power consumed by cooler fans (P_{Fan})	Plant	KWh /day	Measured	Monitored continuously and reported weekly	100%	Electronic	Instrument used: Energy meter including auxiliaries Class: 0.5 S Make: Enercon Data retention period: Crediting period + 2 years
P.13	Exhaust air temperature from cooler ($T_{Exhaust Air Cooler}$)	Plant	°C	Measured	Weekly	100%	Electronic	Instrument used: K type Thermocouple. Calibration: Internal Frequency: Annual Data retention period: Crediting period + 2 years
P.14	Static Pressure from ESP exhaust ($StPr_{ESP Exhaust}$)	Plant	mm water gauge	Measured	Weekly	100%	Electronic	Instrument used: Pitot Tube with digital /mercury manometer. Calibration: External Frequency: Annual Data retention period: Crediting period + 2 years
P.15	Dynamic Pressure from ESP exhaust ($DyPr_{ESP}$	Plant	mm water gauge	Measured	Weekly	100%	Electronic	Instrument used: Pitot Tube with digital /mercury manometer. Calibration: External Frequency: Annual Data retention period: Crediting period + 2

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	$_{Exhaust}$)							years
P.16	Mass flow rate of cooler exhaust gas ($M_{Exhaust\ gas}$)	Plant	kg/hr	Measured & Calculated	Weekly	100%	Electronic	Calculated as per equation 8 in the calculation.
P.17	Specific heat of cooler Exhaust gas ($S_{Exhaust\ gas}$)	Formulae provided by technology suppler	Kcal/ kg / °C	Calculated	Fixed	100%	Electronic	Calculated as per eq 2 in the project calculation section. Data retention period: Crediting period + 2 years
P.18	Temperature of clinker dust from cooler ($T_{Dust\ cooler}$)	Plant	°C	Estimated	Weekly	100%	Electronic	Temperature of dust will be same as exhaust air temperature from cooler. Data retention period: Crediting period + 2 years
P.19	Clinker dust from cooler ($M_{Dust\ Cooler}$)	Plant	Kg /m^3 of exhaust air	Estimated	Every six month	100%	Electronic	Equipment used is the environmental test equipment. The test is considered monthly. Data retention period: Crediting period + 2 years .
P.20	Specific heat of clinker Dust rom cooler	Formulae provided by technology suppler	Kcal/kg°C	Calculated	Fixed	100%	Electronic	Calculated based on the equation no 2. in project calculation section. Data retention period: Crediting period + 2 years

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	($S_{Dust\ cooler}$)							
P.21	Temperature of clinker from cooler ($T_{Clk\ Out}$)	Plant	°C	Calculated	Weekly	100%	Electronic	The date is online monitored in control room. Instrument used: K type Thermocouple. Calibration: Internal Frequency: 6 months Data retention period: Crediting period + 2 years
P.22	Clinker from cooler ($M_{Clk\ Out}$)	Plant	TPD	Measured and Calculated	Daily	100%	Electronic	Difference of clinker inlet and clinker dust
P.23	Specific heat of clinker from cooler ($S_{Clk\ Out}$)	Formulae provided by technology suppler	Kcal/kg°C	Calculated	Fixed	100%	Electronic	Calculated based on the equation no 2. in project calculation section. Data retention period: Crediting period + 2 years
P.24	Radiation losses from cooler (R_{Loss})	Data book	Kcal/hr	Calculated	Weekly	100%	Electronic	6 Kcal/kg of Clinker. Fixed value is used as per the data given by technology supplier.
P.25	Kiln running hours (K hrs)	Plant	Hrs	Monitored	Daily	100%	Electronic	Monitored daily from control room. Data retention period: Crediting period + 2 years
P.26	Cooler	Plant	%	Calculated	Weekly	100%	Electronic	Calculated as per eq 14 of the calculation.

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
	Efficiency (Eff_{Cooler})							Data retention period: Crediting period + 2 years

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

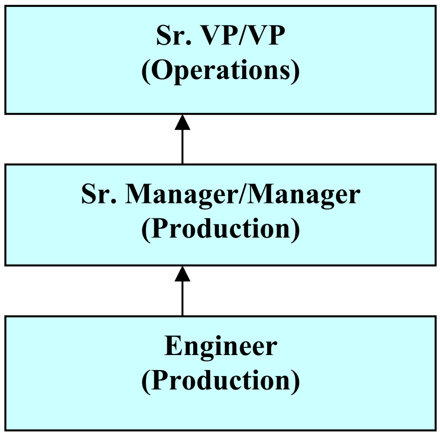
>>

D.4.1 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.
P.3, P.5, P.7, P.9, P.11, P.17, P.20, P.22, P.23, P.26,	*Low*	IPCC values/ Values from Data books/ formulae from technology supplier/calculation
P.1, P.2, P.4, P.6, P.8, P.10, P.12, P.13, P.14, P.15, P.16, P.18, P.19, P.21, P.25,	*Low*	ISO-9001 procedure is in place.
P.6, P.24,	*Medium*	Standard measurement procedure is defined./ values from technology supply.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

>> Emission monitoring and calculation procedure will follow the following organisational structure. All data and calculation formula required to proceed is given in the section D in PDD.

Organisational structure for monitoring plan



Monitoring and calculation activities and responsibility

Monitoring and calculation activities	Procedure and responsibility
Data source and collection	Data is taken from the purchase, materials and accounting system. Most of the data is available in ISO 9001 quality management system.
Frequency	Monitoring frequency should be as per section D of PDD.
Review	All received data is reviewed by the engineers in the production.
Data compilation	All the data is compiled and stored in production department.
Emission calculation	Emission reduction calculations will be done annual based on the data collected. Engineers of production department will do the calculations
Review	Sr. Manager/ Manager, Production will review the calculation.
Emission data review	Final calculations is reviewed and approved by VP/EVP Operations.
Record keeping	All calculation and data record will be kept with the Production.

D.6. Name of person/entity determining the monitoring methodology:

>> Rajashree and its associate consultants

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

>>

E.1.1 Selected formulae as provided in appendix B:

>> No formulae for GHG emission reduction is specified for Category II.D of Appendix B of the Simplified Modalities and Procedures for Small-scale CDM Project Activities.

E.1.2 Description of formulae when not provided in appendix B:

>>

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

>>

1. Clinker Production

Clinker production, Clk, (TPD) = (Raw meal feed to Kiln (TPD)/Raw meal to clinker conversion factor[iii]) (1)

2. Specific Heats of all materials

Specific heat (Kcal/kg/C) = $a + b\,T + c\,T^2$ (2)

Gas/Mat	a*T^0	b*T^1	c*T^2
Air	0.237	2.3E-05	0
Clinker dust	0.206	1.01E-04	-3.7E-08
Clinker	0.186	5.4E-05	0

3. Mass flow rate of cooling air

3.1 Density of Air

Density of air (Da) (kg/m^3) = [1.293[iv] x 273[v] x 9986[vi]]/ [10336[vii] x (273+air temp.)] (3)

3.2 Mass Flow rate of air in cooler (m3/hr)

$M_{cooling\ air}$ = Volume flow rate of Cooling air[viii] x Density (4)

Where

$M_{cooling\ air}$ = Mass flow rate of cooling air (Kg/hr) (5)

[iii] Conversion factor is calculated by the National council for building and materials, India.

[iv] Density of air at normal temp and pressure (NTP) =1.293 kg/Nm^3

[v] Temperature in Kelvin

[vi] Atmospheric pressure at 400 meter altitude (altitude of plant, mm water gauge)

[vii] Atmospheric pressure at 0 meter latitude (mm water gauge)

[viii] The Volume flow rate of cooling air is measured continuously at control room with the help of pizeometer installed in cooling air fans.

4. Heat delivered by cooler fan

Heat delivered by cooler fans (Kcal/hr) = (Power consumed by cooler fans (kWh/day) x 860[ix]/ operating hours) (6)

5. Mass flow rate of cooler exhaust gas

5.1 Velocity of Exhaust Gases

Velocity m/Se= $\left\lfloor \sqrt{(2 * g * Dy\,\mathrm{Pr}) / Density} \right\rfloor \times Pitot\ tube\ factor$ (7)

5.2 Density of exhaust gas

Density of gas (kg/m^3) = [1.293 x 273 x 9827]/ [10336 x (273+gas temp.)] (8)

5.3 Volume flow rate of exhaust gas

M $_{\text{Exhaust gas}}$ m^3/hr= $Velocity \times Area \times 3600$ (9)

5.4 Mass flow rate of exhaust gas

M $_{\text{Exhaust Gases}}$ (kg/hr)= Volume flow rate of Exhaust gases x Density of exhaust gases (10)

Where

g = Acceleration due to gravity (9.8 m/s^2)

DyPr = Dynamic pressure of exhaust gas (mm water gauge)

Pitot tube factor = Coefficient of pitot tube (0.8670)

6. Radiation losses

Radiation losses (Kcal/hr) = 6 Kcal/kg of Clinker[x] (11)

Cooler efficiency calculation

1. Heat input by any incoming streams

$$Heat\ Input = \sum_{i=1.....n} Mass \times Specific\ Heat \times Temperature \quad (12)$$

2. Heat Loss from outgoing streams

$$Heat\ Loss = \sum_{i=1.....n} (Mass \times Specific\ Heat \times Temperature) + Radiation\ Losses \quad (13)$$

3. Efficiency of the clinker cooler

$$Efficiency_{Project} = {(Heat\ Input - Losses)} \Big/ {Heat\ Input} \quad (14)$$

[ix] Thermal equivalent of electricity 1 kWh = 860 Kcal

[x] Based on the data given by technology supplier (Constant)

Average emission factor

1. Total heat supplied to the system

$$Average\ Emission\ factor = \frac{\sum_{i=1.....n}(Quantity\ of\ fuel \times Calorific\ Value \times Emission\ Factor)}{\sum_{i=1.....n}(Quantity\ of\ fuel \times Calorific\ Value)} \quad (15)$$

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

>> Not Applicable

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

>> Same as E.1.2.1

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

>>

1. **Clinker Production**

Clinker production, Clk, (TPD) = (Raw meal feed to Kiln (TPD)/Raw meal to clinker conversion factor[xi]) (16)

2. **Specific Heats of all materials**

Specific heat (Kcal/kg/C) = a + b T + c T^2 (17)

Gas/Mat	a*T^0	b*T^1	c*T^2
Air	0.237	2.3E-05	0
Clinker dust	0.206	1.01E-04	-3.7E-08
Clinker	0.186	5.4E-05	0

3. **Mass flow rate of cooling air**

   a. **Density of Air**

Density of air (Da) (kg/m^3) = [1.293[xii] x 273[xiii] x 9986[xiv]]/ [10336[xv] x (273+air temp.)] (18)

[xi] Conversion factor is calculated by the National council for building and materials, India.

[xii] Density of air at normal temp and pressure (NTP) =1.293 kg/Nm^3

[xiii] Temperature in Kelvin

[xiv] Atmospheric pressure at 400 meter altitude (altitude of plant, mm water gauge)

[xv] Atmospheric pressure at 0 meter latitude (mm water gauge)

b. Mass Flow rate of air in cooler (m3/hr)

$M_{cooling\ air}$ = Volume flow rate of Cooling air[xvi] x Density (19)

Where

$M_{cooling\ air}$ = Mass flow rate of cooling air (Kg/hr)

4. Heat delivered by cooler fan

Heat delivered by cooler fans (Kcal/hr) = (Power consumed by cooler fans (kWh/day) x 860[xvii]/ operating hours) (20)

5. Mass flow rate of cooler exhaust gas

5.1 Velocity of Exhaust Gases

Velocity m/Se= $\left\lfloor \sqrt{(2 * g * Dy\,\mathrm{Pr}) / Density} \right\rfloor \times Pitot\,tube\ factor$ (21)

5.2 Density of exhaust gas

Density of gas (kg/m^3) = [1.293 x 273 x 9827]/ [10336 x (273+gas temp.)] (22)

5.3 Volume flow rate of exhaust gas

$M_{Exhaust\ gas}$ m^3/hr= $Velocity \times Area \times 3600$ (23)

5.4 Mass flow rate of exhaust gas

$M_{Exhaust\ Gases}$ (kg/hr)= Volume flow rate of Exhaust gases x Density of exhaust gases (24)

Where

g = Acceleration due to gravity (9.8 m/s^2)

DyPr = Dynamic pressure of exhaust gas (mm water gauge)

Pitot tube factor = Coefficient of pitot tube (0.8670)

Radiation losses

Radiation losses (Kcal/hr) = 6 Kcal/kg of Clinker[xviii] (25)

Cooler efficiency calculation

1. **Heat input by any incoming streams**

$$Heat\ Input = \sum_{i=1.....n} Mass \times Specific\ Heat \times Temperature \quad (26)$$

2. **Heat Loss from outgoing streams**

[xvi] The Volume flow rate of cooling air is measured continuously at control room with the help of pizeometer installed in cooling air fans.

[xvii] Thermal equivalent of electricity 1 kWh = 860 Kcal

[xviii] Based on the data given by technology supplier (Constant)

$$Heat\ Loss = \sum_{i=1.....n}(Mass \times Specific\ Heat \times Temperature) + Radiation\ Losses \quad (27)$$

3. Efficiency of the clinker cooler

$$Efficiency_{Baseline} = {(Heat\ Input - Losses)}\Big/{Heat\ Input} \quad (28)$$

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

>>

Emission Reduction Calculations

Step 1: Increase in efficiency

$$Increase\ in\ Efficiency = (Efficiency\ in\ project\ activity - Baseline\ efficiency) \quad (29)$$

Step 2: Saving in heat input due to increase in efficiency

$$Saving\ in\ Heat\ Input = \left({Increase\ in\ efficiency}\Big/{Efficiency\ in\ project\ case}\right) \times Heat\ input\ in\ project\ activity \quad (30)$$

Step 3: Emission reduction

$$Emission\ Reduction = (Saving\ in\ heat\ input) \times Average\ Emission\ factor \quad (31)$$

E.2 Table providing values obtained when applying formulae above:

>>

Line 1:

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2007	14112
2008	14112
2009	14112
2010	14112
2011	14112
2012	14112
2013	14112
2014	14112
2015	14112

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2016	14112
Total estimated reductions (tones of CO_2 e)	**141120**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**14112**

Line 3:

Year	Annual estimation of emission reductions in tonnes of CO_2 e
2007	13281
2008	13281
2009	13281
2010	13281
2011	13281
2012	13281
2013	13281
2014	13281
2015	13281
2016	13281
Total estimated reductions (tones of CO_2 e)	**132810**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tones of CO_2 e)	**13281**

SECTION F.: Environmental impacts:

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>> >>

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[xix] of the notification which for setting up new projects or modernization/ expansion will require environmental clearance and will have to conduct an Environment Impact Assessment (EIA) study. However, the project under consideration does not require any EIA to be conducted.

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.

Rajashree Cement being an ISO 14001, OHSAS 18001 organisation, has specialized environmental management systems & consistent evaluation of the impacts, key parameters have ensured that the company meets the environmental targets. The project activity is one such voluntary measure, which has positive long-term environmental impact. The 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.

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. Environmental impacts from project activity are discussed in the table below:

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	REMARKS
A	CATEGORY: ENVIRONMENTAL – RESOURCE CONSERVATION	
1	**Coal conservation:** The project activity reduces specific 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 consumption per unit of cement produced that would have been required to cater to the baseline project option.	The project activity is a step towards and coal conservation.
B	CATEGORY: ENVIRONMENTAL – AIR QUALITY	

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

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	REMARKS
	By reducing the thermal energy content of the cement manufacturing, the project activity reduces CO_2 emissions.	The project activity reduces emission of CO_2 -a global entity.
C	CATEGORY: ENVIRONMENTAL –WATER	
1	The project activity does not contribute to water pollution.	No impact
D	CATEGORY: ENVIRONMENTAL – LAND	
1	Reduction in specific consumption demand further reduces quarry/coal mining; which leads to loss of biodiversity, land destruction and erosions arising from such activities. **There is no possible soil or land pollution arising due to project activity.**	The project activity leads to positive impact on Land environment.
E	CATEGORY: ENVIRONMENTAL – NOISE GENERATION	
1	**The project activity does not contribute to noise pollution.**	-
F	CATEGORY: SOCIAL	
1	**Mining Risks:** Quarry mining of coal experiences landslides and destruction in the history of mining. Thus by less consumption of coal project activity would indirectly reduce chances of landslides and landscape destruction at mining sites. The adverse heath impacts caused from quarrying of materials on the mining persons, nearby habitats and ecosystem, would therefore be avoided.	The project is expected to bring positive changes in the life style and quality of life and reduce mining risks.
G	CATEGORY: ECOLOGY	
1	By reducing the coal, the project activity has a beneficial impact on the flora, fauna in the vicinity of the mining sites.	-

SECTION G. Stakeholders' comments:

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

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

The project activity occurred at RC cement plant in Adityanagar, Karnataka, India. The project activity will reduce the use of thermal energy i.e. fossil fuel. The project activity is in the plant boundary and does not involve any direct interference other than the employees of the plant. The employees were considered as the main stakeholder of the project activity. The various stakeholders identified for the project are as under.

- Karnataka State Pollution Control Board
- Employees of the plant
- Ministry of Environment & Forest (MoEF), Government of India
- Consultants and equipment Suppliers
- Local Population/Village Panchayat

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

G.2. Summary of the comments received:

>> The project activity is energy efficiency in clinker cooler. Due to this project proponent will use less quantities of fossil fuels in clinker manufacturing. The project activity has positive environmental impact in term of emissions. KPCB 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 KPCB during the commissioning of the plant. The project activity reduces the environmental impacts on the local ambient quality and meets all the statutory requirements. RC submits an annual Environmental Statement to KPCB and also describes the Environmental aspects of the plant in its annual report.

The project is being implemented at existing facility of RC thus project does not require any displacement of the local population. This implies that the project will not cause any adverse social impacts on the local population but helps in improving the quality of life for them.

The project proponent has received positive comments from the local population representatives and employees that the project activity has reduced fossil fuel consumptions and given good working environment at the area. The employees of the clinker cooler section were happy about the less maintenance problems in the new system and saving in fossil fuels. The letters received from the stakeholder is already submitted to validators.

The project has not received any comments from international stakeholders. The comment from local panchayat is written below:

ಗ್ರಾಮ ಪಂಚಾಯತ ಕಾರ್ಯಾಲಯ, ಮಳಖೇಡ

ತಾ|| ಸೇಡಂ ಜಿ|| ಗುಲಬರ್ಗಾ

ಸಂಖ್ಯೆ : ದಿನಾಂಕ:

To, 30/8/2001

P H Choudhary,
Dy. General Manger (Production)
Rajeshree cement,
Adityanagar Malkhed,
Dist Gulbarga.

Sir,

I received your latter dated 14/8/2001 & I am happy to note that Rajashree cement is going for pre-heater up gradation & clinker cooler retrofitting in Line-1 & clinker cooler upgradation in line-III. I had learned that these will help the improving the environment status by reducing the CO2.

This upgradation process not only help the environment & reduction of CO2 but also helps to reduction in cement production cost by saving coal, other machinery & maintenance cost.

As a gram panchayat Chairman, I can say that the Rajashree cement company is always maintaining the cordial relation with all the surrounding villagers & trying for welfare of these community by implementing various programmes/activities.

Hence we have no objection for this.

Thanking you,
Yours faithfully,

Rajashekhar Puranik
Chairman,
Gram Panchayat,
Malkhed.

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

>> The project proponent has not received any negative comment for the project activity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Rajashree cement
Street/P.O.Box:	P.O. Adityanagar ,Malkhed road
Building:	
City:	Gulbarga
State/Region:	Karnataka
Postfix/ZIP:	585292
Country:	India
Telephone:	91-8441-288888 / 288339
FAX:	91-8441-287286
E-Mail:	mvramanarao@adityabirla.com
URL:	
Represented by:	
Title:	Assistant Vice President (Technical)
Salutation:	Mr.
Last Name:	Ramanarao
Middle Name:	V
First Name:	M
Department:	Technical
Mobile:	
Direct FAX:	91-8441-288888 / 288339
Direct tel:	91-8441-287286
Personal E-Mail:	mvramanarao@adityabirla.com

<u>**Annex 2**</u>

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the project from parties included in Annex I.

IRR Calculation

IRR calculations for Cooler Upgradation in Rajshree Cement Line 1							
Initial Investment of the proposed project (INR in millions)			46.70				
Expected CER pricing (Rs/ ton of CO_2)			322.00				
Year	Baseyear	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Expenditure							
Initial investment (INR million)	16.80		29.9				
Recurring cost							
Administrative cost		0.42	0.42	1.17	1.17	1.17	1.17
Maintenance Cost @ 1% of cost of project		0.17	0.17	0.47	0.47	0.47	0.47
Production Loss due to plant shutdown during commissioning (15 days)		16.50		11.00			
Cost of insurance (2% of project cost) every year		0.34	0.34	0.93	0.93	0.93	0.93
Income Tax on Fuel Cost Saving		1.69	1.69	3.38	3.38	3.38	3.38
Total cashflow out (A)	**16.80**	**19.11**	**2.61**	**16.95**	**5.95**	**5.95**	**5.95**
Income							
WDV		16.80	12.60	39.35	29.51	22.13	16.60
Depriciation		4.20	3.15	9.84	7.38	5.53	4.15
Saving in income tax due to depreciation		1.5	1.1	3.5	2.6	2.0	1.5
Average fuel cost Rs. 2268/MT with Average calorific value 5400 Kcal/kg	0	4.73	4.73	9.46	9.46	9.46	9.46
Revenue from Emission reduction (INR million)	0	1.45	1.45	2.90	2.90	2.90	2.90
Total project income without considering CER credits(B)	0	6.23	5.86	12.97	12.10	11.44	10.94
Total project income with considering CER credits(C)	0	7.68	7.30	15.87	14.99	14.34	13.84
Net cash flow without considering CER Credits (B-A)	-16.80	-12.88	3.24	-3.97	6.15	5.49	5.00
Net cash flow with considering CER Credits (C-A)	-16.80	-11.43	4.69	-1.07	9.05	8.39	7.90
IRR of the project without considering CER credits	**7.1%**						
IRR of the project with considering CER credits	**15.6%**						

Continuation…

2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47

0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38	3.38
5.95	**5.95**	**5.95**	**5.95**	**5.95**	**5.95**	**5.95**	**5.95**	**5.95**
12.45	9.34	7.00	5.25	3.94	2.95	2.22	1.66	1.25
3.11	2.33	1.75	1.31	0.98	0.74	0.55	0.42	0.31
1.1	0.8	0.6	0.5	0.4	0.3	0.2	0.1	0.1
9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46	9.46
2.90	2.90	2.90	2.90	0.00	0.00	0.00	0.00	0.00
10.57	10.30	10.09	9.93	9.81	9.73	9.66	9.61	9.57
13.47	13.19	12.98	12.83	9.81	9.73	9.66	9.61	9.57
4.63	4.35	4.14	3.98	3.87	3.78	3.71	3.66	3.63
7.52	7.25	7.04	6.88	3.87	3.78	3.71	3.66	3.63

IRR calculations for Cooler Upgradation in Rajshree Cement Line 3					
Initial Investment of the proposed project (INR in millions)			47.00		
Expected CER pricing (Rs/ ton of CO_2)			322.00		
Year	Baseyear	2003-04	2004-05	2005-06	2006-07
Expenditure					
Initial investment (INR million)	47.00				
Recurring cost					
Administrative cost		1.18	1.18	1.18	1.18
Maintenance Cost @ 1% of cost of project		0.47	0.47	0.47	0.47
Production Loss due to plant shutdown during commissioning (8days)		22.00			
Cost of insurance (2% of project cost) every year		0.94	0.94	0.94	0.94
Income Tax on Fuel Cost Saving		4.22	4.22	4.22	4.22
Total cashflow out (A)	**47.00**	**28.81**	**6.81**	**6.81**	**6.81**
Income					
WDV		47.00	35.25	26.44	19.83
Depriciation		11.75	8.81	6.61	4.96
Saving in income tax due to depreciation		4.2	3.1	2.4	1.8
Average fuel cost Rs. 2268/MT with Average calorific value 5400 Kcal/kg	0	11.83	11.83	11.83	11.83
Revenue from Emission reduction (INR million)	0	3.22	3.22	3.22	3.22
Total project income without considering CER credits(B)	0	16.02	14.97	14.19	13.60
Total project income with considering CER credits(C)	0	19.24	18.19	17.41	16.82
Net cash flow without considering CER Credits (B-A)	-47.00	-12.79	8.17	7.38	6.79
Net cash flow with considering CER Credits (C-A)	-47.00	-9.57	11.39	10.60	10.01
IRR of the project without considering CER credits	**4.5%**				
IRR of the project with considering CER credits	**11.0%**				

Continuation…

2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47

0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
4.22	4.22	4.22	4.22	4.22	4.22	4.22	4.22	4.22	4.22	4.22
6.81	**6.81**	**6.81**	**6.81**	**6.81**	**6.81**	**6.81**	**6.81**	**6.81**	**6.81**	**6.81**
14.87	11.15	8.36	6.27	4.71	3.53	2.65	1.99	1.49	1.12	0.84
3.72	2.79	2.09	1.57	1.18	0.88	0.66	0.50	0.37	0.28	0.21
1.3	1.0	0.7	0.6	0.4	0.3	0.2	0.2	0.1	0.1	0.1
11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83	11.83
3.22	3.22	3.22	3.22	3.22	3.22	0.00	0.00	0.00	0.00	0.00
13.15	12.82	12.57	12.39	12.25	12.14	12.06	12.00	11.96	11.93	11.90
16.37	16.04	15.79	15.61	15.47	15.36	12.06	12.00	11.96	11.93	11.90
6.35	6.02	5.77	5.58	5.44	5.33	5.26	5.20	5.15	5.12	5.09
9.57	9.24	8.99	8.80	8.66	8.55	5.26	5.20	5.15	5.12	5.09

Letter from technology supplier

Humboldt Wedag India Private Limited
CC-29, 2nd Floor, Nehru Enclave, New Delhi - 110019.
Tel.: +91-11-42101100,42101200 Fax: +91-11-26227215-16
E-mail : marketing@hw-india.com

HUMBOLDT WEDAG

17th October 2006

M/s Rajashree Cement
P.O. Aditya Nagar
Malkhed Road
Dist:Gulburga-585292
Karnatka

Subject: Letter regarding the clinker cooler modification.

Dear Sir,

This letter is issued to certify that the Omega grate installed in the clinker cooler of Rajashree Cement, Malkhed Road, Gulburga is the first installation of this technology in Indian cement industry.

The installation of Omega grate will improve the specific thermal energy consumption and will reduce the maintenance in the clinker cooler.

For Humboldt Wedag India Pvt. Ltd.

(SITARAM SHARMA
GENERAL MANAGER
