CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

Title: Utilisation of the thermal energy content of the waste gas of clinker cooler and pre-heater for power generation at a cement plant in Rajasthan

Version: 06

Date: 27/04/2011

A.2. Description of the project activity:

The proposed project activity has been planned to be implemented in the cement production unit of Birla Corporation Limited – Unit Chanderia in Chittorgarh, Rajasthan. The project activity is proposed to utilize the waste heat of the flue gas of the pre heater tower and waste cooling air stream of clinker cooler in power generation and replace fossil fuel based power generation.

Birla Corporation Limited, Chanderia unit comprises of two cement manufacturing sub-units *i.e.* Birla Cement Works (BCW) and Chanderia Cement Works (CCW) with a combined annual capacity of 1.815 million tonnes of clinker (considering production capacity of 3500 tpd in CCW, 2000 tpd in BCW and annual operational days to be 330). As project participant is upgrading their CCW plant from 1.155 MTPA of clinker to 1.336 MTPA, with the same the combined capacity of Chanderia unit would be 1.996 MTPA of clinker (up-gradation of the plant started in mid 2007 under the supervision of M/s A-TECH and expected to be completed by 2010-11). This up-gradation leads to an increase in power demand. Initially (*i.e.* before the up-gradation) the power demands of the cement manufacturing facility of BCL, Chanderia unit is primarily met by the power from existing fossil fuel (*i.e.* coal) fired captive Thermal Power Plant (TPP) (capacity: 29.8 MW). As the same would not be able to cater the power demand after up-gradation, project participant proposes to install a new waste heat recovery based captive power plant (*i.e.* project activity) where the waste heat of the waste gas emanating from pre heater and clinker cooler would be utilized for power generation.

In absence of the proposed project activity, waste heat of the waste gas coming from the pre heater tower and clinker cooler would have been vented to atmosphere without any further utilization. The electricity generated by the project activity would have been sourced from a new fossil fuel (*i.e.* coal) fired power generation system (as an extension of existing TPP) resulting in GHG emissions. The proposed project

activity will displace the electricity (generated by the above mentioned coal based power plant) to the tune of 34.81 GWh_e per annum which will lead to an annual reduction in GHG emission by 40,026 ton of CO_2 equivalent *i.e.* a quantum of 400,260 tCO_2 equivalent over the fixed crediting period of ten years.

Contribution to Sustainable Development

The proposed project activity contributes to the sustainable development of the host country – India. The sustainable development has been detailed under the following heads below:

Social Well-Being:

The proposed project activity will contribute to the cause of employment generation for the local inhabitants for the construction, operation and maintenance purposes of the power plant. Also, the project helps the local populace in their technical skills development by means of several training programs to ensure the proper functioning of the unit. The proposed project activity has been implemented within the premises of the existing cement manufacturing facility, without any dislocation of the local populace. Moreover, by reducing electricity import from the grid, the proposed project activity also enhances the power availability at the grid end, thus helping in abridging the demand-supply gap indirectly at a national level, in the electricity deficient country India.

In addition to this, BCL will contribute 2% of the revenue realised through sale of CERs towards different society/ community development programmes as per the scheme developed (please refer to Annexure- A for the same). Such expenditure will be made within one year after the realization of revenues from the sale of the CERs. The details of such expenditure made will be included in the monitoring report for the period following the transaction. The same can be verified by the DOE at the time of verification through the Annual Report of the Company/ a certificate from the statutory auditor/ a certificate from a Chartered Accountant.

Economic Well-Being:

The proposed project activity would contribute to the economic up-liftment of the region in which it is located by providing business opportunities to contractors, consultants and equipment suppliers. The employment opportunities extended to the local inhabitants would result in improvement of their standard of living. The conservation of energy and the natural resources of energy by the proposed project activity would also contribute towards the improvement in the economic situation of the region. Moreover, the enhancement of the power availability at the local grid would promote the growth of industrialisation and economic development of the region.

Environmental Well-Being:

The proposed project activity will reduce the thermal pollution of the immediate environment by utilising the heat energy of the waste energy sources for the purpose of power generation. It would also substitute

the import of fossil-fuel based power generated by the grid connected thermal power plants dominating the grid mix, thus leading to decrease in GHG emission. The local atmospheric pollution will be reduced since the project activity will result in less discharge of SO_X, NO_X, fly-ash and suspended particulate matter (SPM). The project activity also contributes towards conservation of depleting fossil fuels like coal, oil, etc., the non-renewable natural resources of energy.

Technological Well-Being:

The project activity has envisaged utilisation of the waste heat of the cement manufacturing process. Thus the project activity has led to introduction of a clean and energy efficient technology in the cement manufacturing sector. Its success would encourage other cement manufacturers to undertake similar waste energy based power generation projects.

A.3. Project participants:

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Name of Party involved ((Host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	Birla Corporation Limited (Private Entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

India

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

Western India/Rajasthan/ Chittorgarh

A.4.1.3. City/Town/Community etc.:

Chanderia

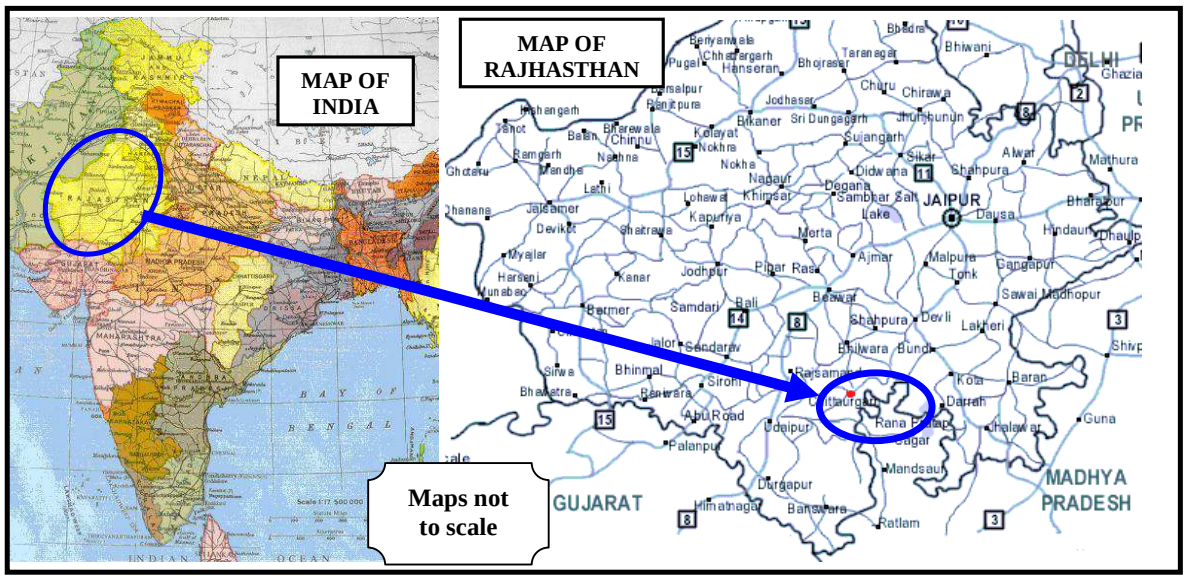
A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

The site of the proposed project activity is in the premises of BCL Chanderia plant consisting of Chanderia Cement Works (CCW) and Birla Cement Works (BCW) are in Chanderia, Rajasthan. The plant is located 6 Km away from Chittorgarh town on the National High way No. 78 and is well connected by rail and road links. The nearest Airport is at Udaipur which is about 100 Km from the plant.

Latitude: 24° 55'50" North

Longitude: 74° 38' 09"East

The details of the location are evident from the following maps:



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

The proposed project activity entails utilization of waste heat of flue gas coming from pre heater and waste gas of clinker cooler for power generation through installation of new waste heat recovery boilers and turbo generator set. So the project activity may principally be categorized under:

Category 1 — Sectoral Scope 01 and 04 - Energy Industries (Renewable/Non-Renewable sources) and manufacturing industries respectively as per the scope of the project activities enlisted in the list of

sectoral scopes and linked approved baseline and monitoring methodologies on the UNFCCC website for accreditation of Designated Operational Entities[1].

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

The project activity entails setting up of a waste heat recovery based Captive Power Plant (CPP) downstream of the clinker cooler and pre-heater (components of the clinker manufacturing process). The proposed project activity involves implementation of waste heat recovery boilers to recover and utilise the waste heat of the emanating gas of clinker cooler and the pre-heater. The project equipments are as follows:

- One boiler downstream of the Kiln No. 1 pre-heater at BCW to utilise the flue gas of the same
- Two boilers downstream of the Kiln No. 2 pre-heater at BCW to utilise the flue gas of the same
- Two boilers downstream of the pre-heater at CCW to utilise the flue gas of the same
- Two boilers downstream of the clinker cooler at CCW to utilise the waste gas of the same

The waste gas, on introduction into the boilers would generate steam by sensible heat transfer after which the gases would be released to the atmosphere post heat recovery.

The steam generated would then be introduced in the condensing type steam turbine to generate gross power to the tune of 29.8 million units during the mills running condition (approximately 273[2] days in a year considering 330 annual operational days) and 8 million units (approximately 57[3] days in a year considering 330 annual operational days) during the mills stopped condition. 8% is the auxiliary power consumption. So the total net electricity generation is 34.81 million units. As a portion of waste gas emanating from pre-heater tower is utilized for fuel preheating in mills (when mills are on), equivalent quantum of waste gases would not be available for power generation during that time. That is why during mill on condition design capacity of the waste heat recovery based power generation system is low *i.e.* 5.8MW.

Electricity generated by the three-phase 3000rpm generator at 0.80PF 6.6 kV; 50Hz would be transmitted to the cement manufacturing process equipments in the industrial unit. The parameters of the steam turbine are provided below:

[1] http://cdm.unfccc.int/DOE/scopes.html

[2] Daily mill running time is expected to be around 20 hours.

[3] Daily mill off condition is expected to be around 4 hours

Steam Turbine		
Parameter	**Unit**	**Value**
Rated Capacity	MW	7.5
Rated Speed	rpm	3000
Primary Steam Pressure	MPa	1.27~2.45
Primary Steam Temperature	°C	310~390
Secondary Steam Pressure	MPa	0.1~0.3
Secondary Steam Temperature	°C	175

A schematic diagram of the Waste Heat Recovery System indicating the location of the various boilers is provided below:

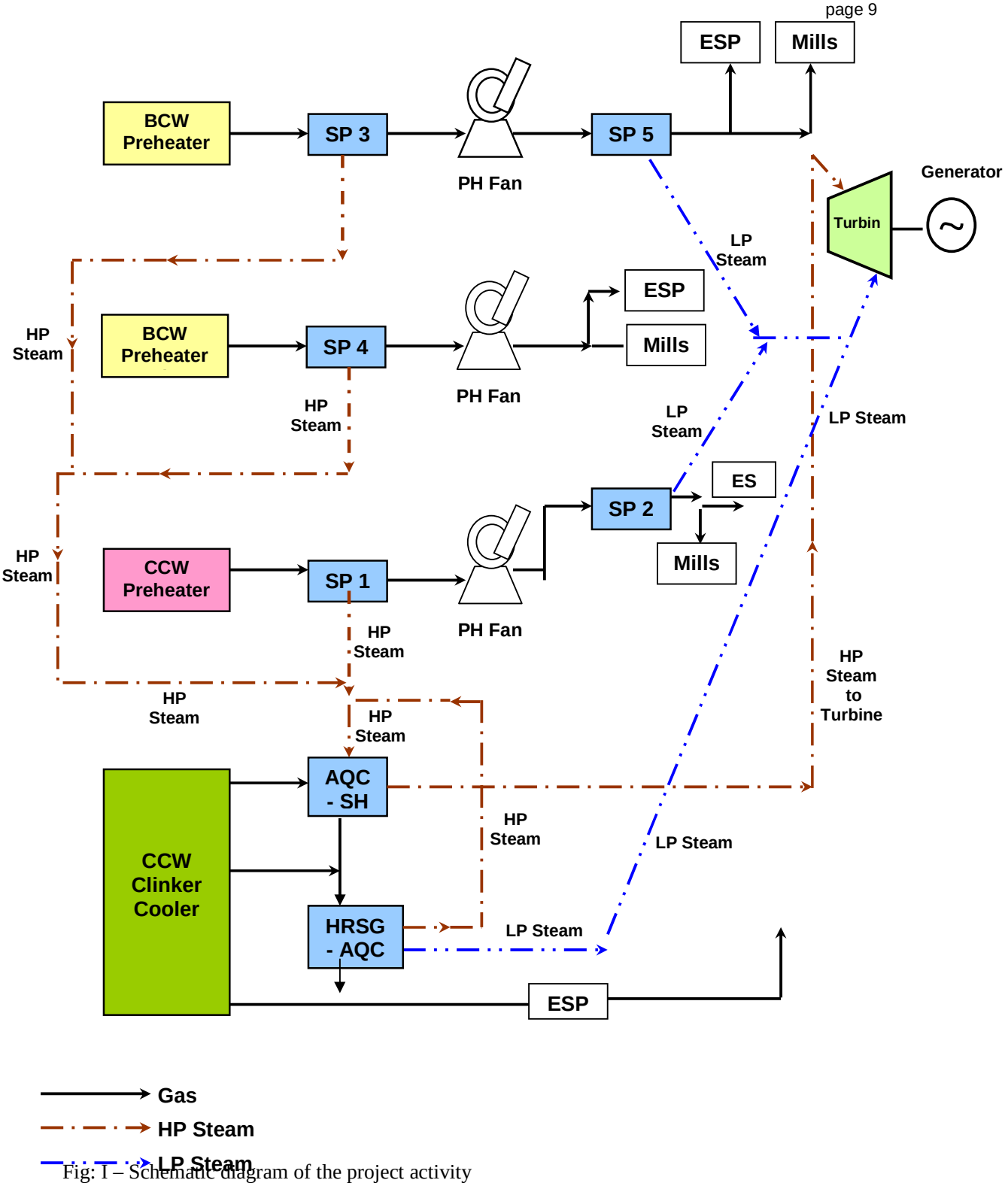


Fig: I – Schematic diagram of the project activity

Legend	
SP1, SP2, SP 3, SP 4, SP 5, AQC-SH, HRSG-AQC	Boiler numbers
PH Fan	Pre-heater fan
ESP	Electrostatic precipitator
HP steam	High pressure steam
LP steam	Low pressure steam

A.4.4. Estimated amount of emission reductions o the chosen crediting period:

Years	Estimation of annual emission reductions in tones of CO_2 e
April 2011 – March 2012	40026
April 2012 – March 2013	40026
April 2013 – March 2014	40026
April 2014 – March 2015	40026
April 2015 – March 2016	40026
April 2016 – March 2017	40026
April 2017 – March 2018	40026
April 2018 – March 2019	40026
April 2019 – March 2020	40026
April 2020 – March 2021	40026
Total estimated reductions CO_2 e	**400260**
Total number of crediting years	**10**
Annual average of the estimated reductions o the crediting period (tCO_2 e)	**40026**

A.4.5. Public funding of the project activity:

There is no public funding available for the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Title: Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants

Reference: Approved baseline methodology AM0024/version 02.1. Sectoral Scope: 01 and 04

Tools referred: "Tool for the demonstration and assessment of additionality (version 05.2)"

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

As per the applicability conditions of the Approved Consolidated Baseline Methodology-AM0024/Version 02.1,

"This methodology is applicable to project activities that use waste heat gas generated in clinker making process (i.e. in the cement kilns) to produce electricity."

The proposed project activity will be implemented in the clinker manufacturing facility of BCL, unit-Chanderia. The project activity entails utilisation of the waste heat of the emanating gas of pre heater and clinker cooler for generation of steam in the waste heat recovery boilers which will be subsequently used to generate electricity.

"The electricity produced is used within the cement works where the proposed project activity is located and excess electricity is supplied to the grid; it is assumed that there is no electricity export to the grid in the baseline scenario (in case of existing captive power plant);"

The electricity demand for clinker production in the cement manufacturing facility of BCL, Unit Chanderia would be met by the power from existing fossil fuel (*i.e.* coal) based TPP and the project activity. Even after power supply form the same there would be shortfall of power which would be met by the grid. In absence of the project activity the electricity produced by the project activity would have been supplied by a new fossil fuel based power plant (*i.e.* baseline scenario) as an extension of existing TPP. Therefore there is no scope of electricity export to the grid in the baseline scenario.

"Electricity generated under the project activity displaces either grid electricity or from an identified specific generation source. Identified specific generation source could be either an existing captive power generation source or new generation source;"

In absence of the project activity the quantum of electricity which would be generated by the project activity would have been generated by a new fossil fuel (*i.e.* coal) based power generation system (as an extension of existing TPP). Therefore the power generated by the proposed waste heat recovery based Captive Power Plant (CPP) will be displacing electricity generated by an identified specific generation source which is a new fossil fuel (*i.e.* coal) based power generation system (as an extension of existing TPP). Please refer to the section B.4. for further details.

"The grid or identified specific generation source option is clearly identifiable;"

The existing TPP which is one of the sources of power for the cement manufacturing facility of BCL, unit-Chanderia is clearly identifiable from the consent to operate certificate provided by the government. The new fossil fuel *(i.e.* coal) based power generation system considered as the baseline scenario of project activity is an extension of this existing TPP (identified specific generation source).

"*Waste heat is only to be used in the project activity;"*

In absence of the project activity the waste heat of the emanating gas of pre-heater and clinker cooler would have been partially used for pre-heating the fuel (*i.e.* coal) and raw material (Type 1 waste heat utilization as per the methodology) and rest of the waste heat would have been released to atmosphere without any further utilization. This portion of waste heat will be utilized under the project activity for power generation. So from the above it is clearly evident that waste heat is only to be used in the project activity.

"In the baseline scenario, the recycling of waste heat is possible only within the boundary of the clinker making process (e.g. clinker production lines in baseline scenario could include some heat recovery systems to capture a portion of the waste heat from the cooler end of the clinker kiln and use this to heat up the incoming raw materials and fuel - so called Type 1 Waste Heat Utilization as described in explanatory note below).Type I Waste Heat Utilization: This is when waste heat is used in the baseline scenario within the energy balance boundary of the clinker making process and which is reflected in the specific fuel consumption of the clinker line per unit output of clinker;"

In the pre-scenario a portion of waste heat is utilized for pre-heating the fuel (*i.e.* coal) and raw material (Type 1 waste heat utilization as per the methodology). And the rest of the waste heat is vented to atmosphere. The same practice would have been followed in absence of the project activity. Because of the technical constraint it is not possible to utilize the same (which will be used under the project activity) outside the boundary of clinker making process.

The pre-project scenario is not the current or identified alternative business as usual use of waste heat supplied to applications outside the boundary of the clinker making process *e.g.* to other local industrial users, local heating schemes, *etc.* So the baseline is not *Type 2 Waste Heat Utilisation.*

Therefore it can be said that the proposed project activity conforms to the applicability criterion of the applied methodology – AM0024.

B.3. Description of the sources and gases included in the project boundary:

"For the purpose of determining GHG emissions of the project activity, project participants shall include the following emissions sources:

- *CO_2 emissions from on-site fuel consumption of fossil fuels.*

For the purpose of determining the baseline, project participants shall include the following emission sources:

- *On-site fossil fuel consumption within project boundary; and*
- *From electricity generation, either in captive power generation source or the generation sources connected to grid that serves the proposed project site, as in the identified baseline scenario*

The physical boundary includes the facilities constructed/erected on account of the project activity at the cement plant. In the case of displaced grid electricity, it further includes the local power grid system connected to the project activity; in the case of captive power, it also includes the "inside the fence" electrical system"

As per the methodology, the physical boundary for computation of emission reduction resulting from the proposed project activity will include:

- The cement manufacturing facility (rotary kiln and calciner where the fossil fuel is being consumed) of BCW and CCW;

- The waste heat recovery based power generation system which is using the waste heat of emanating gas of pre-heater and clinker cooler for power generation
- The electrical system dedicated to supply power to the cement manufacturing facility of BCW and CCW
- And the grid (NEWNE)

The following figure provides a diagrammatic representation of the project boundary:

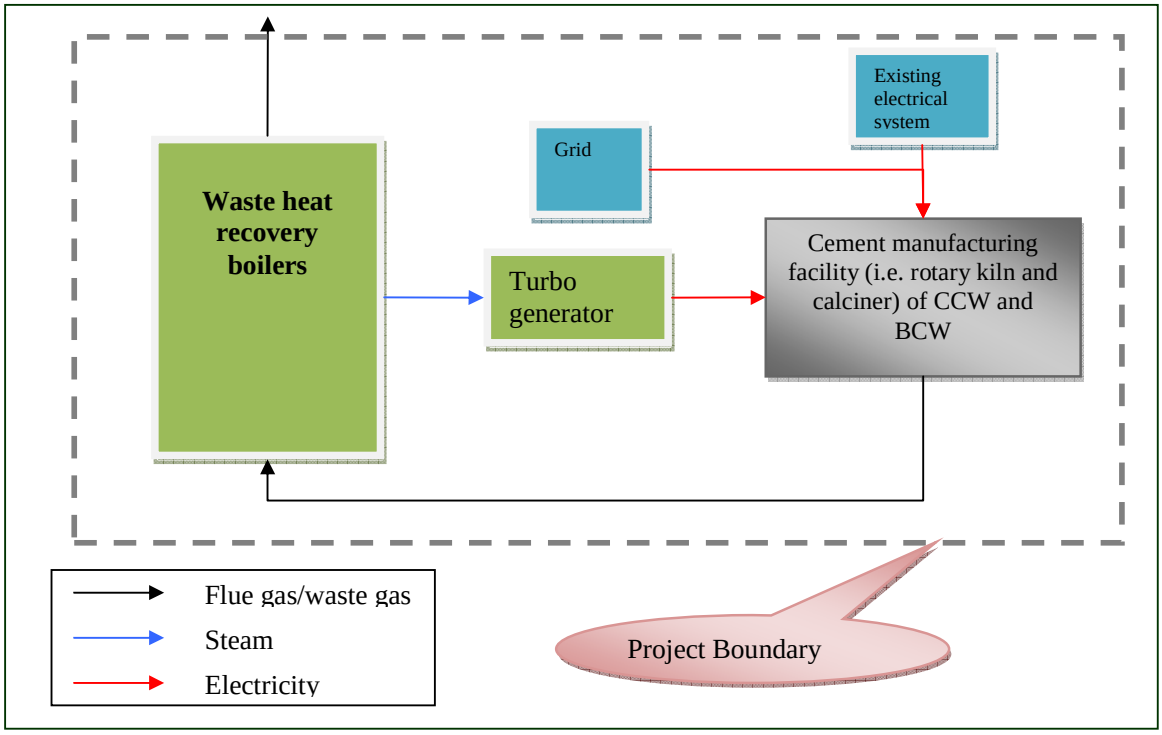


Figure: II – Project Boundary

In accordance with the methodology, the following emission sources are considered for the purpose of determination of baseline emissions and project emissions and hence emission reductions resulting from the project activity:

Table B-1: Overview on emission sources included in or excluded from the project boundary				
	Source	Gas	Included	Justification/ Explanation

Baseline	Identified specific generation source	CO_2	Included	Main emission source since the proposed project activity will result in displacement of equivalent quantum of electricity which would have been generated from a fossil fuel (coal) based power plant.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
Project activity	On site fossil fuel consumption due to the project activity	CO_2	Included	May be the main emission source.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The methodology requires the project participant to identify all the realistic and credible alternatives available to Birla Corporation Limited in absence of the project activity.

The following section will elaborate on selection of baseline scenario for the project activity under consideration:

Step 1: Determination of technically feasible alternatives to the project activity

"1.A. Identify and list, within the local context, the current business, as usual utilization of, and options technically feasible for, waste heat utilization. Include an assessment of potential use of waste heat in the cement work. For identifying and assessing the potential alternative waste heat uses in the baseline, the following approach should be used:

For identifying and assessing the potential alternative waste heat uses in the baseline scenario, the step wise approach suggested by the methodology is followed.

• *Identify the current use of waste heat from the kilns at the cement works and identify the normal uses for waste heat in the cement production process in the local context, which would be replaced by the project activity;*

In the current scenario the waste heat of the emanating gas of pre-heater tower and clinker cooler is partially utilized for the preheating of fuel (*i.e.* coal) and raw material (Type 1 waste heat utilization) and rest of the waste heat is vented to atmosphere without any further utilization. Because of the low temperature and high dust content of this gas, it is not technically feasible to utilise the heat content of the gas (waste heat) for some other purpose inside the clinker manufacturing facility. This is also the normal uses of waste heat in the cement production process in the local context. . Since there is no potential use of the waste heat in absence of the proposed project activity, project participant has no other alternative but to release it to the atmosphere.

• *Establish whether there are other demands for any additional waste heat use that should be considered as part of the baseline;*

Because of low temperature and high dust content of the waste heat carrying gas it is not technically feasible to use the waste heat in the clinker manufacturing facility of BCL, Chanderia unit. So it is evident from the above statement that there is no other utility point *i.e.* demands of additional waste heat use in the baseline scenario.

• *Demonstrate that this waste heat is within the energy balance boundary of the clinker making process (Type 1 waste heat utilization as earlier defined which is a condition of applicability of this methodology)."*

From the Fig. I (depicted in section A.4.3) it is evident that the waste heat which will be utilized in the proposed project activity for power generation is within the energy balance boundary of clinker making process. The project activity is solely dependent on the waste heat available inside the energy balance boundary of clinker making process for power generation.

Following the above stepwise approach for assessing the potential alternative for the waste heat use in the baseline scenario the following option can be considered as the most credible and realistic alternative (as part of baseline).

- Alternative 1: Releasing the waste heat (available after type 1 waste heat utilization) to the atmosphere in absence of the project activity

"1.B Identify and list the source of electric energy supply for the cement plants, in the local context. The current and future situation of the electricity demand and supply to the cement plant, where the project

activity is located, should be included in the CDM-PDD in order to determine what electricity supply is likely to be displaced by the project activity.

• For identifying the current electricity supply and demand baseline, the following should be used:

(i) E_{CEMENT} and E_{LOAD} are the electricity demand of the cement works and other local loads, which should be included in the Project Design Document for at least two years prior to the start date of the project activity. Ex ante projection of these demands over the crediting period should be presented. The meter records and production plan of the cement works and load design data of the cement works can be used for this estimate as can the data for other local loads (if any);

The historical and projection of electricity demand:

Demand side (in million unit)			
Year	**E_{cement}**	**E_{load}**	**Total demand**
2006-07	204.272	1.505	205.777
2007-08	211.508	1.504	213.048
2008-09	199.529	1.489	201.018
2009-10	225.367[4]	1.489	226.856
2010-11	225.367	1.489	226.856

(ii) $E_{GATEXIST}$ is the baseline electricity generation of the existing captive power plant (if existing). Production data for at least the two years prior to the start date of the project activity should be included in the Project Design Document. Ex ante projection of production capacity for the crediting period too should be included. The production records and plan of the captive power plant can be used for this estimate;

The historical and projection of electricity supply:

Supply side (in million unit)		
Year	**$E_{GATEXIST}$**	**Balance Power Requirement (grid /identified generation source/waste heat recovery based CPP)**
2006-07	160.939	44.838
2007-08	176.448	36.600
2008-09	172.510	28.508
2009-	180.552	47.143

[4] In line with the methodology the E_{CEMENT} in 2009-10 and 2010-11 has been estimated considering meter records and production plan (along with the consideration of up-gradation) of the plant. The detail computation has been submitted to the DOE along with the supportive. The values for E_{CEMENT} and E_{LOAD} for rest of the crediting period are expected to be approximately same depending on the production schedule of the plant in the coming years.

10		
2010-11	180.552[5]	47.143

(iii) The data in (i) and (ii) above should be collected once at the start of each crediting period of the project activity and can be analyzed to see if there is an increase of energy demand expected and how this demand could be met, by supply from the grid or alternative captive power sources.

The project participant is opting for fixed crediting period (*i.e.* 10 years). The data in (i) and (ii) will be collected and analyzed at the start of the fixed crediting period (*i.e.* at the time of registration or commissioning of the project, whichever is later.

The following broad categories of options should be analyzed to identify baseline electricity options:
(i) Supply from grid;
(ii) Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists; and
(iii) Construction of a captive plant with different fuel options if electricity demand is increasing."
From the table it is evident that to meet this balance power demand project participant need to generate power in-house or import power from grid.
Project participant has considered the following alternatives for the baseline electricity:

- **Alternative 1**: Proposed project activity not under taken as a CDM project activity

Without considering the CDM revenue, the project participant could have utilized the waste heat for generation of power and meet the balance power requirement with power from waste heat recovery based CPP and power from grid (as waste heat recovery based CPP will not be able to meet the total balance power requirement). Since it is a realistic and credible alternative of the project activity it has been considered as part of baseline.

- **Alternative 2**: Installation of a new fossil fuel (*i.e.* coal) based power generation system as an extension of existing TPP

[5] In line with the methodology the $E_{GATEXIST}$ in 2009-10 and 2010-11 has been estimated considering production records and plan of the plant. The detail computation has been submitted to the DOE along with the supportive. The values for $E_{GATEXIST}$ for rest of the crediting period are expected to be approximately same depending on the power demand of the plant in the coming years.

In absence of the project activity, the project participant could have installed a new fossil fuel (*i.e.* coal) fired power generation system to cater the balance power requirements. Since it is a realistic and credible alternative for the project activity it has been considered as a part of baseline. The capacity of the baseline thermal power plant (*i.e.* 5.4 MW) has been estimated based on the capacity requirement of a coal based thermal power plant to generate equivalent quantum of electricity as that of the project activity[6].

- **Alternative 3**:Import of power from grid[7]

In absence of the project activity the project participant could have import the power from the western regional grid which is now a part of the NEWNE grid to meet the balance power requirement. However reliability of grid power is a big issue. Many a time PP has experienced power cut during the peak hours. Therefore it is a very unlikely scenario to import such a quantum of electricity and subsequently more dependency on grid power in the local context instead of setting up a new power plant. Furthermore in this case cost of grid power is substantially higher than that in alternative 1 and alternative 2. The unit cost of electricity from grid is INR 4.81/unit. Whereas unit cost of power generation through a coal based power plant is INR 2.42 / unit and unit cost of power generation in project scenario is INR 3.09 / unit.[8] Therefore in view of non reliability and high cost of grid power the same is not considered as a realistic and credible alternative for the project activity. So it has not been considered as a part of baseline.

- **Alternative 4:** Captive power generation based on different fuel (natural gas, diesel oil, etc)

1, Diesel oil – Diesel based power generation is mainly used in emergency purpose. Because diesel based electricity generation is highly expensive (price of diesel is around 30.25 INR/ litre[9]). Furthermore unit

[6] The capacity of the baseline thermal power plant (5.4MW) has been derived based on the net electricity generation of the project activity and plant availability factor, percentage of auxiliary power consumption and annual operational days of a thermal power plant as suggested in the techno-commercial offer of the technology supplier (Cethar Consulting Engineers).

[7] Please note that as the approved methodology AM0024/version 02.1 requires PP to use IRR as the financial indicator in step 3 – investment comparison, PP could not consider the case of importing electricity from grid as an alternative to the project activity in step 3- investment analysis. That is why PP chooses to eliminate the same in step 1 showing its financial un-attractiveness compared to that of alternative 1 and alternative 2.

[8] The same is substantiated through the financial assessment report prepared by the appointed consulting firm M/S Cethar Engineering Consultants Pvt. Ltd. at the project approval stage. All relevant assumptions along with the supporting documents have been submitted to DOE.

[9] Source: http://uk.reuters.com/article/idUKDEL1697420080214

cost of generation is exorbitantly high - approximately INR 9 /unit, this is even more that grid electricity cost. So, diesel based power generation is not a plausible alternative. Hence this option has not been further considered for baseline determination.

2. Natural Gas -. No natural gas transporting pipeline network is there in Chanderia. Therefore building power plant as well the pipeline network for such a small scale power plant (in absence of the project activity) is an unrealistic proposition because of its exorbitant capital investment. Considering the locational disadvantages *i.e.* non-availability of natural gas pipeline in Chanderia where the project activity plant is situated, this alternative cannot be considered feasible. In this regard PP has submitted a report of CRISIL.
Hence this option has not been further considered for baseline determination.

3. Bio-mass – There are 8 biomass based power generation project registered[10] under clean development mechanism in Rajasthan. And even another 8 biomass based project is under validation stage. And each of the projects is pursued with serious consideration of CDM in view of their own barriers.

Furthermore PP is also facing the local problem with the suitability of quality of biomass for power generation. PP has tried to use bio-mass as fuel earlier in its existing thermal power plant (TPP) by incorporation of dual firing technology (coal + biomass). However the same did not stand as the chloride content of available biomass is very high (as well as the same is very light in weight). And this high chloride content of biomass is very detrimental for boiler tubes. In view of the same PP discarded this option. Please refer to the bio-mass test report (test carried out by 'Shri ram institute for industrial research') in this regard.

Even PP has appointed one consultant to study further the feasibility of bio-mass based power plant. This consulting firm has also come up with the same conclusion (i.e. quality of available biomass is not appropriate for power generation in boiler). The recommendation is also submitted to DOE.
Hence this option has not been further considered for baseline determination.

Step 2: Compliance with regulatory requirements:
The alternatives listed in the ***Step1*** are outlined which are under further consideration in the selection of baseline scenario (most realistic and credible alternative)

[10] http://cdm.unfccc.int/Projects/projsearch.html

Scenario 1) Proposed project activity not undertaken as a CDM project activity;

The alternative is in compliance with all regulatory requirements

Scenario 2) Releasing the waste heat (available after type 1 waste heat utilization) to atmosphere in absence of the project activity and meeting the power demand by generating electricity in new fossil fuel (*i.e.* coal) based power generation system (as an extension of existing TPP)

This is also in compliance with all regulatory requirements

Step 3: Undertake economic analysis of all scenarios that meet the regulatory requirements

Financial comparison among scenario 1, scenario 2 is given below for the selection of baseline. In line with the methodological guidance IRR has been chosen as a financial indicator for the economic analysis of Scenario 1 and Scenario 2.

Alternatives	*IRR (%)*[11]
Scenario 1	19.02
Scenario 2	29.91

Since scenario 2 is the option with highest IRR, it is evident that this is the most financially attractive option available to the project participant. So the same has been considered as the baseline scenario.

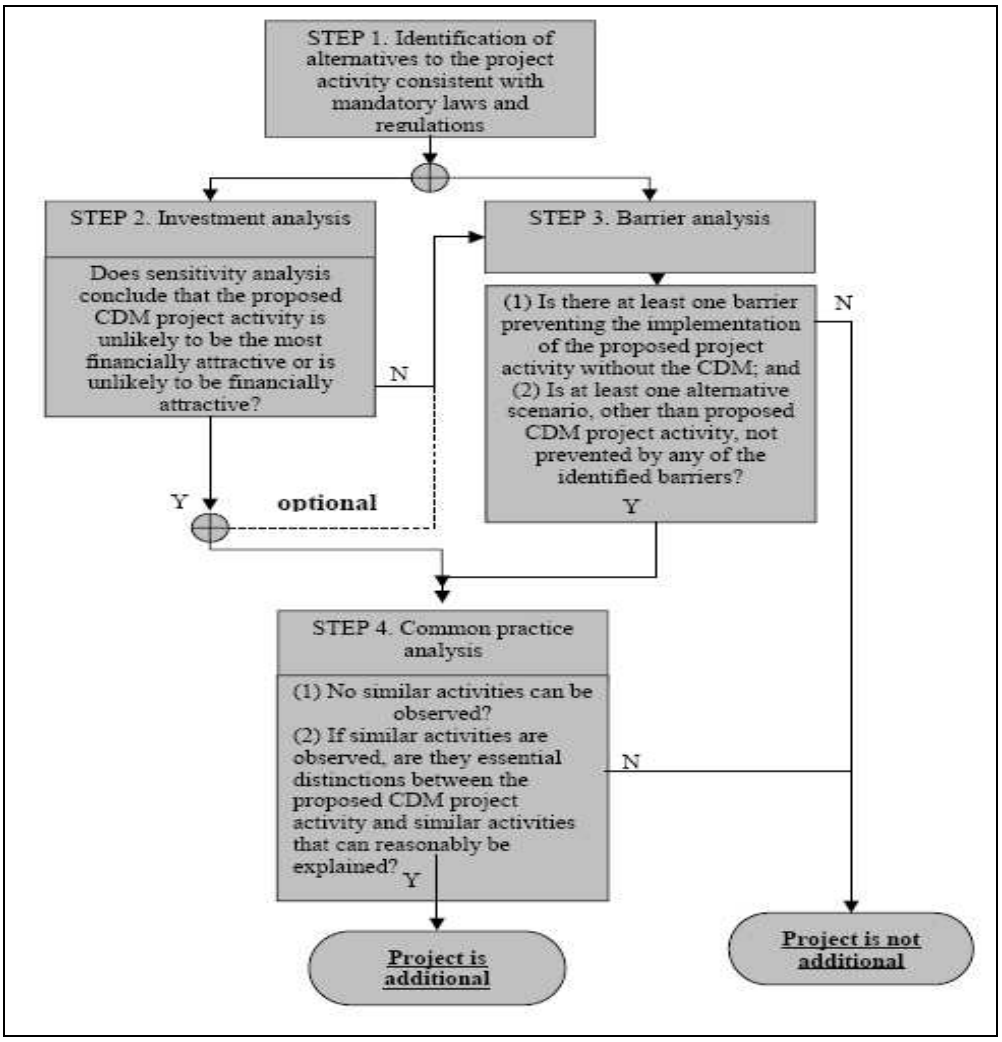
So it can be concluded that the baseline scenario for the project activity is scenario 2.

B.5. 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 (assessment and demonstration of additionality):

As per the decision 17/cp.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in absence of the registered CDM project activity. The methodology requires the project participant to determine its additionality based on the "Tool for the demonstration and assessment of additionality (version 05.2)", agreed by the CDM Executive Board.

[11] All relevant assumptions associated to the IRR of scenario 1and scenario 2 are presented in section B.5.

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



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

In Sub-step 1a (Define alternatives to the project activity) and Sub-step 1b (Consistency with mandatory laws and regulations), Birla Corporation Limited is required to identify the realistic and credible alternative(s) that will provide output or services comparable with the project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

The identification of alternatives for waste gas utilisation and power generation as well as their compliance with the current laws and regulations has been dealt with in details in Section B.4 of the Project Design Document. Scenario-1, scenario-2 are in line with the current laws and regulations enforced in the host country- India. Therefore Birla Corporation Limited could have implemented either the Scenario-1 or scenario-2. However implementation of the project activity without CDM revenue is not a feasible alternative for the project participant. The same has been illustrated below through 'Step 2: Investment Analysis'.

Step 2. Investment analysis

As per the investment analysis, the project participant is required to determine whether the project activity is economically or financially less attractive than other alternatives without the revenue from the sale of Certified Emission Reductions (CERs). To conduct the investment analysis, Birla Corporation Limited is required to use the following sub-steps:

Sub-step 2a. Determine appropriate analysis method

The project activity will generate electricity for in-house consumption and has financial implications other than those related to CDM. Therefore 'Option-I: Simple cost analysis' would not be an appropriate analysis method.

Amongst the other two options *i.e.* 'Option-II: Investment comparison analysis' and 'Option-III: Benchmark analysis', Birla Corporation Limited has adopted the investment comparison analysis wherein the financial indicator(s) of the project activity (*i.e.* scenario 1) is compared with other alternative (*i.e.* "scenario-2"). If at least one of the alternatives has a better indicator (*e.g.* higher project IRR), then the project activity can not be considered as the most financially attractive option.

Sub-step 2b. Option II. Apply investment comparison analysis

Birla Corporation Limited has conducted an investment comparison analysis for all the alternatives (*i.e.* scenario- 1, scenario-2) that were available with them in absence of the project activity. The project IRR has been considered as the financial indicator for the investment comparison analysis. All relevant assumptions used for the investment comparison analysis have been provided below and the financial computations on project IRR for the alternatives have been provided to the DOE.

Sub-step 2c. Calculation and comparison of financial indicators

	Scenario 2 (*i.e.* baseline)	**Project case without CDM (scenario-1)**

Project IRR (%)[12]	29.91	19.02

Assumptions:

Scenario 1:

[12] In line with requirement of paragraph 111, of VVM 2.1, supporting documents of the assumptions used in investment comparison analysis have been submitted to DOE.

Assumptions - project activity (IRR)				
Parameters	**units**	**Value**		**Reference**
Electricity generation Computation				
		Mill on	**Mill off**	Technical scheme' provided by the technology supplier. / Assessment conducted by 3rd party
Power Generation Capacity	MW	5.8	7.5	
Annual Working Days	Days	273	57	
Waste Gas availability factor	%	80	80	
Plant Availability	%	98	98	
Generation	million Kwh	30	8	
Total Generation	million Kwh	38		
Auxiliary Power Consumption	%	8		
Net Generation	million Kwh	34.810		
Grid power rate				
Power Purchase Rate from AVVNL	Rs./kWh	4.81		Electricty Bills' of the Birla Corporation Limited, Chandeia unit
Total Project Cost Breakup				
Land/Building	INR in million	50		Total project cost computation sheet' prepared by the technical consultant involved in the execution of the project activity.
Plant/Machinery	INR in million	600		
Total	**INR in million**	650		
Project Financing(debt:equity-2:1)				
Equity	INR in million	217		Relavent extract of Board Note' - Where the same decision has been made by the Board
Term Loan	INR in million	433		
Depreciation				
Depreciation on Land/Building	%	3.34		Rates of Depreciation under Companies Act - Schedule XIV'
Depreciation on Plant/Machinery	%	5.28		
Rate of Taxation				
Rate of Taxation	%	33.99		As per Income Tax Act
Operational and maintenance cost				
Operational and maintenance cost including insurance and overheads (as percentage of total project cost)	%	1.50		As per the suggestion made by the technical consultant involved in execution of the project activity
The same has been recommended (by the consulting firm M/s Cethar Consulting Engineer's (P) Ltd.) as mentioned in their communicated dated 5th January, 2008) considering the expensess under the following heads				
1. Wages, salaries, PF, etc 2. Stores and spares parts consumed 3.Water Cess 4. Building repair 5. Machine repair 6. Cleaning expenses 7. Insurance charges 8. General charges 9. Contractors PF 10. Stationery and printing 11. Postage, telegrams and telephone 12. Motor vehicle expenses				
Investment schedule				
Investment in 1st year (as percentage of total projcet cost)	%	20.00		
Investment in 2nd year (as percentage of total projcet cost)	%	80.00		
Escalation rate				
Escalation rate of O&M expenses	%	4.33		Base year 2002-03, current year 2006-07 and Assessment perriod - 5 years, Commodity - all commodity. Please refer to the following link: http://eaindustry.nic.in. Web page shared with DOE.
Escalation rate of grid power cost	%	1.98		Base year 2002-03, current year 2006-07 and Assessment perriod - 5 years, Commodity - electricity for industry. Please refer to the following link: http://eaindustry.nic.in. Web page shared with DOE.

Scenario 2:

Parameters	Value	Unit	Reference
Electricity generation computation			
Rated capacity	5.4	MW	Claculated
Percentage of auxiliary consumption	10	%	As per the techno Commercial offer proposed by the technology supplier
Annual working days	330		
Plant availability factor	90	%	
Gross power generation	39	million kWh	Claculated
Net power generation	35	million kWh	Electricity generated by the project actvity, as in absence of the project activity the same quantum of electricity would have been supplied by the coal based power plant considered in the baseline scenario
Grid power rate			
Power Purchase Rate from AVVNL	4.81	INR/kWh	Electricty Bills' of the Birla Corporation Limited, Chandeia unit
Total project cost breakup			
Total project cost(as per supplier's data)	246.3	INR in million	As per the Techno Commercial offer proposed by the technology supplier
Cost of building (as percentage of total project cost)	10	%	
Cost of plant and machinery (as percentage of total project cost)	90	%	
Project Financing(debt:equity-2:1)			
Equity	82	INR in million	Relavent extract of Board Note' - Where the same decision has been made by the Board
Term Loan	164	INR in million	
Rate of Taxation			
Rate of Taxation	33.99	%	As per the recent Bank loan papers
Depreciation			
Depreciation rate on bulding	3.34	%	Rates of Depreciation under Companies Act - Schedule XIV'
Depreciation rate on plant and machinery	5.28	%	
O&M expenses (excluding fuel expenses)			
Wages, salaries, PF, etc	0.0319	INR per kWh	Cost sheet of the existing coal based Thermal Power Plant (TPP)
Stores and spares parts consumed	0.0814	INR per kWh	
Water Cess	0.0003	INR per kWh	
Coal, flyash handling & operation	0.0562	INR per kWh	
Building repair	0.0073	INR per kWh	
Machine repair	0.0224	INR per kWh	
Cleaning expenses	0.0027	INR per kWh	
Insurance charges	0.0212	INR per kWh	
General charges	0.0006	INR per kWh	
S & W	0.0014	INR per kWh	
Contractors PF	0.0005	INR per kWh	
Stationery and printing	0.0001	INR per kWh	
Postage, telegrams and telephone	0.0003	INR per kWh	
Motor vehicle expenses	0.0004	INR per kWh	
Flyash transportation expenses	0.0102	INR per kWh	
O&M expenses(as per 2006-07 -TPP data)	0.24	INR per kWh	
Fuel expenses			
Station Heat Rate (@30% efficiency)	2867	kCal/kWh	As per the techno Commercial offer proposed by the technology supplier
Thermal Energy Input	110889592970	kCal/annum	Calculated
Quantity of Coal consumed	29181	MT/annum	Calculated
Net Calorific Value of Coal	3800	kCal/kg	The technolgy supplier recommended the station heat rate considering the GCV of the coal currently being used in the exisitng coal based thermal power plant (TPP). So the same has been mentioned in their techno commercial offer as well as in their lab reports of the coal being used in the existing coal based thermal power plant.
Coal Cost	1800	INR/MT	Cost sheet of the existing coal based Thermal Power Plant (TPP)
Escalation rate			
Escalation rate of O&M expenses	4.33	%	Base year 2002-03, current year 2006-07 and Assessment perriod - 5 years, Commodity - all commodity. Please refer to the following link: http://eaindustry.nic.in. Web page shared with DOE.
Escalation rate of grid power cost	1.98	%	Base year 2002-03, current year 2006-07 and Assessment perriod - 5 years, Commodity - electricity for industry. Please refer to the following link: http://eaindustry.nic.in. Web page shared with DOE
Escalation on coal cost	4.86	%	Base year 2002-03, current year 2006-07 and Assessment perriod - 5 years, Commodity - non coking coal. Please refer to the following link: http://eaindustry.nic.in. Web page shared with DOE.
Investment schedule - Assumptions			
Investment in 1st year(as percentage of total project cost)	20	%	
Investment in 2nd year(as percentage of total project cost)	80	%	

As per the above investment comparison analysis of the financial indicator for the project activity and the alternatives, it is found that "scenario 2"*i.e* Releasing the waste heat (available after type 1 waste heat utilization) to atmosphere in absence of the project activity and meeting the power demand by generating electricity in new fossil fuel (*i.e.* coal) based power generation system (as an extension of existing TPP)" has the best financial indicator (*i.e.* it has the highest project IRR) amongst all plausible alternatives including the project activity without CDM revenue. As per the "Tool for the demonstration and assessment of additionality (Version 05.2)", *"If one of the other alternatives has the best indicator (e.g. highest IRR), then the CDM project activity can not be considered as the most financially attractive"*. It may therefore be concluded that the project activity can not be considered as the most financially attractive proposition.

Sub step 2d. Sensitivity analysis

The value of the unit cost of electricity generation is found to be sensitive to the following parameters:

- Coal price
- Operational and maintenance cost
- Grid power purchase cost
- Power generated with waste gas
- Total project cost

The sensitivity analysis has been conducted for scenarios with variations in each one of the above-mentioned key factors

- ✓ to assess whether the conclusion regarding the financial attractiveness (of Scenario 2) is robust to reasonable variations in the critical assumptions.
- ✓ to assess whether the conclusion that the project activity is unlikely to be the most financially attractive is robust to reasonable variations in the critical assumptions

Parameters Description	Sensitivity	IRR	
		Base line	Project activity
Without sensitivity	0%	29.91%	19.02%
Electricity generation	+10%	34.06%	20.81%
	-10%	25.58%	17.17%
Grid power cost	+10%	34.28%	20.81%
	-10%	25.32%	17.17%
Coal cost	+10%	28.34%	19.02%
	-10%	31.45%	19.02%
Operational and Maintenance cost	+10%	29.68%	18.90%
	-10%	30.15%	19.14%
Total project cost	+10%	27.46%	17.34%
	-10%	32.86%	21.01%

The results of the sensitivity analysis conducted substantiate that the project IRR in case of scenario 2 is the highest and therefore the same is financially more attractive than the project activity.

Hence, it may be concluded that

(a) 'the project activity without CDM revenue' is not the most financially attractive option available to the project participants and

(b) the CDM revenue the project activity would obtain through sale of the emission reductions has been one of the most important determinants Birla Corporation Limited to opt for the project activity which is financially less attractive than scenario-2.

As per para 18 of EB 51- Annex 58, PP has done a sensitivity analysis to check at what variation of the input parameters the project IRR touches the baseline IRR and has given justification why the variation is not practically possible. The sensitivity analysis has been presented below.

Input parameter	Variation	Project IRR	Justification
Electricity generation	+64.25%	29.91%	Electricity generation has been estimated as per the design specification. Even if we consider 100% waste heat availability factor and 100% plant availability factor (although the same is unrealistic) the generation would increase by only 38% which is way below 64.25%. So the variation is not practically feasible.
Grid power cost	+64.25%		Following the historical trend in grid power cost

			64.25% increase of the same is not possible. The CAGR[13] for the electricity tariff for commercial use over the last 16 years[14] is 6%. Moreover, the change in grid power tariff will have similar bearing on the project IRR and baseline IRR.
Coal cost	62.05%		Following the historical trend in non-coking coal cost 62.05% increase of the same is not possible. The CAGR for the non-coking coal price over the last 10 years is 6.04%[15]. Moreover, in India the coal price is regulated by the Government. So high rate of increase in coal price is unlikely to happen.
O&M cost	-1015%		Not practical
Total Project cost	-39.12%		Project participant has already spent more than 90% of the envisaged cost. And it is expected by completion of the project the same will cross the envisaged project cost (*i.e.* INR 650 million) by a considerable margin. To substantiate the same the POs[16] have been submitted to the DOE.

Step 4. Common practice analysis

The project proponent is further required to conduct the common practice analysis as a credibility check to complement the investment analysis (Step 2). The project proponent is required to identify and discuss the existing common practice through the following sub-steps:

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

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

Project participant has chosen India as the region for demonstrating common practice.

Selection of scale- Project participant has not limited its scope for any specific capacity of a cement plant.

[13] Compound Annual Growth Rate

[14] Source: http://eaindustry.nic.in/

[15] Source: http://eaindustry.nic.in/

[16] Purchase Order

Selection of technology - Implementation of waste heat recovery boilers to recover and utilise the waste heat of the emanating gas of clinker cooler and the pre-heater.

The project activity involves implementation of waste heat recovery boilers to recover and utilise the waste heat of the emanating gas of clinker cooler and the pre-heater. So, Project participant has considered this technology for common practice analysis.

The power generation from the steam produced from waste heat of pre-heater gas and clinker cooler gas is not a common practice. In India following cement manufacturers have decided to set-up waste heat recovery based power plants:

- Three projects registered -
  - Project activity at the Vishnupuram cement plant of The India Cements[17]
  - Project activity at the cement plant of The KCP Limited at Guntur, Andhra Pradesh[18]
  - Project activity of JK Cement Limited at Nimbahera, Chittorgarh, Rajasthan[19]
- Following projects are under validation -
  - Project activity at the Beawar cement plant of Shree Cements Limited[20]
  - Project activity of Shree Cement Limited at Ras in Rajasthan[21]
  - Project activity at cement plant of JK Cement Limited, Mangrol, Chittorgarh, Rajasthan[22]
  - Project activity at the Satna cement unit of Birla Corporation Limited[23]

All these projects have been implemented considering CDM revenue. So it is evident that the technology involved in the project activity is not at all financially lucrative and only CDM revenue is the lifeline for this kind of projects.

Even Cement Manufacturer's Association (a non-profit organization in Indian cement sector) and the technology supplier (Dalian East Energy Project Co. Limited) have acknowledged that cement plants in India are undertaking waste heat recovery projects considering CDM benefit[24].

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[17] Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1161334998.77/view

[18] Source: http://cdm.unfccc.int/Projects/DB/RWTUV1214900280.42/view

[19] Source: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1140718710.42/view

[20] Source: http://cdm.unfccc.int/Projects/Validation/DB/UQCFT6FCSSLYS0LUT9AJA77K6V3DIG/view.html

[21] Source: http://cdm.unfccc.int/Projects/Validation/DB/1VUFGEOLT9ALGQDRZ1KGZVD4PGVE1Y/view.html

[22] Source: http://cdm.unfccc.int/Projects/Validation/DB/EYQ20DYK5JFSJS1BETOK17SM6SJWBM/view.html

[23] Source: http://cdm.unfccc.int/Projects/Validation/DB/LBAW872EPQKBXJ3148WM9NO2FBU6L4/view.html

[24] Necessary documentary evidence has been submitted to the DOE.

The project activity was approved by the Board of Birla Corporation Limited after considering that the project activity would reduce GHG emissions and therefore could have the potential to avail carbon revenue under Kyoto Protocol – Clean Development Mechanism. Subsequent to the approval, the Management has proceeded with the implementation of the project activity as a climate change initiative. The following table gives the chronological events related to the project activity:

Chronology					
Progress of the Project	**Events pertaining to the CDM cycle**	**Date**	**Events pertaining to the implementation of the Project**	**Date**	**Supporting Document**
Prior CDM knowledge of the Project Proponent	The project proponent was having a registered CDM project in one of its cement plants prior to the project activity	26.05.2006			http://cdm.unfccc.int/Projects/DB/DNV-CUK1142507480.99
			Birla Corporation Limited received offer from M/S. Dalian for Waste Heat Recovery Based Power System	18.11.2007	Technical offer from M/S. Dalian
			Birla Corporation Limted received offer from M/S. Cethar Consulting Engineers (P) Ltd. Chennai for Coal Based Power Plant	26.11.2007	Techno-commercial offer from M/S. Cethar Consulting Engineers (P) Ltd.- ref. CCE10067/08 Rev00
			Meeting among Birla Corporation Limited, manufacturers and consultant at Kolkata Office	25.01.2008	Note to Board
CDM Consideration	Board of Birla Corporation Limited approved the Project with CDM consideration	31.01.2008			Extract of the Board Note
Appointment of CDM Consultant	Engagement with CDM Consultant	03.02.2008			Engagement Letter
			Birla Corporation Limited applied for consent to establish to Rajasthan State Pollution Control Board	04.03.2008	Ref: letter no CCW/PP/L-28/3129
			Agreement signed in between Birla Corporation Limited and M/S. Dalian	28.05.2008	Contract with M/S. Dalian – ref. CONTRACT NO WHRS/CHANDERIA/001

Progress of the Project in the CDM cycle	Birla Corporation Limited invited stakeholders for Comments	16.07.2008			Notice inviting stakeholder's comments – ref. CCW/Prod/12
	Birla Corporation Limited received comments from stakeholders	13.08.2008			Letters from the stakeholders
			Birla Corporation Limited received consent to establish from Rajasthan State Pollution Control Board	24.07.2008	Consent to operate for the CPP and cement plant and consent to establish for WHRB – ref F.12 (CII-95) RPCB/Gr. III/584.
	CDM consultant submitted draft PDD to Birla Corporation Limited	17.12.2008			Mail Communication dated 17.12.2008
	CDM consultant submitted final PDD to Birla Corporation Limited	03.03.2009			Mail Communication dated 03.03.2009
	Communication from DNA (MoEF) for presentation of the project to the Ministry	08.05.2009			Mail Communication dated 08.06.2009
	Presentation to the DNA (Ministry of Environment & Forest, Government of India)	14.05.2009			Mail communication from MoEF - Ref- F.No. 4/9/2009-CCC
	Agreement signed in between Birla Corporation Limited and M/S. DNV (DOE)	21.07.2009			REF – HO/CCW/CDM/09-10/002
	PDD webhosted for global stakeholder consultation	18.09.2009			http://cdm.unfccc.int/Projects/Validation/DB/T8I9BVLXM22CB7HQB7EC8QZID7KGQX/view.html

	Site validation	09.10.2009			Draft Validation Report – report no. 2009-0330
	Host Country Approval	30.11.2009			Ref: No. 4/9/2009-CCC

Moreover referring to the guidelines from paragraph 8(a), Annex 22, EB 49, the start date for the project activity was 28th May, 2008 and the date of webhosting of the PDD for global stakeholder consultation was 18th September, 2009. The time gap between these milestones is less than two years which is itself a testimony to the fact that the project proponent has undertaken continuing and real actions to secure CDM status for the project activity. Moreover, many more important steps were taken between the aforementioned milestones, which show a very competitive timeline.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As per the selection of baseline scenario conducted in Section B.4 of this PDD, scenario-2 'Releasing the waste heat (available after type 1 waste heat utilization) to atmosphere in absence of the project activity and meeting the power demand by generating electricity in new fossil fuel (*i.e.* coal) based power generation system (as an extension of existing TPP)' is found to be the baseline scenario. Therefore following the guidance of the methodology, the baseline emissions will be computed by quantifying the emissions related to generation of power equivalent to the power generated in the project activity. Project emissions are applicable only in case of change in specific energy consumption per ton of clinker production. The methodology does not require the project participant to consider any leakage emissions. Therefore the emission reduction resulting from the project activity will be computed as a difference between the baseline emissions and the project emissions.

Baseline emissions:

As per the methodology:

The baseline emissions are those from electricity generation source(s) that:

(a) Would have supplied the cement works; and

(b) Would have been generated by the operation of grid-connected power plants in absence of the proposed CDM project activity. The baseline emissions during a given year y is calculated as:

Since the waste heat recovery based captive power generation system will not export any power to the grid, the baseline emission would have happened only from electricity generation source (*i.e.* a new coal based captive power plant that would have supplied the electricity to the cement manufacturing facility of BCL, Unit - Chanderia in absence of the proposed CDM project activity.

So the baseline emission would be:

$$EB_y = EG_{CP,y} \times EF_{Elec,y} + EG_{Grid,y} \times EF_{Grid,y} \quad (1)$$

Where:

$EG_{CP,y}$ = The electricity supplied from the project activity to the cement plant, (MWh)

$EF_{Elec,y}$ = Is the emissions factor of the baseline electricity supply source, expressed as tCO_2/MWh. If in the baseline scenario electricity is supplied from the grid, then $EF_{Elec,\ y}$ is the emission factor of the grid - $EF_{Grid,y}$; if electricity is supplied from the identified specific captive power generation source, then $EF_{Elec,\ y}$ is the emission factor of it – $EF_{Captive,y}$

$EG_{Grid,y}$=Electricity supplied from project activity to the grid (MWh)

$EF_{Grid,y}$=emission factor of electricity grid (tCO_2 /MWh)

However as project participant would not supply any electricity to the grid, baseline emission associated to the same would be zero.

So, $EB_y = EG_{CP,y} \times EF_{Elec,y}$ (2)

As the electricity generated by the project activity would have been generated by a new fossil fuel based power generation source (as an extension of existing TPP) in absence of the project activity, the $EF_{Elec,y}$ is $EF_{Captive,,y}$. the same would be computed as follows:

Emission Factor (EF) if the baseline electricity supply source is an identified specific generation source:

The baseline emission factor $EF_{Captive,y}$ is estimated *ex ante* as follows:

$$EF_y = EF_{IGS} = [FI_{IGS} \times COEF_{IGS}] \quad (3)$$

Where:

FI_{IGS} = Is the fossil fuel (*i.e.* coal) consumption rate of the identified generation source (IGS) to supply EG_Y, expressed as GJ per MWh

$COEF_{IGS}$ = Is the emission coefficient of the fuel (*i.e.* coal) used in identified generation source, expressed as tCO_2/per GJ lower heating value.

$$COEF_{IGS} = \frac{EF_{CO2,fuel,IGS}}{NCV_{fuel,IGS}}$$

Where:

$NCV_{fuel,IGS}$ = Is the net calorific value (energy content) per mass or volume unit of a fuel used in identified generating source; (TJ/unit mass or volume)

$EF_{CO2,fuel,IGS}$ = Is the CO_2 emission factor per unit of energy of the fuel used in identified generating source, expressed as tCO_2 per unit mass or volume unit. (TCO_2/unit mass or volume)

The EF_{IGS} would be *calculated* at the start of the crediting period and be fixed for the whole crediting period.

Project activity emissions:

Project emission (PE_y) is the difference in CO_2 emissions from use of fossil fuel in the clinker making process in cement manufacturing unit, where the project is being implemented, before and after the project implementation.

PE_y, is determined as follows:

$$PE_y = \left(EI_{P,y} - EI_B\right) \times O_{Clin\,ker,y} \times COEF_{fuel,y} \quad (4)$$

Where:

EI_B = Is the pre-project energy consumption per unit output of clinker in TJ/ton of clinker produced (*i.e.* measured before the Project activity goes into operation)

$EI_{P,y}$ = Is the *ex post* energy consumption per unit output of clinker for given year, *y*, in TJ/ton of clinker produced

$COEF_{fuel,y}$ = Is the carbon coefficient (tCO_2/TJ of input fuel) of the fuel used in the cement works in year *y* to raise the necessary heat for clinker production

$O_{clinker,y}$ = Is the clinker output of the cement works in a given year *y* expressed in tonnes of clinker

$$EI_B = \frac{F_B}{O_{clin\,ker,B}} \quad (5)$$

Where:

F_B = Is the average annual energy consumption, expressed in TJ, of clinker making process prior to the start of operation of the project activity.

$O_{clinker,B}$ = Is the average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity.

$$EI_{P,y} = \frac{F_{P,y}}{O_{clin\,ker,y}} \quad (6)$$

Where:

$F_{P,y}$ = Is monitored annual energy consumption in a year y, expressed in TJ, of clinker making process

$O_{clinker,y}$ = Is monitored annual output, expressed in a year y, in tonnes of clinker

$$COEF_{fuel,y} = \frac{EF_{CO_2,fuel,y}}{NCV_{fuel,y}} \quad (7)$$

Where:

$NCV_{fuel,y}$ = The net calorific value (energy content) per mass or volume unit of a fuel used in clinker making process in year y; (TJ/unit mass or volume)

$EF_{CO2,fuel,y}$ = The CO_2 emission factor per unit of energy of the fuel used in year y, expressed as tCO_2 per unit mass or volume unit. (tCO_2/ unit mass or volume)

Emission Reductions:

The project activity reduces CO_2 emissions either from the grid or from an identified specific electricity generation source by using waste heat to produce electricity. The emission reduction, ER_y, during a given year y is given by:

$$ER_y = EB_y - PE_y \quad (8)$$

Where:

EB_y = Are the baseline emissions in year y, expressed in tCO_2.

PE_y = Are the project emissions due to possible fuel consumption changes in the cement kilns, of the cement works where the proposed project is located, as a result of the project activity in year y, expressed in tCO_2

Leakage

The leakage emissions are negligible hence ignored.

B.6.2. Data and parameters that are available at validation:

The following parameters, required for the computation of baseline emissions and project emissions (and hence emission reductions resulting from the project activity), are standard parameters which will not be monitored throughout the crediting period and will remain fixed for the entire crediting period. The same will be provided to the Validator during validation of the project activity.

Data / Parameter:	EI_B
Data unit:	TJ/ ton
Description:	Pre-project energy consumption per unit output of clinker in TJ/ton of clinker produced (*i.e*. measured before the Project activity goes into operation).
Source of data used:	Plant records
Value applied:	0.0032 (combined of both CCW and BCW)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of the parameter has been calculated using equation 5 of the baseline methodology by dividing F_B with $O_{clinker, B}$. Project specific data has been used to determine the EI_B. However wherever year's worth pre-project activity data is not available, ex-ante design estimate of clinker production data of CCW has been used along with available measured data of last operational year.
Any comment:	-

Data / Parameter:	F_B
Data unit:	TJ
Description:	Average annual energy consumption, expressed in TJ, of clinker making process prior to the start of operation of the project activity.
Source of data used:	Plant records
Value applied:	CCW: 4022 TJ BCW: 2388 TJ Total: 6411 TJ

Justification of the choice of data or description of measurement methods and procedures actually applied :	As a year's worth pre-project activity data for CCW is not available, ex-ante design estimate of energy consumption data of CCW (CCW has undergone modification) has been used. However for BCW the parameter has been computed based on available measured data of last operational year. The detail computation procedure along with all the assumptions have been provided in Annex 3 (*i.e.* baseline information)
Any comment:	-

Data / Parameter:	$O_{clinker, B}$
Data unit:	Ton/ annum
Description:	Average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity
Source of data used:	Plant record and estimated
Value applied:	CCW: 1 336 500 tons BCW: 691 254 tons Total: 2 027 754 tons
Justification of the choice of data or description of measurement methods and procedures actually applied :	As a year's worth pre-project activity data for CCW is not available, ex-ante design estimate of clinker production data of CCW has been used along with available measured data of last operational year of BCW during computation of $O_{clinker, B}$ following a conservative approach.
Any comment:	-

Data / Parameter:	$EF_{captive, y}$ or $EF_{ELEC,y}$
Data unit:	tCO_2/MWh
Description:	The emissions factor of the baseline electricity supply source which is an identified specific captive power generation source
Source of data used:	Calculated from the equation (8). The determining parameters FI_{IGS} and $COEF_{IGS}$ have been described below.
Value applied:	1.
Justification of the choice of data or	For details please refer to the FI_{IGS} and $COEF_{IGS}$.

description of measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	FI_{IGS}
Data unit:	GJ per MWh
Description:	Fossil fuel (*i.e.* coal) consumption rate of the identified generation source (IGS) to supply $EG_{Y,}$ expressed as GJ per MWh
Source of data used:	Proposal from equipment supplier
Value applied:	12.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of this parameter has been chosen from the proposal provided by the equipment supplier during the conceptualization of the project activity.
Any comment:	-

Data / Parameter:	$COEF_{IGS}$
Data unit:	tCO_2/ TJ
Description:	Emission coefficient of the fuel (*i.e.* coal) used in identified generation source, expressed as tCO_2/per TJ
Source of data used:	"India's Initial National Communication to the United Nations Framework Convention on Climate Change (NATCOM)"
Value applied:	95.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	The factor-$COEF_{IGS}$ has been calculated following the methodological guidance based on Lab Analysis Report (enclosed as Annexure-XIV) conducted on coal which would have been used in the baseline coal based power plant and the same is found to be 0.11665tCO2/GJ (Please refer to worksheet 'COEFigs' for details) . However the same was compared with the same factor reported in "India's Initial National Communication to the United Nations Framework Convention on Climate Change (NATCOM)" which shows this factor as 0.0958tCO2/GJ. Therefore consideration of this factor from NATCOM Report

	will entail a conservative computation of baseline emissions and hence emission reductions. This justifies the consideration of this factor as per the NATCOM Report. .
Any comment:	-

Data / Parameter:	$EF_{CO2, fuel, IGS}$
Data unit:	TCO2/ton of coal
Description:	CO2 emission factor per unit of energy of the fuel used in identified generating source, expressed as tCO2 per unit mass or volume unit. (TCO2/unit mass or volume)
Source of data used:	Not required
Value applied:	Not required
Justification of the choice of data or description of measurement methods and procedures actually applied :	The factor-$COEF_{IGS}$ has been calculated following the methodological guidance based on Lab Analysis Report (enclosed as Annexure-XIV) conducted on coal which would have been used in the baseline coal based power plant and the same is found to be 0.11665tCO2/GJ (Please refer to worksheet 'COEFigs' for details) . However the same was compared with the same factor reported in "India's Initial National Communication to the United Nations Framework Convention on Climate Change (NATCOM)" which shows this factor as 0.0958tCO2/GJ. Therefore consideration of this factor from NATCOM Report will entail a conservative computation of baseline emissions and hence emission reductions. This justifies the consideration of this factor as per the NATCOM Report. Therefore value of $EF_{CO2, fuel, IGS}$ is not required. Please refer to Emission reduction computation sheet for detail computation.
Any comment:	

Data / Parameter:	$NCV_{fuel,IGS}$
Data unit:	TJ/ton of coal
Description:	Net calorific value (energy content) per mass or volume unit of a fuel used in identified generating source; (TJ/ton of coal)

Source of data used:	Not required
Value applied:	Not required
Justification of the choice of data or description of measurement methods and procedures actually applied :	The factor-$COEF_{IGS}$ has been calculated following the methodological guidance based on Lab Analysis Report (enclosed as Annexure-XIV) conducted on coal which would have been used in the baseline coal based power plant and the same is found to be 0.11665tCO2/GJ (Please refer to worksheet 'COEFigs' for details) . However the same was compared with the same factor reported in "India's Initial National Communication to the United Nations Framework Convention on Climate Change (NATCOM)" which shows this factor as 0.0958tCO2/GJ. Therefore consideration of this factor from NATCOM Report will entail a conservative computation of baseline emissions and hence emission reductions. This justifies the consideration of this factor as per the NATCOM Report. Therefore value of $NCV_{fuel, IGS}$ is not required. Please refer to Emission reduction computation sheet for detail computation.
Any comment:	-

Data / Parameter:	$OXID_{fuel,IGS}$
Data unit:	Fraction
Description:	Oxidation ratio of fuel used for power generation for identified generation source.
Source of data used:	IPCC default values
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	As local value is not available IPCC default value has been used following the methodological guideline.
Any comment:	-

Data / Parameter:	$EG_{ATEXIST}$
Data unit:	MWh

Description:	Net electricity generation of the existing captive generation plant prior to project
Source of data used:	Plant Records
Value applied:	180552
Justification of the choice of data or description of measurement methods and procedures actually applied :	The same has been estimated as per the production plan of the existing coal based thermal power plant (TPP) considering 10% auxiliary, 85% plant availability factor, 330 working days.
Any comment:	-

Data / Parameter:	E_{CEMENT}
Data unit:	MWh
Description:	Electricity consumption of cement works prior to project
Source of data used:	Plant Records
Value applied:	225367
Justification of the choice of data or description of measurement methods and procedures actually applied :	E_{CEMENT} has been estimated considering meter records and production plan (along with the consideration of up-gradation) of the plant. The same has been estimated under the following three heads (i) Energy consumption up to clinkerization (ii) Energy consumption during grinding (iii) Energy consumption in the other activities like packaging, lighting, water supply etc. Under each head the energy consumption has been computed based upon two parameters *i.e.* specific electricity consumption and total production, whereas specific electricity consumption has been taken from plant records and total production value has been fixed considering production plan. The detail computation has been submitted to the DOE along with the supportive.
Any comment:	-

Data / Parameter:	E_{LOAD}

Data unit:	MWh
Description:	Electricity consumption of other load in the cement works complex prior to project
Source of data used:	Plant Records
Value applied:	1489
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is measured and as per plant records
Any comment:	-

Parameters for ex-ante estimation of project emission:

Data / Parameter:	ΔEI_i
Data unit:	TJ/ton Clinker
Description:	Ex-ante design estimate of the change in the energy consumption of i^{th} clinker kiln in TJ/ton Clinker, due to project implementation
Source of data used:	Supplier's document
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the equipment supplier[25] there would not be any increase in specific energy consumption for per ton of clinker production after the implementation of the proposed project activity.
Any comment:	-

Data / Parameter:	$COEF_{fuel,y}$
Data unit:	tCO_2/TJ of input fuel
Description:	carbon coefficient (tCO_2/TJ of input fuel) of the fuel used in the cement works in year *y* to raise the necessary heat for clinker production
Source of data used:	Not required as ΔEI_i is assumed to be zero.

[25] Please refer to the certificate issued by the technology supplier.

Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

Data / Parameter:	$O_{clinker,i}$
Data unit:	ton
Description:	Annual clinker production from the ith clinker production line in ton
Source of data used:	Not required as ΔEI_i is assumed to zero
Value applied:	-
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

Ex-ante estimation of Baseline Emissions

The ex-ante computation of baseline emission for the project activity (please refer to 'Annex-3: Baseline Information' for detail computation) is tabulated below:

Sl. No.	Operating Year	Baseline Emission (tonnes of CO_2 e)
1.	April 2011 – March 2012	40026
2.	April 2012 – March 2013	40026
3.	April 2013 – March 2014	40026
4.	April 2014 – March 2015	40026
5.	April 2015 – March 2016	40026
6.	April 2016 – March 2017	40026
7.	April 2017 – March 2018	40026

Sl. No.	Operating Year	Baseline Emission (tonnes of CO_2 e)
8.	April 2018 – March 2019	40026
9.	April 2019 – March 2020	40026
10.	April 2020 – March 2021	40026
Total		**400260**

Ex-ante estimation of Project Emissions

The ex-ante estimate of PE_y would be computed as:

$$PE_y = \sum_i \Delta EI_i \times [O_{clinker,i}] \times COEF_{fuel,i}$$

Where:

i = Is the index for each clinker production line in the cement plant where the project activity is being implemented

ΔEI_i = Is the ex ante design estimate of the change in the energy consumption of each clinker kiln in TJ/ton Clinker, due to project implementation

As the project activity does not lead to any change in energy consumption of each clinker kiln, the ΔEI_i has been considered to be zero. Therefore,

$PE_y = 0$

Where,

PE_y = Project Emissions in the year y (tCO_2)

So

Sl. No.	Operating Year	Project emission (tonnes of CO_2 e)
1.	April 2011 – March 2012	0
2.	April 2012 – March 2013	0
3.	April 2013 – March 2014	0
4.	April 2014 – March 2015	0
5.	April 2015 – March 2016	0

Sl. No.	Operating Year	Project emission (tonnes of CO_2 e)
6.	April 2016 – March 2017	0
7.	April 2017 – March 2018	0
8.	April 2018 – March 2019	0
9.	April 2019 – March 2020	0
10.	April 2020 – March 2021	0
Total		**0**

Ex-ante estimation of Emission Reductions

The ex-ante computation of emission reductions resulting from the project activity (please refer to 'Annex-3: Baseline Information' for detail computation) is tabulated below:

Sl. No.	Operating Year	Emission Reduction (tonnes of CO_2 e)
1.	April 2011 – March 2012	40026
2.	April 2012 – March 2013	40026
3.	April 2013 – March 2014	40026
4.	April 2014 – March 2015	40026
5.	April 2015 – March 2016	40026
6.	April 2016 – March 2017	40026
7.	April 2017 – March 2018	40026
8.	April 2018 – March 2019	40026
9.	April 2019 – March 2020	40026
10.	April 2020 – March 2021	40026
Total		**400260**

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of Proposed project activity Emission (tonnes of CO_2 e)	Estimation of baseline Emissions reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions (tonnes of CO_2 e)
April 2011 – March 2012	0	40026	0	40026
April 2012 – March 2013	0	40026	0	40026
April 2013 – March 2014	0	40026	0	40026
April 2014 – March 2015	0	40026	0	40026
April 2015 – March 2016	0	40026	0	40026
April 2016 – March 2017	0	40026	0	40026
April 2017 – March 2018	0	40026	0	40026
April 2018 – March 2019	0	40026	0	40026
April 2019 – March 2020	0	40026	0	40026
April 2020 – March 2021	0	40026	0	40026
Total (tonnes of CO_2 e)	**0**	**400260**	**0**	**400260**

B.7. Application of the monitoring methodology and description of the monitoring plan:

Title: Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants

Reference: Approved baseline methodology AM0024/version 02.1. Sectoral Scope: 01 and 04

B.7.1 Data and parameters monitored:

The approved consolidated monitoring methodology requires the project proponent to monitor the following parameters for the computation of baseline emissions, project emissions and hence the emission reductions resulting from the project activity. The parameters and the monitoring procedures are detailed below:

Data / Parameter:	$EG_{CP,y}$
Data unit:	MWh
Description:	Electricity supplied from the project activity to the cement plant
Source of data to be used:	Plant record
Value of data applied for the purpose of calculating expected emission reductions in section B.5	34810
Description of measurement methods and procedures to be applied:	Monitoring Procedure: Will be monitored continuously (on-line measurement) with energy meter. The same will also be available in the power plant Distributed Control System (DCS) Accuracy of measurement: As per the national or sectoral standard Data Type: Measured and calculated Archiving Procedure: Paper/ Electronic Recording Frequency: Continuously and summarized monthly and annually Responsibility: Operator Calibration Frequency: Annually Proportion of data monitored: 100%
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice. The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters once in a year
Any comment:	The data will be recorded and archived for the whole crediting period plus two years

Data / Parameter:	$EI_{P,y}$
Data unit:	TJ/ tonne
Description:	Ex post energy consumption per unit output of clinker for given year, y, in TJ/ton of clinker produced
Source of data to be used:	Plant record
Value of data applied for the purpose of	The same is not used during ex-ante emission reduction computation

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	This value would be computed by dividing $F_{P,y}$ with $O_{clinker,y}$ in the year *y*. Monitoring Procedure: Please refer to the monitoring tables below for $F_{P,y}$ and $O_{clinker,y}$ Accuracy of measurement: Please refer to the monitoring tables below for $F_{P,y}$ and $O_{clinker,y}$ Data Type: Calculated Archiving Procedure: Paper/ Electronic Recording Frequency: Annually Responsibility: Operator Calibration Frequency: Not applicable Proportion of data monitored: 100%
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice. The uncertainty level of the parameter will be low since the determining parameters will be monitored with calibrated meters once in a year.
Any comment:	The data will be recorded and archived for the whole crediting period plus two years

Data / Parameter:	$F_{P,y}$
Data unit:	TJ
Description:	Annual energy consumption in year y of clinker making process
Source of data to be used:	Plant record
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This has not been used for ex-ante emission reduction computation.

Description of measurement methods and procedures to be applied:	This value would be computed by multiplying the annual coal consumption data for clinker production and the average net calorific value of fuel in the year *y*. Monitoring Procedure: Please refer to the monitoring tables below for coal consumption and $NCV_{fuel,y}$ Accuracy of measurement: Please refer to the monitoring tables below for coal consumption and $NCV_{fuel,y}$ Data Type: Measured Archiving Procedure: Paper/ Electronic Recording Frequency: Continuously, Summarized monthly and annually Responsibility: Operator Proportion of data monitored: 100%
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice. The uncertainty level of the parameter will be low since the determining parameters will be monitored with calibrated meters once in a year.
Any comment:	The data will be recorded and archived for the whole crediting period plus two years

Data / Parameter:	$O_{clinker,y}$
Data unit:	Ton
Description:	clinker output of the cement works in a given year *y*
Source of data to be used:	Plant record and annual report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	CCW: 1336500 tons BCW: 660000 tons Total: 1996500 tons (Ex- ante estimation)
Description of measurement methods and procedures to be applied:	Monitoring Procedure: The parameter will be monitored continuously with the help of weighing machines. The values will also be available in the Distributed Control System (DCS). Accuracy of measurement: As per the national or sectoral standard

	Data Type: Measured Archiving Procedure: Paper/ Electronic Recording Frequency: Continuously, Summarized monthly and annually Responsibility: Operator Calibration Frequency: Annually. Proportion of data monitored: 100%
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice. The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters once in a year.
Any comment:	The data will be recorded and archived for the whole crediting period plus two years

Data / Parameter:	Coal consumption
Data unit:	tonnes
Description:	Annual coal consumption in year y for clinker making
Source of data to be used:	Plant record
Value of data applied for the purpose of calculating expected emission reductions in section B.5	During ex-ante emission reduction calculation ΔEI_i has been assumed zero. So no value for coal consumption is considered in the calculation
Description of measurement methods and procedures to be applied:	Monitoring Procedure: Coal consumption will be monitored by weighing machines. Accuracy of measurement: As per the national or sectoral standard Data Type: Continuously Archiving Procedure: Paper/ Electronic Recording Frequency: Continuously (will be archived on a monthly and yearly basis) Responsibility: Operator Calibration Frequency: Annually Proportion of data monitored: 100%

QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice. The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters once in a year.
Any comment:	The data will be recorded and archived for the whole crediting period plus two years

Data / Parameter:	$COEF_{fuel,y}$
Data unit:	tCO_2/TJ of input fuel
Description:	carbon coefficient (tCO_2/TJ of input fuel) of the fuel used in the cement works in year y to raise the necessary heat for clinker production
Source of data to be used:	Calculated following equation 5 of the approved methodology AM 0024, VER – 02.1, using the value of $NCV_{fuel,y}$, $EF_{CO2,f\ uel,y}$ and $OXID_{fuel,y}$
Value of data applied for the purpose of calculating expected emission reductions in section B.5	During ex-ante emission reduction calculation ΔEI_i has been assumed zero. So no value for $NCV_{fuel,y}$ is considered in the calculation.
Description of measurement methods and procedures to be applied:	Calculated following equation 5 of the approved methodology AM 0024, VER – 02.1, using the value of $NCV_{fuel,y}$, $EF_{CO2,f\ uel,y}$ and $OXID_{fuel,y\backslash}$ Data Type: Calculated Archiving Procedure: Paper/ Electronic Recording Frequency: Monthly Accuracy of measurement: As per the national or sectoral standard Responsibility: Operator Proportion of data monitored: 100%
QA/QC procedures to be applied:	The uncertainty level of the parameter will be low since the same has been taken ‘National Council For Cement And Building Materials’
Any comment:	The data will be recorded and archived for the whole crediting period plus two years

Data / Parameter:	$NCV_{fuel,y}$
Data unit:	TJ/ton of fuel
Description:	Net calorific value (energy content) per mass unit of a fuel used in clinker making process in year *y*
Source of data to be used:	Lab analysis conducted by independent third party
Value of data applied for the purpose of calculating expected emission reductions in section B.5	During ex-ante emission reduction calculation ΔEI_i has been assumed zero. So no value for $NCV_{fuel,y}$ is considered in the calculation.
Description of measurement methods and procedures to be applied:	Monitoring procedure: Lab analysis conducted by independent third party Data Type: Measured Archiving Procedure: Paper/ Electronic Recording Frequency: Monthly Accuracy of measurement: As per the national or sectoral standard Responsibility: Operator Proportion of data monitored: 100%
QA/QC procedures to be applied:	The uncertainty level of the parameter will be low since the same has been taken 'National Council For Cement And Building Materials'
Any comment:	The data will be archived for the entire crediting period and two more years.

Data / Parameter:	$EF_{CO2,f\ uel,y}$
Data unit:	tCO_2/ton of fuel
Description:	CO_2 emission factor per unit of energy of the fuel used in year y, expressed as tCO_2 per unit mass or volume unit.
Source of data to be used:	Lab analysis conducted by independent third party
Value of data applied for the purpose of calculating expected emission reductions in	During ex-ante emission reduction calculation ΔEI_i has been assumed zero. So no value for $NCV_{fuel,y}$ is considered in the calculation.

section B.5	
Description of measurement methods and procedures to be applied:	Monitoring procedure: Lab analysis conducted by independent third party Data Type: Measured Archiving Procedure: Paper/ Electronic Recording Frequency: Monthly Accuracy of measurement: As per the national or sectoral standard Responsibility: Operator Proportion of data monitored: 100%
QA/QC procedures to be applied:	The uncertainty level of the parameter will be low since the same has been taken 'National Council For Cement And Building Materials'
Any comment:	The data will be recorded and archived for the whole crediting period plus two years

Data / Parameter:	$OXID_{f\,uel,y}$
Data unit:	fraction
Description:	Oxidation ratio of fuel used in clinker production
Source of data to be used:	IPCC default value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	Regulations and/or policy that could influence the use of waste heat and generation of power in the region
Data unit:	-
Description:	Regulations and/or policy that could influence the use of waste heat and generation of power in the region in year *y*
Source of data to be used:	Implemented legislation or regulation introduced by the Government of India
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	Implemented regulation or legislation will be considered for the entire crediting period.

B.7.2. Description of the monitoring plan:

Please refer to 'Annex-4: Monitoring Plan' of the PDD for detail description of the Monitoring Plan.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

Parameter	Details
Date of completing the final draft of this baseline selection and monitoring plan	09/09/2010

Name of person/ entity determining the baseline and establishing the monitoring plan	Birla Corporation Limited

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:

28/05/2008 (date of signing of agreement with the technology supplier)

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

25 years[26]

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:

N.A

C.2.1.2. Length of the first crediting period:

N.A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

1/04/2011 (or on registration with UNFCCC whichever is later)

C.2.2.2. Length:

10 y 0 m

SECTION D. Environmental impacts

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

[26] Please refer to the certificate issued by the technology supplier.

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

Schedule 1 of Ministry of Environment and Forests (Government of India) notification dated January 27, 1994 has specified 30 activities that are required to undertake environmental impact assessment (EIA) studies. The details of these activities are available at:

http://envfor.nic.in/divisions/iass/notif/eia.htm

The project activity does not fall under the list of activities requiring EIA. As per the directives of the Ministry of Environment and Forests Government of India (the central governmental authority regulating the assessment of environmental impacts of industrial activities), environment impact assessment of the project activity is not mandatory.

There have not been any negative impacts on the environment during the implementation or operation of the project activity

D.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:

The project activity aims at generation of power utilising the heat content of the waste and flue gas. This will primarily reduce the thermal load of the baseline environment. Furthermore with heat extraction in the waste heat recovery boilers; the operational efficiency of the ESP will be enhanced resulting in reduction in the dust emission level. Therefore the project activity primarily has only positive environmental impacts. However the project performance will be monitored as a part of the regular Environmental Monitoring Plan of BCL and negative impacts, if any, will immediately be taken care off.

SECTION E. Stakeholders' comments

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

Stakeholder consultation is an integral component of every project implementation at BCL. As a responsible corporate citizen, BCL has been consistently consulting with all the identified stakeholders for their feedbacks/opinions and suggestions on the project activity implementation. The following operating protocol is followed for stakeholder consultation at BCL:

Identification of Stakeholders: All the government, non-governmental organisations and private parties who are involved during any stage of project implementation are considered to be a stakeholder for the project activity. For *e.g.*, the following stakeholders are identified for the project activity under consideration:

- Elected body of the representatives administering the local area (Local Nagar Palika)
- Employees of BCL
- Worker's union
- Local NGO

Information Sharing: Salient information about the project activity are forwarded and explained to the identified stakeholders by the representatives of BCL in a way that they clearly understand all the aspects of the project activity implementation. The stakeholders are communicated through written communication (notice dated 16th July, 2008) and requested to provide their feedbacks/opinions and suggestions to BCL regarding the project activity.

Compilation of the comments received: The comments received from all the stakeholders are compiled and considered by the project team of BCL. Here below is the name of the stakeholders along with the date on which they received the communication.

- Elected body of the representatives administering the local area (Local Nagar Palika): 23rd July, 2008
- Employees of BCL: 21st July, 2008
- Worker's union: 23rd July, 2008
- Local NGO: 23rd July, 2008

In case of any significant comment, received from the stakeholders, the same is escalated to the Management Level and necessary actions are taken in order to address the same.

Please refer to the following section for details on the comments received from all the stakeholders identified for the project activity under consideration.

E.2. Summary of the comments received:

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
Comments Received from Non-Governmental Parties				
1	Nagar palika	Brief details on the project activity, its socio-economic and environmental impacts are verbally communicated to the elected representatives of the Local nagar palika the consultants and the equipment suppliers of the project activity. They are also requested to provide their feedbacks on the same.	The nagar palika acknowledged the positive socio-economic and environmental impacts of the project activity. They commended BCL's initiative of implementing the project activity without causing any population dislocation and their role in generating local employment opportunities. They have assured their support to the Management of BCL.	BCL has received a written consent from the nagar palika for the project activity.
2	Employees of BCL	The employees of BCL have been communicated verbally about the project activity implementation.	The employees of BCL realized the positive attributes of the project activity. They have appraised the Management's decision to implement the project activity and assured their support for the same.	BCL has received a written consent from the employees for the project activity.
3	Non-	The project activity	The NGO has	BCL has received a

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
	Governmental Organizations (NGOs)	details, its associated environmental impacts and its contribution towards the up-liftment of the social and economic structure of the locality have been briefed to the NGO through a formal letter and their opinion on the same was requested for.	appreciated the initiative of BCL towards socio-economic development of the locality and their commitment towards developing an environment friendly manufacturing process.	written consent from the NGO for the project activity.
4	Worker's union	The employees of BCL have been communicated verbally about the project activity implementation.	The employees of BCL realized the positive attributes of the project activity. They have appraised the Management's decision to implement the project activity and assured their support for the same.	BCL has received a written consent from the employees for the project activity.

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

BCL has so far received only positive feedbacks on the project activity from all the stakeholders. However stakeholder consultation is an on-going process and BCL will continue the process. All the comments received, so far, have been considered and given due consideration while preparing the CDM Project Design Document.

Furthermore, as per the requirement of UNFCCC, the CDM Project Design Document will be web-hosted on the DOE's (Designated Operational Entity) website for a period of one month for global stakeholder

consultation. The comments received by the Validator during the period of global stakeholder consultation will be properly addressed as a part of the CDM process.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public Funding is available for the project activity

Annex 3
BASELINE INFORMATION

Calculation for EI_B					
Sl no	Parameter	Notation	Unit	Value	Remark
	Assumptions - CCW				
1	Pre-project coal consumption	Not Applicable	tons	130619	Last one year's coal consumption; source: plant records - 2008-09
2	NCV of coal used in the pre-project scenario	Not Applicable	TJ/t	0.023	Last one year's coal analysis; source: plant records 2008-09
3	Clinker production in the pre-project scenario	Not Applicable	tons	964208	Last one year's clinker production; source: plant records 2008-09
4	Design estimate of energy consumption per unit output of clinker after capacity augmentation	Not Applicable	kCal/kg	719	As per the up-gradation scheme of CCW the specific energy consumption for clinker production will decrease by 20 kCal/ kg with respect to the pre-project scenairo (Please refer to ATEC guaranteed figure)
5	Design estimate of energy consumption per unit output of clinker after capacity augmentation	Not Applicable	TJ/t	0.0030	Computed based on parameter number 1,2,3 and 4
6	Clinker production after up-gradation	Not Applicable	tons	1336500	Considering the production capacities of CCW as 4050 tpd and annual operating days for both to be 330
7	Energy requirement for clinker production in the baseline scenario	Not Applicable	TJ	4022	Computed based on metered reading and production plan of CCW in line with the guidance provided by the methodology
	Assumptions - BCW				
8	Pre-project coal consumption	Not Applicable	tons	84626	Last one year's coal consumption; source: plant records - 2008-09
9	NCV of coal used in the pre-project scenario	Not Applicable	TJ/t	0.0282	Last one year's coal analysis; source: plant records 2008-09
10	Clinker production in the pre-project scenario	Not Applicable	tons	691254	Last one year's clinker production; source: plant records 2008-09
11	Pre- project energy consumption per unit output of clinker	Not Applicable	TJ/t	0.0035	Computed based on parameter number 8,9 and 10
12	Baseline energy consumption per unit output of clinker for BCW	Not Applicable	TJ/t	0.0035	As there is no upgradation plan in BCW , energy conusmption per unit output of clinker would remain same (as it is in the pre-project scenario)
13	Clinker production	Not Applicable	tons	691254	Last one year's clinker production; source: plant records 2008-09
14	Energy requirement for clinker production in the baseline scenario	Not Applicable	TJ	2388	Computed based on metered reading and production plan of CCW in line with the guidance provided by the methodology
	Computation of E_{IB}				
15	Average annual energy consumption of clinker making process prior to the start of operation of the project activity	F_B	TJ	6411	Computed based on parameter number 7 and 14
16	average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity	$O_{clinker.B}$	tons	2027754	Computed based on parameter number 6 and 13
17	Baseline energy consumption per unit of clinker production for BCL, Chanderia unit (BCW +CCW)	EI_B	TJ/t	0.0032	Computed based on parameter number 15 and 16

Annex 4

MONITORING INFORMATION

The proposed project activity will result in emission reductions through waste heat recovery based power generation. The financial performance of the project activity depends significantly on the CDM revenue to be availed through sale of Certified Emission Reduction (CER) units accrued from the project activity. This will require proper monitoring of all the relevant GHG performance parameters. Therefore the project participant has developed a robust monitoring protocol which will be followed throughout the proposed crediting period in order to ensure proper operation of the project activity resulting in generation of carbon credits. This includes 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 measurement approaches for the project activity.

This robust and meticulous monitoring plan has been developed in order to ensure:

- proper monitoring and recording of all the parameters required for the computation of emission reductions from the project activity
- proper evaluation of the project activity performance at regular intervals
- future improvements the data monitoring, recording and archiving system in case of any discrepancies observed

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and Reporting

Frequency of Monitoring

Frequency of monitoring of each relevant parameter has been chosen by project proponent in such a manner so that it can suitably justify the appropriateness of the emission reduction unit. Detailed monitoring plan with frequency of each relevant parameter has been mentioned in section B.7.1.

Reliability

The parameters will be monitored following prevalent industry standard procedure.

Accuracy of measurement: As per the national or sectoral standard

Archiving Procedure: Paper/ Electronic

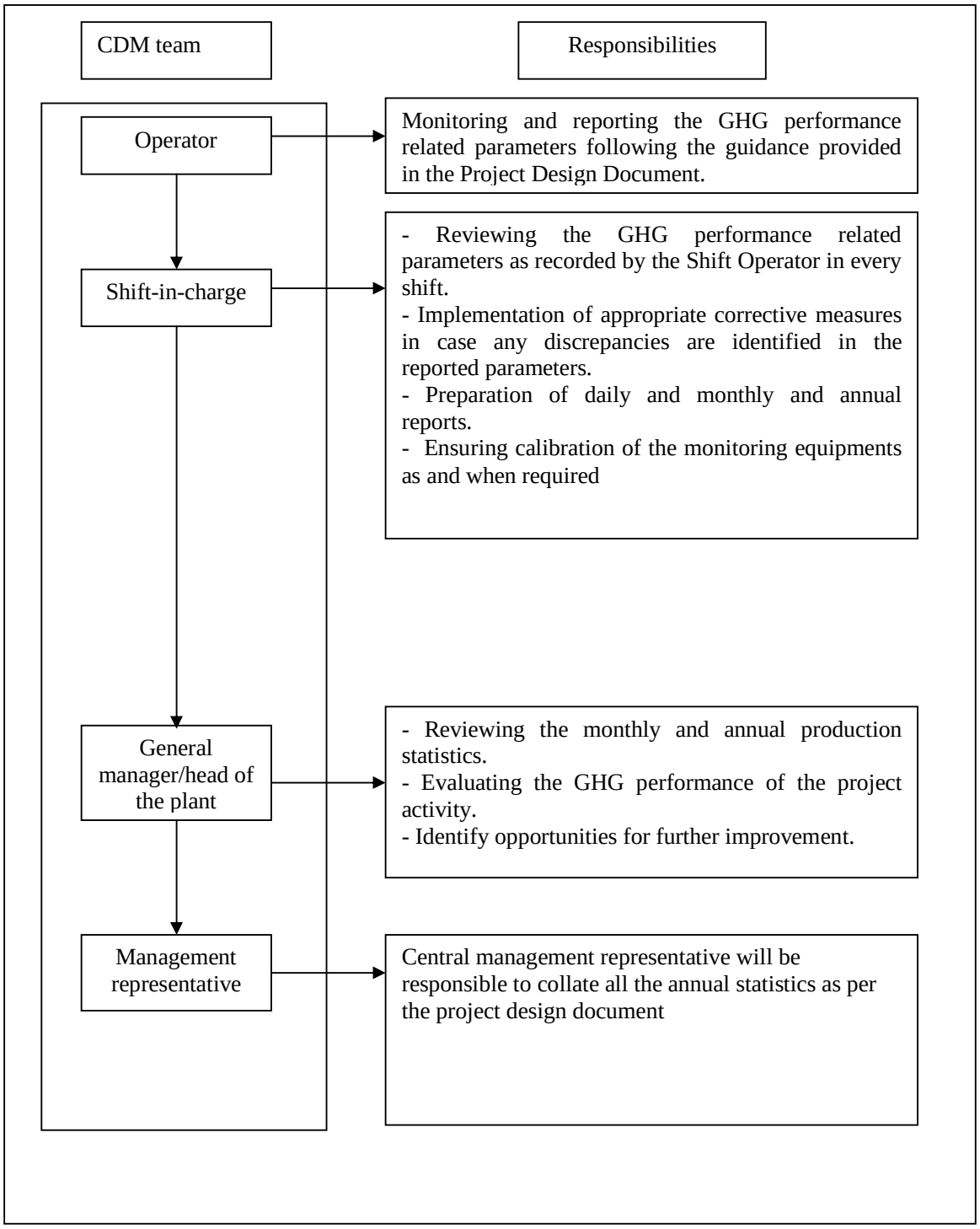
Recording Frequency: Summarized monthly and annually

Responsibility: Operator

Calibration Frequency: Annually

All parameters included in Section.B.7.1 will be monitored for the whole crediting period.and further two years.

Operational structure:



Experience and training:

The Head (Power Plant) will be qualified engineer/ diploma holder with prior work experience. The Shift In-charge will be diploma holder. All the Shift Operators will be provided with extensive on-the-job trainings under the guidance of the Shift In-charge which will include training on plant operations, data monitoring and report generation.

Annexure- 5

Allotment of 2% of the revenue accrued from sale of CERs in society/ community development schemes

Activity	Estimated Budget towards sustainable development (In % of annual CER revenue received by the company)
Education: (1) Infrastructural up- gradation of local primary schools, secondary schools and vocational institutes (ITI) (2) Award of scholarships to meritorious students (3) Conduct Adult education campaign	0.80%
Health and Sanitation: (1) Modernization of rural health centres (2) Donation and maintenance of ambulance service (3) Monthly Medical camps (4) Construction and operation of water supply schemes (Bore Well, Tube Well etc) for nearby villages (5) Vaccination campaigns (6) Improving sanitation in villages	0.70%
Community: (1) Modernization of Village Community centres (2) Improvement of street lightings of nearby villages (3) Capacity building of women and youth for livelihood and employment opportunities (computer education, handicrafts, *etc.*) (4) Other activities in consultation with village panchayats and the community	0.50%
Total (in % of annual CER revenue)	**2.00%**