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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

>> Vikram Cement (VC): Energy efficiency improvement by up gradation of preheater in cement manufacturing.

A.2. Description of the project activity:

>> Vikram Cement (VC) is the progressive Cement Manufacturing Company of India, operating since 1985. Vikram Cements belongs to well known Grasim Industries Ltd., a unit of Aditya Birla group of companies. VC is manufacturing cement {ordinary portland cement (OPC), portland pozzolana cement (PPC)} and clinker. The present capacity of plant is 4.2 Million TPA. VC have three operating line. This project activity is applied to Line 1 and 2 of the VC plant, Neemuch, M.P. state India.

The project activity is the upgradation of preheater section from 5 stages to 6 stages. Under the project activity, VC has enhanced the heat exchange area between outgoing flue gases of kiln and incoming clinker, by installing additional heat exchangers. The project comprises of enhancement of benefits of preheater technology, by addition of one more stage.

To reduce the specific heat consumption in the preheater section and saving the waste heat from the preheater outlet gases VC decided to trap the heat energy by means of addition of one more stage. This stage has increased heat transfer area between incoming feed and out going flue gases, increases the energy efficiency and reduces the fossil fuel use *i.e.* CO_2 emissions.

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

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.

GHG emission reduction

The project activity is helping in the CO2 emission reduction. Due to saving in coal/ petcoke the amount of emission from per unit of clinker is also reduced. This way this project activity is helping in sustainable development.

A.3. Project participants:

>> Vikram cement

Vikramnagar, P.O. Khor,

District Neemuch

Madhya Pradesh, PIN 458 470

India

A.4. Technical description of the project activity:

VC upgraded the manufacturing Line 1 & 2 (operating with rotary kilns 1 & 2 respectively) from 5-Stage pre-heater to 6-Stage preheater. Under the project activity, VC has enhanced the heat exchange area between outgoing flue gases of kiln and incoming clinker, by installing additional heat exchangers. By doing so the pre-heater exist gas temperature reduces to 260°C from 300°C. This 40°C temperature drop gives further reduction in specific fuel consumption, which comes to 700 – 702 from 720-722 Kcal/Kg clinker (clk). In practice, addition of one more 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 fuel (coal or pet coke) saving.

A.4.1. Location of the project activity:

>>

VC is located at P.O. Khor; district Neemuch (MP). Neemuch lies between the parallels of latitude 24°15' – 24°35' North, and between the meridians of longitude 74°45' – 75°37' East. The location of proposed project activity is at Vikram 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.:

>> Madhya Pradesh

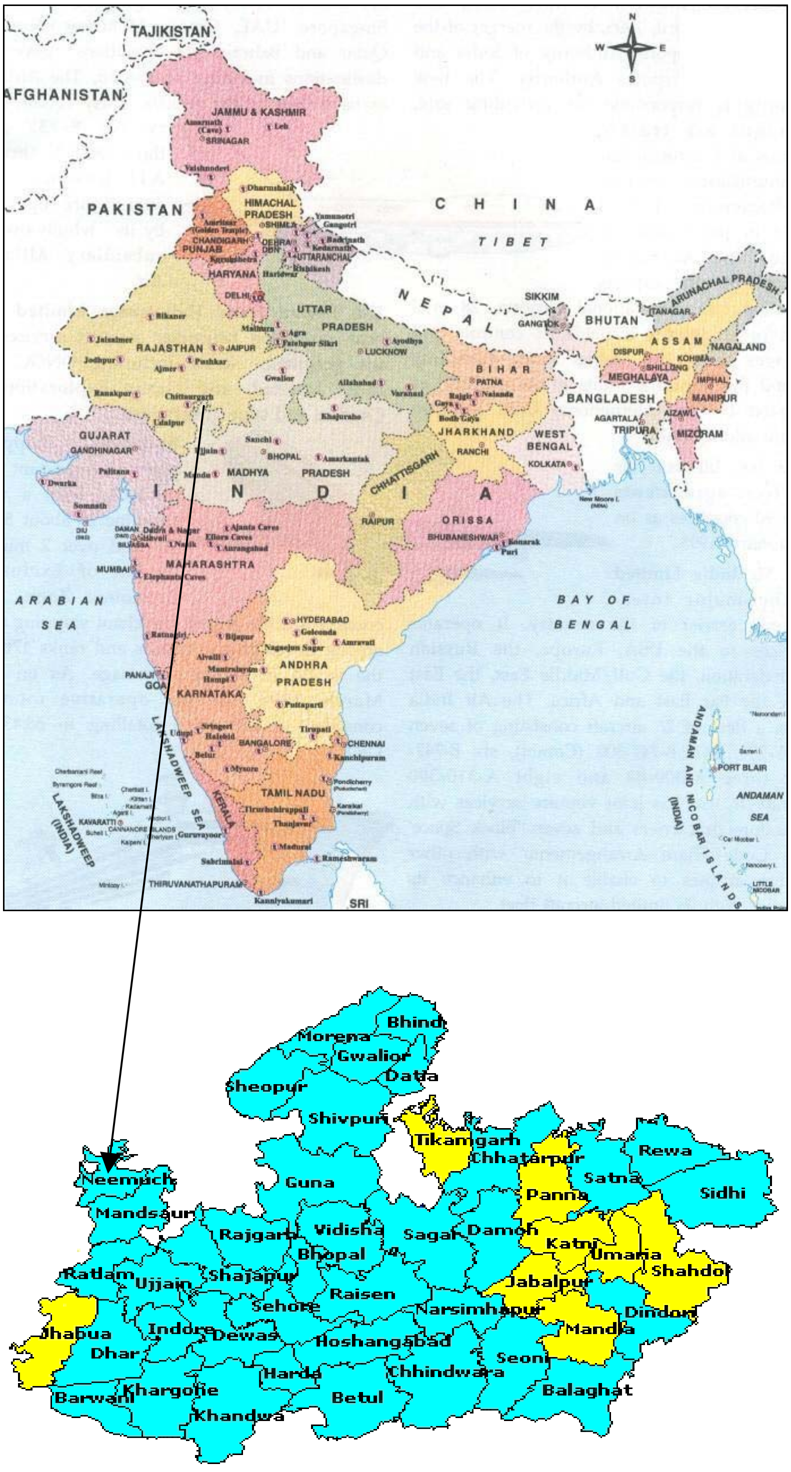
A.4.1.3. City/Town/Community etc:

>> Khor, District Neemuch

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

>>

Figure 1: Physical representation of activity site



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

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The project activity is a cement sector specific project activity. The project activity may principally be categorized in two sectoral scopes for accreditation of operational entities, as following

Category 3: Energy Demand

Category 4 : Manufacturing Industries

This is based on the UNFCCC 'List of Sectoral Scopes' for operational entities (Version 01/ 30 September 2002).

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

>>

The pre-heater consists of number of cyclones to transfer heat from gases to the material entered at top stage. The pre-heater is a counter current flow heat exchanger. Raw meal comes in contact with gas and gets heated up. In cyclone of pre heater there are two parts. The upper part called riser duct is meant for heat transfer, whereas the cone and cylindrical part acts as a separator. Material falls down and is transferred to another cyclone whereas gases are sucked by means of pre heater fan. At the entry point Raw meal temperature is approx. 70°C, but when it reaches kiln inlet; its temperature increases up to 1000 °C. The gas which flows from Kiln is at 1100°C and when it passes out of 5^{th} stage of pre heater it is approx. 300°C and at the outlet of 6^{th} Stage, it is around 260°C.

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.

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

>>

The project activity would reduce the specific heat consumption in the pre heater 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, they do not require cement industries to reduce their specific energy consumption to a prescribed standard. Nor do the Department of Industries/ the Bureau of Indian Standards/ Cement Manufacturers Association/ National Council for Building Materials have imposed any requirement 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.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

>>

Emission reduction from Kiln 1:

S. No.	Year (Financial year (April to March)	Emission reduction
1	2002-03	8836
2	2003-04	8251
3	2004-05	13187
4	2005-06	13187
5	2006-07	13187
6	2007-08	13187
7	2008-09	13187
8	2009-10	13187
9	2010-11	13187
10	2011-12	13187
Total		**122583**

Emission reduction from Kiln 2:

S. No.	Year(Financial year (April to March)	Emission reduction
1	2002-03	2445
2	2003-04	8255
3	2004-05	12822
4	2005-06	12822
5	2006-07	12822
6	2007-08	12822
7	2008-09	12822
8	2009-10	12822
9	2010-11	12822
10	2011-12	12822
11	2012-13	6411
Total		**119687**

A.4.5. Public funding of the project activity:

>> There is no public funding in this project.

SECTION B. Application of a baseline methodology

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

>>

There is no UNFCCC approved methodology available for the project activity. Following is the title of baseline methodology applied to the CDM project.

Title: 'Grasim baseline methodology for the energy efficiency improvement in the heat conversion and heat transfer equipment system.'

The methodology is submitted for approval of UNFCCC along with this PDD.

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

>>

The proposed 'Grasim baseline methodology for the energy efficiency improvement in the heat conversion equipment and heat transfer equipment system', as provided in Annex 3 is applicable only to CDM energy efficiency projects implemented with an intention to save heat energy input in heat energy conversion and/ or heat transfer equipment. This methodology is primarily based on energy efficiency projects for heat energy savings but it also takes into account the electrical energy equipment within the system boundary, for the purpose of heat balance.

VC's project activity was implemented to enable the project proponent to increase the energy efficiency of pre heater and thereby entire kiln system of the cement manufacturing which will reduce the emissions by reducing the amount of fossil fuel used the crediting period.

The main conditions for the application of methodology are:

1. The methodology is applicable for constant output conditions. Constant output levels means that quantity of output per shift/batch should be relatively constant (whether continuous process or batch process), because in absence of constant output it becomes difficult to establish a baseline of consistent and reliable efficiency.
2. The methodology is applicable to heat energy conversion equipment and heat energy transfer equipment, which are essentially connected in series, such that the energy efficiency project taken up in any heat transfer equipment, which is connected in series with heat energy conversion equipment, will save energy in later.
3. Where the historical and current data is available for heat balance parameters vis-à-vis equipment output. This is for defining the baseline criteria and emission reduction estimation.
4. The regular monitoring and/or estimation of heat energy transfer and heat conversion equipment efficiency and/or effectiveness[1] is estimated by direct (Output heat / Input heat) method.

[1] For the purpose of this methodology, the term 'efficiency' is used for 'effectiveness' of heat transfer equipment.

5. The efficiency improvement may result into addition/elimination of some electrical loads or increase /reduction in electrical energy consumption for existing loads. The net emission of CO_2 as a result of energy efficiency project should take into account such electrical load while calculating project emission.

In context of this methodology, the entire kiln equipment system (including preheater, kiln and clinker cooler) is termed as ***'Heat Conversion Equipment'.*** The primary reason for it being a heat conversion system is that fuel is fired in preheater and kiln, where chemical energy of fuel converts into heat energy. ***Input stream to kiln system*** are following:

1. Raw material stream
2. Fine coal stream
3. Primary air stream
4. Cooling air stream
5. Coal conveying stream
6. Seal/excess air stream
7. Water spray

Useful heat output from the system is the heat of clinkerisation.

Since all the conditions mentioned above are applicable to 'pre heater up gradation project', this new baseline methodology is therefore appropriate for the referred CDM project activity. We may therefore adopt the proposed methodology in order to assess the baseline of the project activity and quantify the emission reductions that would be achieved over the entire crediting period.

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

>>

According to methodology the overall approach contains three steps for application of methodology in context of project activity:

Step 1: selection of project boundary : Heat conversion equipment and associated electrical equipment, those have impact on heat balance of project activity.

Step 2: Additionality criteria : As methodology recommends, consolidated additionality tools have been used to demonstrate additionality of project activity (Annex-1 of EB-16 meeting report).

Step 3: Emission reduction calculations : The use of formulae recommended in methodology has been made to calculate the reduction of emissions.

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

>>

As per the decision 17/cp.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

The proposed project activity is energy efficiency improvement activity and results into net reduction in CO_2 emissions of facility.

Following steps for demonstration of additionality are followed as per Annex-1 of EB-16 meeting report on "Consolidated tools for Demonstration of Additionality"

Step 0. Preliminary screening of projects started after 1 January 2000 and prior to 31 December 2005

The procurement started after 1 January 2000. The project is commissioned after January 2002. The CDM fund was seriously being considered before starting the planning of project. There is sufficient evidence available in form of documentation clearly showing that the CDM incentive played a role before the decision-making. Examples of some of the evidences available are following.

1. Minutes of the meeting.
2. GHG auditing conducted by Grasim Industries (cement division).
3. Communication with different parties.

Step 1. Identification of alternatives to the project activity *(energy efficiency project)* consistent with current laws and regulations

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

Sub-step 1a

The alternatives to the proposed retrofit project activity are following.

1. Continuation of current practices, resulting into the emission of historical GHG.
2. Use of expert system (fuggy-logic based computerized combustion control system) to save input energy in kiln system.

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

For energy efficiency projects, there are no legal acts applicable in India. But the project and its alternatives (mentioned above) comply with all good and safe engineering practices.

Step 2. Investment Analysis

If this step is used, determine whether the proposed project activity is the economically or financially less attractive than other alternatives without the revenue from sale of CERs. To conduct the investment analysis, use the following sub-steps:

Sub-step 2a. Determine appropriate analysis method
Option-III of Benchmark Analysis is chosen for demonstration of additionality.

Sub-step 2b – Option III. Apply benchmark analysis

The average rate of risk-free interest on bank deposit in India in year 2001-02 was 8% (financial benchmark). This shows that any project should yield returns more than 8.0%, to consider it for implementation.
Sub-step 2c- Calculation of suitable financial indiactor
The Internal Rate of return calculated (Calculations attached in Annex-5) shows that the IRR of the project (7%) is below minimum rate of return that can be achieved without CDM funds against CERs. It improves to 12% with CDM funds availed against CERs.

According to Consolidated additionality tool (point no. 8 of step 2c), "if the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive."
In the project case, the IRR is better than the minimum returns achievable through financial benchmark (8%) discussed above. This shows that viability of project can be improved substantially i.e, the IRR of project can be improved beyond benchmark with CDM funds.

Sub-step 2d- Sensitivity Analysis
Key assumption in IRR calculations are following.
Fuel cost remains same every year.
Sensitivity analysis done considering following scenario to find out worst case IRR of CDM project (from point of view of additionality of CDM project).
Assumption : Fuel cost increases by 2% every year
IRR without CDM funds is : 7.5%
IRR with CDM funds is : 12%
Therefore in case of sensitivity analysis by ensuring realistic deviations in assumptions, the IRR of project activity remains less attractive than the financial benchmark.

Step 4. Common Practice Analysis
Sub-step 4a. Analyse other activities similar to the proposed project:
The project was started in year 2002, when the project was taken up by very few industries in India. In present situation, some industries in India, while setting up new plant purchase the technology with 6-stage preheater. This does not involve the risks associated with retrofit of pre-heater system and the shutdown of plant and loss of market. The additional cost paid during purchase of new technology does not account for the production losses due to shutdown of operating plant (which is a major risk for operating plant to go for such retrofits).

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

The project of recuperation efficiency enhancement by increased heat transfer area of precalciner (e.g. DD furnace technology) does not pose high risk to the operation of plant and those associated with technological innovativeness. Due this project, a marginal improvement in efficiency takes place. The cost of project is relatively less and results into lower energy savings and lesser CO2 emission reduction but good financial attractiveness. Therefore, the analysis of similar activity further strengthens the additionality based on investment analysis for proposed CDM project.

Step 5. Impact of CDM Registration

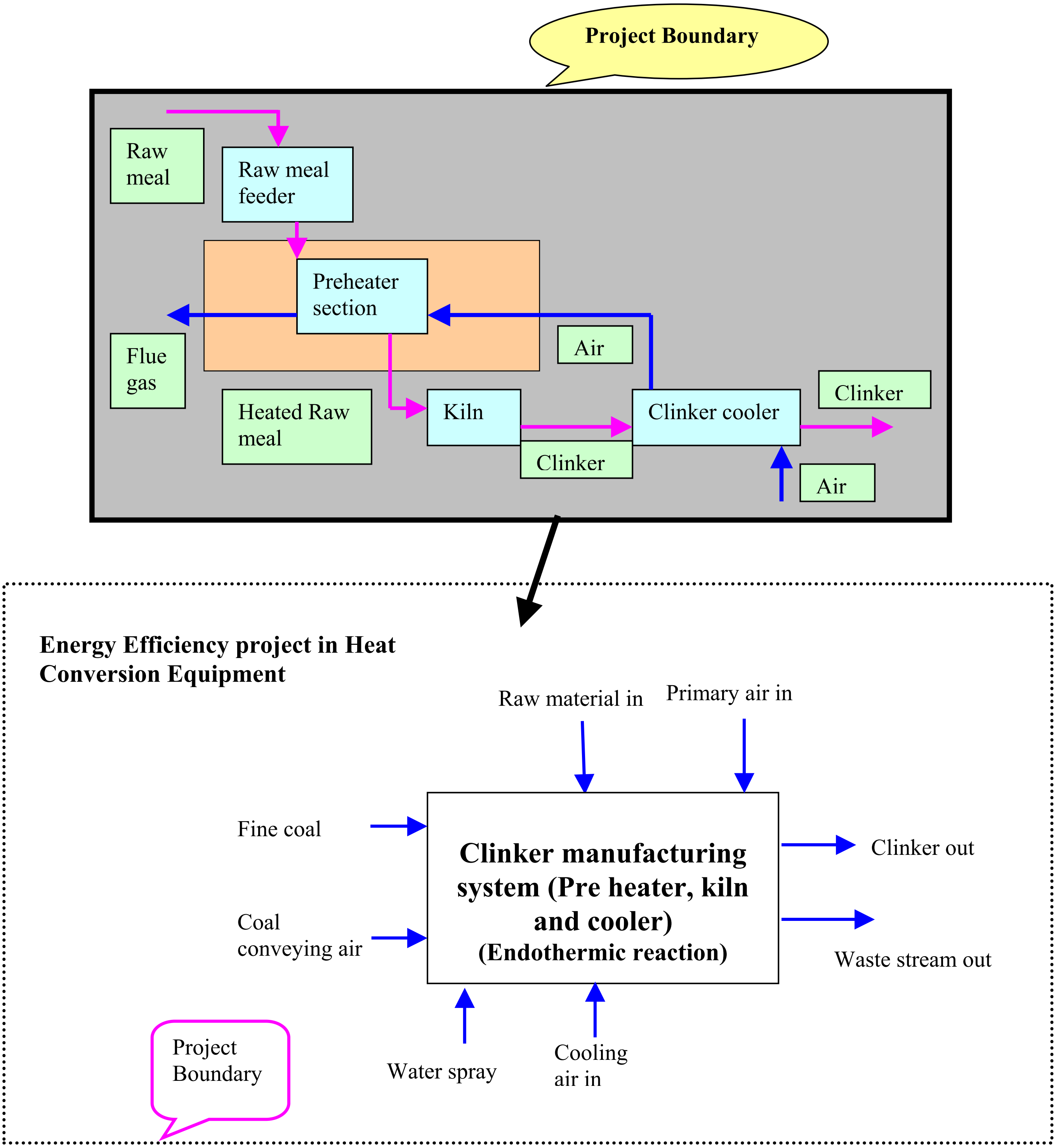
As stated earlier, during the planning stage of proposed CDM project activity the CDM fund was under consideration. Following impacts of CDM fund are identified from the point of view of removal of barriers discussed above.

- Improve IRR of project from 8% to 12% (above financial benchmark of 8%).
- CDM fund will provide additional coverage to the risk due to failure of project, shut down of plant and loss of production. The support will be available to the losses already incurred after commissioning of project
- CDM fund will encourage the Grasim group to come up with more GHG abatement projects for its cement plants and other business units.

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

>>

GHG selected is CO_2.



According to the baseline approach the project boundary selected is the cement manufacturing process, which contains input and output streams. In the above flow diagram Dark black line shows the project boundary.

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:

>>

Vikram cement and associated consultants.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>The starting date of project activity is.
Line 1: January 2002
Line 2: June 2002

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

>> 20 years

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

C.2.1. Renewable crediting period

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Line 1: April 2002
Line 2: April 2003

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:

>>

Title: Grasim monitoring methodology for the energy efficiency improvement in the heat conversion and heat transfer equipment system.

The methodology is submitted for approval of UNFCCC along with this PDD.

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

>>

The proposed monitoring methodology has been developed for monitoring the performance of the heat consumption in pre heater section of cement-manufacturing unit in order to estimate the quantum GHG reductions from reduced thermal energy related emissions. The project activity improves its GHG performance through reduction in thermal energy in the Pre heater section of cement production and has selected the proposed monitoring methodology to calculate the Emission Reduction Units.

As the baseline monitoring methodology is developed for the project activity, which is up gradation of pre heater section in cement manufacturing for energy efficiency, the VC project activity is of similar kind. The monitoring methodology fits for the preheater system upgradation in VC.

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

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

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)[2]	Comment
D.2.1	Calorific value of petcoke used	Instrument	kCal /kg	M	Daily	1%	Electronic	It is assumed that the calorific value in one consignment will be same. For each consignment the calorific value should be measured.
D.2.2	Calorific value of coal used	Instrument	kCal /kg	M	Daily	1%	Electronic	It is assumed that the calorific value in one consignment will be same. After each consignment the calorific value should be measured.
D.2.3	Emission factor of petcoke	Plant/IPCC	TCO_2/TJ	E	Daily	100%	Electronic	Either based on ultimate analysis (for Carbon%) in reputed laboratory. Otherwise IPCC factor to be considered.
D.2.4	Emission factor of Coal	Plant/IPCC	TCO_2/TJ	E	Daily	100%	Electronic	Either based on ultimate analysis (for Carbon%) in reputed laboratory. Otherwise IPCC factor to be considered.
D.2.5	Quantity of petcoke consumed	Instrument	kg /hr	M	Daily	100%	Electronic	Weigh bridge measurements.
D.2.6	Quantity of coal	Instrument	kg / hr	M	Daily	100%	Electronic	Weigh bridge measurements.

[2] Since the primary data is voluminous for cement industry and present system does not have capacity to store the values of individual parameters beyond three months, the estimated daily average efficiency data is maintained for long time, and the same will be made available to validation agency.

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)[2]	Comment
	consumed							
Efficiency calculation parameters (Base temp 0°C[3])								
D.2.7	Inlet temperature of cooling air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.8	Flow rate of cooling air	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.9	Specific heat o cooling air	Data book	$kCal/m^3{}^\circ C$	C	8 hrs (at the end of shift)	100%	Electronic	
D.2.10	Inlet temperature of kiln feed in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.11	Flow rate of kiln feed in system	Instrument	Kg/hr	M & C	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.12	Specific heat of kiln feed	Data book	kCal/kg°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.2.13	Inlet temperature of	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	

[3] The base temperature 0°C denotes that the heat content of incoming/outgoing hot or cold stream has to be estimated based on the difference of its temperature from 0°C. For example temperature difference to be taken in calculation to estimate the heat content of a stream at 100°C is to be taken as (100-0).

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)[2]	Comment
	conveying air in system							
D.2.14	Mass flow rate of conveying air	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.15	Specific heat of conveying air	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.2.16	Inlet temperature of fine coal in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.17	Mass flow rate of fine coal in system	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.18	Specific heat of fine coal	Data book	kCal /m^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.2.19	Inlet temperature of coal conveying air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.20	Mass flow of coal	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	

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)[2]	Comment
	conveying air in system							
D.2.21	Specific heat of coal conveying air	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.2.22	Inlet temperature of primary air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.23	Mass flow rate of primary air	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.24	Specific heat of primary air	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.2.25	Inlet temperature of excess air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.26	Mass flow rate of excess air	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.2.27	Specific heat of excess air	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.2.28	Heat of	Instrument	kCal/kg or	C	8 hrs (at the	100%	Electronic	

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)[2]	Comment
	combustion		kCal/m^3		end of shift)			
D.2.29	Heat of reaction	Data book	kCal/kg or kCal/m^3	M & C	8 hrs (at the end of shift)	100%	Electronic	
D.30	Retrofit (Event)	From plant	-	E	As and when happens	100%	Paper	

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

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Nomenclature for the terms used in formulae is following:

S. No.	Representation	Description
1	H	This letter is used for heat transfer (or heat generation)
2	T	This letter is used for temperature.
3	M	This letter is used for mass flow rate
4	Cp	This notation is used for specific Heat
5	H	This small letter is used for heat content (e.g. heat of reaction)
6	$_{input}$	This suffix (subscript) is used for input streams (e.g. heat of input streams)
7	$_{output}$	This suffix (subscript) is used for output streams (e.g. heat of output streams)
8	I	This small letter is used for incoming streams. (e.g. incoming hot stream)
9	O	This small letter is used for outgoing streams. (e.g. outgoing hot stream)
10	R	This small letter is used as indication of chemical reaction
11	K	Small letter k is used for no. streams (e.g. no. of hot incoming streams k=0,1,2…..n)
12	N	This small letter is used for total no of streams
13	$_p$	This small letter is the indication of the values after project activity (e.g. η_p)
14	B	This small letter is the indication of the values before project activity (Baseline)

15	*A, B, C……m*	This letters are the indications for shifts in a day. (e.g A shift)
16	M	Small letter m represents total no of shifts in a day
17	η	This symbol represents the efficiency of the system.
18	NCV	This notation is used for net calorific value
18	S	This small letter indicates no. of fuels used.
19	E	This capital letter is used for emissions from fuel
20	EF	This notation used for the emission factor
21	$_{total}$	The suffix (subscript) is used for total value. (e.g. H_{total} total heat saved)
22	$_{avg,heat}$	The suffix (subscript) is used for average value based on calorific value (e.g. $E_{avg-heat}$ is emissions $kgCO_2/kCal$)
23	$_{saving}$	The suffix (subscript) is used for Saving. (e.g H_{saving}= Heat saving)
24	$_{actual}$	The suffix (subscript) is used for actual savings. (e.g H_{actual}= actual heat saving)

Step 1:

Heat of clinkerisation, which is the useful output stream, depends upon

1. Composition of raw feed which determines the heat of reaction
2. Quantity of clinker.

Representative normal value of useful output heat stream has to be fixed. The value of output heat stream is calculated by multiplication of quantity of clinker per hour and heat of reaction per unit of clinker. Normal range is based on multiplication of normal capacity of clinker production and normal heat of reaction.

Monitor output quantity and analyse whether it is within the ‘normal range’ or not. If output is with in the ‘normal range’ then calculate the efficiency.

Step 2:

Efficiency calculation (Base temperature 0 °C)						
Heat input by any incoming stream (Base temperature 0°C)						
Hi_{input}	=	Mi	×	Cpi	×	Ti

HI_i = Heat input by stream (kCal/hr) Mi = Mass flow rate of input stream (kg/hr or Nm^3/hr) Cpi = Specific heat of the stream kcal/kg °C Ti = Inlet temperature of the stream °C				
Useful heat output (Heat of clinkerisation)				
H_{output}	=	Mo	×	Hr
H_{output} = Heat output by stream (kCal/hr) Mo = Mass flow rate of clinker (kg/hr) Hr = heat of reaction (kcal/kg of clinker)				
Total heat input				
H_{input}	=	$\sum_{k=0}^{k=1,2,3...n} (Hi_{input})_{,k}$		
H_{input} = total heat input (Kcal/hr) from various incoming streams (and/or fuel fired).				

Step 3:

Efficiency of equipment after project activity				
η_{pA}	=	H_{output}	/	H_{input}
η_{pA} = Efficiency of kiln system after project activity (example- for A-shift on a particular date). Note: Efficiency of only those shifts to be calculated, in which the H_{output} is within normal range.				

Step 4:

Average daily efficiency				
η_p	=	$(\eta_{pA} + \eta_{pB} + \text{-----} \eta_{pm})$	/	m
m = no of shifts or batches/day $\eta_{pA}, \eta_{pB....} \eta_{pm}$ = Efficiency in shifts A^{th}, B^{th}……m^{th} shift.				

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 D.3)***	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated © or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)[4]**	**Comment**
D.3.1	Calorific value of petcoke used	Instrument	kCal/kg	M	Daily	1%	Electronic	It is assumed that the calorific value in one consignment will be same. For each consignment the calorific value should be measured.
D.3.2	Calorific value of coal used	Instrument	kCal/kg	M	Daily	1%	Electronic	It is assumed that the calorific value in one consignment will be same. After each consignment the calorific value should be measured.
D.3.3	Emission	Plant/IPCC	TCO_2/TJ	E	Daily	100%	Electronic	Either based on ultimate analysis (for Carbon%)

[4] Te baseline data of one month is archived and efficiency of kiln is calculated based on this.

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated © or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)[4]	Comment
	factor of petcoke							in reputed laboratory. Otherwise IPCC factor to be considered.
D.3.4	Emission factor of Coal	Plant/IPCC	TCO_2/TJ	E	Daily	100%	Electronic	Either based on ultimate analysis (for Carbon%) in reputed laboratory. Otherwise IPCC factor to be considered.
D.3.5	Quantity of petcoke consumed	Instrument	Kg/hr	M	Daily	100%	Electronic	Weigh bridge measurements on receipt basis and measurement of losses before using fine fuel for burning.
D.3.6	Quantity of coal consumed	Instrument	Kg/hr	M	Daily	100%	Electronic	Weigh bridge measurements on receipt basis and measurement of losses before using fine fuel for burning.
Efficiency calculation parameters (Base temp 0°C)								
D.3.7	Inlet temperature of cooling air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.8	Flow rate of cooling air	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.9	Specific heat of cooling air	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.10	Inlet temperature of kiln feed in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.11	Flow rate of kiln feed in system	Instrument	Kg/hr	M & C	8 hrs (at the end of shift)	2.5%	Electronic	

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated © or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)[4]	Comment
D.3.12	Specific heat of kiln feed	Data book	kCal /kg°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.13	Inlet temperature of conveying air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.14	Mass flow rate of conveying air	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.15	Specific heat of conveying air	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.16	Inlet temperature of fine coal in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.17	Mass flow rate of fine coal in system	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.18	Specific heat of fine coal	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.19	Inlet temperature	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated © or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)[4]	Comment
	of coal conveying air in system							
D.3.20	Mass flow rate of coal conveying air in system	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.21	Specific heat of coal conveying air	Data book	kCal /Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.22	Inlet temperature of primary air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.23	Mass flow rate of primary air	Instrument	Nm^3/hr	C	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.24	Specific heat of primary air	Data book	Kcal/kg°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.25	Inlet temperature of excess air in system	Instrument	°C	M	8 hrs (at the end of shift)	2.5%	Electronic	
D.3.26	Mass flow	Instrument	Nm^3/hr	C	8 hrs (at the	2.5%	Electronic	

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated © or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)[4]	Comment
	rate of excess air				end of shift)			
D.3.27	Specific heat of excess air	Data book	kCal/Nm^3°C	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.28	Heat of combustion	Instrument	kCal /kg	C	8 hrs (at the end of shift)	100%	Electronic	
D.3.29	Heat of reaction	Data book	kCal /kg of clk	M & C	8 hrs (at the end of shift)	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.)

>>

Step 1:

Heat of clinkerisation, which is the useful output stream, depends upon

1. Composition of raw feed which determines the heat of reaction
2. Quantity of clinker

Representative normal value of useful output heat stream has to be fixed. The value of output heat stream is calculated by multiplication of quantity of clinker per hour and heat of reaction per unit of clinker. Normal range is based on multiplication of normal capacity of clinker production and normal heat of reaction.

Step 2:

Efficiency calculation						
Heat input by any incoming stream (Base temperature 0°C)						
Hi_{input}	=	Mi	×	Cpi	×	Ti
Hi_{input} = Heat input by stream (kCal/hr) Mi = Mass flow rate of input stream (kg/hr) Cpi = Specific heat of the stream kcal/kg °C Ti = Inlet temperature of the stream °C						
Useful heat output (Heat of clinkerisation)						
H_{output}	=	Mo	×	Hr		
H_{output} = Heat output by stream (kCal/hr) Mo = Mass flow rate of clinker (kg/hr) Hr = heat of reaction (kcal/kg of clinker)						
Total heat input						
H_{input}	=	$\sum_{k=0}^{k=1,2,3...n}(Hi_{input}),_k$				
H_{input} = total heat input (Kcal/hr) from various incoming streams (and/or fuel fired).						
Useful heat output						
H_{output} = useful heat output (Heat of clinkerisation) (Kcal/hr)						

Step 3:

Efficiency of equipment in baseline				
η_{bA}	=	H_{output}	/	H_{input}

η_{bA} = Efficiency of kiln system in baseline (example for A-shift on a particular date)

Note: Efficiency of only those shifts to be calculated, in which the H_{output} is within normal range.

Step 4:

Benchmark baseline efficiency				
η_b	=	$(\eta_{bA} + \eta_{bB}$ +-----$\eta_{bN})$	/	N
$\eta_{bA} + \eta_{bB}$ +-----η_{bN} = Efficiency in shifts A^{th},B^{th}……N^{th} shift. N = no of shift-wise values taken for calculation (Minimum one month shift-wise data is required)				

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

Not applicable.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculI©(c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

>>

D.2.3. Treatment of leakage in the monitoring plan

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

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), caI©ed (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Not Applicable	Not Applicabl e	Not Applicable	Not Applicabl e	Not Applicable	Not Applicabl e	Not Applicabl e	Not Applicable	Not Applicable

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

>>

Not applicable for this project activity.

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.)

>>

CO_2 Emission								
E_s	=	NCV_s	×	EF_s	×	4.186	/	1000000

E_s = Emission from the s^{th} fuel (kg CO_2/ kg) NCV_s = Net Calorific value of s^{th} fuel (kCal/Kg) EF_s = IPCC emission factors (tCo_2/TJ of fuel)				
Heat generated by fuel				
H_s	=	NCV_s	×	Q_s
H_s = Heat generated by s^{th} fuel (kCal/hr) Q_s = Quantity of fuel used (kg/hr)				
Total heat Generation				
H_{total}	=	$\sum_{s=0}^{s=1,2,3...n}(H)_{,s}$		
H_{total} = Total heat generation by fuel used in the direct fired or heat supplying equipment s = No. of fuels used				
Percentage of fuel used in the process				
% s^{th} fuel used	=	H_s	/	H_{total}
Average heating value of the fuel used				
NCV_{avg}	=	Σ(% of s^{th} fuel used × NCV_s)	/	100
NCV_{avg} = Average net calorific value of fuels used (kCal/kg)				
Average emission factor of all the fuels used				
E_{avg}	=	Σ`(% of s^{th} fuel used × E_s)	/	100
$E_{avg,heat}$	=	E_{avg}	/	NCV_{avg}
$E_{avg,heat}$ = Average emission factor (kg CO_2/kg)				
Increase in energy efficiency				

η_{diff}	=	η_p	-	η_b
η_{diff} = Increase in efficiency η_b = Baseline efficiency η_p = Efficiency in project scenario				
Saving in heat input due to increase in efficiency				

H_{saving}	=	(η_{diff} / η_p)	×	H_{input}		
H_{saving} = Saving in heat by the equipment (kCal/ hr)						

Emission Reduction				
ER	=	H_{saving}	×	$E_{havg,heat}$

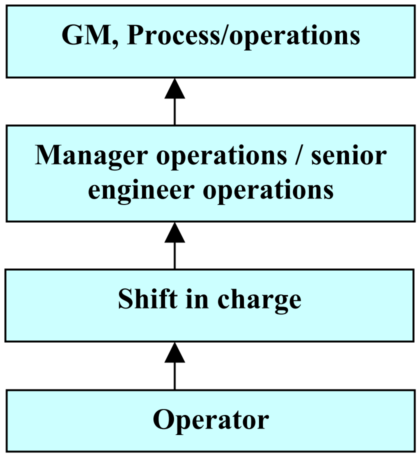
D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data (Indicate table and ID number e.g. 3.-1.; 3.2.)	*Uncertainty level of data (High/Medium/Low)*	*Explain QA/QC procedures planned for these data, or why such procedures are not necessary.*
D.2.1	Low	The procedure is required for testing of fuel. There is no procedure required, if the test certificate given by reputed fuel supplier for each delivery.
D.2.2	Low	The procedure is required for testing of fuel. There is no procedure required, if the test certificate given by reputed fuel supplier for each delivery.
D.2.3	Low	If the emission factor used based on ultimate analysis, procedure for determining % Carbon is required,
D.2.4	Low	If the emission factor used based on ultimate analysis, procedure for determining % Carbon is required,
D.2.5	Low	Procedure required for estimating fine fuel quantity used for burning in kiln system.
D.2.6	Low	Procedure required for estimating fine fuel quantity used for burning in kiln system.
D.2.7	Low	No procedure required.
D.2.8	Low	No procedure required.
D.2.9	Low	No procedure required.
D.2.10	Low	No procedure required.

D.2.11	Low	No procedure required.
D.2.12	Low	No procedure required.
D.2.13	Low	No procedure required.
D.2.14	Low	No procedure required.
D.2.15	Low	No procedure required.
D.2.16	Low	No procedure required.
D.2.17	Low	No procedure required.
D.2.18	Low	No procedure required.
D.2.19	Low	No procedure required.
D.2.20	Low	No procedure required.
D.2.21	Low	No procedure required.
D.2.22	Low	No procedure required.
D.2.23	Low	No procedure required.
D.2.24	Low	No procedure required.
D.2.25	Low	No procedure required.
D.2.26	Low	No procedure required.
D.2.27	Low	No procedure required.
D.2.28	Low	The procedure is required for testing of fuel.
D.2.29	Low	No procedure required.
D.2.30	Low	No procedure required. Based on guideline for monitoring of impact of retrofit on CDM.
D.3.1	Low	The procedure is required for testing of fuel. There is no procedure required, if the test certificate given by reputed fuel supplier for each delivery.
D.3.2	Low	The procedure is required for testing of fuel. There is no procedure required, if the test certificate given by reputed fuel supplier for each delivery.
D.32.3	Low	If the emission factor used based on ultimate analysis, procedure for determining % Carbon is required,
D.3.4	Low	If the emission factor used based on ultimate analysis, procedure for determining % Carbon is required,
D.3.5	Low	Procedure required for estimating fine fuel quantity used for burning in kiln system.
D.3.6	Low	Procedure required for estimating fine fuel quantity used for burning in kiln system.
D.3.7	Low	No procedure required.
D.3.8	Low	No procedure required.
D.3.9	Low	No procedure required.
D.3.10	Low	No procedure required.
D.3.11	Low	No procedure required.
D.3.12	Low	No procedure required.
D.3.13	Low	No procedure required.
D.3.14	Low	No procedure required.

D.3.15	Low	No procedure required.
D.3.16	Low	No procedure required.
D.3.17	Low	No procedure required.
D.3.18	Low	No procedure required.
D.3.19	Low	No procedure required.
D.3.20	Low	No procedure required.
D.3.21	Low	No procedure required.
D.3.22	Low	No procedure required.
D.3.23	Low	No procedure required.
D.3.24	Low	No procedure required.
D.3.25	Low	No procedure required.
D.3.26	Low	No procedure required.
D.3.27	Low	No procedure required.
D.3.28	Low	The procedure is required for testing of fuel.
D.3.29	Low	No procedure required.

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

>>



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

>>

Vikram cement and associated consultants.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

Following sample calculations are carried out for Kiln-1 of VC.

Project Scenario (Based on Average values of year 2002-2003)

Steps	Description	Formula	Value	Unit
Step-1	Representative useful heat output (Heat of clinkerisation)	Heat of reaction (kCal/kg clk)x Clinker Quantity (kg/hr)	44679763.55	kCal/hr
Step-2	Total heat supplied (Heat supplied by cooling air through raw feed, raw feed, conveying air, fine coal, coal conveying air, primary air, seal air and excess air, water spray and heat supplied by coal combustion)	Sensible heat = Mass flow (kg/hr) X Specific Heat (kCal/kg/deg C) X Temperature Difference (deg C) (Temperature of input stream - 0) Heat of combustion of coal = Mass flow of coal (kg/hr) X Net Calorific Value (kCal/kg)	83305630.22	kCal/hr
Step-3	Efficiency of kiln system[5]	((Useful Heat)/ (Total heat supplied)) x 100	53.63	%

E.2. Estimated leakage:

>>

Leakages are not applicable to this project.

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

>>

Since the leakage is not applicable, the emission reductions to be estimated in section E.5 will not include estimation for this.

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

>>

Following sample calculations are carried out for Kiln-1 of VC.

[5]The Grasim methodology (submitted along with this PDD) for the energy efficiency improvement in the heat conversion and heat transfer equipment system is followed for calculations. As per the methodology, in the section E.1, the efficiency of Kiln system is calculated in the project scenario. The baseline efficiency of kiln system is calculated in the section E.4. The emission reduction is estimated based on difference of efficiency obtained in the section E1 and E4, which is then used in section E5 for calculations of emission reduction. Enclosure-1 and Enclosure-2 to this PDD provides detailed emission reduction calculations in kiln-1 and kiln-2 respectively. The approach adopted is as per UNFCCC approved methodology AM-0018.

Baseline Scenario (Sample calculations date 1st Nov. 2001)

Steps	Description	Formula	Value	Unit
Step-1	Representative useful heat output (Heat of clinkerisation)	Heat of reaction (kCal/kg clk) X Clinker Quantity (kg/hr)	39150000.00	kCal/hr
Step-2	Total heat supplied (Heat supplied by cooling air through raw feed, raw feed, conveying air, fine coal, coal conveying air, primary air, seal air and excess air, water spray and heat supplied by coal combustion)	Sensible heat = Mass flow (kg/hr) X Specific Heat (kCal/kg/deg C) X Temperature Difference (deg C) (Temperature of input stream - 0) Heat of combustion of coal = Mass flow of coal (kg/hr) X Net Calorific Value (kCal/kg)	75225641.76	kCal/hr
Step-3	Efficiency of kiln system	((Useful Heat)/ (Total heat supplied)) x 100	52.04	%

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

>>

Emission Reduction Calculations for Kiln-1

Step-1	Increase in efficiency of kiln system	Efficiency of project case- baseline efficiency	1.59	%
Step-2	Saving in heat output	Increase in efficiency (%) X Coal input	1324660.85	kCal/hr
Step-3	Saving in heat input	Saving in heat output/ Kiln system efficiency in project scenario	2469836.42	kCal/hr
Step-4	Saving in coal (NCV 7498 kCal/kg)	Saving in heat input/ NCV of coal	329.40	kg/hr
Step-5	Emission reduction (Average Emission Factor 2.94 T CO_2/T Coal)	Saving in coal X coal emission factor	0.96	Tons/hr
Step-6	Emission reduction in 2002-03 (341 working days per year)	Hourly emission reductions X 24 hours X 341 days	7925.66	Tons/year

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

>>

Emission reduction from kiln 1:

S. No.	**Year (Financial year (April to March)**	**Emission reduction**
1	2002-03	8836
2	2003-04	8251
3	2004-05	13187
4	2005-06	13187
5	2006-07	13187
6	2007-08	13187
7	2008-09	13187
8	2009-10	13187
9	2010-11	13187
10	2011-12	13187
Total		**122583**

Emission reduction from Kiln 2:

S. No.	**Year(Financial year (April to March)**	**Emission reduction**
1	2002-03	2445
2	2003-04	8255
3	2004-05	12822
4	2005-06	12822
5	2006-07	12822
6	2007-08	12822
7	2008-09	12822
8	2009-10	12822
9	2010-11	12822
10	2011-12	12822
11	2012-13	6411
Total		**119687**

SECTION F. Environmental impacts

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

>>

The Ministry of Environment and Forests (MoEF), Government of India, under the Environment Impact Assessment Notification vide S.O. 60(E) dated 27/01/94 has listed a set of industrial activities in Schedule I[6] of the notification which for setting up new projects or modernization/ expansion will require environmental clearance and will have to conduct an Environment Impact Assessment (EIA) study. However, the project under consideration does not require any EIA to be conducted, as the activity is not included in Schedule I.

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

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

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

>>

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

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

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	REMARKS
A	CATEGORY: ENVIRONMENTAL – RESOURCE CONSERVATION	
1	**Coal / Petcoke 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 / petcoke consumption per unit of cement produced that would have been required to cater to the baseline project option. "Coal is a finite natural resource" used as fuel to generate power and for production processes. Since this project activity reduces its thermal energy demand it positively contributes towards conservation of coal and making coal available for other important applications.	The project activity is a step towards fossil fuel conservation.
B	CATEGORY: ENVIRONMENTAL – AIR QUALITY	
	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.	No impact
E	CATEGORY: ENVIRONMENTAL – NOISE GENERATION	
1	The project activity does not contribute to noise pollution.	-
F	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 how comments by local stakeholders have been invited and compiled:

>>

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

The various stakeholders identified for the project are as under.

- Elected body of representatives administering the local area (village Panchayat)
- Central & State Pollution Control Board
- Ministry of Environment & Forest (MoEF), Government of India
- Consultants
- Equipment Suppliers
- Employees

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:

>> No negative comments received on the project till date. The positive verbal comments received were from employees, who have shown their satisfaction on the success of the project. As per the employees, all such projects are welcome, which improves productivity and bottom line of company and makes their future more secured.

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

>>

No negative comments Received on which company needs to take any action.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Vikram cement
Street/P.O.Box:	P.O. Birlagram , Nagda
Building:	
City:	Ujjain
State/Region:	Madhya pradesh
Postfix/ZIP:	456331
Country:	India
Telephone:	07420-230339/230333
FAX:	07420-235524
E-Mail:	sagrawal@adityabirla.com
URL:	www.adityabirla.com
Represented by:	
Title:	Vice President
Salutation:	Mr.
Last Name:	Agrawal
Middle Name:	
First Name:	Sanjay
Department:	Production Planning and Budgeting
Mobile:	
Direct FAX:	022-28244960
Direct tel:	022-28244990
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding available for this project.

Annex 3

BASELINE INFORMATION

Kiln System-1

tCo2 emission per ton of Petcoke	t CO2/ton	3.18
tCo2 emission per ton of Coal	t CO2/ton	2.440
Quantity of fine fuel mix consumed	tons/hr	8.88
Percentage heat contribution by Petcoke in the kiln	%	40.25
Percentage heat contribution by Coal in the kiln	%	59.75
Average calorific value of fuel used	Kcal/ kg	7222.00
Total heat consumption by the kiln	million Kcal/hr	64.10
Average emission factor of fuel used	tons CO2/ton	2.74
Total clinker produced in the kiln	tons/hr	87.66
Efficiency calculation (Ref. 0 deg C)		
Heat input		
Inlet temperature of the cooling air in system	C	30
flow rate of cooling air in system	Nm3/hr	192857.34
Specific heat of cooling air	kcal/Nm3 C	0.306
Inlet temperature of the feed in system	C	68
flow rate of feed in system	Nm3/hr	139383.257
Specific heat of raw feed	kcal/Nm3 C	0.210
Inlet temperature of conveying air	C	45.000
flow rate of conveying air in system	Nm3/hr	7889.618
Specific heat of conveying air	kcal/Nm3 C	0.305
Inlet temperature of fine coal in system	C	65.000
flow rate of fine coal	Nm3/hr	12009.752
Specific heat of fine coal	kcal/Nm3 C	0.265
Inlet temperature of coal conveying air	C	45.000
Flow rate of coal conveying air	Nm3/hr	1753.249
specific heat of coal conveying air	kcal/Nm3 C	0.305
inlet temperature of primary air	C	45.000
Flow rate of primary air	Nm3/hr	3594.159
specific heat of primary air	kcal/Nm3 C	0.305
Temperature of seal air+excess air	C	30.000
Flow rate of seal air+excess air	Nm3/hr	21915.606

specific heat of seal air+excess air	kcal/Nm3 C	0.306
Heat from coal burning	kcal/hr	64104780.159
Total heat input		**68455334.860**
Useful Heat output		
Heat of reaction	kcal/hr	35503282.464
Efficiency of system		**51.863**

Kiln System-2

tCo2 emission per ton of Petcoke	t CO2/ton	3.18
tCo2 emission per ton of Coal	t CO2/ton	2.440
Quantity of fine fuel mix consumed	tons/hr	9.18
Percentage heat contribution by Petcoke in the kiln	%	40.24
Percentage heat contribution by Coal in the kiln	%	59.76
Average calorific value of fuel used	Kcal/ kg	7241.00
Total heat consumption by the kiln	million Kcal/hr	66.51
Average emission factor of fuel used	tons CO2/ton	2.74
Total clinker produced in the kiln	tons/hr	91.39
Efficiency calculation (Ref. 0 deg C)		
Heat input		
Inlet temperature of the cooling air in system	C	30
flow rate of cooling air in system	Nm3/hr	201061.03
Specific heat of cooling air	kcal/Nm3 C	0.306
Inlet temperature of the feed in system	C	68
flow rate of feed in system	Nm3/hr	145312.292
Specific heat of raw feed	kcal/Nm3 C	0.210
Inlet temperature of conveying air	C	45.000
flow rate of conveying air in system	Nm3/hr	8225.224
Specific heat of conveying air	kcal/Nm3 C	0.305
Inlet temperature of fine coal in system	C	65.000
flow rate of fine coal	Nm3/hr	12520.619
Specific heat of fine coal	kcal/Nm3 C	0.265
Inlet temperature of coal conveying air	C	45.000
Flow rate of coal conveying air	Nm3/hr	1827.828
specific heat of coal conveying air	kcal/Nm3 C	0.305
inlet temperature of primary air	C	45.000
Flow rate of primary air	Nm3/hr	3747.047

specific heat of primary air	kcal/Nm3 C	0.305
Temperature of seal air+excess air	C	30.000
Flow rate of seal air+excess air	Nm3/hr	22847.845
specific heat of seal air+excess air	kcal/Nm3 C	0.306
Heat from coal burning	kcal/hr	66505011.141
Total heat input		**71040628.161**
Useful Heat output		
Heat of reaction	kcal/hr	37013508.233
Efficiency of system		**52.102**

Annex 4

MONITORING PLAN

Description of the Monitoring Plan

The Monitoring and Verification (M&V) procedures define a project-specific standard (baseline of historical emissions) against which the project's performance (i.e. GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on specific energy consumption parameters. It also allows scope for review, scrutinize and benchmark all this information against reports pertaining to M & V protocols.

The M&V protocol provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

The project employs latest state of art monitoring and control equipment that measure, record, and control various key parameters.

Parameters monitored will be as follows.

- Quantity, Calorific value and emission factors of petcoke, and coal used
- Inlet temperature of cooling air, kiln feed, conveying air, fine coal, primary air, of excess air
- Flow rate of cooling air, kiln feed, conveying air, fine coal, primary air, of excess air
- Specific heat of cooling air, kiln feed, conveying air, fine coal, primary air, of excess air
- Heat of combustion
- Heat of reaction depending upon quality of lime.

The instrumentation system installed for the project is Distributed Control System (DCS) of reputed make, with shift-wise recording and feedback facility with desired level of accuracy. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.

GHG SOURCES

Direct On-Site Emissions

Direct on-site emissions after implementation of the CDM project arise from the following sources.

Net emissions due to use of coal/ petcoke in kiln and preheater.

As discussed above, these emissions are monitored and taken into account while estimating net emission reductions of project.

Direct Off-Site Emissions

There is no off-site emission due to the project.

Indirect On-Site Emissions

There is no indirect on-site emission due to the project.

Indirect Off-Site Emissions

No indirect off-site emissions could occur due to CDM project.

Project Parameters affecting Emission Reduction

Monitoring Approach

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and reporting

As the emission reduction units from the project are determined by the heat balance across the kiln system, it is important to discuss the monitoring principles in context of monitoring these parameters.

Frequency of monitoring

The project developer has installed all metering facilities within the plant premises. The measurements is, monitored and controlled on continual basis and recorded shift-wise (8-hours shift) in a Distributed Control System (DCS). In case of non-availability of data from DCS due to unforeseen situations, the desired data shall be logged in log sheets by operator duly authenticated by head of plant

Reliability

The amount of emission reduction units is proportional to the net energy reduction due to project. All temperature and flow measurement devices are having good accuracy and are procured from reputed manufacturers. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment for reproducibility, all instruments must be calibrated once a year for ensuring reliability of the system. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. Therefore it ensures the monitoring system is highly reliable.

Registration and reporting

Registration is done on the basis of shift-wise data logging in computer. Weekly and monthly reports are prepared stating the coal/ pet coke reduction.

Verification

The reduction in coal/petcoke consumption leads to the CO_2 emission reductions. The project control system comprises sophisticated monitoring system like on-line display meters and Distributed Control Systems (DCS) which measures, collects the information about various process parameters, monitors and controls and records on a continuous basis. Fully functional management information is built, which is generated through DCS in pre-decided daily reports formats so that accessing and verification of actual data are possible at any point of time. A computerised MIS can is generated and distributed among decision makers of the project. The major activities to be verified are as under

- Verification of various measurement and monitoring methods
- Verification of instrument calibration methods
- Verification of data generated through on-line meters and DCS
- Verification of measurement accuracy

Annex 5

IRR CALCULATIONS

IRR calculations for preheater upgradation in VC line 1 and 2												
Project parameters												
Initial Investment of the proposed project (Rs in millions)	270.00											
Annual administrative cost (Rs in millions)	1.00											
Annual escalation in administrative cost	5.00%											
Expected CER pricing (Rs/ ton of Co2)	270.00											
Production loss (Rs in million)	78.27											
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Expenditure												
Initial investment (equity)	108.00											
Recurring cost												
Administrative cost		1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55	1.63
Annual installment on debt.(60% of initial investment, with interest 12.5%)		29.26	29.26	29.26	29.26	29.26	29.26	29.26	29.26	29.26	29.26	29.26
Maintenance Cost @ 3% of initial investment with 10% escalation every year.		3.24	3.56	3.92	4.31	4.74	5.22	5.74	6.31	6.95	7.64	8.40
Production loss	78.27											
Total cashflow out (A)	186.27	33.50	33.87	34.28	34.73	35.22	35.76	36.34	36.98	37.68	38.45	39.29
Income												
Incresed profit due to Increased production in both kilns (870 TPD)	0.00	43.07	43.07	43.07	43.07	43.07	43.07	43.07	43.07	43.07	43.07	43.07
Energy saving (based on constant fuel price every year)	0	11.67	13.79	20.56	20.56	20.56	20.56	20.56	20.56	20.56	20.56	10.13

CER credits	0	3.05	4.46	7.02	7.02	7.02	7.02	7.02	7.02	7.02	7.02	1.73
Total project income without considering CER credits(B)	0	54.74	56.85	63.62	63.62	63.62	63.62	63.62	63.62	63.62	63.62	53.20
Total project income with considering CER credits(C)	0	57.78	61.31	70.64	70.64	70.64	70.64	70.64	70.64	70.64	70.64	54.93
Net cash flow without considering CER Credits (A-B)	-186.27	21.24	22.98	29.34	28.89	28.40	27.87	27.28	26.64	25.94	25.17	13.90
Net cash flow with considering CER Credits (A-C)	-186.27	24.28	27.43	36.36	35.91	35.42	34.89	34.30	33.66	32.96	32.19	15.64
IRR of the project without considering CER credits	7%											
IRR of the project with considering CER credits	12%											

Annex 6

Abbreviations

CDM	Clean development mechanism
CER	Certified emission reduction
clk	Clinker
CO_2	Carbon dioxide
Distt	District
EIA	Environment impact assessment
GHG	Greenhouse gas
IRR	Internal Rate of Return
MP	Madhya pradesh
MNES	Ministry of Non-conventional Energy Source
MoEF	Ministry of Environment & Forest
OPC	Ordinary Portland cement
PDD	Project design document
PPC	Portland pozzolana cement
P.O.	Post office
TPA	tonne per annum
t	Tons
UNFCCC	United Nations Framework Convention on Climate Change
VC	Vikram cement

Annex 7

References

Sl. No.	Particulars of the references
1	Kyoto Protocol to the United Nations Framework Convention on Climate Change
2	Website of United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int
3	UNFCCC document: 'GUIDELINES FOR COMPLETING CDM-PDD, CDM-NMB and CDM-NMM'-Version 01
4	UNFCCC document: CLEAN DEVELOPMENT MECHANISM, PROJECT DESIGN DOCUMENT FORM (CDM-PDD), VERSION 02 - IN EFFECT AS OF: 1 JULY 2004)
5	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual
6	Information received by technology supplier