



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

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**SECTION A. General description of project activity.****A.1. Title of the project activity:**

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

Version: 04

Date: 30/03/2011

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 Satna, Madhya Pradesh. 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 (BCL), Satna unit comprises of two cement manufacturing sub-units *i.e.* Birla Vikas Cement (BVC) and Satna Cement Works (SCW), located in the same premise of BCL. As project participant has upgraded its SCW plant from 3400 tpd¹ of clinker to 4500 tpd (upgraded on 29th September, 2008) and BVC plant from 2900 tpd to 5100 tpd (up-graded on 24th July, 2010), the combined capacity of Satna unit reaches to 3.216 MTPA² of clinker. This up-gradation has led to an increase in power demand. Initially (*i.e.* before the up-gradation) the power demands of the cement manufacturing facility of BCL, Satna unit were primarily met by the power from existing fossil fuel (*i.e.* coal) fired captive Thermal Power Plant (TPP) of capacity 27 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 comprising of two independent waste heat recovery based power generating facility (*i.e.* project activity)³. These two independent power generating facilities (each of them will be comprised of 3

¹ Tonnes per day

² Million tonnes per annum

³ Balance power requirement will be met from grid.



boilers and one 7.5MW TG set) will generate power utilizing the waste heat of waste gas emanating from pre-heater towers and clinker coolers of respective clinker production lines BVC and SCW⁴.

This waste heat recovery based captive power plant will generate power to the tune of 65.3 GWh_e per annum (net electricity generation)⁵. The power generated under the project activity will be catered to two clinker production lines (i.e. SCW and BVC) through a common bus bar.

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 65.3 GWh_e per annum which will lead to an annual reduction in GHG emission by 75087 ton of CO₂ equivalent *i.e.* a quantum of 750870 tCO₂ 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

⁴ However it is noteworthy to mention both the clinker production lines (i.e. SCW and BVC) along with their respective waste gas based power generating facilities are situated in the same premise of Birla Corporation Limited, Satna unit.

⁵ Please refer to section A.4.3 for further details



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 upliftment 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 (air) 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:

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	No



	(Private Entity,)	
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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.:

Central India/Madhya Pradesh/ Satna

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

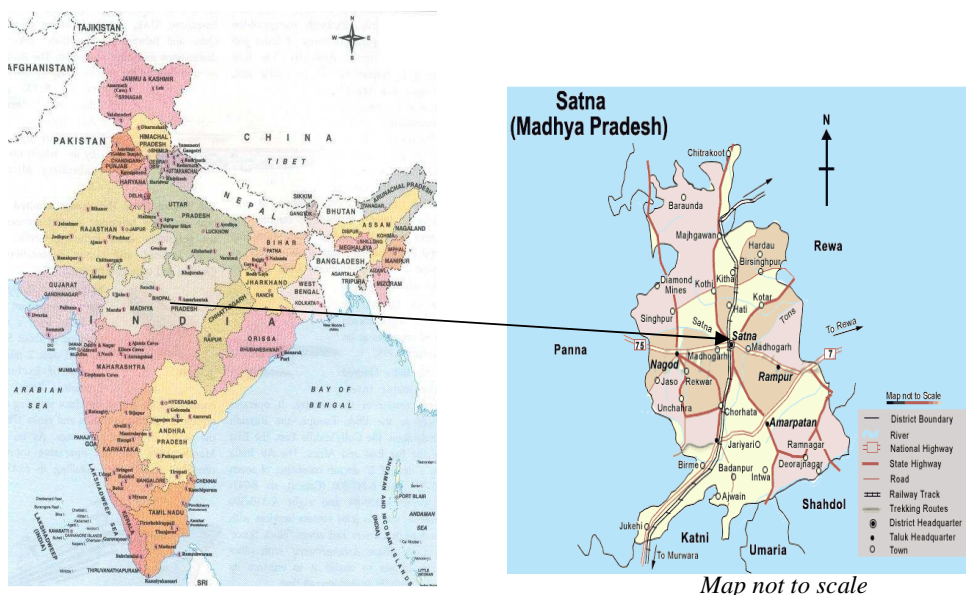
Satna

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 Satna plant consisting of Satna Cement Works (SCW) and Birla Vikash Cement (BVC) located at Satna, Madhya Pradesh. Satna is well connected by rail and road links. National Highway passes through this town. The nearest Airport is at Khajuraho which is about 130 Km away.

Latitude: **24°34'03" N**Longitude: **80°55'06" E**

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 Entities⁶.

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) comprising of two independent power generating facilities, located in the same plant premise of BCL, Satna unit. These two independent power generating facilities will generate power utilizing the waste heat emanating from waste gas of pre-heater towers and clinker coolers of respective clinker production lines of BVC and SCW.

⁶ <http://cdm.unfccc.int/DOE/scopes.html>



Under the proposed project activity waste heat recovery boilers will recover the waste heat of the emanating gas of clinker cooler and the pre-heater tower in the form of steam and subsequently will supply the same to turbo generator (TG) set to generate power (in each of the two production lines). The project equipments are as follows:

Birla Vikash Cement (BVC):

- One boiler at the downstream of the Kiln pre-heater at BVC to utilise the flue gas of the same
- Two boilers at the downstream of the clinker cooler at BVC to utilise the waste gas of the same
- One 7.5MW TG set

Satna Cement Works (SCW):

- One boiler at the downstream of the Kiln pre-heater at SCW to utilise the flue gas of the same
- Two boilers at the downstream of the clinker cooler at SCW to utilise the waste gas of the same
- One 7.5MW TG set

Uniqueness of the technology:

Although in SCW and BVC many a waste gas streams are available from pre-heater tower and clinker cooler, it is difficult to entrap that waste heat and utilize the same in power generation because of its low temperature. In view of this constraint, the equipments and their ratings have been designed (by technology supplier) in such a way so that the same could generate power to the best possible.

In each of the power generating facilities three boilers will be installed to entrap waste heat of waste gases emanating from pre-heater tower and cooler in the form of steam. Thereafter this steam will be sent to 7.5MW TG set for power generation.

Maximum power generation capacity of the turbine will be to the tune of 7.5MW. However it is not possible to generate power at this rate throughout the day. Because a substantial quantity of hot gas emanating from pre heater tower is used in coal mills for coal drying purpose. In BVC and SCW, coal mill runs at 20 hours/day to supply adequate quantity of coal to kiln for clinker production (following the design capacity the coal mills). During this time period hot gas needs to be supplied for coal drying. And the same will subsequently reduce the power generation rate. The quantity of waste gas capable to generate power at the rate of 7.5MW is available only for 4 hours per day (while coal mills are off). Considering this fluctuation in waste gas availability the daily average power generation rate will be to the tune of 6MW (approx).

However even this daily average power generation will fall during monsoon season⁷. In monsoon season coal contains higher moisture. Therefore during that period (75 days per annum) coal drying process requires higher quantity of hot gas, resulting a regular shortfall of hot gas for power generation. Considering the same daily average power generation will be tune of 4.5MW (approx) in monsoon season.

⁷ In non monsoon season the daily average power generation rate will be to the tune of 6MW.



Parameters like clinker production, waste gas temperature may also influence power generation. Few of them are mentioned below (as suggested by technology supplier) -

- The waste heat recovery based power generation system has been designed considering clinker upgraded production capacity of SCW *i.e.* 4500TPD (upgraded from 3400TPD) and BVC *i.e.* 5100TPD (upgraded from 2900TPD). If the expected production level is not achieved, the same will lead to less waste gas (waste heat) generation and subsequently decrease in power generation.⁸
- Any forced plant (kiln, calciner) shutdown or fluctuation in raw material availability would lead to further reduction in clinker production and subsequent reduction in power generation through waste heat recovery based power generation system.
- Reduction in clinker production by 100TPD would lead to reduction in power generation capacity by 0.09MW during mill on condition and 0.12MW during mill off condition
- If the daily ambient temperature goes above 35 degree Celsius, which is a very likely scenario, the power generation will fall
- The rated power generation capacity (both during mill on and off condition) of the waste heat recovery based power generation system is subjected to operating conditions (like temperature) of waste gas emanating from pre-heater tower and clinker cooler as well. Any change in the same would directly affect the power generation. Like reduction in waste gas temperature at boiler I inlet by 10⁰C (reference 280⁰C) would lead to reduction in generation capacity by 0.243MW

During annual electricity generation computation all the above uncertainties have been accounted by considering a waste gas availability factor of 80%⁹ as suggested by technology supplier¹⁰. The same is also supported by an independent consultant¹¹.

:

Detail electricity generation computation is as follows:

⁸ However both the clinker production lines are yet to achieve these capacities (i.e. 4500TPD for SCW and 5100 TPD for BVC). As per the recent clinker production (as up-gradation has already been carried out) data SCW has produced clinker at the rate of 4090TPD (from April 2010 to March 2011) and BVC has produced clinker at the rate of 4159TPD (from August 2010 to March 2011). Therefore in totality there is a significant short fall of clinker production with respect to the expected production capacity due to up-gradation.

⁹ The waste heat recovery based captive power plant has come under operation. And generation is slightly lower than what was expected. The same has produced power at the rate of 3.33 MW in SCW (based on plant data of March 2011). However the power generation rate in BVC is very low. The same will take some more time to stabilize. The data has been shared with DOE.

¹⁰ M/S. Dalian

¹¹ M/S Cethar Consulting Engineers Pvt. Ltd.



Assumptions for WHRB based power generators						
Parameter description	Key factors considered during designing	Unit	SCW		BVC	
			Normal Season	Rainy Season	Normal Season	Rainy Season
TG capacity	Not applicable	MW	7.5		7.5	
Maximum power generation capacity	Coal mill off condition (4 hours /day)	MW	7.5		7.5	
Daily average power generation rate (when clinker production line is maintaining its design operating parameters)	In normal season (i.e. non monsoon season) - coal mill on and off condition In rainy season (i.e. monsoon season)- mill on and off condition, increased moisture content of coal.	MW	5.9	4.59	6	4.46
Annual Working Days	Planned and forced shutdown of clinker production lines	Days	260	75	260	75
Waste gas availability factor	Waste gas temperature, clinker production rate, ambience temperature, waste gas pressure etc.	%	80	80	80	80
plant availability	Forced shutdown of waste heat recovery based power generating equipments (like boilers, TG sets etc.)	%	98	98	98	98
Generation	Not applicable	Million kWh/annum	29	6	29	6
Total Generation	Not applicable	Million kWh/annum	71			
Auxiliary Power Consumption	Not applicable	%	8			
Net Generation	Not applicable	Million kWh/annum	65.31			

Detail plant lay out is as follows:

Fig. -1: Plant Layout – Birla Corporation Limited – Unit Satna

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

Years	Estimation of annual emission reductions in tones of CO ₂ e
July 2011 – June 2012	75087
July 2012 – June 2013	75087
July 2013 – June 2014	75087
July 2014 – June 2015	75087
July 2015 – June 2016	75087



Years	Estimation of annual emission reductions in tones of CO ₂ e
July 2016 – June 2017	75087
July 2017 – June 2018	75087
July 2018 – June 2019	75087
July 2019 – June 2020	75087
July 2020 – June 2021	75087
Total estimated reductions CO₂ e	750870
Total number of crediting years	10
Annual average of the estimated reductions o the crediting period (tCO₂ e)	75087

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

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-Satna. 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 Satna is met partially by the power from existing fossil fuel (i.e. coal) based TPP and grid power in the pre-project scenario. Therefore there is no scope of electricity export to the grid in the pre-project scenario. In the post project scenario, along with the existing TPP, the project activity will cater to the electricity demand to the cement manufacturing facility. Rest of the demand will be met by the grid power. The baseline selection has been made considering the power demand of BCL, Unit - Satna as explained in the Section B.



“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;”

In the pre-project scenario the existing TPP which is one of the sources of power for the cement manufacturing facility of BCL, unit-Satna 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 the pre-project scenario the waste heat of the emanating gas of pre-heater and clinker cooler is 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 is 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).”



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

- *CO₂ 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 SCW and BVC;



- 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 existing captive power generation source to the cement manufacturing facility of SCW and BVC
- Grid (NEWNE)

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

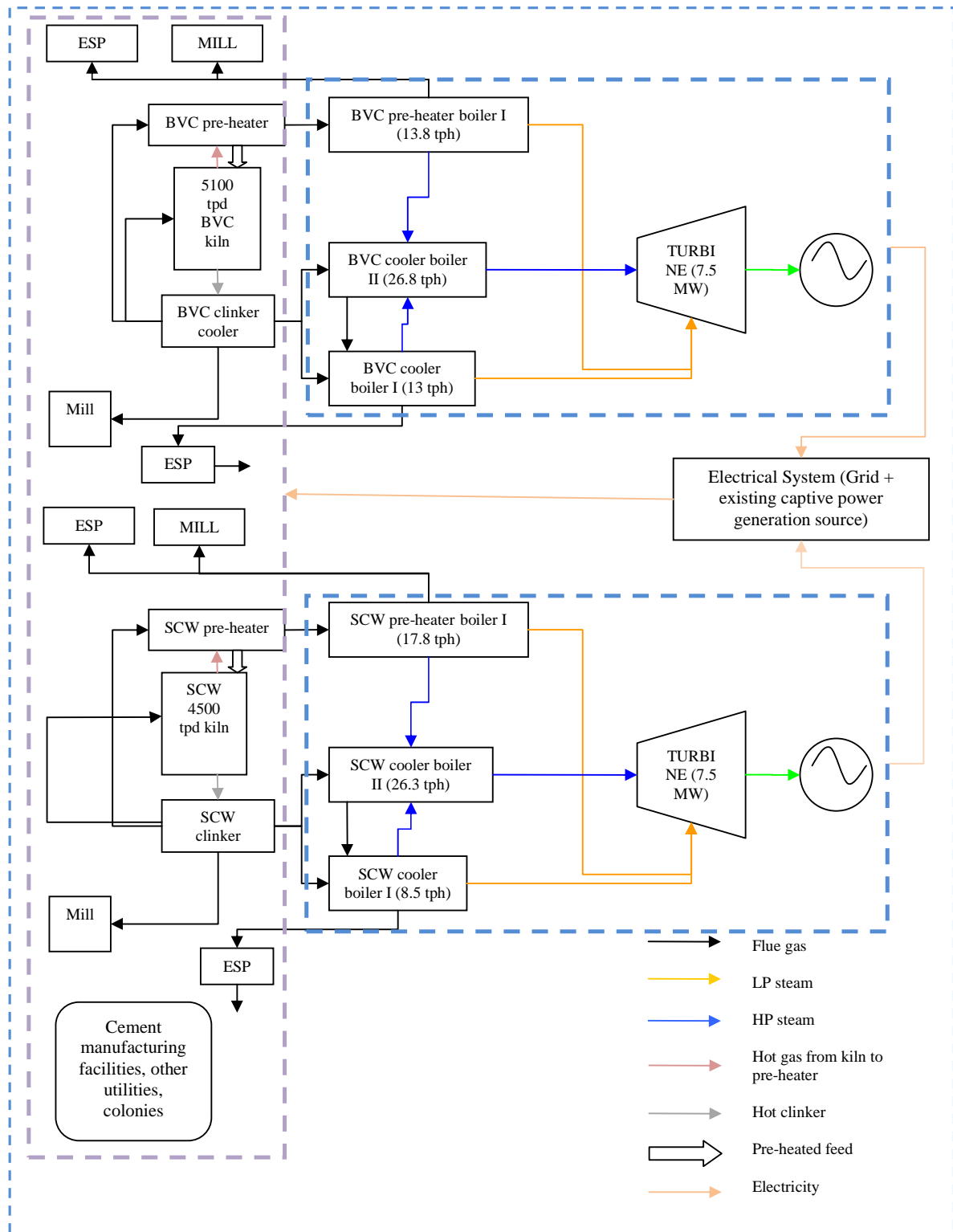


Fig. 2 – Project Boundary



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 ₂ O	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 ₂ O	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, Satna unit. So it is evident from the above statement that there is no other utility point *i.e.* demand 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. 1 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 kWh units)			
Year	E_{cement}	E_{load}	Total demand
2006-07	199.58	11.07	210.64
2007-08	204.31	12.16	216.47
2008-09	210.16	11.97	222.13
2009-10	228.69	11.53	240.23
2010-11	278.80	7.40	286.20
2011-12 (crediting period starts from July 2011)	278.80 ¹²	7.40	286.20

- (ii) $EG_{ATEXIST}$ 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 kWh units)		
Year	$EG_{ATEXIST}$	Balance Power Requirement (grid /identified generation source/waste heat recovery based CPP)

¹² In line with the methodology the E_{CEMENT} in 2010-11 and 2011-12 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.



2006-07	167.55	43.09
2007-08	180.40	36.07
2008-09	177.25	44.88
2009-10	189.60	50.62
2010-11	182	104.20
2011-12 (crediting period starts from July 2011)	182 ¹³	104.20

- (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 projection of future power demand and supply has already been done and duly presented. Since the project participant is opting for fixed crediting period (*i.e.* 10 years), same analysis at the start of crediting period is not required

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

¹³ In line with the methodology the E_{GATEXIST} in 2010-11 and 2011-12 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.



power requirement). Since it is a realistic and credible alternative of the project activity it has been considered as part of baseline.

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

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.

- **Alternative 3:** Import of power from grid

In absence of the project activity the project participant could have imported the power from the western regional grid which is now a part of the NEWNE grid to meet the balance power requirement. However in this case cost of grid power is substantially higher (3.89 INR/kWh as per power purchase rate of December 2007) than that in alternative 1 and alternative 2. IRR computations for Alternative 1 and 2 have been done based upon the saving in grid electricity import. Furthermore it is a very unlikely scenario to import such a quantum of electricity in the local context instead of setting up a new power plant. So this is not 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*)

Diesel based electricity generation is highly expensive (price of diesel is around 31.25 INR/litre¹⁴). So, diesel based power generation is not a plausible alternative. Hence this option has not been further considered for baseline determination.

On the other hand, considering the locational disadvantages *i.e.* non-availability of natural gas in Madhya Pradesh¹⁵ where the project activity plant is situated, this alternative cannot be considered feasible.

Hence this option has not been further considered for baseline determination.

¹⁴ Source: <http://uk.reuters.com/article/idUKDEL1697420080214>

¹⁵ Source: <http://petroleum.nic.in/ng.htm>

***Step 2: Compliance with regulatory requirements:***

The alternatives listed in the *Step 1* are outlined which are under further consideration in the selection of baseline scenario (most realistic and credible alternative)

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. Assumptions have been mentioned in sub-step 2.c of section B.5.

<i>Alternatives</i>	<i>IRR (%)</i>
<i>Scenario 1</i>	17.36
<i>Scenario 2</i>	26.30

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.

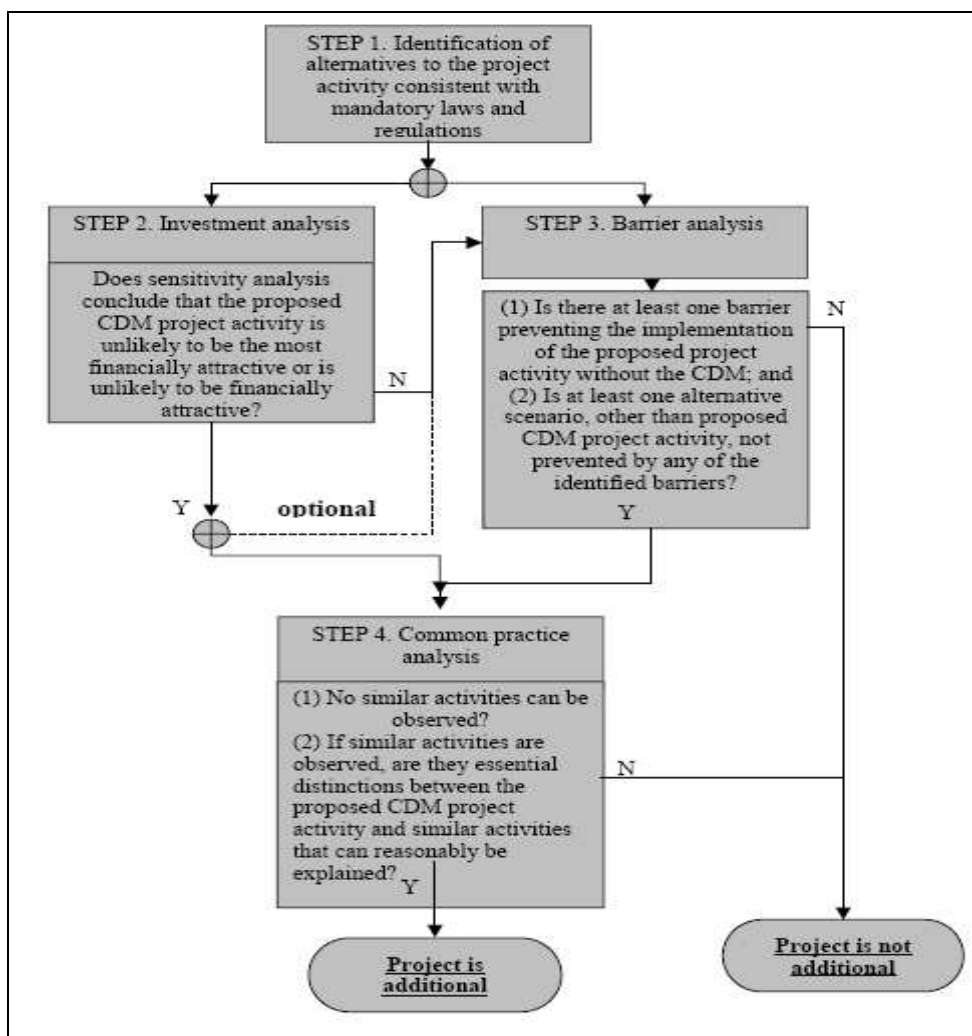
B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

>>

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.

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 and 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 / lower unit cost of service), 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 and 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>i.e.</i> baseline)	Project case without CDM (scenario-1)
--	--	--



Project IRR (%)	26.30	17.36
------------------------	-------	-------

Assumptions:

Scenario 1:

Assumptions for WHRB based power generators						
Parameter description	Key factors considered during designing	Unit	SCW		BVC	
			Normal Season	Rainy Season	Normal Season	Rainy Season
TG capacity	Not applicable	MW	7.5		7.5	
Maximum power generation capacity	Coal mill off condition (4 hours /day)	MW	7.5		7.5	
Daily average power generation rate (when clinker production line is maintaining its design operating parameters)	In normal season (i.e. non monsoon season) - coal mill on and off condition In rainy season (i.e. monsoon season)- mill on and off condition, increased moisture content of coal.	MW	5.9	4.59	6	4.46
Annual Working Days	Planned and forced shutdown of clinker production lines	Days	260	75	260	75
Waste gas availability factor	Waste gas temperature, clinker production rate, ambience temperature, waste gas pressure etc.	%	80	80	80	80
plant availability	Forced shutdown of waste heat recovery based power generating equipments (like boilers, TG sets etc.)	%	98	98	98	98
Generation	Not applicable	Million kWh/annum	29	6	29	6
Total Generation	Not applicable	Million kWh/annum	71			
Auxiliary Power Consumption	Not applicable	%	8			
Net Generation	Not applicable	Million kWh/annum	65.31			



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Parameters	units	Value	Reference
Electricity generation Computation			
Net Generation	million Kwh	65.3	Technical scheme provided by the technology supplier. The whole computation procedure is depicted in sheet 1
Grid power rate			
Power Purchase Rate (2006-07)	Rs ./kWh	3.89	Electricity Bill of the Birla Corporation Limited, Satna unit
Total Project Cost Breakup			
Land/Building	INR in million	175	Total project cost computation sheet' prepared by the technical consultant involved in the execution of the project activity.
Plant/Machinery	INR in million	905	
Total	INR in million	1080	
Project Financing(debt:equity-2:1)			
Equity	INR in million	360	Relavent extract of Board Note' - Where the same decision has been made by the Board
Term Loan	INR in million	720	
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
Investment schedule			
Investment in 1st year (as percentage of total project cost)	%	20.00	
Investment in 2nd year (as percentage of total project cost)	%	80.00	
Escalation rate			
Escalation rate of O&M expenses	%	4.33	Base year 2002-03, current year 2006-07 and Assessment period - 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 period - 5 years, Commodity - electricity for industry. Please refer to the following link: http://eaindustry.nic.in . Web page shared with DOE.

Scenario 2:

Assumptions for 10 MW coal based power plant		
parameters	value	unit
Rated capacity	10	MW
Annual working days	340	days/annum
Percentage of auxiliary consumption	10	%
Plant availability factor	90	%
Gross power generation	73	million units
net power generation	65	million units



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Parameters	Value	Unit	Reference
Electricity generation computation			
Net power generation	65	million units	Electricity generated by the project activity, 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 (2006-07)	3.89	INR/kWh	December 2007 Electricity tariff of the Birla Corporation Limited, Satna unit
Total project cost breakup			
Total project cost (as per supplier's data)	470.4	INR in million	As per the Techno Commercial offer proposed by the technology supplier (Cethar Consulting Engineers)
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	157	INR in million	Relavent extract of Board Note' - Where the same decision has been made by the Board
Term Loan	314	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 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 (Cethar Consulting Engineers)
Thermal Energy Input	208045507921	kCal/annum	Calculated
Quantity of Coal consumed	54749	MT/annum	Calculated
Net Calorific Value of Coal	3800	kCal/kg	The technolgy supplier (Cethar Consulting Engineers) recommended the station heat rate considering the GCV of the coal currently being used in the existng 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. A coal analysis report has been submitted for reference.
Coal Cost	1180	INR/MT	Source: 'Details of Packing Material, Raw Materials and coal consumed in 2006-07- Satna Cement Works'
Escalation rate			
Escalation rate of O&M expenses	4.33	%	Base year 2002-03, current year 2006-07 and Assessment period - 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 period - 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 period - 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 project 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 Alternative-1) 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%	26.30%	17.36%
Electricity generation	+10%	29.62%	19.05%
	-10%	22.84%	15.62%
Grid power cost	+10%	29.86%	19.05%
	-10%	22.58%	15.62%
Coal cost	+10%	25.25%	17.36%
	-10%	27.33%	17.36%
Operational and Maintenance cost	+10%	26.06%	17.24%
	-10%	26.54%	17.49%



Total project cost	+10%	24.14%	15.78%
	-10%	28.89%	19.23%

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 can 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	+56%	26.30%	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 28% which is way below 56%. So the variation is not practically feasible.
Grid power cost	+56%		Following the historical trend in grid power cost 56% increase of the same is not possible. The CAGR ¹⁶ for the electricity tariff for commercial use over the last 16 years ¹⁷ is 6%. Moreover, the change in grid power tariff will have similar bearing on the project IRR and baseline IRR.
Coal cost	+77.20		Following the historical trend in non-coking coal cost 77.20% increase of the same is not possible.

¹⁶ Compound Annual Growth Rate

¹⁷ Source: <http://eaindustry.nic.in/>



			The CAGR for the non-coking coal price over the last 10 years is 6.04% ¹⁸ . 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	-799%		Not practical
Total Project cost	-36%		Project participant has already spent almost 90% of the envisaged cost. And it is expected by completion of the project the same will cross the envisaged project cost (<i>i.e.</i> INR 1080 million) by a considerable margin. To substantiate the same the POs ¹⁹ 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.

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 -

¹⁸ Source: <http://eaindstry.nic.in/>

¹⁹ Purchase Order



- Project activity at the Vishnupuram cement plant of The India Cements²⁰
- Project activity at the cement plant of The KCP Limited at Guntur, Andhra Pradesh²¹
- Project activity of JK Cement Limited at Nimbahera, Chittorgarh, Rajasthan²²
- Following projects are under validation -
 - Project activity at the Beawar cement plant of Shree Cements Limited²³
 - Project activity of Shree Cement Limited at Ras in Rajasthan²⁴
 - Project activity at cement plant of JK Cement Limited, Mangrol, Chittorgarh, Rajasthan²⁵
 - Project activity at the Satna cement unit of Birla Corporation Limited²⁶

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 benefit²⁷.

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:

²⁰ Source: <http://cdm.unfccc.int/Projects/DB/SGS-UKL1161334998.77/view>

²¹ Source: <http://cdm.unfccc.int/Projects/DB/RWTUV1214900280.42/view>

²² Source: <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1140718710.42/view>

²³ Source: <http://cdm.unfccc.int/Projects/Validation/DB/UQCFT6FCSSLYS0LUT9AJA77K6V3DIG/view.html>

²⁴ Source: <http://cdm.unfccc.int/Projects/Validation/DB/1VUFGEOLT9ALGQDRZ1KGZVD4PGVE1Y/view.html>

²⁵ Source: <http://cdm.unfccc.int/Projects/Validation/DB/EYQ20DYK5JFSJS1BETOK17SM6SJWBM/view.html>

²⁶ Source: <http://cdm.unfccc.int/Projects/Validation/DB/LBAW872EPQKBXJ3148WM9NO2FBU6L4/view.html>

²⁷ Necessary documentary evidence has been submitted to the DOE.



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. 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. CCE10068/07 Rev00
			Meeting among Birla Corporation Limited, technology supplier and consultant at Kolkata Office	25.01.2008	Note to Board ²⁸

²⁸ The Project Department of Birla Corporation Limited prepared a note presenting before the Board the plausible ways to meet the increased power demand projected from the expansion projects at their Satna and Chanderia units. The note was prepared based on the meeting among BCL, technology supplier and consultant. The note gives an insight into the financial feasibilities of the different options of meeting the increased power requirement. Based on this Note to Board, the Board of Management of BCL took the decision to undertake the waste heat recovery projects at the Satna and Chanderia units.



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	03.03.2008			Engagement Letter
			Agreement signed in between Birla Corporation Limited and M/S. Dalian	28.05.2008	Contract with M/S. Dalian – ref. Contract No. WHRS/Satna/001
Progress of the Project in the CDM cycle	Birla Corporation Limited invited stakeholders for Comments	15.06.2009			Notice inviting stakeholder's comments
	Birla Corporation Limited received comments from stakeholders	19.06.2009 – 26.06.2009			Letters from the stakeholders



		Birla Corporation Limited received Consent to Establish from Madhya Pradesh Pollution Control Board	22.05.2008	Consent to operate for the CPP and cement plant and consent to establish for WHRB – ref F.12 (CII-95) RPCB/Gr. III/584.
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	31.10.2009			http://cdm.unfccc.int/Projects/Validation/DB/LBAW872EPQKBXJ3148WM9NO2FBU6L4/view.html
Host Country Approval	11.01.2010			Ref: No. 4/12/2009-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 31st October, 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-3 '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 - Satna 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)

$EF_{Elec,y}$ = The emissions factor of the baseline electricity supply source, expressed as tCO₂/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 the captive power generation source – $EF_{Captive,y}$

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

$EF_{Grid,y}$ = Emission factor of electricity grid (tCO₂/MWh)

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

So

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

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

$COEF_{IGS}$ = The emission coefficient of the fuel (*i.e.* coal) used in identified generation source, expressed as tCO₂/per GJ lower heating value.

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 CO₂ 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:

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

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 (tCO₂/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

$$EI_B = \frac{F_B}{O_{clinker,B}} \quad - (5)$$

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. (kWh)

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

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

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)

$EF_{CO_2,fuel,y}$ = The CO₂ emission factor per unit of energy of the fuel used in year y, expressed as tCO₂ per unit mass or volume unit. (tCO₂/ unit mass or volume)

Emission Reductions:

The project activity reduces CO₂ 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 tCO₂.

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 tCO₂.

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>i.e.</i> measured before the Project activity goes into operation).
Source of data used:	Plant records
Value applied:	SCW: 0.00343



	BVC: 0.00354
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of the parameter has been computed by dividing F_B with $O_{\text{clinker, B}}$ as per plant records of the year 2009- 10.
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:	<p>SCW: $4500 \text{ (Production of clinker per day in tonnes)} \times 0.00343 \text{ (Specific energy consumption for clinker production in TJ/ tonne)} \times 335 \text{ (annual operational days)} = 5170.73 \text{ TJ}$</p> <p>BVC: $5100 \times 0.00354 \times 335 = 6048.09 \text{ TJ}$</p>
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of the parameter has been computed based on the combined rated production capacity of SCW and BVC and the specific energy consumption for clinker making as per plant records of the year 2009- 10.
Any comment:	-

Data / Parameter:	$O_{\text{clinker, B}}$
Data unit:	Tonnes/ annum
Description:	Average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity



Source of data used:	Rated clinker production capacity of SCW and BVC
Value applied:	SCW: $4500 \times 335 = 1507500$ tonnes BVC: $5100 \times 335 = 1708500$ tonnes Total: 3216000 tonnes
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value corresponds to the combined production capacity of SCW and BVC.
Any comment:	-

Data / Parameter:	FI_{IGS}
Data unit:	GJ per MWh
Description:	Fossil fuel (<i>i.e.</i> 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 (Cethar Consulting Engineers) 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>i.e.</i> coal) used in identified generation source, expressed as tCO_2 /per GJ lower heating value.
Source of data used:	The value has been sourced from 'India's Initial National Commission' – Chapter 2 – 'Greenhouse Gas Inventories'
Value applied:	95.81
Justification of the choice of data or description of measurement methods	As the value has been sourced from 'India's Initial National Commission' – Chapter 2 – 'Greenhouse Gas Inventories', the same is reliable and authentic.



and procedures actually applied :	
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:		<table><tr><th>Year</th><th>EG_{ATEXIST}</th></tr><tr><td>2006-07</td><td>167549</td></tr><tr><td>2007-08</td><td>180396</td></tr><tr><td>2008-09</td><td>177253</td></tr><tr><td>2009-10</td><td>189603</td></tr></table>	Year	EG _{ATEXIST}	2006-07	167549	2007-08	180396	2008-09	177253	2009-10	189603		
Year	EG _{ATEXIST}													
2006-07	167549													
2007-08	180396													
2008-09	177253													
2009-10	189603													
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is measured and as per production records of last four years.													
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:		<table><tr><th>Year</th><th>E_{ce}ment</th></tr><tr><td>2006-07</td><td>199575</td></tr><tr><td>2007-08</td><td>204314</td></tr><tr><td>2008-09</td><td>210160</td></tr><tr><td>2009-10</td><td>228692</td></tr></table>	Year	E _{ce} ment	2006-07	199575	2007-08	204314	2008-09	210160	2009-10	228692	
Year	E _{ce} ment												
2006-07	199575												
2007-08	204314												
2008-09	210160												
2009-10	228692												
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is measured and as per plant records of last four years.												



Any comment:	-
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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:		Year	E_{load}	
		2006-07	11065	
		2007-08	12156	
		2008-09	11969	
		2009-10	11534	
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is measured and as per plant records of last four years.			
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:	Plant records
Value applied:	0 (ex-ante value)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As discussed with the technology supplier (Dalian East New Energy Development Co. Ltd.), the plant personnel is not expecting any increase in specific energy consumption for per ton of clinker production after the implementation of the proposed project activity w.r.t the pre-project value.
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:	The value has been sourced from ‘India’s Initial National Commission’ – Chapter 2 – ‘Greenhouse Gas Inventories’
Value applied:	95.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	-
Any comment:	The uncertainty level of the parameter will be low since the same has been taken from ‘India’s Initial National Commission’ – Chapter 2 – ‘Greenhouse Gas Inventories’.

Data / Parameter:	$O_{clinker,i}$
Data unit:	ton
Description:	Annual clinker production from the ith clinker production line in ton
Source of data used:	Annual clinker projection report and equipment supplier’s data
Value applied:	SCW: 4500 (ton per day) x 335= 1507500 tonnes BVC: 5100 (ton per day) x 335= 1708500 tonnes
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is projected considering the rated capacity of the kilns.
Any comment:	-

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

Ex-ante estimation of Baseline Emissions

As per equation (3), $EF_y = EF_{IGS} = [FI_{IGS} \times COEF_{IGS}]$

Where

$FI_{IGS} = 12 \text{ GJ/ MWh}$



$$COEF_{IGS} = 95.81 \text{ tCO}_2/\text{TJ}$$

$$\text{Therefore, } EF_y = EF_{Elec,y} = EF_{Captive,y} = 1.150 \text{ tCO}_2/\text{MWh} \text{ - (9)}$$

$$\text{As per equation (2), } EB_y = EG_{CP,y} \times EF_{Elec,y}$$

Where

$$EG_{CP,y} = 65309 \text{ MWh}$$

$$\text{Therefore, } EB_y = 75087 \text{ tCO}_2 \quad \text{ - (10)}$$

Following table shows the projected baseline emissions during the crediting period of ten years.

Sl. No.	Operating Year	Baseline Emission (tonnes of CO ₂ e)
1.	July 2011 – June 2012	75087
2.	July 2012 – June 2013	75087
3.	July 2013 – June 2014	75087
4.	July 2014 – June 2015	75087
5.	July 2015 – June 2016	75087
6.	July 2016 – June 2017	75087
7.	July 2017 – June 2018	75087
8.	July 2018 – June 2019	75087
9.	July 2019 – June 2020	75087
10.	July 2020 – June 2021	75087
Total		750870

Ex-ante estimation of Project Emissions

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

$$PE_y = \sum_i \Delta EI_i \times [O_{clinker,i}] \times COEF_{fuel,i} \quad \text{ - (11)}$$

Where:

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

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



After discussing with the technology supplier, the plant personnel is not expecting any increase in specific energy consumption for per ton of clinker production after the implementation of the proposed project activity w.r.t the pre-project value. So the ΔEI_i has been considered to be zero.

Therefore,

$$PE_y = 0 \quad - (12)$$

Where,

PE_y = Project Emissions in the year y (tCO₂)

Following table shows the projected project emissions during the crediting period of ten years.

Sl. No.	Operating Year	Project Emissions (tonnes of CO ₂ e)
1.	July 2011 – June 2012	0
2.	July 2012 – June 2013	0
3.	July 2013 – June 2014	0
4.	July 2014 – June 2015	0
5.	July 2015 – June 2016	0
6.	July 2016 – June 2017	0
7.	July 2017 – June 2018	0
8.	July 2018 – June 2019	0
9.	July 2019 – June 2020	0
10.	July 2020 – June 2021	0
Total		0

Ex-ante estimation of Emission Reductions

As per equation (8), $ER_y = EB_y - PE_y$

Where

$$EB_y = 75087 \text{ tCO}_2$$

$$PE_y = 0 \text{ tCO}_2$$

Therefore²⁹, $ER_y = 75087 \text{ tCO}_2$

The ex-ante computation of emission reductions resulting from the project activity is tabulated below:

Sl. No.	Operating Year	Emission Reduction (tonnes of CO ₂ e)
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²⁹ The leakage emissions are negligible hence ignored.



Sl. No.	Operating Year	Emission Reduction (tonnes of CO ₂ e)
1.	July 2011 – June 2012	75087
2.	July 2012 – June 2013	75087
3.	July 2013 – June 2014	75087
4.	July 2014 – June 2015	75087
5.	July 2015 – June 2016	75087
6.	July 2016 – June 2017	75087
7.	July 2017 – June 2018	75087
8.	July 2018 – June 2019	75087
9.	July 2019 – June 2020	75087
10.	July 2020 – June 2021	75087
Total		750870

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)
July 2011 – June 2012	0	75087	0	75087
July 2012 – June 2013	0	75087	0	75087
July 2013 – June 2014	0	75087	0	75087
July 2014 – June 2015	0	75087	0	75087
July 2015 – June 2016	0	75087	0	75087
July 2016 – June 2017	0	75087	0	75087
July 2017 – June 2018	0	75087	0	75087
July 2018 – June 2019	0	75087	0	75087
July 2019 – June 2020	0	75087	0	75087
July 2020 – June 2021	0	75087	0	75087



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)
Total (tonnes of CO₂e)	0	750870	0	750870

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	65309
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



	<p>Data Type: Measured and calculated</p> <p>Archiving Procedure: Paper/ Electronic</p> <p>Recording Frequency: Continuously and summarized monthly and annually</p> <p>Responsibility: Operator</p> <p>Calibration Frequency: Annually</p>
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice.
Any comment:	The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters once in a year.

Data / Parameter:	$EI_{P,y}$
Data unit:	TJ/ tonne
Description:	<i>Ex post</i> 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 calculating expected emission reductions in section B.5	<p>SCW: 0.00343 (ex-ante estimation)</p> <p>BVC: 0.00354 (ex-ante estimation)</p>
Description of measurement methods and procedures to be applied:	<p>This value would be computed by dividing $F_{P,y}$ with $O_{clinker,y}$ in the year y.</p> <p>Monitoring Procedure: Please refer to the monitoring tables below for $F_{P,y}$ and $O_{clinker,y}$</p> <p>Accuracy of measurement: Please refer to the monitoring tables below for $F_{P,y}$ and $O_{clinker,y}$</p> <p>Data Type: Calculated</p> <p>Archiving Procedure: Paper/ Electronic</p> <p>Recording Frequency: Summarized monthly and annually</p> <p>Responsibility: Operator</p> <p>Calibration Frequency: Annually</p>
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice.
Any comment:	The uncertainty level of the parameter will be low since the determining parameters will be monitored with calibrated meters once in a year.



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	SCW: 4500 (production of clinker per day in tonnes) x 0.00343 (specific energy consumption for clinker production in TJ/ tonne) x 335 (annual operational days) = 5170.73 TJ (ex-ante) BVC: 5100 x 0.00354 x 335 = 6048.09 TJ (ex-ante)
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: Calculated Archiving Procedure: Paper/ Electronic Recording Frequency: Summarized monthly and annually Responsibility: Operator Calibration Frequency: Annually
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice.
Any comment:	The uncertainty level of the parameter will be low since the determining parameters will be monitored with calibrated meters once in a year.

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	SCW: 4500 (ton per day) x 335 = 1507500 tonnes (Ex- ante estimation)



for the purpose of calculating expected emission reductions in section B.5	BVC: 5100 (ton per day) x335= 1708500 tonnes (Ex- ante estimation)
Description of measurement methods and procedures to be applied:	<p>Monitoring Procedure: The parameter will be monitored continuously with the help of weighing machines. The values will be available in the Distributed Control System (DCS).</p> <p>Accuracy of measurement: As per the national or sectoral standard</p> <p>Data Type: Measured and calculated</p> <p>Archiving Procedure: Paper/ Electronic</p> <p>Recording Frequency: Summarized monthly and annually</p> <p>Responsibility: Operator</p> <p>Calibration Frequency: Annually.</p>
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice.
Any comment:	The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters once in a year.

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:	<p>Monitoring Procedure: Coal consumption will be monitored by weighing machines.</p> <p>Accuracy of measurement: As per the national or sectoral standard</p> <p>Data Type: Measured and calculated</p> <p>Archiving Procedure: Paper/ Electronic</p> <p>Recording Frequency: Summarized monthly and annually</p> <p>Responsibility: Operator</p>



	Calibration Frequency: Annually
QA/QC procedures to be applied:	QA/QC procedures are according to the standard industry practice.
Any comment:	The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters once in a year.

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:	In-house lab report or by an 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: Will be determined either in the in-house laboratory or by an independent third party Data Type: Measured and Calculated Archiving Procedure: Paper/ Electronic Recording Frequency: Once in a year Responsibility: Operator Calibration Frequency: As per industry standard.
QA/QC procedures to be applied:	-
Any comment:	The data will be archived for the entire crediting period and two more years.

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	27/07/2010
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:**

26/06/2008 (date of signing of agreement with the technology supplier)

**C.1.2. Expected operational lifetime of the project activity:**25 y 0 m³⁰**C.2. Choice of the crediting period and related information:****C.2.1. Renewable crediting period:****C.2.1.1. Starting date of the first crediting period:****C.2.1.2. Length of the first crediting period:****C.2.2. Fixed crediting period:****C.2.2.1. Starting date:**

1/ 07/ 2011 (on commencement of operation 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:**

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.

As per EIA notification³¹ of Ministry of Environment and Forests dated 14th September, 2006, waste heat recovery based power plant in cement industry will not require environment impact assessment.

Project participant is ensuring that there is no negative impact on the environment during the implementation or operation of the project activity

³⁰ Please refer to the certificate issued by the technology supplier

³¹ Source: <http://envfor.nic.in/legis/eia/so1533.pdf>

**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. The necessary environment clearances and consents for the project activity have been obtained and submitted to the DOE. 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**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 15th June, 2009) 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. Date of comments received by the stakeholders as follows

- Elected body of the representatives administering the local area (Local Nagar Palika): 19th June, 2009
- Employees of BCL: 26th June 2009
- Worker's union: 25th June, 2009
- Local NGO: 20th June, 2009

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
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	BCL has received a written consent from the nagar palika for the project activity.



SI No.	Name of Stakeholders	Mode of Communication	Feedback	Status
			employment opportunities. They have assured their support to the Management of BCL.	
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-Governmental Organizations (NGOs)	The project activity 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	The NGO has appreciated the initiative of BCL towards socio-economic development of the locality and their commitment towards developing an environment friendly	BCL has received a written consent from the NGO for the project activity.



SI No.	Name of Stakeholders	Mode of Communication	Feedback	Status
		NGO through a formal letter and their opinion on the same was requested for.	manufacturing process.	
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**

Organization:	Birla Corporation Limited
Street/P.O.Box:	9/1 R. N. Mukherjee Road
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State/Region:	West Bengal
Postfix/ZIP:	700001
Country:	India
Telephone:	+91 – (33) 30573700/30410900
FAX:	: +91 – (33) 22482827/22487988
E-Mail:	project@birlacorp.com
URL:	www.birlacorporation.com/cementframe.html
Represented by:	Mr. Sanjay Banthiya
Title:	Asst. Vice President – Projects
Salutation:	Mr.
Last Name:	Banthiya
Middle Name:	NA
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public Funding is available for the project activity

**Annex 3****BASELINE INFORMATION**

Description	Notation	Unit	Value	Remarks
The electricity supplied from the project activity to the cement plant,	$EG_{CP,y}$	MWh	65309	As per the detailed project report provided by the equipment suppliers and consultant
The emissions factor of the baseline electricity supply source, 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 – $EF_{Captive,y}$	$EF_{Captive,y}$	tCO ₂ /MWh	1.150	Calculated based upon FI_{IGS} and $COEF_{IGS}$ below mentioned
The fossil fuel (<i>i.e.</i> coal) consumption rate of the identified generation source (IGS) to supply EG_y	FI_{IGS}	GJ/MWh	12.00	Considering heat rate of the new coal based power plant - 2867kcal/kWh (as per the supplier)
The emission coefficient of the fuel (<i>i.e.</i> coal) used in identified generation source, expressed as tCO ₂ /per GJ lower heating value.	$COEF_{IGS}$	tCO ₂ /GJ	0.0958	As per the 'India's Initial National Commission – Chapter 2 – 'Greenhouse Gas Inventories'
Electricity supplied from project activity to the grid	$EG_{Grid,y}$	MWh	0.0	No supply of power (generated by the waste heat recovery based captive power plant) to grid
Emission factor of electricity grid	$EF_{Grid,y}$	tCO ₂ /MWh	0.798	Emission factor of NEWNE grid



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.

Archiving Procedure: Paper/ Electronic

Recording Frequency: Summarized monthly and annually

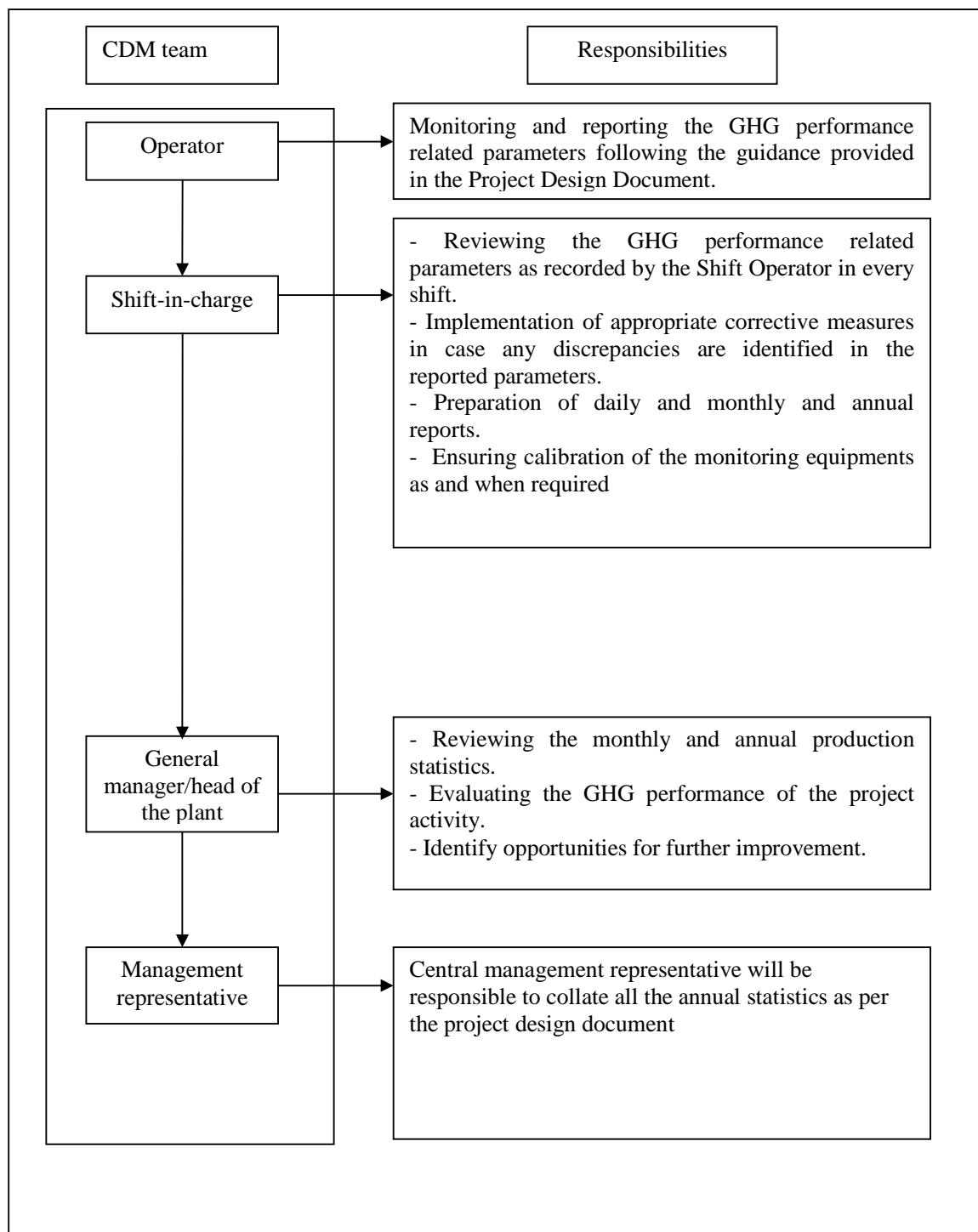


Responsibility: Operator

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- A

Action Plan for expenditure incurred through 2% of CER revenues									
Financial Year (A)	Activity (B)	Issued CERs (C)	CER Price (D)	Total CDM Amount (E=CxD)	Expenditure in Current year (F)	Expenditure Carried forward (G)	Net Expenditure for Current Year (H=F -G)	Expenditure as % of CDM amount for current year (I=H/E)	Reference Documentation (J)
Year 1	1. Education <ul style="list-style-type: none"> ▪ Infrastructural up-gradation of local primary schools, secondary schools and vocational institutes (ITI) ▪ Award of scholarships to meritorious students ▪ Conduct Adult education campaign 	75087 approx.	Say X	$75087 \times X$	(1) $750.87 \times X$	0	(1) $750.87 \times X$	(1) 1%	Such expenditure will be made within one year after the realization of revenues from the sale of CERs. The details of such expenditure made will be included in the monitoring report for the period
	2. Community <ul style="list-style-type: none"> ▪ Modernization of Village Community 				(2) $750.87 \times X$	0	(2) $750.87 \times X$	(2) 1%	



	centres								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.
	<ul style="list-style-type: none"> Improvement of street lightings of nearby villages Capacity building of women and youth for livelihood and employment opportunities (computer education, handicrafts, <i>etc.</i>) Other activities in consultation with village panchayats and the community 				Total - 1506.28× X		Total - 1506.28× X	Total - 2 %	
Year 2		75087 approx.	Say X	75087 × X					
	1. Education				(1) 750.87×X	0	(1) 750.87× X	(1) 1%	

- Infrastructural up-gradation of local



	<p>meritorious students</p> <ul style="list-style-type: none"> Conduct Adult education campaign <p>2. Community</p> <ul style="list-style-type: none"> Modernization of Village Community centres Improvement of street lightings of nearby villages Capacity building of women and youth for livelihood and employment opportunities (computer education, handicrafts, <i>etc.</i>) Other activities in consultation with village panchayats and the community 				(2) 750.87× X	0	(2) 750.87× X	(2) 1%	
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %	



Year 3	1. Education <ul style="list-style-type: none"> ▪ Infrastructural up-gradation of local primary schools, secondary schools and vocational institutes (ITI) ▪ Award of scholarships to meritorious students ▪ Conduct Adult education campaign 				(1) 750.87×X	0	(1) 750.87× X	(1) 1%	
	2. Community <ul style="list-style-type: none"> ▪ Modernization of Village Community centres ▪ Improvement of street lightings of nearby villages ▪ Capacity building of women and youth for livelihood and employment opportunities (computer education, 	75087 approx.	Say X	$75087 \times X$	(2) 750.87× X	0	(2) 750.87× X	(2) 1%	

[illegible]



	centres								
	<ul style="list-style-type: none"> Improvement of street lightings of nearby villages Capacity building of women and youth for livelihood and employment opportunities (computer education, handicrafts, <i>etc.</i>) Other activities in consultation with village panchayats and the community 								
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %	
Year 5	1. Education	75087	Say X	75087 × X	(1) 750.87×X	0	(1) 750.87× X	(1) 1%	
	<ul style="list-style-type: none"> Infrastructural up-gradation of local 	approx.							



	scholarships to meritorious students ▪ Conduct Adult education campaign 2. Community ▪ Modernization of Village Community centres ▪ Improvement of street lightings of nearby villages ▪ Capacity building of women and youth for livelihood and employment opportunities (computer education, handicrafts, <i>etc.</i>) ▪ Other activities in consultation with village panchayats and the community				(2) 750.87× X	0	(2) 750.87× X	(2) 1%	
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %	



Year 6	1. Education <ul style="list-style-type: none"> ▪ Infrastructural up-gradation of local primary schools, secondary schools and vocational institutes (ITI) ▪ Award of scholarships to meritorious students ▪ Conduct Adult education campaign 				(1) 750.87×X	0	(1) 750.87× X	(1) 1%	
	2. Community <ul style="list-style-type: none"> ▪ Modernization of Village Community centres ▪ Improvement of street lightings of nearby villages ▪ Capacity building of women and youth for livelihood and employment opportunities (computer education,	75087 approx.	Say X	$75087 \times X$	(2) 750.87× X	0	(2) 750.87× X	(2) 1%	

	handicrafts, <i>etc.</i>) ▪ Other activities in consultation with village panchayats and the community							
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %
Year 7	1. Education ▪ Infrastructural up-gradation of local	75087	Say X	75087 × X	(1) 750.87×X	0	(1) 750.87× X	(1) 1%



	<ul style="list-style-type: none">▪ Modernization of Village Community centres▪ Improvement of street lightings of nearby villages▪ Capacity building of women and youth for livelihood and employment opportunities (computer education, handicrafts, <i>etc.</i>)▪ Other activities in consultation with village panchayats and the community							
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %



Year 8	1. Education <ul style="list-style-type: none"> ▪ Infrastructural up-gradation of local primary schools, secondary schools and vocational institutes (ITI) ▪ Award of scholarships to meritorious students ▪ Conduct Adult education campaign 				(1) 750.87×X	0	(1) 750.87× X	(1) 1%	
	2. Community <ul style="list-style-type: none"> ▪ Modernization of Village Community centres ▪ Improvement of street lightings of nearby villages ▪ Capacity building of women and youth for livelihood and employment opportunities (computer education,	75087 approx.	Say X	$75087 \times X$	(2) 750.87× X	0	(2) 750.87× X	(2) 1%	



	handicrafts, <i>etc.</i>)								
	<ul style="list-style-type: none"> Other activities in consultation with village panchayats and the community 								
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %	
Year 9	1. Education	75087	Say X	75087 × X	(1) 750.87×X	0	(1) 750.87× X	(1) 1%	
	<ul style="list-style-type: none"> Infrastructural up-gradation of local 	approx.							



	<ul style="list-style-type: none">▪ Modernization of Village Community centres▪ Improvement of street lightings of nearby villages▪ Capacity building of women and youth for livelihood and employment opportunities (computer education, handicrafts, <i>etc.</i>)▪ Other activities in consultation with village panchayats and the community							
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %



Year 10	1. Education <ul style="list-style-type: none"> ▪ Infrastructural up-gradation of local primary schools, secondary schools and vocational institutes (ITI) ▪ Award of scholarships to meritorious students ▪ Conduct Adult education campaign 				(1) 750.87×X	0	(1) 750.87× X	(1) 1%	
	2. Community <ul style="list-style-type: none"> ▪ Modernization of Village Community centres ▪ Improvement of street lightings of nearby villages ▪ Capacity building of women and youth for livelihood and employment opportunities 	75087 approx.	Say X	$75087 \times X$	(2) 750.87× X	0	(2) 750.87× X	(2) 1%	



	handicrafts, <i>etc.</i>) <ul style="list-style-type: none">Other activities in consultation with village panchayats and the community								
					Total - 1506.28× X		Total - 1506.28× X	Total - 2 %	