VALIDATION REPORT

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 IN INDIA

REPORT NO. 2010-0142

REVISION NO. 03

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VALIDATION REPORT

Date of first issue:	ConCert Project No.:	
27 Jan 2010	PRJC-189521-2009-CCS-IND	
Recommended for approval Ole A. Flagstad	Approved by Michael Lehmann	Organisational unit: DNV Climate Change and Environmental Services
Client: Birla Corporation Limited		Client ref.: Mr. Sanjay Banthiya

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Summary

Project Name: 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
Country: India
Methodology: AM0024
Version: 2.1
GHG reducing Measure/Technology: Waste heat based power generation in cement plant.
ER estimate: 75 087 tCO_2e per year (average)
Size
☒ Large Scale
☐ Small Scale
Validation Phases:
☒ Desk Review
☒ Follow up interviews
☒ Resolution of outstanding issues
Validation Status
☐ Corrective Actions Requested
☐ Clarifications Requested
☒ Full Approval and submission for registration
☐ Rejected

In summary, it is DNV's opinion that the project activity "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" in India, as described in the PDD, version 05 of 23 Sep 2011, meets all relevant UNFCCC requirements for the CDM and all relevant host Party criteria and correctly applies the baseline and monitoring methodology AM0024, version 2.1. Hence DNV requests the registration of the project as a CDM project activity.

Report No.:	Subject Group:
2010-0142	Environment
Report 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 in India	
Work carried out by: Indrajit Rana, Sasim Chattopadhyay, Santhosh Jayaram	
Work verified by: Ole A. Flagstad, Matteo Faggin	

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Abbreviations

BCL	Birla Corporation Limited
BVC	Birla Vikash Cement
CAGR	Compound Annual Growth Rate
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reduction(s)
CL	Clarification request
CMA	Cement Manufacturers' Association
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CPP	Captive Power Plant
DNA	Designated National Authority
DNV	DNV Climate Change Services AS
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
HCA	Host Country Approval
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of approval
MoEF	Ministry of Environment and Forest
MPPCB	Madhya Pradesh Pollution Control Board
N_2O	Nitrous oxide
NEWNE	Northern Eastern Western and North Eastern electricity grid
NGO	Non-governmental Organisation
ODA	Official Development Assistance
PDD	Project Design Document
SCW	Satna Cement Works
tCO_2e	Tonnes of CO_2 equivalents
TPD	Tonnes per Day
UNFCCC	United Nations Framework Convention on Climate Change
WHRB	Waste Heat Recovery Boiler

1 EXECUTIVE SUMMARY – VALIDATION OPINION

DNV Climate Change Services AS (DNV) has performed a validation of the project activity "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" in India. The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host Party criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The review of the project design documentation and the subsequent follow-up interviews have provided DNV with sufficient evidence to determine the fulfilment of stated criteria.

The host Party is India. No Annex-I Party is involved in the project. The Party fulfil the participation criteria and have approved the project and authorized the project participant Birla Corporation Limited. The DNA from India confirmed that the project assists in achieving sustainable development.

The project correctly applies the baseline and monitoring methodology AM0024, version 2.1 "Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants" /42/.

The project activity is intended to generate power from two 7.5 MW waste heat recovery turbines in a cement plant and thereby replacing fossil fuel based captive power generation. As a result, the project results in reductions of CO_2 emissions that are real, measurable and give long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.

The total emission reductions from the project are estimated to be on the average 75 087 tCO_2e per year over the selected 10 year fixed crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

The monitoring plan provides for the monitoring of the project's emission reductions. The monitoring arrangements described in the monitoring plan are feasible within the project design and it is DNV's opinion that the project participants are able to implement the monitoring plan.

In summary, it is DNV's opinion that the project activity "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" in India, as described in the PDD, version 05 dated 23 Sep 2011, meets all relevant UNFCCC requirements for the CDM and all relevant host Party criteria and correctly applies the baseline and monitoring methodology AM0024, version 2.1. Hence, DNV requests the registration of the project as a CDM project activity.

Bangalore and Oslo, 4 October 2011

Indrajit Rana
CDM Validator
DNV Bangalore, India

Michael Lehmann
Director of Services and Technologies
DNV Climate Change Services AS

2 INTRODUCTION

Birla Corporation Limited has commissioned DNV Climate Change Services AS (DNV) to perform a validation of the "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" project in India. This report summarises the findings of the validation of the project, performed on the basis of UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, and the subsequent decisions by the CDM Executive Board.

2.1 Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria are validated in order to confirm that the project design, as documented, is sound and reasonable and meets the identified criteria. Validation is a requirement for all CDM projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

2.2 Scope

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology AM0024. The validation was based on the recommendations in the Validation and Verification Manual /41/.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

3 METHODOLOGY

The validation consisted of the following three phases:

I a desk review of the project design documents

II follow-up interviews with project stakeholders

III the resolution of outstanding issues and the issuance of the final validation report and opinion.

The following sections outline each step in more detail.

3.1 Desk review of the project design documentation

The following tables list the documentation that was reviewed during the validation.

3.1.1 Documentation provided by the project participants

/1/ Birla Corporation Limited: *CDM-PDD for project activity "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" in India, Version 01 dated 5 October 2009, version 04 dated 30 March 2011 and version 5 dated 23 Sep 2011.*

/2/ Birla Corporation Limited: *Annual Report stating that BVC and SCW are subsidiaries of BCL.*

/3/ Birla Corporation Limited: *Purchase order for parts for BVC Kiln and Pyro System for Satna dated 27 April 2007*

/4/ Birla Corporation Limited: *Order for up gradation for clinker capacity to 4500 TPD for SCW plant dated 29 August 2006*

/5/ Birla Corporation Limited: *Power consumption report of BVC and SCW for the year 2007-2008*

/6/ Birla Corporation Limited: *Request for granting consent to establish for coal washery in BCL, Satna dated 13 May 2009*

/7/ F. L. Smidth Limited: *MoM of base line test of SCW dated 27 September 2007*

/8/ Tangshan Guohua Technology CO. Limited: *Technical specification of coal washery provided to BCL in Satna in the year 2008 - 2009*

/9/ Birla Corporation Limited: *Details of energy consumption of BVC for the financial year year 2007-2008, 2008-2009 and 2009-2010*

/10/ Birla Corporation Limited: *Details of energy consumption of SCW for the financial year 2007-2008, 2008-2009 and 2009-2010*

/11/ Birla Corporation Limited: *Note to board for implementation of project activity dated 25 January 2008*

/12/ Birla Corporation Limited: *Board approval note of the waste heat recovery project dated 31 January 2008*

/13/ Birla Corporation Limited: *Agreement for waste heat recovery system for Satna unit of BCL with Dalian East Energy Project Co. Limited dated 26 June 2008.*

/14/ Birla Corporation Limited: *Stake holder consultation documentations dated 17 August 2009 15 June 2009, 20 June 2009 and 19 June 2009*

/15/ Birla Corporation Limited: *Agreement signed with DNV dated 21July 2009*

/16/ Birla Corporation Limited: *Techno commercial offer of Cethar Consulting Engineers (P) Ltd for supply and execution of EPC basis for 2 X 7.5 MW coal based thermal power plant dated 26 November 2007*

/17/ Dalian East Energy Project Co. Limited: *Technical specification of WHR based power plant in SCW and BVC dated 16 November 2007*

/18/ MPPCB: *Consent to operate (air) of Satna cement works of BCL dated 19 December 2008*

/19/ MPPCB: *Consent to operate (water) of Satna cement works of BCL dated 18 December 2008*

/20/ MPPCB: *Consent to establish of waste heat recovery power plant of BCL in Satna dated 22 May 2008*

/21/ Reuters: *Diesel price in the year 2007 and 2008,* http://uk.reuters.com/article/idUKDEL1697420080214

/22/ Ministry of Petroleum, Government of India: *Natural gas sources in India* http://petroleum.nic.in/ng.htm

/23/ M.P. Poorv Kshetra Vidyut Vitaran Co. Ltd.: *Monthly electricity bill towards BCL for the month of December 2007*

/24/ Birla Corporation Limited: *Consolidated sheet for grid tariff for the year 2006-2007*

/25/ Birla Corporation Limited: *Break-up cost of coal for power plant for the year 2006-2007, source: Details of Packing Material, Raw Materials and coal consumed in 2006-07- Satna Cement Works*

/26/ Cement Manufacturers' Association: *CMA environmental task force 39th meeting – minutes of meeting dated 9 July 2010 – Stated every waste heat recovery project in cement industry in India comes after considering CDM benefit*

/27/ Birla Corporation Limited: *Energy balance work sheet from the year 2006 to 2010 and extrapolated to 2012 for BVC and SCW*

/28/ Birla Corporation Limited: *Engagement with CDM consultant dated 3 March 2008*

/29/ Birla Corporation Limited: *Coal NCV analysed at in house laboratory*

/30/ Birla Corporation Limited: *Cost sheet for existing coal based power plant for determining O & M cost ending on 31 March 2007 and 31 March 2008.*

/31/ Birla Corporation Limited: *Details of Packing Material, Raw Materials and coal consumed in 2006-07- Satna Cement Works dated 31 March 2007*

/32/ Birla Corporation Limited: *Emission reduction calculation work sheet version 3 dated 28 September 2011*

/33/ Birla Corporation Limited: *IRR analysis work sheet version 1 dated 28 September 2010*

/34/ Investopedia: *Compound annual growth rate calculator , available in* http://www.investopedia.com/calculator/CAGR.aspx

/35/ Birla Corporation Limited: *Commissioning certificate of clinker capacity expansion dated 11 April 2011*
BVC capacity expansion done on 24 July 2010
SCW capacity expansion done on 29 September 2008

/36/ Birla Corporation Limited: *Commissioning certificate of waste heat based power plant dated 11 April 2011*
WHR based power plant at BVC commissioned on 26 February 2011,

WHR based power plant at SCW commissioned on 10 October 2010

/37/ Nitin S. Agarwal & Co, Chattered accounts: *Certificate of capital investment dated 25 April 2011. Total capital investment for the WHR based power plants in BCL, Satna unit is INR 1136.597 million*

/38/ Birla Corporation Limited: *WHR based Power generation log book for BVC and SCW since commission.*

/39/ Birla Corporation Limited: *Clinker production in BVC and SCW since commissioning of expanded capacity*

3.1.2 Letters of approval

/40/ MoEF (DNA of India*): Letter of approval dated 11 Jan 2010*

3.1.3 Methodologies, tools and other guidance by the CDM Executive Board

/41/ CDM Executive Board: *Validation and Verification Manual*. Version 1.2

/42/ CDM Executive Board: *Baseline and monitoring methodology AM0024, version 2.1*

/43/ CDM Executive Board: *Additionality Tool version, Version 5.2*

/44/ CDM Executive Board: *Tool to calculate the emission factor for an electricity system version 2*

/45/ CDM Executive Board: *Guidelines on the demonstration and assessment of prior consideration of CDM version 3*

/46/ CDM Executive Board: *project information of WHRB based power plant in India considering CDM benefit prior to installation*
http://cdm.unfccc.int/Projects/DB/SGS-UKL1161334998.77/view
http://cdm.unfccc.int/Projects/DB/RWTUV1214900280.42/view
http://cdm.unfccc.int/Projects/Validation/DB/UQCFT6FCSSLYS0LUT9AJA77K6V3DIG/view.html
http://cdm.unfccc.int/Projects/Validation/DB/1VUFGEOLT9ALGQDRZ1KGZVD4PGVE1Y/view.html
http://cdm.unfccc.int/Projects/Validation/DB/Q3ZAG11B6DHEYOV3Q3KY3DBSLIOWQI/view.html
http://cdm.unfccc.int/Projects/Validation/DB/EYQ20DYK5JFSJS1BETOK17SM6SJWBM/view.html
http://cdm.unfccc.int/Projects/Validation/DB/T8I9BVLXM22CB7HQB7EC8QZID7KGQX/view.html

3.1.4 Documentation used by DNV to validate / cross-check the information provided by the project participants

/47/ CEA of India: *CO_2 Baseline Database for the Indian Power Sector, User Guide, ver. 4 October 2008*

/48/ Office of the Economic Adviser to the Government of India
Ministry of Commerce and Industry: *Whole sale price index for electricity tariff, coal price and O&M cost which is used for escalation of these commodities considering base financial year 2002 -2003*

Whole sale price index for all commodities considering base year 2004: available in http://eaindustry.nic.in/

/49/ Birla Corporation Limited: *Procurement status of the equipments for the project activity as on May 2010*

/50/ Birla Corporation Limited: *Work order to M/s.Khandelwal Construction Co for civil construction dated 7 April 2009*

/51/ Birla Corporation Limited: *Purchase order no. PUR/SCW/WHRS/ 08 /09-10 dated 26 Sep.2009 to M/s Ahluwalia Erectors & Fabricators Pvt. Ltd.*

/52/ Birla Corporation Limited: *Purchase order no PUR/BVC/WHRS/ 10 /09-10 dated 26 Sep 2009 to M/s Hajee A.P. Bava & Co.*

/53/ Birla Corporation Limited: *Purchase order no PUR/SCW-BVC/WHRS/03/09-10 dated 30 Jan 2010 to M/s Hawa Valves (India) Private Limited*

/54/ Birla Corporation Limited: *Purchase order no PUR/SCW-BVC/WHRS/09-10/02 to M/s. Mather and Platt Pumps Ltd. Dated 11 July 2009*

/55/ Birla Corporation Limited: *Purchase order no PUR/BVC/WHRS/12/09-10 dated 10 Nov 2009 to M/s Turbovent Industries Private Limited*

/56/ Birla Corporation Limited: *Purchase order no PUR/SCW/WHRS/11/09-10 dated 10 Nov 2009 to M/s Turbovent Industries Private Limited*

/57/ Birla Corporation Limited: *Purchase order no PUR/-BVC/WHRS/ 05 /09-10 dated 21 August 2009 to M/s Thermax Limited*

/58/ Birla Corporation Limited: *Purchase order no PUR/SCW/WHRS/04 /09-10 dated 21 August 2009 to M/s Thermax Limited*

/59/ MoEF: *India's initial national communication to UNFCCC for GHG inventory in the year 2004: Chapter 2 GHG inventory information; available in* http://unfccc.int/resource/docs/natc/indnc1.pdf

/60/ MoEF: *Link to access the Host Country approved project* http://www.cdmindia.nic.in/cdmindia/searchProject.jsp

/61/ Dalian East Energy Project Co. Limited*: Letter to substantiate the technical life time of the project activity dated 15 September 2010 – Technical life time is 25 years*

/62/ CEA: *Report of the expert committee on fuels for power generation, February 2004.* http://www.cea.nic.in/thermal/Special_reports/Report%20of%20the%20expert%20committee%20on%20fuels%20for%20power%20generation.pdf

/63/ BCL: *Coal analysis report no. CCW/PROD dated 14 April 2010*

/64/ Reserve Bank of India: *Weekly statistical supplement on Cash Reserve Ratio and Interest Rates, dated 4 January 2008.*

/65/ Government of India*: Indian Income Tax Act 1961, Section 32 (Rule 5) Appendix 1 and Section 80-1A, paragraph 2.0*

/66/ Cement Manufacturer's Association(CMA): *Highlights of Indian Cement Industry, as on 31 March 2009* http://www.cmaindia.org/industry.html

/67/ Cethar Consulting Engineers (P) Ltd*: Technical analysis report for WHRB power plant in BVC and SCW of Birla Corporation Limited dated 8 December 2010*

/68/ Official web site of UNFCCC: *Financial analysis of the Registered CDM project - KCP Waste Heat Recovery Project in a Cement Plant by The KCP Limited (Cement Unit), India* http://cdm.unfccc.int/filestorage/V/E/X/VEXI2RUWOGCZL3A0NYP9QTJSFB5KM1/KCP%20Financial%20corrected.xla?t=QkF8MTMwMzg4NTQyMi45MQ==|PZvBgSFl

hpaJIZEw26PPRa0GRek=

/69/ CERC: *Order no. L/7/25(5)/2003-CERC dated 26 March 2004* *http://www.cercind.gov.in/28032004/finalregulations_terms&condition.pdf*

/70/ CRISIL: *CRISIL research report on the natural gas supply and demand in India dated June 2009*

/71/ M/s LNV technology private limited: *MoM of base line test of BVC dated 27 April 2007*

/72/ BCL, Satna unit: *Baseline clinker production and energy consumption data of BVC from October 2009 to September 2010 and of SCW August 2010 to January 2011*

/73/ National Council for Cement and building material: *Coal analysis report dated 15 September 2010*

3.2 Follow-up interviews with project stakeholders

On 2 December 2009 DNV visited the BVC and SCW of Birla Corporation Limited and performed interviews with project stakeholders.

	Date	Name	Organization	Topic
/74/	2 December 2009	Mr. Tanmay Maitra	BCL	Proposed CDM project, WHR based power plant in the cement plant of BCL in Satna
/75/	2 December 2009	Mr. Ashim Kr. Bhattacharya	BCL	
/76/	2 December 2009	Mr. Sanat Kr. Bandyopadhyay	BCL	
/77/	2 December 2009	Mr. Sudipta Das	Ernst & Young	
/78/	2 December 2009	Mr Shyamasis Das	Ernst & Young	

The main difference between the web hosted PDD and the final PDD are:

a) The investment comparison analysis method changed from levelized cost analysis to IRR analysis as per the applicable methodology AM0024 version 2.1.
b) The region selected for common practice analysis changed from the state of Madhya Pradesh to India.
c) The CERs have been revised from 75 314 tCO_2 to 75 087 tCO_2 due to rectification of error in station heating rate used in ER calculation and change in coal emission factor.
d) The source of emission factor of coal is revised from IPCC default value of 96.1 tCO_2/TJ to national value of 95.81 tCO_2/TJ
e) Project boundary has been revised in the final PDD
f) Description of pre project activity and post project activity has been clearly mentioned in the final PDD, which was not there in the web hosted PDD
g) Monitoring of coal NCV and coal quantity has been included in the monitoring plan of the final PDD.
h) Direct monitoring of clinker production has been introduced in the monitoring plan instead of using raw material to clinker conversion factor.
i) Crediting period of start date has been revised

3.3 Resolution of outstanding issues

The objective of this phase of the validation is to resolve any outstanding issues which need be clarified prior to DNV's positive conclusion on the project design. In order to ensure transparency a validation protocol was customised for the project. The protocol shows in a transparent manner the criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of four tables. The different columns in these tables are described in the figure below. The completed validation protocol for the project activity "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" in India is enclosed in Appendix A to this report.

A corrective action request (CAR) is raised if one of the following occurs:

(a) The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;

(b) The CDM requirements have not been met;

(c) There is a risk that emission reductions cannot be monitored or calculated.

A clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

A forward action request (FAR) is raised during validation to highlight issues related to project implementation that require review during the first verification of the project activity. FARs shall not relate to the CDM requirements for registration.

Validation Protocol Table 1: Mandatory Requirements for CDM Project Activities		
Requirement	***Reference***	***Conclusion***
The requirements the project must meet.	*Gives reference to the legislation or agreement where the requirement is found.*	*This is either acceptable based on evidence provided (**OK**) or a **corrective action request (CAR)** if a requirement is not met.*

Validation Protocol Table 2: Requirement Checklist				
Checklist question	***Reference***	***Means of verification (MoV)***	***Assessment by DNV***	***Draft and/or Final Conclusion***
The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in different sections, following the logic of the CDM-PDD	*Gives reference to documents where the answer to the checklist question or item is found.*	*Means of verification (MoV) are **document review (DR)**, **interview (I)** or any other follow-up actions (e.g., on site visit and telephone or email interviews) and **cross-checking (CC)** with available information relating to projects or technologies similar to the proposed CDM project activity under validation.*	*The discussion on how the conclusion is arrived at and the conclusion on the compliance with the checklist question so far.*	*OK is used if the information and evidence provided is adequate to demonstrate compliance with CDM requirements. A **corrective action request (CAR)** is raised when project participants have made mistakes, the CDM requirements have not been met or there is a risk that emission reductions cannot be monitored or calculated. A **clarification request (CL)** is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met. A **forward action request (FAR)** during validation is raised to highlight issues related to project implementation that require review during the first verification of the project activity.*

Validation Protocol Table 3: Resolution of Corrective Action and Clarification Requests			
Corrective action and/ or clarification requests	***Ref. to checklist question in table 2***	***Response by project participants***	***Validation conclusion***
*The **CARs** and/or **CLs** raised in Table 2 are repeated here.*	*Reference to the checklist question number in Table 2 where the CAR or CL is explained.*	*The responses given by the project participants to address the CARs and/or CLs.*	*The validation team's assessment and final conclusions of the CARs and/or CLs.*

Validation Protocol Table 4: Forward Action Requests		
Forward action request	***Ref. to checklist question in table 2***	***Response by project participants***
The FARs raised in Table 2 are repeated here.	*Reference to the checklist question number in Table 2 where the FAR is explained.*	*Response by project participants on how forward action request will be addressed prior to first verification.*

Figure 1: Validation protocol tables

3.4 Internal quality control

The validation report underwent a technical review performed by a technical reviewer qualified in accordance with DNV's qualification scheme for CDM validation and verification.

3.5 Validation team

				Type of involvement						
Role	***Last Name***	***First Name***	***Country***	Desk review	Site visit / Interviews	Reporting	Supervision of work	Technical review	TA 4.1 competence	Financial expertise
Team leader (Validator)	Rana	Indrajit	India	✓	✓	✓	✓			
Validator	Chattopadhyay	Sasim	India	✓	✓	✓				
Expert	Jayaram	Santhosh	India	✓					✓	
Technical reviewer	Flagstad	Ole	Norway					✓		
Person with sectoral competence assisting technical reviewer	Faggin	Matteo	Italy						✓	

The qualification of each individual validation team member is detailed in Appendix B to this report.

4 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of verification and the results from validating the identified criteria are documented in more detail in the validation protocol in Appendix A.

The final validation findings relate to the project design as documented and described in the PDD, version 05 dated 23 Sep 2011.

4.1 Participation requirements

The project participant is Birla Corporation Limited of host Party of India. The host Party (India) meets all relevant participation requirements.

A letter of approval (LoA) /40/ was issued by DNA of India on 11 Jan 2010, authorizing Birla Corporation Limited of host Party as project participant and confirming that the project assists in achieving sustainable development. DNV did not find any reason to doubt the authenticity of the letter of approval as DNV confirmed it from CDM India web site /60/.

The letters of approval were received from the project participants. DNV does not doubt the authenticity of the letters of approval. DNV also cross verify this from the websites http://cdmindia.nic.in/cdmindia/projects/1597-09.doc.pdf
http://cdmindia.nic.in/cdmindia/projectList.jsp?search=search

DNV considers the letters are in accordance with paragraphs 45- 48 of the VVM /41/.

4.2 Project design

The project is located at the plant premises of Birla Corporation Limited (BCL), Satna unit. BCL satna unit consists of Birla Vikas Cement (BVC) and Satna Cement Works (SCW). Thus BVC and SCW are the fully owned cement manufacturing units of Birla Corporation Limited, Satna in the state of Madhya Pradesh of India /2/. Both BVC and SCW went for capacity expansion. Before capacity expansion BVC has a clinker production capacity of 2900 tonne/day and SCW has a capacity 3400 tonne/day. After the expansion the capacity is being expanded to 5100 tonne/day for BVC and 4500 tonne/day for SCW /3/ /4/. Capacity expansion of BVC and SCW was completed and operation started on 24 July 2010 and 29 September 2008 /35/. The project entails utilization of the heat content of the waste gas from pre-heaters and clinker cooling sections of the clinker production lines of BVC and SCW for generation of power in a waste heat recovery based power plant. The power generated by the project activity will partially meet the electrical energy requirement after capacity expansion of the cement plants of Birla Corporation Limited, Satna. Thus the combined capacity of Birla Corporation Limited Satna unit reaches to 3.216 millions tonne of clinker per year. This up scaling has led to an increase in power demand /7/. Initially (*i.e.* before the up scaling) 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 /5/ and partially by grid. As the same would not be able to cater the power demand after up scaling, project proponent has decided and implemented new waste heat recovery based captive power plant (*i.e.* project activity) where the waste heat of the waste gas emanating from pre heater and clinker cooler would be utilized for power generation.

In the project activity after fulfilling baseline requirement for pre heating of coal and raw material gas available from the revamped capacity of the clinkers in BVC and SCW will be utilized in WHR based power plant. WHR based power plant in BVC and WHR based power plant in SCW are independent in operation. WHR based power plant in BVC used waste heat generated from clinker production process of BVC and WHR based power plant in SCW used waste heat generated from clinker production process of SCW. The capacity of each WHR based power plant is 7.5 MW (Turbine: 7.5 MW and generator: 7.5 MW). The project activity involves the installation of the following equipments in BCL, Satna unit /17/:

BVC

- One boiler at the downstream of the Kiln pre-heater at BVC to utilise the flue gas of the same. Total waste flue gas comes out from the Kiln pre-heater is 323 000 Nm^3/h. Waste flue gas utilized in coal drying and raw material heating are 55 606 Nm^3/h and 142 211 Nm^3/h. Thus available flue gas in WHRB is 125 183Nm^3/h at 240°C~280°C.
- Two boilers at the downstream of the clinker cooler at BVC to utilise the waste gas of the same. Total waste flue gas comes out from the clinker cooler is 217 000 Nm^3/h. Out of this waste flue gas of 49 500 Nm^3/h at ~500°C and 85 500 Nm^3/h at ~395°C will be extracted and utilized in the two WHRBs. Rest 82 000 Nm^3/h will be discharged from the hot air outlet of clinker cooler.
- One 7.5 MW generator driven by a condensing type turbine of 7.5 MW capacity, utilizing the steam from the WHR boilers at BVC.

SCW

- One boiler at the downstream of the Kiln pre-heater at SCW to utilise the flue gas of the same. Total waste flue gas comes out from the Kiln pre-heater is 280 000 Nm^3/h. Waste flue gas utilized in coal drying and raw material heating are 30 000 Nm^3/h and 217 000 Nm^3/h. Thus available flue gas in WHRB is 33 000Nm^3/h at 240°C~280°C.
- Two boilers at the downstream of the clinker cooler at SCW to utilise the waste gas of the same. Total waste flue gas comes out from the clinker cooler is 190 000 Nm^3/h. Out of this waste flue gas of 41 800 Nm^3/h at ~500°C and 72 200 Nm^3/h at ~375°C will be extracted and utilized in the two WHRBs. Rest 76 000 Nm^3/h will be discharged from the hot air outlet of clinker cooler.
- One 7.5 MW generator driven by a condensing type turbine of 7.5 MW capacity, utilizing the steam from the WHR boilers at SCW.

The WHR boilers and the generator are supplied by M/s. Dalian East Energy Project Co. Ltd., China /13/. The total steam requirement of the turbo generator is being made available by WHR boilers installed as part of the project activity. As per the conventional clinker manufacturing process, the waste gases emanating from clinker cooler and pre-heater are vented to the atmosphere without heat recovery, except for a small portion used to pre-heat the incoming raw materials and fuel. In the project scenario, the waste gases from clinker cooler and pre-heater will be introduced into the Waste Heat Recovery Boilers (WHRB) where the heat content of the kiln gases will be extracted and utilized for generation of steam. After 8% auxiliary consumption, 65.31 GWh/annum electricity will be supplied to the cement plants of Birla Corporation Limited, Satna. The technical details of the WHRBs and turbo generator have been verified from the technical scheme of the equipment /17/.

In absence of the project activity, the equivalent amount of electricity would have been sourced from a new coal based captive power plant which would be the extension of existing fossil fuel based CPP /16/. The waste heat recovery boiler and the steam turbo generator have

been designed and supplied by M/s. Dalian East Energy Project Co. Ltd., China and a reputed organisation in the field of power generation equipment. Thus, the project design reflects good engineering practice.

The starting date of the project activity has been selected as 26 June 2008 which is the date of contract /13/ for the supply of WHRB and steam turbo generator and reflects the earliest date on which real action for the project was initiated. The construction work was started on April 2009 /50/ when civil construction began. The WHR based power plant in BVC and SCW has started operation on 26 February 2011 and 10 October 2010 respectively /36/.

The lifetime of the project is 25 years, which is deemed reasonable and certified by the technology supplier of the project activity /61/. The project has selected a fixed crediting period of 10 years starting from 1 July 2011, or from the date of registration, whichever is later. The validation did not reveal any information that indicates that the project can be seen as a diversion of ODA.

The project description is considered by DNV to be complete and accurate in line with VVM version 1.2 /41/. DNV considers the project description of the project contained in the PDD to be complete and accurate. The PDD complies with the relevant forms and guidance for completing the PDD.

4.3 Application of selected baseline and monitoring methodology

The methodology AM0024 (version 2.1) "Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants" was applied for the baseline determination.

DNV was able to verify that the project meets all applicability criteria of the baseline methodologies as stated below in line with VVM version 1.2 /41/:

- The project involves generation of electricity from clinker waste heat, which has been verified from the contract for the supply of waste heat recovery system /13/.
- The entire electricity generated will be used within the industrial facility for captive consumption. The power requirement of BCL, Satna units is presently met mainly by a coal based captive power plant and the balance through imports from the grid. The verification of electricity bills /23/ /24/, power consumption report for the year 2007 – 2008 /5/ and detail energy consumption in BVC, SCW /9/ /10/ show that the BCL, Satna units imports power from the grid to make up the shortfall in captive production and the power generated by the project activity can be consumed internally.
- Energy generated by the project activity will replace the power from an identifiable generation source. The BVC has a clinker production capacity of 2900 tonne/day and SCW has a capacity 3400 tonne/day, which is being expanded to 5100 tonne/day and 4500 tonne/day respectively /3/ /4/. The additional requirement of the proposed expansion would have been met from coal based power plant, since the cost of grid power is high /23/ /24/ .
- New coal fired power plant is the identified generation source. The new coal based CPP as an extension of the existing CPP 27 MW /5/ is the identified generation source, as stated above.
- The waste heat is used in the project activity alone. This has been verified from the contract for supply of WHRBs /13/ /17/.

In the baseline, a part of the waste heat from the gas is captured to preheat the incoming raw materials and fuel (Type 1 activity) and the rest is vented out. This has been verified during the site visit.

It has also been evidenced from process flow diagram of pre project scenario and project scenario/1/ the project is not a Type 2 activity as waste heat used in the project activity is not located outside of the clinker making process. This has also been verified during the site visit.

The assessment of the project's compliance with the applicability criteria of AM0024 (version 2.1) are documented in detail in section B.2 of Table 2 in the validation protocol in Appendix A to this report.

4.4 Baseline determination

A) Baseline determination

The project activity applies the baseline methodology of AM0024 version 2.1. The baseline has been determined in accordance with the applied baseline methodology.
During the site visit, DNV verified that most of the waste heat from pre-heater and clinker cooler in the clinker production lines of BCL, Satna unit was being vented to the atmosphere in the baseline scenario. Only a small portion of the waste heat was used in the clinker section to pre-heat the raw materials. Therefore the project activity falls into the category of Type 1 waste heat utilization as per the methodology /42/. The waste heat is generated during the clinker production and has direct impact on the fuel consumption, which is reflected in the specific fuel consumption of the clinker. The venting of waste heat from pre-heater and clinker cooler is the current practice of similar plants in India, as detailed in common practice analysis. DNV has also confirmed during the site visit that there is no possibility of utilising the waste heat by other users in the locality. Measurement of the specific fuel consumption per unit clinker before and after the project implementation would capture any change in emission resulting from this change in Type 1 waste heat flows.

The electricity consumption from the energy consumption records in BVC and SCW for the years 2007-08 2008-09 2009-10 /9/ /10/ show that the electricity requirement of BCL is mostly met from the coal based captive power plant and the rest is imported from the grid. The BVC has a clinker production capacity of 2900 tonne/day and SCW has a capacity 3400 tonne/day, which is being expanded to 5100 tonne/day and 4500 tonne/day respectively /3/ /4/. Thus the combined capacity of Birla Corporation Limited Satna unit reaches to 3.216 millions tonne of clinker per year. This upscaling has led to an increase in power demand /7/. This additional electricity demand can be met by either imports from grid or by installing a new coal based power plant. The historical operation data of the plant suggest that the majority of the power requirement of the plant was met by captive generation with only the surplus demand after exhausting the captive generation was imported from the grid /9/ /10/. It is thus reasonable to assume that this trend would be continued in the future also. The variables E_{load} and EG_{cement} calculated in line with the methodology indicate that the power generated by the project activity can be fully absorbed by the cement manufacturing plants of BCL at Satna. The energy balance work sheet from the year 2006 to 2010 and extrapolated to 2012 for BVC and SCW /27/ and data provided in the PDD /1/, have been verified against the energy consumption records in BVC and SCW for the years 2007-08 2008-09 2009-10 /9/

/10/. The calculations show that BCL, Satna will continue to import power from the grid even after implementation of the project activity.
In line with the methodology historical and projected values of electricity demand of the cement works (E_{CEMENT}) and other local loads (E_{LOAD}) have been given in the PDD ver.03. The average annual power demand in the post project scenario is envisaged to be 286.2 million kWh.
Electricity supply is also stated in PDD, both historic and extrapolated future values. Average annual electricity generation of the existing captive power plant ($EG_{ATEXIST}$) of 27 MW coal based Thermal Power Plant is envisaged to be 182 million kWh /27/.
It has been evidenced from the electricity demand and supply in BCL, Satna unit 104.2 million kWh per annum (i.e. the difference of 286.2 million kWh and 182 million kWh) needs to be met from other sources. However in meeting this balance power requirement, only 65.3 million kWh will be supplied by the waste heat recovery based power plant *i.e.* the project activity and remaining 38.9 million kWh will be drawn from the local grid.

Since only 65.3 million kWh /annum of electricity supply is likely to be displaced by the project activity all the credible and realistic alternatives have been identified based on net generation of 65.3 million kWh /annum.

The credible and realistic alternatives to the project activity identified are as follows:
Alternative 1: The project activity undertaken without being registered as a CDM project activity.
Alternative 2: Installation of a new coal based power plant as an extension of the existing 27 MW captive power plant and releasing the waste heat (available after type 1 waste heat utilization) to atmosphere.
In absence of the project activity, the project participant would have sourced the power from a new coal based power plant of minimum 10MW capacity, which is the capacity required to supply the same quantity of electricity than the WHR power plant as demonstrated below:

Rated capacity = [Net power generation / ((1- auxiliary power percentage) X Annual working days X Plant availability Factor)] /33/
The assumptions are as follows:

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	72.57	million kWh
net power generation	65.31	million kWh

The coal based power plant could have a bigger size to deliver total power of 104.2 million kWh per annum (65.3 million kWh/ annum + 38.9 million kWh) which could be even more financially attractivethan a 10MW plant.
But to compare apple to apple, the net electricity generation from the project activity has been considered to determine the baseline alternative. Moreover in Indian scenario some grid support is required for emergency purpose. In the historic electric supply and demand of BCL, Satna unit /9/ /10/ /27/ some grid power has always been used instead of higher cost. Therefore the same philosophy has been used to determine the capacity of the coal based power plant.

On basis of the above analysis a new coal based captive power plant of capacity 10MW has been considered as realistic and plausible baseline alternative.

Alternative 3: Import of electricity from NEWNE grid of India and continue venting of waste heat to atmosphere. However the cost of grid power is much higher /23/ /24/ than that of alternative 1 & 2 and the financial analysis is done based on the savings compared to the cost of grid power. Moreover approved methodology AM0024 version 02.1 /42/ mandates to use IRR as the financial indicator in step 3 – investment comparison. IRR can be calculated only when there is an investment. But there is no investment when importing all electricity from Grid, so IRR cannot be calculated. Moreover in the project activity net electricity generated would be used for internal consumption not for sale and investment comparison of alternative 1 and 2 were done based on the savings compared to the cost of grid power. The investment comparison analysis also indirectly suggests that alternative and 1 and 2 are more financially attractive than alternative 3. Because under investment comparison analysis both alternative 1 and 2 show positive IRR when the financial analysis is done. DNV also review the unit cost of power for the alternatives 1, 2 and 3. The unit cost of electricity from grid (i.e. alternative 1) is 3.89 INR/kWh as per power purchase during the approval of the project activity /23//24/. Whereas as per financial assessment report prepared by the appointed consulting firm M/S Cethar Engineering Consultants Pvt. Limited and based on which note to board for approval of the project activity was prepared /11/, unit cost of power generation through a coal based power plant (i.e. alternative 1) is INR 2.5 /kWh and unit cost of power generation in project scenario (i.e. alternative 2) is INR 2.89 /kWh.
Moreover reliability of grid power is not so strong in Madhya Pradesh. Hence it is hardly possible that entire power requirement after the capacity expansion in BCL, Satna unit would be met from grid. The historical operation data of the plant /27/ also shows that the majority of the power requirement of the plant was met by captive generation with only the surplus demand after exhausting the captive generation was imported from the grid. It is thus reasonable to assume that this trend would be continued in the future also. So Alternative 3 is not a realistic and credible alternative for the project activity.
Alternative 4: Captive power generation based on different fuel (natural gas, diesel oil, *etc*). Price of diesel is quite higher than coal /21/. Hence unit cost of power generation from diesel is higher than unit cost of power generation from coal. Moreover, the diesel generator is used as emergency backup not for continuous operation due to high cost of power generation from diesel. Thus power generation from diesel is less attractive than from coal.
Natural gas is not available in the state of Madhya Pradesh /22/ as there is no source of natural gas. The CRISIL report /70/ also states that in Madhya Pradesh there is no NG pipe line. Thus

construction of captive power plant based of natural gas is not a realistic and credible baseline alternative for the project proponent due to prohibitive barrier.
In general for implementation of biomass based power plant CDM is required. In Madhya Pradesh there are two CDM registered biomass based power generation project. Hence biomass based power plant is not a realistic and credible baseline alternative for the project proponent as it is financially unattractive.
Thus Construction of a captive plant with different fuel options has also not been considered as baseline scenario.

DNV consider the list of alternatives to be realistic, credible and complete. Both the alternatives 1 & 2 are in compliance with the regulatory requirements.

Based on the above discussion, it has been concluded that alternatives 1 and 2 were feasible and investment analysis was carried out to determine the most attractive alternative.

Under section 4.5.3 of the investment analysis discussions, the project IRR of the proposed project (alternative 1) and the new coal based captive power plant and releasing the waste heat (available after type 1 waste heat utilization) to atmosphere (alternative 2) were analyzed . It has been observed from the post tax IRR analysis /33/ that the 17.36% IRR of alternative 1 is lower than the 26.3% IRR of alternative 2. As per applicable methodology AM0024 version 2.1 the option with the highest IRR is the baseline scenario for waste heat recovery and electricity supply to the cement works**.** Therefore the new coal based captive power plant and releasing the waste heat (available after type 1 waste heat utilization) to atmosphere (alternative 2) is considered to be the most realistic baseline considering investment in alternative 1 is financially unattractive.

DNV was able to verify that among all the identified baseline scenarios, taking into account the technological and economical considerations, alternative 2 - Installation of a new coal based power plant as an extension of the existing 27 MW captive power plant and releasing the waste heat (available after type 1 waste heat utilization) to atmosphere is the baseline scenario.

The approved baseline methodology has been correctly applied to identify a complete list of realistic and credible baseline scenarios, and the identified baseline scenario most reasonably represents what would occur in the absence of the proposed CDM project activity.

All the assumption and data used by the project participants are listed in the PDD and/or supporting documents. All documentations relevant for establishing the baseline scenario are correctly quoted and interpreted in the PDD. Assumptions and data used in the identification of the baseline scenario are justified appropriately, supported by evidence and can be deemed reasonable. Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD.

B) Project boundary

The project boundary includes the cement manufacturing units of BCL, Satna unit, the waste heat sources (rotary kilns generating the waste heat for the project), heat recovery boilers, turbo generator and electrical distribution system of BCL, Satna unit, existing CPP and the NEWNE grid of India.

Only CO_2 is the emission source involved in baseline emission and project emission.

The system boundaries have been presented in tabular format:

	GHGs involved	Description
Baseline emissions	CO_2	Identified specific generation source
Project emissions	CO_2	On site fossil fuel consumption due to the project activity
Leakage	Nil	

DNV validated the project boundary in line with VVM version1.2 /41/

The identified boundary and selected sources and gases are justified for the project activity. The validation of the project activity did not reveal other greenhouse gas emissions occurring within the proposed CDM project activity boundary as a result of the implementation of the proposed project activity which are expected to contribute more than 1% of the overall expected average annual emission reduction, which are not addressed by AM0024 (version 2.1).

4.5 Additionality

The additionality of the project has been established using the "Tools for the demonstration and assessment of additionality" version 5.2 approved by the CDM-EB /43/. The project activity demonstrates the additionality through the investment analysis and common practice analysis.

4.5.1 Evidence for prior CDM consideration and continuous actions to secure CDM status

CDM was seriously considered in the decision to proceed with the project activity in compliance with "*Guidelines on the demonstration and assessment of prior consideration of CDM" version 3*, /45/ which was confirmed through:

- On 16 November 2007 BCL received the technical offer for WHRB based power plant from Dalian East Energy Project Co. Limited /17/.
- On 26 November 2007 Techno-commercial offer for coal based power plant from M/S. Cethar Consulting Engineers (P) Ltd /16/
- On 25 January 2008 BCL top management submit the cost analysis report of the project activity to BCL Board of Directors and stated with CDM benefit BCL could implement the project activity /11/
- Early consideration of CDM is evidenced by Board of Directors resolution of BCL /12/, dated 31 January 2008, in which the CDM benefits were considered prior to the start date of the of the project which is 26 June 2008.
- BCL has appointed M/s Ernst & Young as consultants for the CDM project on 3 March 2008 /28/.

- BCL signed the agreement /13/ with M/s Dalian for the WHRB and turbo generator on 26 June 2008, which is the project start date.

The assessment that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation is summarized below:

- BCL invited stake holder comments by sending letters on 15 June 2009 /14/.
- The stake holder responses were received on 19 June 2009 and 20 June 2009 /14/.
- Appointment of DoE for validation of the project on 21 July 2009 /15/.
- Web hosting of PDD for global stakeholder consultation on 31 October 2009.
- Receipt of Host country approval for the project activity 11 January 2010 /40/.

It has been evidenced from the above chronology of events that the time gap between two events for securing CDM status for the project activity is less than two years which implies the continuous procedures towards securing CDM status and demonstrates sufficient efforts to secure CDM status in parallel with the implementation. Thus DNV was able to confirm that in compliance with EB41 annex 46, CDM benefits were seriously considered in the decision to proceed with the project activity and real and continuing action were undertaken to ensure CDM benefits during the implementation of the project activity.

It is DNV's opinion that the proposed CDM project activity complies with the requirements of the latest version of the guidance on prior consideration of CDM.

4.5.2 Identification of alternatives to the project activity

The project's additionality is demonstrated using "Tool for the demonstration and assessment of additionality", version 5.2, /43/.

Four alternatives to the project activity have been considered as the baseline scenario. These are i) project activity undertaken without CDM benefits, ii) generation of power in a coal fired 10 MW plant as an extension of the existing captive power plant and releasing the waste heat (available after type 1 waste heat utilization) to atmosphere**,** iii) import of power from the NEWNE grid and iv) Captive power generation based on different fuel (natural gas, diesel oil, *etc*). All the alternatives were discussed in section 4.4 and alternative (iii) and (iv) were eliminated, since the cost of grid power is the highest and the financial analysis is done based on the savings compared to the cost of grid power. Price of diesel is quiter high than coal /21/ and natural gas is not available in the state of Madhya Pradesh /22/. Alternatives (i) and (ii) are in compliance with the laws and regulations of India. The project proponent has calculated the post tax project IRR /33/ for these two alternatives and has considered the alternative with highest IRR as the baseline in line with the methodology. The IRR comparison establishes that alternative ii) has the highest IRR among the two alternatives and has hence been selected as the most likely baseline scenario.

Although the capacity of the project activity is 15 MW (7.5 MW for BVC and 7.5 MW for SCW) total power generated from the project activity per annum is equivalent to power generation in a 10 MW coal based CPP. This is due to less availability of waste gas in monsoon season as in the monsoon season more quantity of waste flue gas from clinker coolers and kiln pre heaters will be utilised for preheating of coal and raw material. DNV has verified the estimated annual power generation in the project activity from the technical

specification of the project activity provided by the technology supplier Dalian East Energy Project Co. Limited /17/. Thus to meet the uniformity of the financial analysis total out put from both the alternatives has been fixed at 65.309 GWh/annum which is the guaranteed power generation from the project activity provided by the technology supplier Dalian East Energy Project Co. Limited /17/.

4.5.3 Investment analysis:

Choice of approach

The CDM project activity and the alternative identified in section 4.4 generate financial or economic benefits other than CDM related income. Therefore the investment comparison analysis (Option II) or the benchmark analysis (Option III) is applicable to the project activity. Among these two options BCL has adopted the investment comparison analysis. The post tax project internal rate of return (IRR) has been used as the financial indicator for the investment comparison analysis. DNV consider the investment comparison analysis with IRR as the financial indicator to be an appropriate choice.

Input parameters

The assumptions used in the investment comparison analysis are deemed appropriate and the values were verified/cross-checked from the documents shown in the following table.

Inputs values	Value used for financial analysis	Documents verified/cross-checked
Project cost inclusive of 6 WHR boilers and two 7.5 MW turbo generators.	INR 1 080 million	The project cost was verified from the note to the Board for implementation of the project activity dated 25 January 2008 /11/ and the Board resolution dated 31 January 2008 /12/, deciding to proceed with the project activity. DNV has cross checked the project cost against the contracts for supply and erection of the equipments and structurals amounting to INR 848.84 million as of May 2010 /13/, /49/ to /58/, which constitutes 78.59% of the estimated project cost. The WHR based power plant in BVC and SCW has been commissioned on 26 February 2011 and 10 October 2010 respectively /36/. Thus DNV checked the total capital investment towards the project

		activity from the certification letter issued by Agarwal & Co, Chattered accounts: Certificate of capital investment dated 25 April 2011. Total capital investment for the WHR based power plants in BCL, Satna unit is INR 1 136.597 million./37/ which is more than the estimated project cost INR 1 080 million used in the IRR calculation. Based on the above discussion DNV concludes that the project cost considered in the IRR analysis is appropriate.
Baseline cost inclusive of coal fired boiler and 10 MW turbo generator	INR 470.4 million	The baseline cost is calculated on pro rata basis depending on the offer from M/s. Cethar Consulting Engineers (P) Ltd. dated 26 November 2007 for two 7.5 MW coal fired power plant /16/. As per the offer the price is INR 600 million and as per national standard accounting method [600 X $(10/15)^{0.6}$], the cost of 10 MW coal based power plant is INR 470.4 million. DNV has cross checked the baseline cost with independent data source. According to the report of CEA /62/ available in public domain, the estimated cost of coal based power plant in 2004 was INR 40 million/MW. Considering the increase of CAGR 6% in the commodity prices since 2004 /48/, the cost in 2007 - 2008 would have been INR 47.6 million /MW and 476 million for 10 MW. Hence it is DNV's opinion that the baseline cost is deemed appropriate./62/ DNV has also checked the IRR analysis with the baseline cost INR 600 million and it is found that the baseline IRR is 21.09%

		which is till higher than the project IRR 17.36%. Thus it is DNV's opinion the baseline cost is deemed appropriate.
Cost of coal	INR 1180/tonne	The coal cost was verified from the note to the Board for implementation of project activity dated 25 January 2008 /11/ DNV has cross-checked the cost against the Details of Packing Material, Raw Materials and coal consumed in 2006-07-Satna Cement Works dated 31 March 2007 /31/
Annual escalation of coal cost	4.86%	Escalation rate is verified from the web site of Ministry of commerce industry: Yearly wholesale price index for non coking coal by considering 2002-2003 as the base year /48/. DNV has also calculated the CAGR of coal cost by using the tool /34/ and found correct.
Auxiliary power consumption for WHRB	8%	The auxiliary consumption was verified from the technical offer of Dalian East Energy Project Co. Limited /17/. Based on the sectoral competence DNV confirms that 8% auxiliary power consumption for WHRB is deemed appropriate. It was also cross-checked against the 10% auxiliary consumption used in the financial analysis of the similar CDM registered project "KCP Waste Heat Recovery Project in a Cement Plant by The KCP Limited (Cement Unit), India" (UNFCCC registration no. 1907) /68/.The auxiliary consumption of the project activity is lower than the KCP and is conservative.

Auxiliary power consumption for new CPP in baseline	10%	The auxiliary consumption was verified from the offer of M/s. Cethar Consulting Engineers (P) Ltd. for the coal fired power plant /16/. Based on the sectoral competence DNV confirms that 10% auxiliary power consumption for CPP is deemed appropriate. This was cross-checked against the CERC order no. L/7/25(5)/2003-CERC of 2004 /69/according to which, for coal fired units of less than 200 MW capacity, the normative value of auxiliary consumption is 8.5 to 9%. Hence 10% auxiliary consumption for a small capacity power plant of 10 MW capacity is reasonable.
Availability of WHRB (amount of waste gas available without disturbing the baseline requirement of raw material and coal pre heating)	SCW: normal season 5.9 MW for 260 days rainy season 4.59 MW for 75 days BVC: normal season 6 MW for 260 days rainy season 4.46 MW for 75 days Common: Plant availability (annual operation time): 98% of the operating hours of the cement kiln. waste gas availability factor: 80% The gross electricity generation estimated is 71 GWh per annum (overall PLF of 54%)	The guaranteed power generation capacity, waste gas availability factor and plant availability have been validated from the technical offer of Dalian East Energy Project Co. Limited /17/. WHRB based power plant operation depends on the waste gas availability. Thus WHRB based power plant availability is 98% of the operating hours of the cement plant which is deemed appropriate. However in the project activity waste gas availability varies from normal season to rainy season. Moreover in any particular day waste gas availability also varies depending on coal mill and raw mill operation. Coal mill and raw operation is batch process. Coal mill operates 18 hours per day and raw mill operates 20 hours per day /67/. In the project

		activity the baseline requirement will not be disturbed. Thus when raw mill and coal mill will be operated the waste gas availability for power generation will reduce. It has also been evidenced from the technical analysis report provided by Cethar Consulting Engineers (P) Ltd /67/ that 4 hours per day plant waste gas availability will be more than normal waste gas availability when raw mill and coal mill will not under operation and in that time the turbine of SCW and BVC could generate power at7.5 MW/hr in normal season. Hence the capacity of the turbines are high than the average capacity of power generation to entrap the maximum possible waste heat from the WHRBs. As per technical offer of Dalian East Energy Project Co. Limited /17/ over this above discussed design philosophy the waste gas availability is also depends on clinker production rate, waste gas temperature, etc. Based on this uncertainty waste gas availability factor of 80% is recommended by Dalian East Energy Project Co. Limited /17/. After capacity expansion maximum clinker production /39/ achieved in BVC and SCW are 4700 tonne per day in the month of January 2011 and 4221 tonne per day in the month of October 2010 which are less than rated capacities after the capacity expansion. Hence after start of operation till date waste gas generation is also reduced. DNV has cross checked the technical specification of WHRB

		based power plant in BVC and SCW provided by Dalian East Energy Project Co. Limited with independent source – technical analysis report by Cethar Consulting Engineers (P) Ltd /67/ and found all the assumption used in IRR analysis sourced from technical offer of Dalian East Energy Project Co. Limited /17/ are correct. Thus estimated gross electricity generation is 71 GWh/annum. The estimated overall PLF has been cross-checked against the values used in the financial of the similar CDM registered project "KCP Waste Heat Recovery Project in a Cement Plant by The KCP Limited (Cement Unit), India" (UNFCCC registration no. 1907) /68/. In this project, load factor of 60% and run hours of 7200 per year were applied. The overall PLF for KCP project thus works out to 49.3%, which is lower than the PLF of the project activity. Further, actual generation from the project activity, since commissioning of the WHR based power plant in BVC and SCW on 26 February 2011 and 10 October 2010 respectively /36/ has been cross checked. SCW has commissioned earlier and highest PLF achieved in the month of March 2011 and it was 47.84% /38/. BVC has commissioned later. Hence it is now under stabilisation process. Its PLF in the month of March 2011 was very low (2%) /38/. The overall highest PLF achieved by the project is 24.95% in the month of March

		2011 /38/. Hence the overall PLF 54% used for the financial analysis is deemed appropriate.
Availability of new CPP in baseline	Plant load factor of 90%,	The plant load factor was verified from the offer of M/s. Cethar Consulting Engineers (P) Ltd. for the coal fired power plant /16/. DNV confirms that plant load factor of new coal based CPP varies from 90% to 100%. However for same net electricity out put the project proponent is needed to install baseline coal based CPP at lower capacity, if the plant load factor has been considered 100% which in turn reduce the baseline installation cost. Thus 90% plant load factor of coal fired boiler is deemed appropriate and conservative.
Operation and Maintenance cost WHRB	1.5% of total project cost	The O&M cost was verified from the suggestion made by the technical consultant involved in execution of the project activity and which is reflected in note to the Board for implementation of the project activity /11/. DNV has cross checked operation and maintenance cost WHRB from the technical analysis report provided by Cethar Consulting Engineers (P) Ltd /67/ and found appropriate.
Operation and Maintenance cost new CPP in baseline	INR 0.24/kWh	The O&M cost was verified from the note to the Board /11/. DNV has cross checked this figure against the actual O&M cost of the existing captive power plant for the year 2006-07 /30/.
Annual escalation of O&M cost	4.33%	Escalation rate of O & M cost is verified from the web site of Ministry of commerce industry: Yearly wholesale price index for all commodities by considering 2002-2003 as the base year /48/

		DNV has also calculated the CAGR of all commodities cost by using the tool /34/ and found correct.
Design station heat rate of coal fired boiler	2867 Kcal/KWh	Station heat rate was verified from the offer of M/s. Cethar Consulting Engineers (P) Ltd. for the coal fired power plant /16/. Based on the coal analysis report /63/ DNV confirms that 2867 Kcal/KWh of Design station heat rate of coal fired boiler is deemed reasonable.
NCV of coal	3800 Kcal/kg	NCV of coal was verified from the offer of M/s. Cethar Consulting Engineers (P) Ltd. /16/. DNV has cross checked the coal NCV against the analysis report of coal /63/ which is 3875 Kcal/kg.
Grid electricity tariff	INR 3.89/KWh	The tariff was verified from the note to the Board for project implementation /58/. DNV has cross-checked the electricity tariff against electricity bill for the month of December 2007 /23/ and consolidated sheet for grid tariff for the year 2006-2007 /24/.
Annual escalation of tariff	1.98%	Escalation rate of electricity tariff is verified from the web site of Ministry of commerce industry: Yearly wholesale price index for electricity for industry by considering 2002-2003 as the base year/48/. DNV has also calculated the CAGR of all commodities cost by using the tool /34/ and found correct.
Debt to equity ratio	2:1	The debt: equity ratio was verified from the note to the Board for project implementation /58/ and is used for the tax calculation.

Interest rate on term loan	12.5%	The interest on term loan was verified from the Reserve Bank of India's third quarter review of annual statement on monitory policy for the year 2007-08 /64/.
Depreciation, Income Tax, salvage value	Depreciation rate for plant & machinery @ 5.28% and 3.34% for civil works were considered for financial analysis. The depreciation is considered up to 90% of the total asset value and the residual value is accounted during the 20th year. The income tax is calculated at the rate of 33.99%	The depreciation and Income Tax rates were verified from the note to the for project implementation Board /58/ and cross-checked against the Indian Income Tax Act 1961 /65/.

After reviewing all the references used above to substantiate all the input values used in the investment analysis DNV confirms that input values are valid and applicable at the time of the investment decision taken by the project participant.
The IRR of the two alternatives are listed below /33/:

- Alternative 1: Project activity undertaken without CDM benefits had an post tax project IRR of 17.36%,
- Alternative 2: Generation of power in a coal based 10 MW plant as an extension of the existing captive power plant had a post tax project IRR of 26.30%.

Calculation and conclusion

From the investment comparison analysis of the project activity and the alternative, it has been found that the alternative-2, generation of power in a coal fired 10 MW plant as an extension of the existing captive power plant had the highest IRR amongst all plausible alternatives including the project activity without CDM revenue /33/. As per the "Tool for the demonstration and assessment of additionality", version 5.2 /43/, *"If one of the other alternatives has the best indicator, 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.

The IRR calculations were provided in a spreadsheet /33/. The calculations and assumptions used in the calculations were deemed to be correct by DNV. The project-IRR without CDM revenues at 17.36% is lower than the 26.3% for the alternative 2 and confirms that the project in the absence of CDM benefits is not financially attractive

Sensitivity analysis

To make investment comparison analysis robust and realistic, a sensitivity analysis has been done by varying the values of input parameters which has more than or equal to 20% contribution in either total project costs or total project revenues. Project proponent has done the baseline sensitivity analysis by variation of project cost, coal price, grid power tariff, O&M costs and power generation from waste gas /33/.

It has been evidenced with ± 10% variation of the above parameters the IRR in project with out CDM benefit is less than the IRR in baseline.

More over DNV has checked that the difference in IRR between baseline and project increases in sensitivity analysis for most of the cases which implies IRR in project will be less than baseline /33/.

However in three cases the difference in IRR decreases in sensitivity analysis. These are:

1. Decrease in electricity generation
2. Decrease in Grid power cost
3. Increase in coal cost

Thus DNV has checked the sensitivity analysis beyond ± 10% variation for the above cases. DNV has checked the following scenarios:

- If electricity generation is decreased by 50% then IRR will be higher than baseline IRR which is not likely as per the technical specification provided by Dalian East Energy Project Co. Limited /17/.
- If grid power cost decreases by 40% then IRR will be higher than baseline IRR which is not likely as grid power cost is in increasing trend /48/.
- If coal cost increases by 78% then IRR will be higher than baseline IRR which is also not likely as coal price is partially regulated by Government of India.

Thus it is DNV's opinion the sensitive analysis is complete and in any realistic situation project IRR will not be higher than the baseline IRR.

4.5.4 Common practice analysis

For assessing the common practice analysis, all the cement plants operating in India have been considered. Since the cement plants in India operate under the same set of economical, environmental and political conditions, the choice of the region, scale and technology for the common practice analysis is deemed justified. As per the data base of Cement Manufacturer's Association, /66/ there are 148 cement plants in India as of 31 March 2009. Among the 148 cement plants in India, only 7 other plants have installed/installing WHRB for power generation and all of them have considered CDM benefit for implementation of the same. This has been verified from the list of CDM projects published in CDM pipeline /46/. Moreover DNV has verified from "Cement Manufacturers' Association: CMA environmental task force 39th meeting – minutes of meeting dated 9 July 2010" that every waste heat recovery project in cement industry in India comes after considering CDM benefit /26/. Hence it can be concluded that WHRB based power generation is not a common practice for cement plants in India and the installation of such WHRB is feasible only with CDM benefit.

From the above discussion it can be concluded that the project is not a business-as-usual scenario and thus additional.

4.6 Monitoring

The project applies the approved monitoring methodology AM0024 version 2.1, "Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants". The selected monitoring methodology is applicable for the project activity as it involves waste heat recovery and utilization for power generation at cement plants.

All the data collected under the monitoring plan will be kept for 2 years after the end of crediting period or till the last issuance of CERs, whichever is later. The monitoring plan stated in the PDD is feasible and of the project participants have ability to implement it. The

monitoring plan is in accordance with the monitoring methodology and will give opportunity for real measurements of achieved emission reductions.

Monitoring of sustainable development indicators is not required by the DNA of India.

The project monitoring plan is in compliance with the monitoring methodology AM0024 (version 2.1).

It is DNV's opinion, that the project participant is able to implement the monitoring plan.

4.6.1 Parameters determined ex-ante

The following parameters are determined *ex-ante* and verified by DNV.

Parameters	Unit	Value applied	Description and source of data used
$NCV_{fuel,y}$	TJ/tonne	3800	Net calorific value (energy content) per mass unit of the fuel (coal) consumed by the clinker production lines prior to the start of operation of the project activity /63/.
EI_B	TJ/ tonne	0.003313	Pre-project energy consumption per unit output of clinker in TJ/tonne of clinker produced (*i.e.* measured before the Project activity goes into operation) is a calculated parameter. This has been calculated by the following equation /3/ /4/ /7/./63/ /71/: $EI_B = \frac{F_B}{O_{clinker,B}}$ As per the guidance provided in the approved methodology AM0024, version 2.1. *'If a year's worth of pre-Project Activity data is not available, then the Project Developer should outline the plan for ensuring conservativeness based on a combination of the ex-ante design estimate of energy consumption plus available measured data.'* Since pre-project scenario data was not available at the time of validation because plants were supposed to undergo up-gradation, PP decided to use design data provided by the technology

			suppliers (i.e. LNVT and FLS Smith). The same is in compliance with the above mentioned guideline. However at a later stage after getting the actual data these design figure has been cross checked with the real pre-project plant data. It was found that the design data is more conservative than the actual pre-project data. As per the design data, EI_B = 0.003313 /7/ /71/ Whereas as per actual plant data (which was made available at a later time), EI_B = 0.003363 /72/ Since the former one is more conservative to the later one PP decided to stick to the former one (i.e. EI_B = 0.003313)
F_B	TJ	SCW = 5111.42 Tera Joule / annum BVC = 5542.63 Tera Joule / annum The Summation of the above two has been used in the revised PDD to compute F_B. Therefore F_B = 10654.05 Tera Joule / annum	The average annual energy consumption of clinker making process determined prior to the start of operation of the project activity. Since pre-project scenario data was not available at the time of validation because plants were supposed to undergo up-gradation /3/ /4/, PP decided to use design data provided by the technology suppliers (i.e. LNVT and FLS Smith). The same is in compliance with the above mentioned guideline. However at a later stage after getting the actual data these design figure has been cross checked with the real pre-project plant data. It was found that the design data is more conservative than the actual pre-project data. As per the design data, F_B for SCW is 5111.42 Tera Joule / annum /7/ F_B for BVC is 5542.63 Tera Joule / annum /71/

			The Summation of the above two has been used in the revised PDD to compute F_B Whereas as per actual plant data (which was made available at a later time), F_B for SCW is = 4137 Tera Joule / annum /72/ F_B for BVC is = 3681 Tera Joule / annum /72/
$O_{clinker,B}$	tonne	SCW : 1505750 tonne / annum BVC : 1708500 tonne / annum The Summation of the above two has been used in the revised PDD to compute $O_{clinker,B}$. $O_{clinker,B}$ = 3216000 tonne /annum	The average annual output of clinker determined prior to the start of operation of the project activity /3/ /4/. Since pre-project scenario data was not available at the time of validation because plants were supposed to undergo up-gradation /3/ /4/, PP decided to use design data provided by the technology suppliers (i.e. LNVT and FLS Smith). The same is in compliance with the above mentioned guideline. However at a later stage after getting the actual data these design figure has been cross checked with the real pre-project plant data. It was found that the design data is more conservative than the actual pre-project data. As per the design data, $O_{clinker,B}$ of SCW : 1505750 tonne / annum /7/ $O_{clinker,B}$ of BVC : 1708500 tonne / annum /71/ The Summation of the above two has been used in the revised PDD to compute $O_{clinker,B}$. $O_{clinker,B}$ = 3216000 tonne /annum Whereas as per actual plant data

				(which was made available at a later time), $O_{clinker,B}$ for SCW is = 1213197 tonne /annum /72/ $O_{clinker,B}$ for BVC is = 1128214 tonne/ annum /72/
$COEF_{IGS}$	tCO_2/ TJ	95.81 (considering sub-bituminous coal)		Emission coefficient of the fuel (*i.e.* coal) used in identified generation source, expressed as tCO_2/GJ, lower heating value. Sourced from national values of emission factor of coal/59/. The factor-$COEF_{IGS}$ has been calculated following the methodological guidance based on Lab Analysis Report conducted on coal /73/ which would have been used in the baseline coal based power plant and the same is found to be 0.123255tCO_2/GJ /32/. However the same was compared with the same factor reported in "India's Initial National Communication to the United Nations Framework Convention on Climate Change (NATCOM)" which shows this factor as 0.0958tCO_2/GJ. Therefore consideration of this factor from NATCOM Report will entail a conservative computation of baseline emissions and hence emission reductions. This justifies the consideration of this factor as per the NATCOM Report.
$EG_{ATEXIST}$	MWh	2006-07	167549	Net electricity generation of the existing captive generation plant determined prior to project implementation based on historical data /9/ /10/
		2007-08	180396	
		2008-09	177253	
		2009-10	189603	
E_{CEMENT}	MWh	2006-07	199575	Electricity consumption of cement works prior to the start of operation of the project activity /9/ /10/.
		2007-08	204314	
		2008-09	210160	
		2009-10	228692	
E_{LOAD}	MWh	2006-07	11065	Electricity consumption of other

		2007-08	12156	load in the cement works complex prior to project /9/ /10/.
		2008-09	11969	
		2009-10	11534	
FI_{IGS}	GJ/ MWh	12.0		Fossil fuel (*i.e.* coal) consumption rate of the identified generation source (IGS) to supply $EG_{Y,}$ expressed as GJ per MWh /16/.This is calculated based on the technical specification provided by the Cethar Consulting Engineers (P) Ltd for supply and execution of EPC basis for 2 X 7.5 MW coal based thermal power plant /16/.
ΔEI_i	TJ/ton Clinker	0		As per the technical specification provided by Dalian East Energy Project Co. Limited /17/.This is an estimated value provided by the technology supplier which is used for *ex-ante* emission reduction calculation. In actual scenario it will be calculated ex-post based on monitored value.

4.6.2 Parameters monitored ex-post

According to AM0024 and "Tool to calculate the emission factor for an electricity system" version 2.1, the following data and parameters should be monitored:

Parameter	unit	Recording frequency	Monitoring equipment/ data source	Data variable
$EG_{CP,Y}$	MWh	Measured continuously, recorded monthly,	Energy Meter, calibrated annually	Quantity of electricity supplied to cement plant from the project activity.
$NCV_{fuel,y}$	TJ/tonne	Monthly	In-house lab report or analysis by an independent third party	Calorific value of fuel (coal) used in clinker production.
FP_y	TJ	Calculated monthly and annually	Plant records	Annual energy of fuel (coal) consumed by the clinker production lines in

				year *y* calculated by multiplying coal quantity with coal NCV.
Coal consumption	tonne	Measured on monthly basis	Plant records	Annual coal consumption by the clinker production lines
$COEF_{fuel,y}$	tCO_2/ TJ	Monthly	The value would be calculated as per formula from the methodology: ($COEF_{fuel,y}$ = $EF_{CO2,fuel,y}$ / $NCV_{fuel,y}$)	Emissions factor for fuel used in clinker production
$EF_{CO2,fuel,y}$	tCO_2/ton of fuel	Measured on monthly basis	The value would be calculated based on the lab analysis of coal and same will be compared with the value sourced from 'India's Initial National Commission'. The more conservative one will be used in emission reduction calculation.	CO_2 emission factor per unit of energy of the fuel used in year y, expressed as tCO_2 per unit mass or volume unit.
$OXID_{fuel,y}$	fraction		IPCC default value	Oxidation ratio of fuel used in clinker production
$O_{clinker,y}$	Tonne	Monitored continuously and recorded monthly	Plant records and annual reports	Annual production of Clinker after implementation of project. The parameter will be monitored continuously with the help of weighing machines.

$EI_{P,y}$	TJ/t	specific energy consumption/tonne of clinker produced after project implementation, Calculated on monthly basis: $EI_{p,y} = \frac{F_{p,y}}{O_{Clinker,y}}$	Plant records and annual reports	The data will be recorded annually.
Regulations and/or policy that could influence the use of waste heat and generation of power in the region	Not applicable	Not applicable	Implemented legislation or regulation introduced by the Government of India	Not applicable

4.6.3 Management system and quality assurance

The existing data management, review and audit systems of Birla Corporation Limited are conforming to ISO 9001:2000 standards. Thus it can be expected that the management of the project activity will provide adequate reliability in data monitoring, archiving and performance reviews.

4.7 Estimation of GHG emissions

The emission reduction ER_y by the project activity during the crediting period is the difference between baseline emissions (EB_y), project emissions (PE_y).

$$ER_y = EB_y - PE_y$$

Where, EB_y is the baseline emissions in year *y*, expressed in tCO_2; PE_y is the project emissions due to possible fuel consumption changes in all cement kilns of the BCL works where the proposed project is located, as a result of the project activity in year *y*, expressed in tCO_2.

Baseline emissions: The power generated by the project activity is supplied to the cement production facility of BCL, Satna unit, with no extra power available for delivery to the grid, the baseline emissions will be calculated as:

$$EB_y = EG_{CP,y} \times EF_{Elec,y}$$

Where, $EG_{CP,y}$ is electricity supplied from the project activity to the cement plant (MWh) and $EF_{Elec,,y}$ is the emissions factor of the baseline electricity supply source, expressed as tCO_2/MWh. Since 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 CPP, in the absence of the project activity, the $EF_{Elec,y}$ is $EF_{Captive,y}$. is emission factor of the baseline electricity (tCO_2e/MWh).
The baseline emission factor $EF_{Captive,y}$ is estimated as follows:

$$EF_y = EF_{IGS} = [FI_{IGS} \times COEF_{IGS}]$$

Where, FI_{IGS} is the fossil fuel (*i.e.* coal) consumption rate of the identified generation source (IGS) to supply EG_Y, expressed as GJ/MWh, $COEF_{IGS}$ is the emission coefficient of the fuel (*i.e.* coal) used in identified generation source, expressed as tCO_2/per GJ lower heating value.
The EF_{IGS} has been *calculated* at the start of the crediting period and be fixed for the whole crediting period.
The baseline emission estimate /32/ can be replicated using the data and parameter values provided in the PDD /1/ and supporting files submitted for registration. The data sources mentioned have been verified by DNV. The $EF_{Captive,y}$ of 1.150 tCO_2/MWh is fixed *ex-ante* for the entire first crediting period. The calculations for baseline emission factor were verified and found to be correct by DNV /32/.
2) Project emissions: The project emissions (PE_y) are the difference in CO_2 emissions from the use of fossil fuel in the clinker making process where the project is being implemented, before and after the project implementation.
PE_y, is determined as follows-

$$PE_y = (EI_{p,y} - EI_B) \times O_{clinker,y} \times COEF_{fuel,y}$$

Where, EI_B is the pre-project energy consumption per unit output of clinker in TJ/tonne of clinker produced, $EI_{p,y}$ is the *ex-post* energy consumption per unit output of clinker for given year *y*, in TJ/tonne of clinker produced, $COEF_{fuel,y}$ is the carbon coefficient (tCO_2/TJ of input fuel) of the fuel used in the cement works in year *y* to raise the necessary heat for clinker production, and $O_{Clinker,y}$ is the clinker output of the cement works in a given year *y*.
For *ex-ante* estimation project emission has been considered as zero based on technology supplier's estimation, however actual project emission will be monitored *ex-post*
The annual emission reductions calculated based on the estimated power generation from the project is 75 087tCO_2e per annum represents a reasonable estimation using the assumptions given by the project proponent. DNV confirmed that the baseline methodology has been applied correctly to calculate the emission reductions, all assumptions and data used by PP have been listed in the PDD and all values used in the PDD are considered reasonable.

The emissions sources not foreseen by the methodology is unlikely to contribute more than 1% of the estimated emission reductions of the project. The baseline emission estimate can be replicated using the data and parameter values referenced to in the PDD. The data sources mentioned have been verified by DNV. In summary, the emission reduction calculations are complete, transparent and the data accuracy has been verified.

Based on the calculations and results presented in the sections above the implementation of the project activity will result in an average *ex-ante* estimation of emission reduction conservatively calculated to be 75 087 tCO_2e per year for the selected crediting period.

All assumptions and data used by the project participants are listed in the PDD and/or supporting documents, including their references and sources. All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD. All values used in the PDD are considered reasonable in the context of the proposed CDM project activity. The baseline methodology has been applied correctly

to calculate project emissions, baseline emissions, leakage and emission reductions. All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in the PDD.

4.8 Environmental impacts

The project does not require an environmental impact analysis as per the EIA notification of the MoEF. The project is not likely to create any adverse environmental effects. The project complies with environmental regulations in India. Necessary licenses and environmental clearances have been obtained /18/ /19/ /20/ from Madhya Pradesh pollution control board.

4.9 Comments by local stakeholders

The stakeholders identified for the project include elected representatives of the administering the local area (Local Nagar Palika), employees of BCL, worker's union and local NGOs. The stakeholders are communicated through written communication dated 17 August 2009 and requested to provide their feedbacks/opinions and suggestions to BCL regarding the project activity. The stakeholders were also contacted on a one to one basis and comments by issuing letter on 15 June 2009 and comments were received on the project activity on, 20 June 2009 and 19 June 2009 /14/. A summary of the comments received have been provided in the PDD /1/. The project did not receive any adverse comments during the stakeholder consultation and hence no mitigating actions were required.

DNV considers the local stakeholder consultation carried out adequately.

4.10 Comments by Parties, stakeholders and NGOs

The PDD, version 1 dated 5 Oct 2009, was made publicly available on the CDM website http://cdm.unfccc.int/Projects/Validation/DB/LBAW872EPQKBXJ3148WM9NO2FBU6L4/view.html and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 31 Oct 2009 to 29 Nov 2009.

No comments were received in the above mentioned period.

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APPENDIX A

CDM VALIDATION PROTOCOL

Table 1 Mandatory requirements for Clean Development Mechanism (CDM) project activities

Requirement	Reference	Conclusion
About Parties		
1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3.	Kyoto Protocol Art.12.2	OK
2. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC.	Kyoto Protocol Art.12.2.	OK
3. The project shall have the written approval of voluntary participation from the designated national authority of each Party involved.	Kyoto Protocol Art. 12.5a, CDM Modalities and Procedures §40a	~~CAR 2~~ OK
4. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof.	Kyoto Protocol Art. 12.2, CDM Modalities and Procedures §40a	~~CAR 2~~ OK
5. In case public funding from Parties included in Annex I is used for the project activity, these Parties shall provide an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of these Parties.	Decision 17/CP.7, CDM Modalities and Procedures Appendix B, § 2	OK
6. Parties participating in the CDM shall designate a national authority for the CDM.	CDM Modalities and Procedures §29	OK
7. The host Party and the participating Annex I Party shall be a Party to the Kyoto Protocol.	CDM Modalities §30/31a	OK
8. The participating Annex I Party's assigned amount shall have been calculated and recorded.	CDM Modalities and Procedures §31b	NA
9. The participating Annex I Party shall have in place a national system for estimating GHG emissions and a national registry in accordance with Kyoto Protocol Article 5 and 7.	CDM Modalities and Procedures §31b	NA
About additionality		
10. Reduction in GHG emissions shall be additional to any that would occur in the absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those	Kyoto Protocol Art. 12.5c, CDM Modalities and Procedures §43	OK ~~CAR 4~~

Requirement	Reference	Conclusion
that would have occurred in the absence of the registered CDM project activity.		~~CAR 5~~ ~~CL 5~~ ~~CL 6~~ ~~CL 7~~ ~~CL 8~~ ~~CL 9~~ ~~CL 10~~
About forecast emission reductions and environmental impacts		
11. The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change.	Kyoto Protocol Art. 12.5b	OK
For large-scale projects only		
12. Documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, shall be submitted, and, if those impacts are considered significant by the project participants or the Host Party, an environmental impact assessment in accordance with procedures as required by the Host Party shall be carried out.	CDM Modalities and Procedures §37c	OK
About stakeholder involvement		
13. Comments by local stakeholders shall be invited, a summary of these provided and how due account was taken of any comments received.	CDM Modalities and Procedures §37b	OK
14. Parties, stakeholders and UNFCCC accredited NGOs shall have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available.	CDM Modalities and Procedures §40	OK
Other		
15. The baseline and monitoring methodology shall be previously approved by the CDM Executive Board.	CDM Modalities and Procedures §37e	OK
16. A baseline shall be established on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances.	CDM Modalities and Procedures §45c,d	OK

Requirement	Reference	Conclusion
17. The baseline methodology shall exclude to earn CERs for decreases in activity levels outside the project activity or due to force majeure.	CDM Modalities and Procedures §47	OK
18. Provisions for monitoring, verification and reporting shall be in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP.	CDM Modalities and Procedures §37f	OK

Table 2 Requirements checklist

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A General description of project activity					
A.1 Title of the project activity (VVM para 55-57)					
A.1.1 Does section A.1 of the PDD include a clearly identifiable project title, version number of the PDD and date of the PDD?	/1/	DR	☒ Clearly identifiable title of the project activity ☒ Version number of the PDD is included ☒ Date of the PDD is included.		OK
A.1.2 Is the PDD is in accordance with the applicable requirements for completing PDDs?	/1/	DR	☒ Yes		OK
A.2 Description of the project activity (VVM para 58-64)					
A.2.1 How was the design of the project assessed?	/1/	DR	*What type is the project?* ☒ Project in existing facility or utilizing existing equipment(s) ☒ Project is either a large scale project or a small scale project with emission reductions exceeding 15 000 tCO_2e per year. In this case, a site visit must be performed. ☐ Project is a bundled small scale project, with each project in the bundle with emission reductions not exceeding 15,000 tCO_2e per year. In such case the number of physical site visits may be based on sampling, if the sampling size is appropriately justified through statistical analysis. ☐ The project is an individual small scale project activity with emission		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				reductions not exceeding 15 000 tCO_2e per year. In this case, DOE may not conduct a physical site visit as appropriate. ☐ Greenfield project *How was the design of the project assessed?* ☒ Physical site inspection ☒ Reviewing available designs and feasibility studies		
A.2.2	If a greenfield project, describe the physical implementation of the project when the validation was commenced.	/1/	DR	The project is not a Greenfield project.		OK
A.2.3	If physical site visits were performed based on sampling (only applicable for bundled small scale projects, each with emission reductions not exceeding 15 000 tCO_2e per year), justify the sampling through a statistical analysis:	/1/	DR	As this is a large scale stand alone one this point is not applicable.		OK
A.2.4	Is the description of the proposed CDM project activity as contained in the PDD sufficiently covers all relevant elements, is accurate and that it provides the reader with a clear understanding of the nature of the proposed CDM project activity?	/1/	DR/I	The proposed CDM project activity has been based on exiting facility. The project activity has been planned to utilise the waste gas generated from clinkering process in both SCW and BVC, which are also undergoing through production capacity expansion. However the production capacity expansion has not been clearly depicted in the PDD. Hence, the project proponent is requested to mention the same explicitly in the PDD.	~~CAR 1~~	OK
A.2.5	Does the project activity involve alteration of existing installations? If so, have the differences between pre-project and post-project activity been clearly described in the PDD?	/1/	DR	The project activity involves alteration of existing installations. In pre project scenario the waste heat of the flue gas of the pre hater tower and clinker cooler used to be vented in the atmosphere, which would be used in the project activity for electricity generation.		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				Thus difference between pre-project and post project activity have been clearly described in the PDD.		
A.2.6	Does the project design engineering reflect current good practices?	/1/	DR	The unutilised waste (flue) gas will be utilised in the project activity for electricity generation. This will lead to improvement in energy efficiency od the cement plants and also have positive environmental impacts. Equipment for the project activity have been ordered to manufacturers of repute. Thus the design engineering reflects current good practice.		OK
A.2.7	Would the technology result in a significantly better performance than any commonly used technologies in the host country? Is any transfer of technology from any Annex-I Party involved?	/1/	DR	The waste heat recovery technology, similar to that used for the project activity is not widely used in India. For the project activity the technology has been supplied by Dalian East New Energy Development Company Limited who has good reputation in this field. However technology transfer from the Annex-I country is not associated for the project activity.		OK
A.3	**Participation requirements (VVM para 51-54, 125-127)**					
A.3.1	Do all participating Parties fulfil the participation requirements as follows:	/1/	DR	Host Party India is the sole participating Party in the project activity.		OK
		India (host)				
	a) Party has ratified the Kyoto Protocol	☒ Yes ☐ No				
	b) Party has designated a Designated National Authority	☒ Yes ☐ No				
	c) The assigned amount has been determined	☐ Yes ☒ No				
A.3.2	Do the letters of approval meet the following requirements?	/1/	DR	The project proponent is requested to submit copy of the host country approval to the	~~CAR 2~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			validator.		
	India (host)				
a) LoA confirms that Party has ratified the Kyoto Protocol	☒ Yes ☐ No				
b) LoA confirms that participation is voluntary	☒ Yes ☐ No				
c) The LoA confirms that the project contributes to the sustainable development of the host country?	☒ Yes ☐ No				
d) The LoA refers to the precise project activity title in the PDD	☒ Yes ☐ No				
e) The LoA is unconditional with respect to (a) to (d) above	☒ Yes ☐ No				
f) The LoA is issued by the respective Party's DNA	☒ Yes ☐ No				
g) The LoA was received directly by the DNA or the PP	☐ DNA ☒ PP				
h) In case of doubt regarding the authenticity of the letter of approval, describe how it was verified that the letter of approval is authentic	Not required				
A.3.3 Have all private/public project participants been authorized by an involved Party?	/1/	DR	The project proponent is requested to submit copy of the host country approval to the validator.	~~CAR 2~~	OK
A.4 Technical description of the project activity (VVM para 58-64)					
A.4.1 Is the project's location clearly defined?	/1/	DR	Yes, the project activity is being implemented by M/s Birla Corporation Limited at the premises of Birla Vikash Cement (BVC) and Satna Cement Works (SCW), located at Satna, in the state of Madhya Pradesh in India.		OK
A.5 Public funding of the project activity					
A.5.1 In case public funding from Parties included in Annex I is used for the project activity, have these Parties provided an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is	/1/	DR	The validation did not reveal involvement of public funding from any Annex I Party. No Annex I Party has also been involved in the project		OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	not counted towards the financial obligations of these Parties?					
B	**Application of a baseline and monitoring methodology**					
B.1	**Methodology applied (VVM para 65-76)**					
B.1.1	Does the project apply an approved methodology and the correct and valid version thereof?	/1/	DR	Approved consolidated methodology AM0024, version 2.1 has been applied for the project, which was relevant at the time of web hosting.		OK
B.1.2	If applicable, has any specific guidance provided by the CDM EB in respect to the applied methodology been considered?	/1/ /41/ /42/ /43/ /44/	DR	All specific guidance provided by the CDM EB in respect to the applied methodology has been considered		OK
B.2	**Applicability of methodology (and tools) (VVM para 65-76)** *Insert a row for each applicability criteria of the applied methodology (and tools)*					
B.2.1	How was it validated that project complies with the following applicability criteria: *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)*?	/1/	DR	In the baseline scenario electricity generated from the existing CPP has been fully utilised within the cement works along with grid electricity to meet the total electricity demand of the cement works. The project activity is intended to cater to additional electricity requirement necessitated due to capacity expansion of clinkering process. Thus applicability condition has been fulfilled.		OK
B.2.2	How was it validated that project complies with the following applicability criteria: *Electricity generated under*	/1/	DR	Electricity generated under the project activity will displace electricity generation		OK

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	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?			from a new fossil fuel based CPP. During the site visit DNV has assessed the capacity expansion of clinkering process. However in PDD it is not clearly mentioned that the project activity comes up due to clinker production capacity expansion. Thus the project proponent is requested to revise the justification of this applicability criteria in view of the production capacity expansion.	~~CAR 1~~	
B.2.3	How was it validated that project complies with the following applicability criteria: *The grid or identified specific generation source option is clearly identifiable?*	/1/	DR	In pre project scenario there is a fossil fuel based CPP in the cement works of BCL located in Satna. The new fossil fuel based CPP is the expansion of the existing CPP. Thus identified specific generation source is clearly identified.		OK
B.2.4	How was it validated that project complies with the following applicability criteria: *Waste heat is only to be used in the project activity?*	/1/	DR	In pre project scenario the waste heat of the emanating gas of pre-heater and clinker cooler was partially being 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 was being released to atmosphere which would be used in the project activity.		OK
B.2.5	Is the selected baseline on of the baseline(s) described in the methodology and this hence confirms the applicability of the methodology?	/1/	DR	Refer B.2.2.	~~CAR 1~~	OK
B.3	**Project boundary (VVM para 78-80)**					
B.3.1	What are the project's system boundaries (components and facilities used to mitigate GHGs)? Are they clearly defined and in accordance with the methodology?	/1/	DR	The project system boundary encompasses the cement plants, 6 waste heat recovery boilers (WHRBs), two condensing steam turbine generator with auxiliaries and the		OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				electrical system dedicated to supply power to the cement plants. The PP is requested to include the waste heat gas sources, captive power plant and the local grid also in the project boundary, in line with the methodology. Schematic diagram of the project activity is required to be included in the PDD and the capacities of the kiln, WHRBs and turbine to be clearly stated.	~~CL 1~~	
B.3.2	Which GHG sources are identified for the project? Does the identified boundary cover all possible sources linked to the project activity? Give reference to documents considered to arrive at this conclusion.	/1/	DR	The PP is requested to include the waste heat gas sources, captive power plant and the local grid also in the project boundary, in line with the methodology. Schematic diagram of the project activity is to be included in the PDD and the capacities of the kiln, WHRBs and turbine to be clearly stated.	~~**CL 1**~~	OK
B.3.3	Does the project involve other emissions sources not foreseen by the methodologies that may question the applicability of the methodology? Do these sources contribute with more than 1% of the estimated emission reductions of the project?	/1/	DR	The project does not involve other emission sources not for seen by the methodology. The project have only one emission source which is the equivalent to the difference in CO2 emissions from use of fossil fuel in the clinker making process in cement manufacturing units, before and after the project implementation.		OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.4 Baseline scenario determination (VVM para 81-88, 105-107) *Ensure that the evaluation of all alternatives provided in the PDD and required by the methodology and also possible alternatives/offshoots of alternatives are discussed. Check that all alternatives required to be considered by the methodology are included in the final PDD. If baseline alternatives required to be considered by the methodology are considered not applicable, please assess the justification for this.*					
B.4.1 Which baseline scenarios have been identified? Is the list of baseline scenarios complete?	/1/	DR	Three baseline scenarios have been identified. Those have been described in the following. 1. Proposed project activity not under taken as a CDM project activity. 2. New fossil fuel (i.e. coal) based power generation system as an extension of existing TPP 3. Import of power from grid However the list of baseline scenarios does not include construction of a captive plant with different fuel options if electricity demand is increasing. Thus the PP is requested to revise the list of plausible baseline scenarios as required by the applied methodology.	~~CL 2~~	OK
B.4.2 How have the other baseline scenarios been eliminated in order to determine the baseline?	/1/	DR	To determine the baseline the other baseline scenario has not been eliminated as per the applicable methodology AM0024 version 2.1 (on the basis of IRR). Thus the PP is requested to describe the baseline selection	~~CAR 3~~	OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				in line with the methodology AM0024 version 2.1		
B.4.3	What is the baseline scenario?	/1/	DR	The baseline scenario is release of 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 from new fossil fuel (*i.e.* coal) based power generation system (as an extension of existing TPP).		OK
B.4.4	Is the determination of the baseline scenario in accordance with the guidance in the methodology?	/1/ /3/ /4/ /8/	DR/I	It has been evidenced from the site visit and relevant documents that the baseline scenario is in accordance with the guidance in the methodology. However the selected baseline is applicable only when there is increase of energy demand. Thus the PP is requested to describe selection of baseline scenario in accordance with the guidance in the applied methodology.	~~CL 3~~	OK
B.4.5	Has the baseline scenario been determined using conservative assumptions where possible?	/1/	DR	The baseline scenario has been determined based on unit cost of power generation. However as per the applied methodology, AM0024 version 2.1, the option with the highest IRR is the baseline scenario for waste heat recovery and electricity supply to the cement works**.** Thus the PP is requested to provide the investment comparison analysis as per the applied methodology with relevant supporting documents.	~~CAR 4~~	OK
B.4.6	Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations?	/1/	DR	In the host country India power generation from waste heat recovery in cement plant has not been considered under sectoral policies. Thus the baseline scenario		OK

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Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			sufficiently takes into account the Sectoral policie.		
B.4.7 Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced?	/1/	DR	In line with AM0024 version 2.1 the option with the highest IRR is the baseline scenario for waste heat recovery and electricity supply to the cement works. Thus the PP is requested to provide the investment comparison analysis as per the applicable methodology with all supporting documents. The PP is requested to provide total electricity demand envisaged in post implementation phase of the project activity and the means of meeting the same along with relevant supporting documents.	~~CAR 4~~ ~~CL 4~~	OK
B.4.8 Is the baseline determination adequately documented in the PDD? • All assumptions and data used by the project participants are listed in the PDD and related document to be submitted for registration. The data are properly referenced. • All documentation is relevant as well as correctly quoted and interpreted. • Assumptions and data can be deemed reasonable • Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD. • The methodology has been correctly applied to identify what would occurred in the absence of the proposed CDM project activity	/1/		The baseline determination is not adequately documented in the PDD. The baseline determination has not been stated clearly in the PDD as the selected baseline is applicable only when there is increase of energy demand. Thus the PP is requested to describe the selection of baseline scenario in accordance with the guidance in the methodology. Moreover in line with AM0024 version 2.1 the option with the highest IRR is the baseline scenario for waste heat recovery and electricity supply to the cement works. Thus the PP is requested to provide the investment comparison analysis as per the applicable methodology with all supporting documents.	~~CL 3~~ ~~CAR 4~~	OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.5	**Additionality determination (VVM para 94-121)**					
B.5.1	What approach/tool does the project use to assess additionality? Is this in line with the methodology?	/1/	DR	Tool for the demonstration and assessment of additionality version 05 has been used the project to assess the additionality. This is in line with methodology.		OK
B.5.2	Have the regulatory requirements correctly been taken into account to evaluate the project activity and the alternatives?	/1/ /18/ /19/ /20/	DR	Regulatory requirements of host country India have been correctly been taken into account to evaluate the project activity and the alternatives.		OK
B.5.3	Is sufficient evidence provided to support the relevance of the arguments made?	/1/	DR	The PP is requested to provide the investment comparison analysis as per the applied methodology with all supporting documents.	~~CAR 4~~	OK
B.5.4	What is the project additionality mainly based on (Investment analysis or barrier analysis)?	/1/	DR	The project additionality demonstration is mainly based on investment analysis.		OK
	Prior consideration of CDM (VVM para 98-103)					
B.5.5	What is the evidence for serious consideration of CDM prior to the time of decision to proceed with the project activity?	/1/	DR	The PP is requested to provide the evidence for serious consideration of CDM prior to taking decision for implementation of the project activity.	~~CL 5~~	OK
B.5.6	If the starting date is after 2 August 2008 and before the global stakeholder consultation, has the DNA and UNFCCC confirmed that the project participants have informed in writing of the project's intention to seek CDM status?	/1/	DR	The start date of the project activity has been considered as 26 June 2008 which is before 2 August 2008. However the PP is requested to provide the basis of start date with documentary evidence.	~~CL 6~~	OK
	Continuous efforts to secure CDM status (only to be completed if starting date is before 2 August 2008)					
B.5.7	What initiatives where taken by the project participants from the starting date of the project activity to the start of validation in parallel with the physical implementation of the project activity?	/1/	DR	The PP is requested to provide chronology of events in order to demonstrate continuous actions taken to secure the CDM status.	~~CL 7~~	OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.5.8	When did the construction of the project activity start?	/1/	DR	The PP is requested to provide the start date of the construction of the project activity.	~~CL 8~~	OK
B.5.9	When was the project commissioned?	/1/	DR	The project is still under construction phase. This has been confirmed during the site visit.		OK
B.5.10	Does the timeline of the project confirm that continuous actions in parallel with the implementation were taken to secure CDM status?	/1/	DR	The PP is requested to provide chronology of events in order to demonstrate continuous actions taken to secure the CDM status.	~~CL 7~~	OK
	Investment analysis (VVM para 108-114) *The list of questions below must be adjusted to the parameters in the investment analysis relevant to the project under validation.*					
B.5.11	Does the project activity or any of the remaining alternatives generate revenues apart from CDM? Is this reflected in the PDD?	/1/	DR	The project activity generates revenues apart from the CDM. This is reflected in the PDD.		OK
B.5.12	Do any of the alternatives to the project activity involve investment? Is this reflected in the PDD?	/1/	DR	Except import from the grid all other alternatives involve investment. This is reflected in the PDD		OK
B.5.13	Is the choice of benchmark analysis, investment comparison or simple cost analysis correct?	/1/	DR	The PP has compared the alternatives with respect to the unit cost of power generation. However in line with AM0024 version 2.1 the option with the highest IRR is the baseline scenario for waste heat recovery and electricity supply to the cement works. Thus the PP is requested to provide the investment comparison analysis as per the applied methodology with all supporting documents	~~CAR 4~~	OK
B.5.14	Is the benchmark/discount rate the latest available at the time of decision?	/1/	DR	The project has not chosen bench mark analysis for demonstration of additionality..		OK
B.5.15	What is the financial indicator? Is it on equity/project basis?	/1/	DR	In line with AM0024 version 2.1 IRR is the	~~CAR 4~~	OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	Before/after tax? Is the financial indicator in correspondence with the benchmark?			only applicable financial indicator. However the PP has compared the alternatives with respect to the unit cost analysis of power generation. The PP is requested clearly state the basis of IRR analysis (project or equity basis). The PP is also requested to clearly state that the IRR is before tax or after tax.		
B.5.16	Are the underlying assumptions appropriate, e.g. what is considered as waste in the baseline is considered to have zero value?	/1/	DR	The PP is requested to clearly reference the underlying assumptions which would have been used in the IRR analysis.	~~CAR 4~~	OK
B.5.17	Does the income tax calculation take depreciation into account? Is the depreciation year in accordance with normal accounting practice in the host country?	/1/	DR	The PP is requested to clearly state income tax calculation, if it is incorporated in the IRR analysis. The PP is also requested to provide the documentary evidence of depreciation rate in the host country India.	~~CAR 4~~	OK
B.5.18	Is the time period of the investment analysis and operating time of the project realistic? Has salvage value been taken into account? Is working capital returned in the last year of operation?	/1/	DR	The PP is requested to use realistic operating time period of the investment analysis. The PP is also requested to consider the salvage in investment analysis if time period of the investment analysis is less than operating life time of the project. The PP is also requested to consider the return of working capital in the last year of operation.	~~CAR 4~~	OK
B.5.19	When a feasibility study report or similar approved by the government is used as the basis for the investment analysis: Can it be confirmed that the values used in the PDD are fully consistent with the FSR and is the period of time between finalization of the FSR and the investment decision adequate?	/1/	DR	The project proponent is requested to provide evidences used as basis of the IRR analysis.	~~CAR 4~~	OK
B.5.20	How was the amount of output (e.g. sales of electricity) assessed? Remember to include all the data sources used and list all the projects that have been used for cross-checking in	/1/ /17/	DR	☐ The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to		OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	accordance with VVM paragraph 95.			the government while applying the project activity for implementation approval ☒ The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company) ☐ Other approach. *Provide details on how the load factor was validated::* The load factor of WHR based power plant has been validated from the technical speciation of the same which has been provided by Dalian East Energy Project Co. Limited		
B.5.21	How was the output price (e.g. electricity price) assessed? Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM paragraph 95.	/1/	DR	☒ Cross-check against third-party or publicly available sources (e.g. invoices or price indices) ☐ Review of feasibility reports, public announcements and annual financial reports related to the project and the project participants *Provide details on how the output price was validated:* The price of unit cost of electricity has been verified from electricity bill. The PP is requested to provide copies of electricity bill to the validator.	~~CL 9~~	OK
B.5.22	How were the investment costs assessed? Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM paragraph 95.	/1/	DR	☒ Cross-check against third-party or publicly available sources (e.g. invoices or price indices) ☐ Review of feasibility reports, public announcements, contracts and annual financial reports related to the project and		OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				the project participants *Provide details on how the investment costs were validated:* The PP is requested to provide the investment comparison analysis as per the applicable methodology with all supporting documents of investment costs which was valid at the time of decision making towards project activity.	~~CAR 4~~	
B.5.23	How were the O&M costs assessed? Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM paragraph 95.	/1/	DR	☒ Cross-check against third-party or publicly available sources (e.g. invoices or price indices) ☐ Review of feasibility reports, public announcements and annual financial reports related to the project and the project participants *Provide details on how the O&M costs were validated:* The PP is requested to provide the investment comparison analysis as per the applicable methodology with all supporting documents of O & M costs which was valid at the time of decision making towards project activity.	~~CAR 4~~	OK
B.5.24	Describe the assessment of the other input parameters. Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM paragraph 95.	/1/	DR	☒ Cross-check against third-party or publicly available sources (e.g. invoices or price indices) ☐ Review of feasibility reports, public announcements and annual financial reports related to the project and the project participants *Provide details on how other input*		OK

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				parameters were validated: This section will filled up after assessment of IRR analysis. After assessing the other input parameters DNV validated that all the input parameters are deemed appropriate		
B.5.25	Was the financial calculation spreadsheet verified and found to be correct?	/1/	DR	The PP is requested to provide the financial calculation spreadsheet to the DOE.	~~CAR 4~~	OK
B.5.26	Sensitivity analysis: Have the key parameters contributing to more than 20% of the revenue/costs during operating or implementation been identified? Has possible correlation between the parameters been considered?	/1/	DR	The PP is also requested to perform the sensitivity analysis as per EB guide line after computing the IRR analysis.	~~CAR 5~~	OK
B.5.27	Sensitivity analysis: Is the range of variations is reasonable in the project context?	/1/	DR	Please refer to B.5.26	~~CAR 5~~	OK
B.5.28	Have the key parameters been varied to reach the benchmark and the likelihood of this to happen been justified to be small?	/1/	DR	The project doesn't consider benchmark analysis.		OK
	Barrier analysis (VVM para 115-118)					
B.5.29	Are the barriers identified complimentary to a potential investment analysis? Does the barrier have a clear impact on the financial returns so that it can be assessed in an investment analysis? Each barrier is discussed separately.	/1/	DR	The Project has not argued on the barrier analysis.		OK
	Common practice analysis (VVM para 119-121)					
B.5.30	What is the geographical scope of the common practice analysis? Is this justified?	/1/	DR	While the PDD indicates that clinker manufacturing plants in the state of Madhya Pradesh have been considered for common practice analysis, few of them are located in the state of Rajasthan. The PP is requested to rectify the same in the PDD. The PP further requested to clarify suitability of selection of geographical area for demonstration of common practice. The	~~CL 10~~	OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				PP is also requested to provide referrenecs for the data used for common practice analysis.		
B.5.31	What is the scope of technology and size (e.g. capacity of power plant) for the common practice analysis and how has this been justified?	/1/	DR	The scope of the common practice analysis is WHR based power plant in cement plant.		OK
B.5.32	What is the data source(s) used for the common practice analysis?	/1/	DR	The PP is requested to provide the data sources of the common practice analysis.	~~CL 10~~	OK
B.5.33	How many similar non-CDM-projects exist in the region within the scope?	/1/	DR	Refer B.5.30.	~~CL 10~~	OK
B.5.34	How were possible essential distinctions between the project activity and similar activities assessed?	/1/	DR	In common practice analysis cement plant has been considered where similar project activity could be in existence/installed. Thus there is no distinction among the chosen cases.		OK
B.5.35	What is the conclusion of the common practice analysis?	/1/	DR	While the PDD indicates that clinker manufacturing plants in the state of Madhya Pradesh have been considered for common practice analysis, few of them are located in the state of Rajasthan. The PP is requested to rectify the same in the PDD. The PP further requested to clarify suitability of selection of geographical area for demonstration of common practice. The PP is also requested to provide referrenecs for the data used for common practice analysis.	~~CL 10~~	OK
Conclusion						
B.5.36	What is the conclusion with regard to the additionality of the project activity?	/1/	DR	Refer B.5.1 to B.5.47	~~CAR 4~~ ~~CAR 5~~ ~~CL 5~~	OK

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Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				~~CL 6~~ ~~CL 7~~ ~~CL 8~~ ~~CL 9~~ ~~CL 10~~	
B.6 Calculations of GHG emission reductions					
Data and parameters that are available at validation and that are not monitored (VVM para 199-203)					
B.6.1 How was the average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity available at validation verified?	/1/	DR	This value has been calculated based based on the combined production capacity of SCW and BVC and the specific energy consumption for clinker making as per plant records of the year 2008- 09. However there are capacity expansions in both the cement plant. Thus the PP is requested to further calculate annual energy consumption based on the capacity expansion.	~~CL 11~~	OK
B.6.2 How was the fossil fuel (*i.e.* coal) consumption rate of the identified generation source (IGS) to supply $EG_{Y,}$ expressed as GJ per MWh available at validation verified?	/1/	DR	The average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity has been calculated based on the current capacity. The project proponent is requested recalculate the average annual output separately after the capacity expansion.	~~CL 12~~	OK
B.6.3 How was the Emission coefficient of the fuel (*i.e.* coal) used in identified generation source, expressed as tCO_2/per GJ lower heating value available at validation verified?	/1/	DR	The pp is rquested to provide the supporting document of the fossil fuel (i.e. coal) consumption rate of the identified generation source (IGS) to supply $EG_{Y,}$ expressed as GJ per MWh	~~CL 13~~	OK
B.6.4 How was the Emission coefficient of the fuel (*i.e.* coal) used in identified generation source, expressed as tCO_2/per GJ	/1/	DR	The emission coefficient of coal has been sourced from 2006 IPCC Guidelines for	~~CL 14~~	OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	lower heating value available at validation verified?			National Greenhouse Gas Inventories. As the national value is available for host country India, the PP is requested to consider the same for the project activity.		
B.6.5	How was the Net electricity generation of the existing captive generation plant prior to project available at validation verified?	/1/	DR/I	The data has been measured as per the production record.		OK
B.6.6	How was the *ex-ante* design estimate of the change in the energy consumption of i^{th} clinker kiln in TJ/ton Clinker, due to project implementation available at validation verified?	/1/		Ex-ante design estimate of the change in the energy consumption of i^{th} clinker kiln in TJ/ton Clinker, due to project implementation has been considered as zero on the basis of equipment supplier's data. The project proponent is requested to provide the documentary evidence of *ex-ante* design estimate of the change in the energy consumption of i^{th} clinker kiln in TJ/ton Clinker.	~~CL 15~~	
	Baseline emissions (VVM para 89-93)					
B.6.7	Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	The calculations are documented according to the approved methodology AM0024 version 2.1.		OK
B.6.8	Have conservative assumptions been used when calculating the baseline emissions?	/1/	DR	Refer to B.6.3 and B.6.4.	~~CL 13~~ ~~CL 14~~	OK
B.6.9	Are uncertainties in the baseline emission estimates properly addressed?	/1/	DR	There are no uncertainties in the estimation of baseline emission		OK
	Project emissions (VVM para 89-93)					
B.6.10	Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	The calculations are documented according to the approved methodology AM0024 version 2.1.		OK
B.6.11	Have conservative assumptions been used when calculating the project emissions?	/1/	DR	Refer to B.6.6	~~CL 15~~	OK

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Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.6.12 Are uncertainties in the project emission estimates properly addressed?	/1/	DR	There are no uncertainties in the estimation of baseline emission		OK
Leakage (VVM para 89-93)					
B.6.13 Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR	In line with applicable methodology AM0024 version 2.1 there is no leakage emission in the project.		OK
B.6.14 Have conservative assumptions been used when calculating the leakage emissions?	/1/	DR	Not applicable		OK
B.6.15 Are uncertainties in the leakage emission estimates properly addressed?	/1/	DR	Not applicable		OK
Emission Reductions (VVM para 89-93)					
B.6.16 Algorithms and/or formulae used to determine emission reductions: • All assumptions and data used by the project participants are listed in the PDD and related document submitted for registration. The data are properly referenced • All documentation is correctly quoted and interpreted. • All values used can be deemed reasonable in the context of the project activity • The methodology has been correctly applied to calculate the emission reductions and this can be replicated by the data provided in the PDD and supporting files to be submitted for registration.	/1/	DR	Refer to B.6.1 to B.6.15	~~CL 13~~ ~~CL 14~~ ~~CL 15~~	OK
B.7 Monitoring plan (VVM para 122-124)					
Data and parameters monitored					
B.7.1 Do the means of monitoring described in the plan comply with the requirements of the methodology?	/1/	DR	The means of monitoring described in the plan comply with the requirements of the methodology AM0024 version 2.1		OK
B.7.2 Does the monitoring plan contains all necessary parameters, and are they clearly described?	/1/	DR	The monitoring plan does not include all necessary parameters. The PP is requested to	~~CAR 6~~	OK

MoV= Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				separately describe the coal consumption in clinker making process and calorific value of coal which has been used to calculate annual energy consumption in year y of clinker making process More over clinker production has been monitored based on the raw material input to the kiln. Thus project proponent is requested to determine the raw material to clinker conversion factor and explicitly specify the same in the PDD.		
B.7.3	In case parameters are measured, is the measurement equipment described? Describe each relevant parameter.	/1/	DR	The PP is requested describe monitoring technique for all such parameters and also to describe measurement capability, e.g., range, accuracy, calibration control procedure etc., of the monitoring equipment used for the project activity.	~~CAR 7~~	OK
B.7.4	In case parameters are measured, is the measurement accuracy addressed and deemed appropriate? Describe each relevant parameter.	/1/	DR	The PP is requested to address the measurement accuracy of all the measuring equipment.	~~CAR 7~~	OK
B.7.5	In case parameters are measured, are the requirements for maintenance and calibration of measurement equipment described and deemed appropriate? Describe each relevant parameter.	/1/	DR	The PP is requested to address the maintenance and calibration of all the measuring equipment.	~~CAR 7~~	OK
B.7.6	Is the monitoring frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	The monitoring frequencies of all the parameters are adequate.		OK
B.7.7	Is the recording frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	The recording frequency of monitoring parameters is not matching in the section B.7.1 and B.7.2 of the PDD. The PP is requested to revise the recording frequency consistently in the PDD.	~~CL 16~~	OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	Ability of project participants to implement monitoring plan					
B.7.8	How has it been assessed that the monitoring arrangements described in the monitoring plan are feasible within the project design?	/1/	DR	The monitoring arrangements described in the monitoring plan are feasible.		OK
B.7.9	Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)?	/1/	DR	Day to day records handling and the responsibility has been clearly defined.		OK
B.7.10	Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified?	/1/	DR	The data management and quality assurance and quality control procedures are sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified.		OK
B.7.11	Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later?	/1/	DR	All monitored data required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later.		OK
	Monitoring of sustainable development indicators/ environmental impacts					
B.7.12	Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host country?	/1/	DR	The monitoring of sustainable development indicators is stipulated by the MoEF, DNA of India.		OK
B.7.13	Does the monitoring plan provide for the collection and archiving of relevant data concerning environmental, social and economic impacts?	/1/	DR	Yes the monitoring plan provides for the collection and archiving of relevant data concerning social impacts		OK
B.7.14	Are the sustainable development indicators in line with stated national priorities in the host country?	/1/	DR	In line with stated national priorities in the host country India 2% of CER revenues would be utilized for sustainable development. Thus the sustainable development indicators in line with stated		OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				national priorities in the host country		
C Duration of the project activity / crediting period						
C.1.1	**Start date of project activity (VVM para 99-100, 104)**					
C.1.2	How has the starting date of the project activity been determined? What are the dates of the first contracts for the project activity? When was the first construction activity?	/1/	DR	The start date of the project activity has been considered as 26 June 2008. However the PP is requested to provide the basis of start date with documentary evidence.	~~CL 6~~	OK
C.1.3	Is the stated expected operational lifetime of the project activity reasonable?	/1/	DR	The operational lifetime is 20 years which is reasonable.		OK
C.1.4	Is the start date, the type (renewable/fixed) and the length of the crediting period clearly defined and reasonable?	/1/	DR	The start date of the fixed 10 year crediting period has been selected to be 1 April 2011, (on commissioning or on registration with UNFCCC whichever is later. This is justified). However due to incompleteness message received from UNFCCC the project has been again submitted after 1 April 2011 and new crediting period start date has been chosen as 1 July 2011 (on submission of request for registration or registration with UNFCCC whichever is later.		OK
D Environmental Impacts (VVM para 131-133)						
D.1.1	Are there any host country requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved? Does the approval contain any conditions that need monitoring?	/1/	DR	The project activity does not fall under the list of activities requiring EIA as per the EIA notification 2006 by the MoEF.		OK
D.1.2	Does the project comply with environmental legislation in the host country?	/1/ /20/	DR	Yes the project complies with the environmental legislation. The project has valid consent to establish issued by the		OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				MoEF dated 22 May 2008		
D.1.3	Will the project create any adverse environmental effects?	/1/	DR	Being a waste heat recovery project, it is unlikely to have adverse environmental impacts due to the project activity.		OK
D.1.4	Have identified environmental impacts been addressed in the project design?	/1/	DR	Not applicable.		OK
D.1.5	Has an analysis of the environmental impacts of the project activity been sufficiently described?	/1/	DR	Not applicable.		OK
D.1.6	Are transboundary environmental impacts considered in the analysis?	/1/	DR	Not applicable.		OK
E Stakeholder Comments (VVM para 128-130)						
E.1.1	Have relevant stakeholders been consulted?	/1/	DR	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		OK
E.1.2	Have appropriate media been used to invite comments by local stakeholders?	/1/	DR	The stakeholders are communicated through written communication notice dated 17 August 2009 and requested to provide their feedbacks/opinions and suggestions to BCL regarding the project activity		OK
E.1.3	If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder	/1/	DR	In host country stake holder consultation is not mandatory		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	consultation process been carried out in accordance with such regulations/laws?					
E.1.4	Is a summary of the stakeholder comments received provided?	/1/	DR	Summary of the stake holder comments received has been provided in the PDD.		OK
E.1.5	Has due account been taken of any stakeholder comments received?	/1/	DR	There is no negative feed back from stake holder consultation.		OK

Table 3 Resolution of corrective action requests and clarification requests

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
CAR 1 The proposed CDM project activity has been based on exiting facility. The project activity has been planned to utilise the waste gas generated from clinkering process in both SCW and BVC, which are also undergoing through production capacity expansion. However the production capacity expansion has not been clearly depicted in the PDD. Hence, the project proponent is requested to mention the same explicitly in the PDD.	A.2.4 B.2.2 B.2.5	Birla Corporation Limited, Satna unit comprises of two cement manufacturing units –Satna Cement Works (SCW) and Birla Vikas Cement (BVC). Initially *i.e.* before the up-gradation of SCW and BVC the combined clinker production capacity was 2.079 million tonnes per annum. Thereafter, in April 2009, the project participant (PP) undertook the expansion of both SCW and BVC which increased the annual combined clinker production capacity to 3.216 million tonnes. The up-gradation of the cement manufacturing units has led to a substantial increase in power demand of the cement plant. The existing captive power facility *i.e.* the 27 MW coal based thermal power plant was not sufficient to meet this increment in power demand. Then the PP being a responsible industry house instead of increasing the power generating capacity of the existing coal based thermal power plant opted for a clean technology *i.e.* utilizing the thermal energy of clinker cooler waste gas and pre-heater flue gas for power generation in order to partially meet the increase in	**OK.** The capacity expansion of clinker making process in two cement manufacturing units of BCL, namely SCW and BVC has been described in the final PDD version 3 dated 27 Jul 2010 /1/ The combined capacity of clinker manufacturing has been increased from 2.079 million tonnes per annum to 3.216 million tones per annum /3/ /4/. Thus existing captive power facility *i.e.* the 27 MW coal based thermal power plant was not sufficient to meet this increment in power demand. The PP decided to utilize the thermal energy of clinker cooler waste gas and pre-heater flue gas for power generation in order to partially meet the increase in power demand of the cement plant instead of installation of new coal based power plant. Hence the baseline of the project is in line with applicable

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		power demand of the cement plant. The PP agrees to address the concern of the DOE and hence necessary changes in the Section A.2 will be incorporated.	methodology AM0024 version 2.1 "*Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists"* CAR is closed
CAR 2 The project proponent is requested to submit copy of the host country approval to the validator	A.2.9 A.2.10	The project participant (*i.e.* Birla Corporation Limited) has received the Host Country Approval, conveyed through Ministry's letter no 4/12/2009-CCC dated 11th January, 2010, for the CDM project titled "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". The soft copy of the HCA has been submitted to the DOE for their reference.	**OK.** Letter of approval from host Party India dated 11 January 2010 /40/ has been provided to DNV. DNV validates that the host country approval meet all the requirements in line with Kyoto protocol. CAR is closed
CAR 3 To determine the baseline the other baseline scenario has not been eliminated as per the applicable methodology AM0024 version 2.1 (on the basis of IRR). Thus the PP is requested to describe the baseline selection in line with the methodology AM0024 version 2.1	B.4.2	As per the applicable methodology AM0024 version 2.1 the PP needs to identify technically feasible options for waste heat utilizations under the guidance provided in 1.A. and source of electrical energy supply for the cement plants under the guidance provided in 1.B. Furthermore it is also recommended to consider the following as electricity	**OK.** In line with applicable methodology AM0024 version 2.1 the baseline selection has been described in the PDD version 3 dated 27 Jul 2010 /1/. Among the applicable baseline alternatives: - '*Supply from grid;*

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		options. - *'Supply from grid;* - *Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists; and* - *Construction of a captive plant with different fuel options if electricity demand is increasing'* 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 than generating electricity through coal based power plant or waste heat recovery based power plant. 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. Diesel based electricity generation is highly expensive (price of diesel is around 31.25 INR/ litre). So, diesel	- *Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists; and* - *Construction of a captive plant with different fuel options if electricity demand is increasing'* Supply from grid has not been considered as baseline as cost of power from grid is substantially higher than generating electricity through coal based power plant or waste heat recovery based power plant /23/ /24/ 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 as cement industry is an energy intensive industry for which only grid electricity can not cater the entire need of electricity in cement plant in Indian context.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		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 Pradesh where the project activity plant is situated, this alternative cannot be considered feasible. Hence this option has not been further considered for baseline determination. Following the above guidelines under 'Identification of the baseline scenario' of the applicable methodology AM0024 version 2.1 the PP has short listed the following alternatives/options: - Scenario 1) Proposed project activity not undertaken as a CDM project activity - 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)	Moreover it has been evidenced from historical data of electricity demand and supply /5/ /9/ /10/ the major part of the electricity demand had been met from coal based power plant. Diesel and natural gas have been considered as different fuels. Price of diesel is quite high than coal /21/ and natural gas is not available in the state of Madhya Pradesh /22/. Thus Construction of a captive plant with different fuel options has also not been considered as baseline scenario. Thus following two scenario has been analyzed for baseline scenario Scenario 1) Proposed project activity not undertaken as a CDM project activity 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

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		As the methodology recommends choosing the option with highest IRR as the baseline scenario for waste heat recovery and electricity supply to cement works, IRR analysis for the rest two options (*i.e.* scenario 1 and scenario 2) has been presented herewith concluding scenario2 as the baseline scenario (as asked by the DOE as well).	electricity in new fossil fuel (*i.e.* coal) based power generation system (as an extension of existing TPP) As scenario 2 has the higher IRR than scenario 1, scenario 2 has been selected as baseline. CAR is closed
CAR 4 The baseline scenario has been determined based on unit cost of power generation. However as per the applied methodology, AM0024 version 2.1, the option with the highest IRR is the baseline scenario for waste heat recovery and electricity supply to the cement works**.** Thus the PP is requested to provide the investment comparison analysis as per the applied methodology with relevant supporting documents.	B.4.5 B.4.7 B.4.8 B.5.3 B.5.13 B.5.15 B.5.16 B.5.17 B.5.18 B.5.19 B.5.22 B.5.23 B.5.25 B.5.36	As per the applicable methodology AM0024 version 2.1 the PP needs to identify technically feasible options for waste heat utilizations under the guidance provided in 1.A. and source of electrical energy supply for the cement plants under the guidance provided in 1.B. Furthermore it is also recommended to consider the following as electricity options. - '*Supply from grid;* - *Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists;* *and* - *Construction of a captive plant with different fuel options if*	**OK.** In line with applicable methodology AM0024 version 2.1 the baseline selection has been described in the PDD version 3 dated 27 Jul 2010 /1/. Among the applicable baseline alternatives: - '*Supply from grid;* - *Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists; and* - *Construction of a captive plant with different fuel options if electricity demand is*

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		electricity demand is increasing' In absence of the project activity the project participant could have import the power from the western regional grid which is now a part of the NEWNE grid to meet the balance power requirement. However in this case cost of grid power is substantially higher than generating electricity through coal based power plant or waste heat recovery based power plant. 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. Diesel based electricity generation is highly expensive (price of diesel is around 31.25 INR/ litre). 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 Pradesh where the project activity plant	*increasing'* Supply from grid has not been considered as baseline as cost of power from grid is substantially higher than generating electricity through coal based power plant or waste heat recovery based power plant /23/ /24/ 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 as cement industry is an energy intensive industry for which only grid electricity can not cater the entire need of electricity in cement plant in Indian context. Moreover it has been evidenced from historical data of electricity demand and supply /5/ /9/ /10/ the major part of the electricity demand had been met from coal based power plant. Diesel and natural gas have been considered as different fuels. Price of diesel is quite high than coal /21/ and natural

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		is situated, this alternative cannot be considered feasible. Hence this option has not been further considered for baseline determination. Following the above guidelines under 'Identification of the baseline scenario' of the applicable methodology AM0024 version 2.1 the PP has short listed the following alternatives/options: - Scenario 1) Proposed project activity not undertaken as a CDM project activity - 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) As the methodology recommends choosing the option with highest IRR as the baseline scenario for waste heat recovery and electricity supply to cement works, IRR analysis for the rest two	gas is not available in the state of Madhya Pradesh /22/. Thus Construction of a captive plant with different fuel options has also not been considered as baseline scenario. Thus following two scenario has been analyzed for baseline scenario Scenario 1) Proposed project activity not undertaken as a CDM project activity 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) As scenario 2 has the higher IRR 26.3% than scenario 1 17.36%, scenario 2 has been selected as baseline. All the input assumption used in IRR analysis has been checked /13//16//30//49/ - /58/ and found

<table>
<tr><th>Corrective action and/ or clarification requests</th><th>Reference to Table 2</th><th>Response by project participants</th><th>Validation conclusion</th></tr>
<tr><td></td><td></td><td>options (i.e. scenario 1 and scenario 2) has been presented herewith concluding scenario2 as the baseline scenario (as asked by the DOE as well).</td><td>correct
CAR is closed</td></tr>
<tr><td>CAR 5
The PP is also requested to perform the sensitivity analysis as per EB guide line after computing the IRR analysis.</td><td>B.5.26
B.5.27
B.5.36</td><td>The PP would like to clarify that the IRR for the baseline and the project activity has been computed with sensitivity analysis to make investment comparison analysis robust and reliable. Sensitivity analysis has been done considering +/- 10% variations in the following parameters:
▪ Electricity generation
▪ Grid power cost
▪ Coal cost
▪ Operational & maintenance cost
▪ Total project cost
Following is the result:
<table>
<tr><td rowspan="2">Parameters Description</td><td rowspan="2">Sensitivity</td><td colspan="2">IRR</td></tr>
<tr><td>Base line</td><td>Project activity</td></tr>
<tr><td>Wi tho</td><td>0%</td><td>26.30 %</td><td>17.36 %</td></tr>
</table></td><td>OK. The IRR analysis has been done for project and baseline.
Scenario 1) Proposed project activity not undertaken as a CDM project activity
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)
As scenario 2 has the higher IRR 26.3% than scenario 1 17.36%, scenario 2 has been selected as baseline.
From IRR analysis it has been evident with out CDM benefit IRR of the project activity is less than the baseline. The PP has also done sensitivity analysis of the input parameters</td></tr>
</table>

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants				Validation conclusion
		ut sensitivity				used in IRR analysis to substantiate the robustness and reliability of IRR analysis. All the input parameters which have 20% share in cost or revenue were considered in sensitivity analysis. Following parameters are considered in sensitivity analysis ▪ Electricity generation ▪ Grid power cost ▪ Coal cost ▪ Operational & maintenance cost ▪ Total project cost It has been evidenced with ± 10% variation of the above parameters the project IRR with out CDM benefit is less than the baseline IRR. More over DNV has checked the difference in baseline IRR and project IRR increases in sensitivity analysis for most of the cases which implies project IRR will be less than baseline IRR. However in four cases the
		Electricity generation	+ 10 %	29.62 %	19.04 %	
			- 10 %	22.83 %	15.61 %	
		Grid power cost	+ 10 %	29.85 %	19.04 %	
			- 10 %	22.57 %	15.61 %	
		Coal cost	+ 10 %	25.25 %	17.36 %	
			- 10 %	27.32 %	17.36 %	
		Operatio	+ 10 %	26.05 %	17.23 %	

<table>
<tr><th>Corrective action and/ or clarification requests</th><th>Reference to Table 2</th><th>Response by project participants</th><th>Validation conclusion</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>nal and Maintenance cost</td><td>-10 %</td><td>26.54 %</td><td>17.48 %</td></tr>
<tr><td rowspan="2">Total project cost</td><td>+10 %</td><td>24.14 %</td><td>15.77 %</td></tr>
<tr><td>-10 %</td><td>28.88 %</td><td>19.23 %</td></tr>
</table>

It is evident that in every scenario the project activity is less financially attractive compared to baseline. It is also found that the project IRR will never exceed baseline IRR in any realistic scenario.</td><td>difference in baseline IRR and project IRR decreases in sensitivity analysis. These are:
4. Decrease in electricity generation
5. Decrease in Grid power cost
6. Increase in coal cost
7. Increase in project cost
If electricity generation is decreased by 50% then project IRR will be higher than baseline IRR which is not feasible
If grid power cost decreases by 40% then project IRR will be higher than baseline IRR which is not feasible as grid power cost is in increasing trend.
If coal cost increases by 78% then project IRR will be higher than baseline IRR which is also not feasible as coal price is partially regulated by Government of India.
With even 100% increase in project cost project IRR will not cross baseline IRR

Thus it is DNV’s opinion the</td></tr>
</table>

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
			sensitive analysis is complete and in any realistic situation project IRR will not cross the baseline IRR. CAR is closed.
CAR 6 The monitoring plan does not include all necessary parameters. The PP is requested to separately describe the coal consumption in clinker making process and calorific value of coal which has been used to calculate annual energy consumption in year y of clinker making process More over clinker production has been monitored based on the raw material input to the kiln. Thus project proponent is requested to determine the raw material to clinker conversion factor on continuous basis and explicitly specify the same in the PDD.	B.7.2	The PP wishes to clarify that annual energy consumption of clinker making process in year *y* ($F_{P,y}$) has been included in the Monitoring Plan in Section B.7.1. of the PDD ver.01. As stated in Section B.7.1, the parameter will be monitored by monitoring the annual coal consumption for clinker production and the net calorific value of the fuel *i.e.* coal used. As per the Corrective Action Request the PP agrees to include both the parameters separately in the Monitoring Plan *i.e.* in Section B.7.1. Regarding the monitoring of clinker production, the PP agrees to address the concern of the DOE. Direct monitoring of clinker will be done in the project activity.	OK. Monitoring of annual coal consumption for clinker production and the net calorific value of the fuel *i.e.* coal used has been included in the monitoring plan of the PDD. In line with the monitoring methodology AM0024 direct monitoring of clinker production has been introduced in the monitoring plan. CAR is closed.
CAR 7 The PP is requested to describe monitoring technique for all such parameters and also to describe measurement capability, e.g., range,	B.7.3 B.7.4 B.7.5	Required changes have been made in the PDD.	**OK.** In the monitoring plan of the PDD all monitoring parameters' monitoring frequency, reporting frequency

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
accuracy, calibration control procedure etc., of the monitoring equipment used for the project activity.			has been mentioned. Accuracy class and calibration interval of all the monitoring equipment has been described in the PDD. CAR is closed
CL 1 The project system boundary encompasses the cement plants, 6 waste heat recovery boilers (WHRBs), two condensing steam turbine generator with auxiliaries and the electrical system dedicated to supply power to the cement plants. The PP is requested to include the waste heat gas sources, captive power plant and the local grid also in the project boundary, in line with the methodology. Schematic diagram of the project activity is required to be included in the PDD and the capacities of the kiln, WHRBs and turbine to be clearly stated.	B.3.1 B.3.2	Waste heat gas sources, captive thermal power plant and local grid have been duly included in the project boundary. The required changes have also been made in the schematic diagram with mentions of the capacities of the kiln, WHRBs and turbine.	**OK.** The waste heat gas sources, captive power plant and the local grid have been included in the project boundary, in line with the methodology. Schematic diagram of the project activity has also been included in the PDD and the capacities of the kiln, WHRBs and turbine has been clearly stated. CL is closed
CL 2 Three baseline scenarios have been identified. Those have been described in the following. 1. Proposed project activity not under taken as a CDM project activity. 2. New fossil fuel (i.e. coal) based power generation system as an extension of existing TPP	B.4.1	The PP wishes to clarify that BCL considers the following two options as feasible (please refer to the Note to Board) – ▪ Power generation through utilization of thermal energy of clinker cooler waste gas and pre-heater flue gas ▪ Power generation from a new fossil	OK. In line with methodology construction of a captive plant with different fuel options if electricity demand is increasing has been described in the PDD. However due to lack of resource for natural gas in MP /22/ and more cost of power

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
3. Import of power from grid However the list of baseline scenarios does not include construction of a captive plant with different fuel options if electricity demand is increasing. Thus the PP is requested to revise the list of plausible baseline scenarios as required by the applied methodology.		fuel (*i.e.* coal) based power generation system (as an extension of existing TPP) Power generation of capacity equivalent to a 10 MW coal based power plant using other fuels *viz.* diesel (source: http://uk.reuters.com/article/idUKDEL1697420080214), natural gas (source: http://petroleum.nic.in/ng.htm) and biomass (source: http://www.cea.nic.in/planning/Tapping%20of%20Surplus%20Power%20from%20Captive%20Power%20Plants/Replies%20of%20CPP%20(Annex-I%20to%20report).pdf) were not considered plausible due to lack of availability of the fuel in the region or fuel price.	generation for diesel /21/ these options has not been considered as baseline option. CL is closed
CL 3 It has been evidenced from the site visit and relevant documents that the baseline scenario is in accordance with the guidance in the methodology. However the selected baseline is applicable only when there is increase of energy demand. Thus the PP is requested to describe selection of baseline scenario in accordance with the guidance in the applied methodology.	B.4.4 B.4.8	In accordance with the methodology one of the broad categories of options could be considered during baseline selection '*Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists; and'* Birla Corporation Limited, Satna unit comprises of two cement manufacturing	**OK.** Birla Corporation Limited, Satna unit comprises of two cement manufacturing units – Satna Cement Works (SCW) and Birla Vikas Cement (BVC). Initially *i.e.* before the up-gradation of SCW and BVC the combined clinker production capacity was 2.079 million tonnes per annum. Thereafter, in April 2009, the project

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		units –Satna Cement Works (SCW) and Birla Vikas Cement (BVC). Initially *i.e.* before the up-gradation of SCW and BVC the combined clinker production capacity was 2.079 million tonnes per annum. Thereafter, in April 2009, the project participant (PP) undertook the expansion of both SCW and BVC which increased the annual combined clinker production capacity to 3.216 million tonnes. The up-gradation of the cement manufacturing units has led to a substantial increase in power demand of the cement plant. The existing captive power facility *i.e.* the 27 MW coal based thermal power plant was not sufficient to meet this increment in power demand (The detail computation sheet has already been submitted to the DOE). In view of this balance electricity requirement project participant assessed all probable electricity generation/supply sources. Following are the realistic and credible alternatives considered during the decision making: (i) Install a new fossil fuel (*i.e.* coal) based power plant as an extension of the existing captive	participant (PP) undertook the expansion of both SCW and BVC which increased the annual combined clinker production capacity to 3.216 million tonnes. The up-gradation of the cement manufacturing units has led to a substantial increase in power demand of the cement plant. The existing captive power facility *i.e.* the 27 MW coal based thermal power plant was not sufficient to meet this increment in power demand. For meeting the energy demand the PP considered two alternatives 1. Install a new fossil fuel (*i.e.* coal) based power plant as an extension of the existing captive power plant 2. Install a waste heat recovery based power plant and meeting rest of the demand through grid (As the unit cost of grid power is substantially high compared to the other two

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		power plant (ii) Install a waste heat recovery based power plant and meeting rest of the demand through grid (As the unit cost of grid power is substantially high compared to the other two options, the same has not been considered further.) The above justifies the consideration of a new coal based power plant (as an extension of new coal based power plant) as an identifiable generation source.	options, the same has not been considered further.) This is in line with the methodology. Here alternative one is baseline and alternative two is project activity. CL is closed.
CL 4 The PP is requested to provide total electricity demand envisaged in post implementation phase of the project activity and the means of meeting the same along with relevant supporting documents.	B.4.7	The PP wishes to clarify that both historical and projected values of electricity demand of the cement works (E_{CEMENT}) and other local loads (E_{LOAD}) have been mentioned in the PDD ver.03. Necessary documentary evidences have been submitted to the DOE. The average annual power demand in the post project scenario is envisaged to be 286.2 million KWh. Now, to meet this power requirement, following electricity sources will be used: - 182 million kWh will be generated from the existing 27 MW coal based Thermal Power Plant	**OK.** In line with the methodology historical and projected values of electricity demand of the cement works (E_{CEMENT}) and other local loads (E_{LOAD}) have been mentioned in the PDD ver.03. Electricity supply is also stated in PDD for historic and extrapolated future vale. The average annual power demand in the post project scenario is envisaged to be 286.2 million KWh. Now, to meet this power requirement, following electricity sources

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		- 65.3 million kWh will be generated in the waste heat recovery based power plant *i.e.* the project activity - Remaining 38.9 million kWh will be drawn from the local grid Necessary documentary evidences have been submitted to the DOE.	will be used /27/: - 182 million kWh will be generated from the existing 27 MW coal based Thermal Power Plant - 65.3 million kWh will be generated in the waste heat recovery based power plant *i.e.* the project activity - Remaining 38.9 million kWh will be drawn from the local grid CL is closed.
CL 5 The PP is requested to provide the evidence for serious consideration of CDM prior to taking decision for implementation of the project activity.	B.5.5 B.5.36	In view of the high investment and economic unattractiveness (low IRR) of the project activity the board agreed to go ahead with the project with serious consideration of CDM revenue. To substantiate the same 'Official note to board' and 'Board note' showing the consideration of CDM has been submitted to DOE. PP would like to mention that 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	**OK.** Evidence for serious consideration of CDM prior to taking decision for implementation of the project activity has been provided to DNV. It has been evidenced from board note /12/ dated 31 January 2008 and official note to board /11/ dated 25 January 2008 the project proponent considered CDM prior to taking decision for implementation of the project activity.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		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.	CL is closed
CL 6 The start date of the project activity has been considered as 26 June 2008 which is before 2 August 2008. However the PP is requested to provide the basis of start date with documentary evidence.	B.5.6 B.5.36 C.1.2	The date of placing purchase order of project equipments to the technology supplier i.e. Dalian East New Energy Development Co. Ltd. has been considered as the start date of the project. The purchase order/ the agreement letter of the same have been submitted to the DOE.	**OK.** After reviewing all the purchase orders for the project activity/13//16//30//49/ - /58/ DNV has validated the date of agreement for the project equipments with the technology supplier i.e. Dalian East New Energy Development Co. Ltd. is the earliest one, dated 26 June 2008 and hence it has been considered as the start date of the project. CL is closed
CL 7 The PP is requested to provide chronology of events in order to demonstrate continuous	B.5.7 B.5.10 B.5.36	In accordance with the recommendation provided by the DOE the chronology of events has been presented in the project	**OK.** The chronology of events in order to demonstrate continuous action to secure

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
actions taken to secure the CDM status.		design document under section B.5. The same demonstrate the continued real action taken by project participant to secure CDM along with the project participant.	CDM status has been provided in the PDD and all the supporting documents has been provided to DNV. It has been evidenced from the chronology the time gap between two consecutive events is less than two years which implies continuous actions taken to secure the CDM status. CL is closed
CL 8 The PP is requested to provide the start date of the construction of the project activity.	B.5.8 B.5.36	April, 2009	**OK.** Civil construction started on April 2009 /50/. CL is closed
CL 9 The price of unit cost of electricity has been verified from electricity bill. The PP is requested to provide copies of electricity bill to the validator.	B.5.21 B.5.36	As per the request, the photocopy of the electricity bill has been submitted to the DOE.	**OK.** The electricity bill for the month of December 2007 has been used for determining energy charge of the grid electricity /23/. The PP has provided the electricity bill to DNV. The energy charge as per the electricity bill is INR 3.89/kWh CL is closed
CL 10	B.5.30	PP hereby wishes to justify the selection	**OK.** For common practice

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
While the PDD indicates that clinker manufacturing plants in the state of Madhya Pradesh have been considered for common practice analysis, few of them are located in the state of Rajasthan. The PP is requested to rectify the same in the PDD. The PP further requested to clarify suitability of selection of geographical area for demonstration of common practice. The PP is also requested to provide references for the data used for common practice analysis.	B.5.32 B.5.33	of the region, scale and technology used for the demonstration of common practice analysis in the following way: As per EB39 Annex 10 (page 10), PP needs to provide common practice analysis that are "*operational and that are similar to the proposed project activity. Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc*". Selection of region- India Justification- PP has chosen India as the region for demonstrating common practice. Selection of scale- PP 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. Justification- The project activity	analysis whole India is selected. It has been evidenced from /46/ two WHRB based power plant in cement industry were registered as CDM project. Other five cement plant who have WHRB power plant or implementing WHRB power plant have also considered CDM benefit. Moreover CMA also certifies all WHRB based power plants in India are coming up after considering CDM benefit only /26/. CL is closed

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		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, PP has considered this technology for common practice analysis. PP would like to inform that in India following cement manufacturers have decided to set-up waste heat recovery based power plants: □ Two projects registered - o Project activity at the Vishnupuram cement plant of The India Cements (Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1161334998.77/view) o Project activity at the cement plant of The KCP Limited at Guntur, Andhra Pradesh (Source: http://cdm.unfccc.int/Projects/DB/RWTUV1214900280.42/view) □ Following projects are under validation - o Project activity at the Beawar cement plant of Shree Cements Limited (Source: http://cdm.unfccc.int/Projects/Validation/DB/UQCFT6FCSSLYS0LUT9AJA77K6	

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		V3DIG/view.html) o Project activity of Shree Cement Limited at Ras in Rajasthan (Source: http://cdm.unfccc.int/Projects/Validation/DB/1VUFGEOLT9ALGQDRZ1KGZVD4PGVE1Y/view.htm) o Project activity of JK Cement Limited at Nimbahera, Chittorgarh, Rajasthan (Source: http://cdm.unfccc.int/Projects/Validation/DB/Q3ZAG11B6DHEYOV3Q3KY3DBSLIOWQI/view.html) o Project activity at cement plant of JK Cement Limited, Mangrol, Chittorgarh, Rajasthan (Source: http://cdm.unfccc.int/Projects/Validation/DB/EYQ20DYK5JFSJS1BETOK17SM6SJWBM/view.htm) o Project activity at the Chanderia cement unit of Birla Corporation Limited (Source: http://cdm.unfccc.int/Projects/Validation/DB/T8I9BVLXM22CB7HQB7EC8QZID7KGQX/view.htm) All these projects have been implemented considering CDM revenue. So it is evident that the technology involved in the project activity is not at	

<table>
<tr><th>Corrective action and/ or clarification requests</th><th>Reference to Table 2</th><th>Response by project participants</th><th>Validation conclusion</th></tr>
<tr><td></td><td></td><td>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) has acknowledged that cement plants in India are undertaking waste heat recovery projects considering CDM benefit. 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.</td><td></td></tr>
<tr><td>CL 11
This value has been calculated based on the combined production capacity of SCW and BVC and the specific energy consumption for clinker making as per plant records of the year 2008- 09. However there are capacity expansions in both the cement plant. Thus the PP is requested to further calculate annual energy consumption based on the capacity expansion.</td><td>B.6.1</td><td>The PP would like to clarify that total thermal energy consumption for clinker making, clinker production and hence specific energy consumption have been considered from the 2009-10 plant records (after capacity expansion).
<table>
<tr><td></td><td>SCW</td><td>BVC</td></tr>
<tr><td>Thermal energy consumption in clinker making</td><td>5170.73</td><td>6048.09</td></tr>
</table></td><td>OK. Specific thermal consumption has been considered after expansion of the clinker production capacity. DNV validated the energy balance of the year 2009-10 (i.e. after capacity expansion of clinker production) /27/ and found annual energy consumption for clinker production is correct.

CL is closed</td></tr>
</table>

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		Clinker production: 1134224 / 947761 Specific thermal consumption: 0.00343 / 0.00354	
CL 12 The average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity has been calculated based on the current capacity. The project proponent is requested recalculate the average annual output separately after the capacity expansion.	B.6.2	Birla Corporation Limited, Satna unit comprises of two cement manufacturing units –Satna Cement Works (SCW) and Birla Vikas Cement (BVC). Initially *i.e.* before the up-gradation, SCW and BVC had a production capacity of 3400 tpd and 2900 tpd respectively. Thereafter, in April 2009, the project participant (PP) undertook the expansion of both SCW and BVC when their capacities become 4500 tpd and 5100 tpd respectively, thus the annual combined clinker production capacity reaches to 3.168 million tonnes.	**OK.** Specific thermal consumption has been considered after expansion of the clinker production capacity. DNV validated the energy balance of the year 2009-10 (i.e. after capacity expansion of clinker production) /27/ and found annual energy consumption for clinker production is correct. CL is closed
CL 13 The pp is rquested to provide the supporting document of the fossil fuel (i.e. coal) consumption rate of the identified generation source (IGS) to supply $EG_{Y,}$ expressed as GJ per MWh	B.6.3 B.6.8	The PP wishes to clarify that the fossil fuel consumption rate of the identified baseline generation source (FI_{IGS}) to supply EG_y has been calculated considering the station heat rate of the new coal based thermal power plant which is 2867 kCal/ kWh as per the technology supplier. Required documentary evidence for the station	**OK.** the fossil fuel consumption rate of the identified baseline generation source (FI_{IGS}) to supply EG_y has been calculated considering the station heat rate of the new coal based thermal power plant which is 2867 kCal/ kWh as per the technology supplier /16/.

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
		heat rate of the new coal based thermal power plant has been submitted to the DOE.	CL is closed
CL 14 The emission coefficient of coal has been sourced from 2006 IPCC Guidelines for National Greenhouse Gas Inventories. As the national value is available for host country India, the PP is requested to consider the same for the project activity.	B.6.4 B.6.8	In accordance with the UNFCCC requirement, value from 'India's Initial National Commission' – Chapter 2 – 'Greenhouse Gas Inventories' has been considered.	OK. Emission coefficient of coal has been taken from national value available in India /59/. This is used as local value is not available. CL is closed
CL 15 Ex-ante design estimate of the change in the energy consumption of i^{th} clinker kiln in TJ/ton Clinker, due to project implementation has been considered as zero on the basis of equipment supplier's data. The project proponent is requested to provide the documentary evidence of *ex-ante* design estimate of the change in the energy consumption of i^{th} clinker kiln in TJ/ton Clinker.	B.6.6 B.6.11	The project activity is about utilizing the waste heat of the waste gas (*i.e.* over and above its utilization for raw material pre-heating-Type I utilization) emanating from the clinker cooler for power generation. The technology supplier devised the plant design (as depicted in their technical proposal) based on that available waste heat of the waste gas only. As the same was the basis of the design PP is not expecting any change in the energy consumption patter of the kilns due to the implementation of the project activity. That is why the design estimate of change in energy consumption of i^{th} clinker kiln (*i.e.* ΔEI_i) has been taken as zero at this stage.	**OK.** The technology supplier devised the plant design (as depicted in their technical proposal) based on that available waste heat of the waste gas only. The PP also considers the same criteria for design of WHRB. Thus the design estimate of change in energy consumption of i^{th} clinker kiln (*i.e.* ΔEI_i) has been taken as zero at this stage for ex-ante estimation. However actual energy consumption after project implementation will be monitored ex-post. CL is closed

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
CL 16 The recording frequency of monitoring parameters is not matching in the section B.7.1 and B.7.2 of the PDD. The PP is requested to revise the recording frequency consistently in the PDD.	B.7.7	Necessary changes have been made accordingly.	**OK**. The recording frequency of monitoring parameters mention consistently in the PDD CL is closed

Table 4 Forward action requests

Forward action request	Reference to Table 2	Response by project participants
No FAR has been raised during the validation of this project		

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APPENDIX B

CURRICULUM VITAE OF THE VALIDATION TEAM MEMBERS

Indrajit Rana

Mr. Indrajit Rana holds double Bachelor Degree, in Chemical engineering and in Chemistry and is a certified energy auditor from Bureau of Energy Efficiency (BEE) of Government of India. Having an overall experience of around nine years. Prior to joining DNV having around six years experience in Chemical process industry namely Petrochemical industry covering production, day to day production planning, energy efficiency improvement, safety, and capacity expansion of existing unit. His experience also covers the fields of environmental management and resource conservation including optimization of steam consumption. Being shift in charge of HDPE unit he has acquired the knowledge of utility services like, nitrogen, hydrogen, plant air and water, steam, power and flare system. He is adequately experienced in handling many types of energy intensive rotating equipment like brine refrigerator (screw compressor), centrifugal and reciprocating compressor, blower, vertical mounted centrifugal pump, extruder, etc. and also experienced in handling DCS and advanced process control systems. He has knowledge in material balance and energy balance of HDPE plant. He has also experience in intrigated offsite plant (IOP) mainly waste water treatment plant, cooling tower operation and flare operation.
He has experience of around 3 years in validation and verification of numerous CDM projects in DNV, both in India & abroad.

His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in Energy demand

Sasim Chattopadhyay

Sasim Chattopadhyay holds a Master Degree (M. Sc.) in Physics and a Master Degree (M. Tech.) in "Energy Science and Technology". Having an overall experience of around seventeen years. Prior to joining DNV having five years experience in Energy Auditing in various industries like Engineering, Jute & Textile, Cement, Iron & Steel, Chemical, Automotive etc. covering Analysis of Energy Consumption pattern, Measurement of energy/fuel consumption & environmental emission parameters and Analysis for identifying Energy Conservation Opportunities.

He has experience of around three years in validation and verification of CDM projects and around six years in Management System Certification (QMS/EMS/OHSAS/SA) services.

His qualification, industrial experience and experience in CDM demonstrate him sufficient sectoral competence in "(1) 1.2 - Energy generation from renewable energy sources and (2) 3.1 - Energy Demand."

Santhosh Jayaram

Mr. Santhosh Jayaram holds a Master of Technology Degree in Environmental Technology. Having an overall experience of around 17 years. Prior to joining DNV having 9 years experience in cement industry covering manufacturing of cement, implementation of Environmental Management system against ISO 14001 in 3 cement units, co-ordinating Total

Productive Maintenance (TPM) activities. Have done projects on utilisation of alternative fuels in cement kiln as well as on electro static precipitators (ESP)

He has experience of validation and verification of out more than 40 CDM projects as team leader and team member. This includes projects from India and abroad.

His qualification, industrial experience and experience in CDM demonstrate his sufficient sectoral competence in cement sector to a reasonable degree.

Ole Andreas Flagstad

Ole Andreas Flagstad holds a Master Degree in thermodynamics/energy efficiency and has an overall working experience of around 20 years. He has worked both in public and private sector, including 5 years with a research institute (IFE) where specific responsibilities included running an energy efficiency network in the food industry and direct intervention with the industry. Other work experience includes working in European research programmes, administering national research programmes and International Energy Agency annexes.

Ole Andreas Flagstad has 4 years experience in validation and verification of projects within CDM, JI and other carbon credit schemes. His qualifications and experience in carbon credit schemes (primarily CDM and JI), qualifies him for different roles in a broad group of technical areas.

Matteo Faggin

Matteo Faggin holds a Master Degree in Business Administration and a Master Degree in Mechanical Engineering.

He has an overall experience of around 8 years. Prior to joining DNV having 7 years experience in the cement, construction and aluminum industries covering industrial operations and new project implementation for cement plants, quarries, energy and thermal distribution projects.

He has experience of around 1 year in validation and verification of numerous CDM projects.

His qualification, industrial experience and experience in CDM demonstrate him sufficient sectoral competence in Cement Industry, Electricity Distribution, Heat Distribution, Mining and Mineral processes.

Expertise in Project Management for the execution of large projects aimed at reducing the greenhouse gasses emissions and increasing the energy efficiency of manufacturing plants.