VALIDATION REPORT

GHG Emission Reductions through grid connected high efficiency power generation in India

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DET NORSKE VERITAS

VALIDATION REPORT

DET NORSKE VERITAS
CERTIFICATION AS

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Approved by: Michael Lehmann	Organisational unit: Climate Change Services
Client: Coastal Gujarat Power Limited	Client ref.: Mr. Ramesh Subramanyam

Project Name: GHG Emission Reductions through grid connected high efficiency power generation
Country: India
Methodology: ACM0013
Version: 02
GHG reducing Measure/Technology: New grid connected fossil fuel fired power plant using less GHG intensive technology.
ER estimate: 2 651 753 tCO_2e per annum
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 "GHG Emission Reductions through grid connected high efficiency power generation", as described in the project design document version 3 dated 4 January 2010, meets all relevant UNFCCC requirements for the CDM and correctly applies the approved baseline and monitoring methodology ACM0013. Hence, DNV requests the registration of the "GHG Emission Reductions through grid connected high efficiency power generation" project as CDM project activity.

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Report title:
GHG Emission Reductions through grid connected high efficiency power generation in India

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Validation

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Abbreviations

BM	Build margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CERC	Central Electricity Regulatory Commission
CGPL	Coastal Gujarat Power Limited
CL	Clarification request
CM	Combined margin
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DDG	Decentralized distributed generation
DNA	Designated National Authority
DNV	Det Norske Veritas
EPC	Engineering, Procurement and Construction
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LOA	Letter of Approval
MoEF	Ministry of Environment and Forests
MP	Monitoring Plan
NGO	Non-governmental Organisation
NOX	Nitrogen Oxides
NTPC	National Thermal Power Corporation
ODA	Official Development Assistance
OM	Operating margin
PDD	Project Design Document
PPA	Power purchase agreement
SO_x	Sulphur Oxides
SPM	Suspended particulate matter
TPCL	Tata Power Company Limited
UMPP	Ultra mega power projects
UNFCCC	United Nations Framework Convention on Climate Change

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VALIDATION REPORT

1 EXECUTIVE SUMMARY – VALIDATION OPINION

Det Norske Veritas Certification AS (DNV) has performed a validation of the "GHG Emission Reductions through grid connected high efficiency power generation" project 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 has yet been identified. India fulfils the participation criteria and has approved the project and authorized the project participant. The DNA from India confirmed that the project assists in achieving sustainable development.

The project correctly applies ACM0013 "Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology", version 2.

By generating electricity from coal using supercritical power generation technology, which is more efficient than commonly used sub-critical technology, the project will result 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 2 651 753 tCO_2e per year over the selected 10 year 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.

Adequate training and monitoring procedures have been developed.

In summary, it is DNV's opinion that the "GHG Emission Reductions through grid connected high efficiency power generation" project in India, as described in the PDD of 4 January 2010, meets all relevant UNFCCC requirement for the CDM and all relevant host Party criteria and correctly applies the baseline and monitoring methodology ACM0013, version 2. DNV thus requests the registration of the project as a CDM project activity.

2 INTRODUCTION

Coastal Gujarat Power Limited has commissioned Det Norske Veritas Certification AS (DNV) to perform a validation of the "GHG Emission Reductions through grid connected high efficiency power generation" 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 ACM0013, version 2.

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 table outlines the documentation reviewed during the validation:

/1/ CGPL: *CDM PDD, version 1 dated 3 December 2007, version 2 dated 1 September 2009 and version 3 dated 4 January 2010.*

/2/ CDM Executive Board: *Validation and Verification Manual.* Version 01

/3/ CDM Executive Board: *ACM0013: Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology,* version 02.

/4/ CGPL: *Letter of engagement of consultant for assisting Sasan Power Limited for registering 4000 MW Sasan UMPP with CDM-Executive Board,*

/5/ CGPL: *Letter from Ernst & Young to M/s Jas Infrastructure capital private Limited confirming the former's appointment for providing CDM advisory services for high efficiency power generation using steam at super critical condition in Bihar, India*

/6/ CGPL: *Letter from Ernst & Young to M/s Jawaharlal Darda Yavatmal Energy Limited confirming the former's appointment for providing CDM advisory services for high efficiency power generation using steam at super critical condition in Maharasthra, India,*

/7/ DNV: *Appointment of DOE (DNV) for validation Adani Power Limited's super critical power generation project at Mundra, Gujarat, India 9the project is currently under validation stage),*

/8/ DNV: *Enquiry from M/s Adani Power Limited to DNV for appointment of DOE for validation of their second super critical power generation project in Gujarat, India,*

/9/ CGPL: *Contract agreement between M/s Andhra Pradesh Power Generation Corporation Limited and M/s Ernst & Young for CDM advisory services for new projects including the Krishnapatnam Thermal Power Plant (2x800 MW)*

/10/ CGPL: *NM0217, "Grid-connected supercritical coal-fired power generation" submitted by NTPC Ltd, India.*

/11/ CGPL: *Letter from International Finance Corporation, World Bank Group dated 26 February 2008 on consideration of carbon credit revenues as part of financial due diligence for loan to CGPL.*

/12/ CGPL: *Letter from Asian Development Bank dated 14 February 2008 on consideration of potential carbon credit revenues as part of financial due diligence for loan to CGPL.*

/13/ CGPL: *Power purchase agreement for 4000 MW Mundra ultra mega power project.*

/14/ CGPL: *Excerpts of the minutes of the meeting of the executive committee of the board*

of TPCL dated 2 December 2006.

/15/ *Report of the working group on power for eleventh plan (2007-12), Volume II, ministry of Power, Government of India.*

/16/ CERC: *Notification no. Eco 2 (R)/2006-CERC dated 22 November 2006*

/17/ CERC: *Order dated 22 May 2007.*

/18/ CERC: *Notification no. Eco 2/2007-CERC dated 24 September 2008.*

/19/ CERC: *Order dated 29 May 2007.*

/20/ CERC: *Notification no. Eco 2/2007-CERC dated 24 September 2007.*

/21/ Ministry of Power: *Hydro power policy 2008.*

/22/ CGPL: *Spec no. TCE 5146A-H-510-02, section – Data sheet A, Design parameters of steam generators and auxiliaries.*

/23/ CGPL: *Spec no. TCE 5146A-C-563-011, section – C6, Coal handling system*

/24/ CGPL: *Port services agreement between CGPL and Mundra Port and Special Economic Zone Limited.*

/25/ CGPL: *Capex plan*

/26/ CGPL: *CRISIL report on power generation –equipment availability, a critical focus area.*

/27/ CGPL: *CRISIL report on impact of RIL's KG gas price on end-user segments.*

/28/ CERC: *Depreciation schedule.*

/29/ CGPL: *Lenders letters confirming debt-equity ratio.*

/30/ CGPL: *Asian development bank report on initial poverty and social assessment, IND: Mundra UMPP.*

/31/ CGPL: *Offshore equipment supply contract*

/32/ CGPL: *Host country approval, letter no. 4/24/2007-CCC dated 15 February 2008.*

/33/ CGPL: *Communications with stakeholders.*

/34/ CGPL: *Clearances from Ministry of Environment & Forest for establishing the project.*

/35/ CGPL: *Proof of engagement of TPCL in other sub-critical power generation projects.*

/36/ CGPL: *Detailed project report*

/37/ CGPL: *Power performance report 2006.*

/38/ CGPL: *Power sector rating report 2005.*

/39/ CGPL: *Appendix 1_levelized cost_baseline.xls*

/40/ CGPL: *Appendix 2_CGPL Financial Model.xls*

/41/ CGPL: *Appendix 3_ Emission Reduction.xls*

/42/ CGPL: *Indicative term sheet for the financing of the Mundra UMPP 4000 MW project dated 12 march 2008*

/43/ CGPL: *Power sector rating – consolidated report to the ministry of power*

/44/ CGPL: *GPCB consent to establish PC/CCA-KUTCH-437/21029 dated 17 July 2007*

/45/ CGPL: *MoEF clearance – letter no. J-13011/41/2006-IA.II(T) dated 2 March 2007*

/46/ CGPL: *Tariff Policy published by the Ministry of Power, government of India (No. 23/2/2005-R&R(vol.III) dated 6 January 2006)*

/47/ Notice to proceed issued to Toshiba Corporation and Doosan Heavy Industries & Construction Company Ltd. (they are the major equipment suppliers for the project

activity.))

/48/ Ref.: http://cdm.unfccc.int/Projects/Validation/DB/JB9AVH5IAWF0MDFULY3P4678XR05JN/view.html).

/49/ Ref.: http://cdm.unfccc.int/Projects/Validation/DB/GV4Q5DLY8Z3NBDLMVIEANVT992JRKY/view.html)

/50/ Ref.: http://cdmindia.nic.in/cdmindia/projectList.jsp?n=y&off=91

/51/ Ref.: http://cdm.unfccc.int/Projects/Validation/DB/259L8CYWH665QF5XEXXKIGR1A6FO0Y/view.html

/52/ Ref.: http://www.cea.nic.in/Thermal/Project%20Appraisal/central-state-thermal.pdf and http://www.ntpc.co.in/aboutus/installed_capac.shtml

/53/ http://www.thehindubusinessline.com/2007/04/08/stories/2007040804260100.htm

/54/ http://www.financialexpress.com/news/No-coal-price-hike-this-year-Bagrodia/312666/

/55/ http://pfc.gov.in/Tariff_Policy.pdf
http://pfc.gov.in/selection_process.pdf

/56/ http://www.cercind.gov.in/13042007/Terms_and_conditions_of_tariff.pdf, Page 20

/57/ http://www.hindu.com/2007/04/08/stories/2007040801471900.htm

/58/ IFC: *Tata Ultra Mega – Summary of proposed investment*

/59/ http://www.cercind.gov.in/03022007/No_18-2007.pdf

/60/ Country default spreads and risk premiums by Aswath Damodaran based on Moody's country rating
http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html

/61/ Information on international coal price
http://www.businessstandard.com/india/storypage.php?autono=155593

/62/ Gujarat Electricity Regulatory Commission – Eight Annual Report, 2006-2007

/63/ Letter from International Finance Corporation (World Bank Group), dated 26 February 2008, indicating consideration of impact of carbon credit revenues as part of financial due diligence for loan sanction

/64/ Email letter from Asian Development Bank, dated 14 February 2008, indicating consideration of impact of carbon credit revenues as part of financial due diligence for loan sanction

/65/ Mott MacDonald: Report by Mott MacDonald, engaged by the British High Commission, on exploring the use of carbon financing

/66/ Siemens: AG E911-Heat Flow Diagram for Mundra

3.2 Follow-up Interviews with Project Stakeholders

On 14 February 2008, DNV performed interviews with project stakeholders at CGPL's office at Mumbai, India, to confirm selected information and to resolve issues identified in the document review. Further meetings have also been held at DNV Bangalore office on 15 April 2009 and at M/s Ernst & Young's Kolkata office on 23 January 2009. Representatives from

M/s Coastal Gujarat Power Limited and M/s Ernst & Young were interviewed. The main topics of the interviews are summarized below.

Name of interviewee	Interview Topics
CGPL *1. Mr. Nitin Johar* *Associate Group Head – Finance* *2. Mr. Ramesh Subramanyam* *Chief Financial Officer & Company Secretary* *3. Mr. Alok Kanagat* *Project Director* *4. Mr. K. P. Sreenivasan* *Sr. Manager* *5. Mr. P. P. Kokil* ***E & Y*** *1. Mr. Ajeya Bandopadhyay* *2. Ms. Amrita Ganguly* *3. Mr. Sudipta Das*	➢ Proof of CDM consideration ➢ Determination of baseline ➢ Assessment of project additionality and discussed barriers ➢ Uniqueness of project activity ➢ Emission reduction calculations and data used ➢ Review of project design and technology used ➢ Review of monitoring and verification procedure of the organisation and management structure of the organization for the project activity. ➢ Environmental consents and permits ➢ Review of the stakeholder consultation process.

3.3 Resolution of Outstanding Issues

The objective of this phase of the validation was to resolve any outstanding issues which needed be clarified prior to DNV's positive conclusion on the project design. In order to ensure transparency a validation protocol is 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 three tables. The different columns in these tables are described in the figure below. The completed validation protocol for the "*GHG Emission Reductions through grid connected high efficiency power generation" project* is enclosed in Appendix A to this report.

Findings established during the validation can either be seen as a non-fulfilment of CDM criteria or where a risk to the fulfilment of project objectives is identified. Corrective action requests (CAR) are issued, where:

i) mistakes have been made with a direct influence on project results;
ii) CDM and/or methodology specific requirements have not been met; or
iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

A request for clarification (CL) may be used where additional information is needed to fully clarify an issue.

A response to the CARs and CLs initially raised by DNV and presented to the project participants in DNV's draft validation report dated 10 March 2008 (rev. 00), was invited from the project proponent. Since modifications to the Project Design Document were necessary to resolve DNV's concerns, CGPL decided to revise the PDD and resubmitted the same as version 2 dated 1 September 2009. Further to this, the project could not be submitted for registration to the UNFCCC before the expiry of grace period (29 January 2009) for the applied baseline and monitoring methodology ACM0013 version 1. Hence, the PDD was revised to comply with the revised version of the applied methodology.

Further, the PDD has been revised (revision 3 dated 4 January 2010) in order to address the issues identified by the UNFCCC during completeness check at requesting registration stage. The most significant differences between the final PDD of 4 January 2010 and the PDD which was put up for global stakeholders' are listed below:

i) Change in estimated annual CER volume from 2 831 222 tCO_2e (web hosted PDD) to 2 651 753 tCO_2e (final version of the PDD). The electricity generation figure reported in the web-hosted PDD was 29 784 GWh. However this did not exclude the auxiliary consumption of the power plant. This figure has been revised subsequently to 27550.2 GWh after deducting 7.5% auxiliary consumption, thus leading to an estimated annual CER volume of 2 651 753 tCO_2e.

(It is required to address here that the annual average CER volume reported in an earlier version of the PDD submitted for registration was 4 267 604 tCO_2e. The initial request for registration was found incomplete by the Secretariat, and while addressing the incompleteness issues, DNV has re-checked the CER calculations and found that the project emission was calculated for the fuel consumption for net electricity generation instead of gross electricity generation resulting in higher CER estimates. The calculations have been corrected to accommodate total fuel consumption due to gross electricity generation. The corrected estimation of CER thus comes out to be 2 651 753 tCO_2e per annum.)

ii) In the webhosted PDD, the baseline emission factor considered initially was 1.09 tCO_2/MWh as per option 1 of the methodology since data required for calculating emission factor as per option 2 was not publicly available. The emission factor has now been revised to 0.941 tCO_2/MWh. This has been calculated by the Central Electricity Authority as per the guidance provided in the applied methodology (http://www.cea.nic.in/planning/cdm.pdf). As the value published by CEA is more conservative, DNV considers that use of this value as the emission factor is justified and this also is in compliance with the applied methodology.

iii) In the webhosted PDD, the project emissions were calculated based on NCV (25.8 GJ/MT) and EF (0.946 tCO_2e/GJ) of other bituminous coal, values were taken from IPCC database. In the final PDD, the project emissions have been calculated based on project specific value for carbon content of the coal that will be used in the power plant in preference to IPCC default values. This value has been verified from the proximate analysis report of the relevant type of coal as reported in the DPR (/36/). Thus DNV considers that the changes from the webhosted PDD are justified.

iv) In the web-hosted PDD the coal consumption figure was estimated from the DPR of the project and the applied value was 12 million tonnes of coal per year for 4000 MW capacity power plant. During the validation, the coal consumption figures were re-estimated from the plant efficiency value provided by Siemens AG /66/. The document provides a gross efficiency value of ~43.75% for a PLF of 85%. This gives a station heat rate of 1965.714 kcal/kWh (calculated as 860/43.75%) which has been approximated to 1965 kcal/kW and used in the financial calculations. Using this value provides a coal consumption value of 10.198756 million tonnes per annum for the entire power plant which has been used in the financial calculations. The same calculations have also been used to arrive at the coal consumption value used for project emission calculations. However in this case the efficiency value used was approximated to 43.7% which resulted in annual coal consumption of 10.214136 million tonnes. This has been conservatively approximated to 10.22 million tonnes as this approximation leads to higher project emissions.

v) Efficiency of the power generation technology that has been identified as the most likely baseline scenario (η_{BL}) has been revised from 0.313 to 0.351. The latter value has been calculated on the basis of the data available with CERC & CEA and has been chosen conservatively. CERC and CEA both are independent bodies under the Ministry of Power, Government of India and are responsible for maintaining power sector database in India. Hence these sources can be considered as trustworthy and authentic. Thus DNV considers that the efficiency value used for emission reduction calculations is justified.

vi) All assumptions for calculation of levelized cost of electricity generation have been depicted in the PDD as required by the applied methodology.

vii) Levelized cost of electricity generation has been calculated and compared between sub-critical and super critical technology of power generation for both domestic and imported coal. This provides more clarity among the available credible options.

viii) Investment analysis has been introduced for demonstrating additionality of the project. Some of the barriers, stated in the webhosted PDD could not be substantiated or considered prohibitive for the implementation of the project and hence removed from the PDD.

ix) Start date of project activity has been revised to the date of placing the first purchase order. This is in line with the guideline provided by the CDM Executive Board in its 41st meeting.

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**), a **Corrective Action Request (CAR)** of risk or non-compliance with stated requirements or a request for **Clarification (CL)** where further clarifications are needed.*

Validation Protocol Table 2: Requirement checklist				
Checklist Question	***Reference***	***Means of verification (MoV)***	***Comment***	***Draft and/or Final Conclusion***
The various requirements in Table 2 are linked to checklist questions the project should meet. The checklist is organised in different sections, following the logic of the large-scale PDD template, version 03 - in effect as of: 28 July 2006. Each section is then further sub-divided.	*Gives reference to documents where the answer to the checklist question or item is found.*	*Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable.*	*The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.*	*This is either acceptable based on evidence provided (**OK**), or a c**orrective action request (CAR)** due to non-compliance with the checklist question (See below). A request for clarification (CL) is used when the validation team has identified a need for further clarification.*

Validation Protocol Table 3: Resolution of Corrective Action and Clarification Requests			
Draft report clarifications and corrective action requests	***Ref. to checklist question in table 2***	***Summary of project owner response***	***Validation conclusion***
If the conclusions from the draft Validation are either a CAR or a CL, these should be listed in this section.	*Reference to the checklist question number in Table 2 where the CAR or CL is explained.*	*The responses given by the project participants during the communications with the validation team should be summarised in this section.*	*This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion".*

Figure 1 Validation protocol tables

3.4 Internal Quality Control

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

3.5 Validation Team

The validation team consisted of the following personnel:

				Type of involvement					
Role/Qualification	***Last Name***	***First Name***	***Country***	Desk review	Site visit / Interviews	Reporting	Supervision of work	Technical review	Expert input
CDM validator / technical team leader	Ramachandran	Ramesh	India	✓		✓	✓		
GHG auditor	Biswas	Soumik	India	✓	✓	✓	✓		
GHG auditor	Chattopadhyay	Sasim	India	✓	✓	✓			
Sector expert	Kakarapartthi	Raman Venkata	India	✓	✓				✓
Technical reviewers	Chandrashekara	Kumaraswamy	India					✓	

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 in version 3 dated 4 January 2010.

4.1 Participation Requirements

The project participant is the private entity Coastal Gujarat Power Limited of India. No participating Annex-I Party has yet been identified. The host Party India meets all the requirements for participating in a CDM project. Approval for the project has been obtained from the Ministry of Environment and Forests, the DNA of India, vide letter no. 4/7/2008-CCC dated 13 April 2009.

4.2 Project Design

The project activity involves power generation through the use of fossil fuel (coal) but with a more efficient technology. The project proponent has planned to install a 4000 MW (5x800 MW) supercritical coal fired power plant at Mundra in the state of Gujarat, India, that will be operated by supercritical technology. The technology uses steam at supercritical condition. The "critical point" refers to the thermodynamic state where all three states of a substance coexist. The critical pressure of water being 22.1 MPa, the steam above this pressure will be at super-critical pressure and below this critical pressure, the steam is deemed to be sub-critical.

Unlike sub-critical boilers, the super-critical boiler is a once through type of boiler where water and steam remains in saturated condition in the boiler drum and water is re-circulated for generation of steam. The once through boiler does not require any circulating pump or drum except for boiler feed water (BFW) pump. Energy required for circulation is provided by the feed pump.

The project activity involves steam generation at super-critical condition (output condition at main steam header: steam temperature of 568.5^0C and pressure of 255 kg/cm^2 g) and subsequent generation of power through condensing type steam turbine. Due to the super-critical conditions, the efficiency of steam generation through super-critical technology is significantly higher than that of the conventional sub critical technology (which typically operates in Indian condition at 16.6 MPa main steam pressure and 538 ^{0}C). Higher steam generation efficiency and hence higher overall cycle efficiency will lead to lower specific coal (*i.e.* fossil fuel) consumption and in turn will lead to reduction of CO_2 emissions.

The project is one of the first supercritical technology based power plants which have been planned for implementation in India.

The start date of the project activity was initially chosen to be 7 December 2006, the date of submission of bid for the project activity. DNV has verified extracts from the minutes of the meeting of the executive committee of the board of Tata Power Company Limited (TPCL), held on 2 December 2006 and found that the committee has recognized potential revenue stream available under clean development mechanism as an offsetting parameter for incremental costs and technological risks associated with the project. However, in line with

the EB guidelines, the projects start date has now been chosen to be 1 September 2007. This is the date for 'Notice to proceed' issued to Toshiba Corporation and Doosan Heavy Industries & Construction Company Ltd. (they are the major equipment suppliers for the project activity) /47/.

The life time of the project activity has been defined to be 25 years, which is reasonable. The project proponent has opted for a fixed crediting period of 10 years starting from 1 January 2011 or the date of registration of project with UNFCCC, whichever is later.

4.3 Baseline Determination

Approved consolidated methodology ACM0013, *"Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plant using a less GHG intensive technology", version 2,* has been applied for the project activity.

4.3.1 Applicability of baseline and monitoring methodology

ACM0013 version 2 is applicable where the project activity involves construction and operation of a new fossil fuel fired grid-connected electricity generation plant that uses a more efficient power generation technology than what would otherwise be used with the given fossil fuel and is not a co-generation power plant. The project under discussion is a super critical power plant in India, where at present all existing power plants are run by sub-critical nature. The project activity is meant for power generation only and does not aim for cogeneration. The methodology, ACM0013, also requires that data on fuel consumption and electricity generation of recently constructed power plants is available and the identified baseline fuel is used in more than 50% of total generation by utilities in the geographical area within the country or in the country. Also the geographical area has to be the limited by the physical boundary of the host country. For the project activity under consideration, the geographical area is limited within India. Fuel consumption and electricity generation data are publicly available from Central Electricity Authority (CEA) of India. It has been confirmed from the official website of CEA (http://www.cea.nic.in/) that coal, the identified baseline fossil fuel, is used in more than 50% of total electricity generation facilities in India. Contribution of coal in Indian power generation scenario has been found to be 72.19% in 2004-'05, 69.15% in 2005-'06 and 68.57% in 2006-'07. Thus selection of the applied methodology ACM0013 is appropriate for the project activity.

4.3.2 Determination of plausible baseline scenario

Baseline for the project activity has been determined in the following manner as required by the applied baseline and monitoring methodology ACM0013.

Step 1: *Identify plausible baseline scenario:*

In order to identify plausible and realistic baseline scenarios, various options have been considered as given below.

i) *Implementation of the project activity without CDM benefit:* This alternative has been considered further in step 2 for arriving at the baseline scenario.

ii) *Power generation using coal fired sub-critical power generation technology*: In India, coal fired power plants are predominant over other types of generation technologies and plays a vital role in Indian energy scenario. Till date, all coal based power plants run on sub-critical technology and these are meant for primarily meeting the base load requirements. India being a coal abundant country, there are more such power plants in pipeline for implementation. This alternative has also been considered for further analysis in step 2.

iii) *Power generation using energy sources other than coal*: This alternative addresses various power generation alternatives other than coal as detailed below.

a) Natural gas based power plant is one of such options. DNV has reviewed the report of the working group on power for the eleventh plan (2007 – 2012), published by the Ministry of Power, Government of India /15/, and noted that installation of natural gas based 4000 MW power plant is unlikely as compared to coal based thermal power plants. The report states that "Although gas is relatively a clean fuel, at present there is uncertainty about the availability, period of availability and price of gas. Only 2,114 MW gas based capacity has been planned for in the eleventh plan period where gas supply has already been tied up". While the report does not rule out possibility of construction of more natural gas based projects in future, it is sufficiently demonstrated that the availability and price of gas is a barrier to natural gas based power generation. Hence, this option has been excluded from being a plausible baseline scenario and this exclusion is deemed adequate by DNV.

b) Hydro electricity generation has also been considered as a plausible baseline scenario. It has been noted that India has a large potential for hydro electricity generation and there are many hydro projects, predominantly small/mini/micro projects, planned for implementation during eleventh and twelfth plan period /21/. However, DNV has reviewed the new hydro power policy of the Ministry of Power, Government of India, and noted that "Despite being recognized as a relatively benign and renewable source of energy, the share of hydro power in the overall generating capacity in the country has been steadily declining since 1963. The hydro share has declined from 44% in 1970 to 26% in 2007". The report also states that development of hydro power projects is fraught with a number of uncertainties. Broadly, the problems faced by the developers have been grouped into those related to the project location, to its geology and to issues of resettlement and rehabilitation. Typically hydro projects are high cost, long gestation projects and are highly vulnerable to any uncertainties. It has also been addressed in the aforementioned policy document that hydro stations are a natural choice for meeting the peak demand, while the project activity is meant to meet the base load demand. Hence, DNV considers that exclusion of this option from further consideration as a plausible baseline scenario is justified.

c) Power generation using liquid fossil fuel, e.g., diesel, fuel oil, naphtha etc. has not been found to be a plausible baseline alternative. Higher cost of fuel is the main reason behind this. Also, liquid fuel based thermal power plants have not been considered by the working group on power (ref.: Report of the working group on power for the eleventh plan (2007 – 2012) published by the Ministry of Power, Government of India). Coal, lignite and natural gas based power generation has been considered under the future capacity addition plan. Hence, this option has also been reasonably excluded from being a plausible baseline scenario.

d) Renewable energy sources have also been discussed as a plausible baseline scenario to the project activity. Although India has a good potential for wind energy generation, due to its topographical and seasonal variation, the average plant load factor is lower than coal based power plant and hence is improbable to be a base load supplier. The above mentioned report of the working group on power also indicates that average plant load factor of wind turbine plants is only of the order of 15-20%. Availability of biomass stand out as a major constraint for setting up large biomass power plants with

comparable capacity as the proposed project. Biomass based power plants are preferred choice to meet captive requirements than to be a supplier to the grid. The working group on power has planned for only 3200 MW /15/ solar power plants during 2007 – 2012. It has also been observed from the report of the working group on power that decentralized distributed generation (DDG) has been considered for some of the remote areas, where extension of grid supply is not techno-economically feasible. For meeting the demand of such remote areas, the working group has proposed to setup some power plants based on local energy sources available. These are small hydro and non-conventional sources such as biomass, wind, DG sets etc wherein other sources are not available. During the eleventh plan period a capacity addition of about 5,000 MW of under DDG has been envisaged by the working group to meet local demands. Hence, it can be concluded that generation of electricity using renewable energy sources (other than hydro) can not be a feasible baseline alternative to the project activity.

e) Nuclear power plant is a likely alternative to the project activity. However, in India, setting up of nuclear power plants are limited to the Government organizations only and hence can not be a feasible baseline alternative to the project activity.

f) Electricity imported from neighbouring countries meets less than 1% of electricity demand in India and at present there is no suitable infrastructure for importing electricity. The report of working group on power also has not included electricity import as part of capacity addition programme of India for the eleventh five year plan. Hence this option can not be a feasible baseline alternative to the project activity.

The methodology, ACM0013, further requires inclusion of "all relevant power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in official power expansion plans)" as plausible alternatives.

In this regard it is worth to mention here that the Ministry of Power, Government of India, has planned for installation of nine ultra mega power plants (UMPP) based on super critical technology across the country. The power plants are supposed to be awarded to project developers through tariff based competitive bidding process. The Ministry of Power, in its tariff policy of 2006, has stated that "Tariff fixation for all electricity projects (generation, transmission and distribution) that result in lower Greenhouse Gas (GHG) emissions than the relevant baseline should take into account the benefits obtained from the Clean Development Mechanism (CDM) into consideration /46/, in a manner so as to provide adequate incentive to the project developers." On verification DNV has also observed reflection of the above in practice, i.e. consideration of CDM by the UMPP project developers. Among the nine proposed UMPPs, four projects have been awarded to project developers so far. The first UMPP namely Coastal Gujarat Power Limited (the project activity under consideration) was awarded to M/s Tata Power. The Sasan UMPP project has been awarded to M/s Reliance Power Limited and the same is also undergoing CDM validation process. The other two UMPPs, at Krishnapatnam, Andhra Pradesh and Tilaiya, Jharkhand, have also been awarded to M/s Reliance Power Limited and financial closure is still awaited. Thus, it can be concluded that the supercritical thermal power plants, proposed under UMPP programme of Government of India, and those that are under implementation has considered CDM benefit for the respective projects.

Further, DNV has verified the following documents related to other supercritical power plants planned for implementation and observed that CDM benefit has been considered as part of implementation of the projects.

i) Letter of engagement of consultant for assisting Sasan Power Limited for registering 4000 MW Sasan UMPP with CDM-Executive Board. This project is currently under validation stage /48/.

ii) Letter from Ernst & Young to M/s Jas Infrastructure Capital Private Limited confirming the former's appointment for providing CDM advisory services for high efficiency power generation using steam at super critical condition in Bihar, India /5/.

iii) Letter from Ernst & Young to M/s Jawaharlal Darda Yavatmal Energy Limited confirming the former's appointment for providing CDM advisory services for high efficiency power generation using steam at super critical condition in Maharasthra, India /6/.

iv) Appointment of DOE (DNV) for validation of M/s Adani Power Limited's super critical power generation project at Mundra, Gujarat, India. This project has been registered with UNFCCC as a CDM project (ref. no.: UNFCCC 2716) /49/.

v) Contract agreement between M/s Andhra Pradesh Power Generation Corporation Limited (APGENCO) and M/s Ernst & Young for CDM advisory services for new projects including the Krishnapatnam Thermal Power Plant (2x800 MW) /9/ APGENCE has obtained host country approval from the DNA of India for their proposed CDM project namely "Power generation by grid connected supercritical technology based thermal power plant at Krishnapatnam, Nellore District, Andnra Pradesh" /50/.

vi) NM0217: "Grid-connected supercritical coal-fired power generation" submitted by NTPC Ltd, India for their planned super critical technology based thermal power plant at Sipat, India /10/.

vii) Letter of enquiry from M/s Adani Power Maharasthra Limited to DNV for appointment of DOE for validation of their 1320 MW (660 MW x 2) super critical technology based thermal power plant at Tirora /8/. This project is currently under validation stage /51/.

It is also true that there may be other supercritical technology based power plants of smaller scale in the planning stage and possibility of installation of these without CDM benefit can not be ruled out. However, the above mentioned documents indicate that CDM benefits have been considered for almost all of the supercritical technology based power plants, those have been determined for installation. Hence it can be concluded that exclusion of these projects from considering as plausible baseline options is in line with requirements of ACM0013 and therefore justified. From the above discussion, it is evident that the realistic and plausible alternatives to the project activity could be setting up of coal based sub-critical power plant or implementation of the project activity without considering CDM benefit. These two options have been further analysed in step 2 below in order to find out economically most attractive alternative.

Step 2: *Identify the economically most attractive baseline scenario alternative:*

The applied baseline and monitoring methodology ACM0013 requires that the economically most attractive alternative amongst the identified alternatives in step 1 be the baseline to the project activity. To arrive at a justified conclusion, the PP has chosen levelized cost of electricity generation as the indicator. Investment analysis along with relevant assumptions for calculation of levelised cost has been included in the PDD. The analysis has also been submitted in excel worksheet format. DNV has validated the assumptions to the analysis and the means of validation of the applied data are provided below.

Project size	The project activity involves installation of 5 electricity generation units each having 800 MW generation capacity. In India, the largest coal based electricity generation units are of 500 MW capacity and run by sub-critical technology /52/. Hence, for sub-critical power plant, unit size has been taken as 500 MW and it is comparable to the project activity under consideration. This conforms to the requirements of the applied methodology ACM0013.
Project cost	For the project activity, the project cost has been taken from estimated project cost (ref.: Indicative term sheet for the financing of the Mundra UMPP 4000 MW project dated 12 March 2008 from M/s BNP Paribas) /41/ and also from International Finance Corporation /58/). For sub-critical plant, the project cost has been estimated from CERC order dated 22 May 2007.
Debt equity ratio	It has been noted from lenders documents (International Finance Corporation and BNP Paribas) that the debt equity ratio for the project activity is 75:25. For sub-critical plant, the same ratio has been used to maintain parity between the two options.
Rate of interest on loan capital	A value of 10% has been applied for both options and this has been obtained from the budgetary quote from the lenders.
Rate of interest on working capital	The rate of interest on working capital has been assumed to be 8.50%. At the time of bid, it was assumed the working capital interest rate as that of rate of AAA+ Companies Corporate bond / Commercial Papers during December 06, and the rate was in the range of 8 to 8.50%. (verified from the scanned copy of Bloomberg online money market software)
Depreciation	15% depreciation has been considered for both options and it is as per the Income Tax Act of India.
O&M cost – fixed and variable	Based upon the budgetary quotes from the equipment suppliers this has been assumed to be 0.6175 million INR/MW of the project cost (from budgetary cost estimates as provided by Siemens)
Escalation, insurance, maintenance spares & auxiliary	Input values for these parameters have been obtained from respective CERC orders as referred in the PDD.

consumption	
Plant life	Plant life has been considered to be 25 years and it is in line with CERC regulations.
PLF	Plant load factor has been taken to be 85% and this plant load factor is comparable to the current Indian scenario, as available from CEA database, for coal based power plants.
Coal (fuel)	GCV and price for domestic coal have been taken from CERC order dated 22 May 2007. GCV for imported coal has been taken from sample proximate analysis report from the project consultant (TCE Consulting Engineers Limited) and price for the same has been estimated from detailed project report. Fuel price escalation has been obtained from CERC notification dated 22 November 2006 and same value is applied for both options. The fuel price escalation has been taken as applicable on the date 22 November 2006 since the issuance of LoI to successful bidder (M/s Tata Power) was done on 28 December 2006 /59/ and Tata Power had considered the escalation rate of coal as applicable at that time to arrive at their bid value.
Gross SHR	Gross station heat rate for sub-critical plant has been obtained from CERC order dated 22 May 2007 and that for supercritical plant has been estimated from the plant efficiency provided in the specifications by Siemens /66/.

It has been observed and accepted by DNV that values applied for most of the assumptions have been taken from the orders of the Central Electricity Regulatory Commission (CERC) of India, which is an authentic and designated source of data. It is worth to mention here that the financial closure for the project under consideration has been announced on 24 April 2008 (http://economictimes.indiatimes.com/Power/TPC_announces_financial_closure_of_Mundra_project/articleshow/2980723.cms). Hence, selection of the period, for which CERC data have been used, is found to be justified. The input values for the assumptions have been validated against the reference documents as mentioned in the PDD and found to be correct. In order to arrive at economically most attractive baseline scenario, the PP has presented calculations for levelized cost of power generation for both sub-critical and super-critical technology based power plants using domestic coal (from Indian mines) as well as imported coal (mines outside India) as fuel. The estimated levelised costs have been found to be as the followings:

Power plant technology	Source of coal	Levelized cost (INR/KWh)
Sub-critical	Domestic	1.61
Sub-critical	Imported	1.80
Super critical	Domestic	1.71
Super critical	Imported	1.86

Hence, the levelized cost of power generation is lowest for sub-critical technology based power plants using domestic coal as fuel. The PP has also carried out and submitted sensitivity analysis considering variation in coal price, PLF and project cost. The sensitivity analysis has been done by varying the coal price by +/- 20%, PLF by +/- 10% and project cost by +/- 10%. It has been observed that for similar variations, sub-critical domestic coal based power generation remains the alternative with the minimum levelised cost for power generation. The assumed variations in the coal prices are reasonable since coal being the most predominant energy source in India, change in coal price not only affects energy cost, but also the socio-economy of the country. Thus a 20% rise in domestic coal prices is unlikely in the near future /54/. It is also observed that at a PLF of even 100%, the domestic coal based sub-critical alternative remains the least cost option. Also it is unreasonable to assume that the project cost for the super-critical technology will reduce by more than 10% considering that the technology is new and costs are only likely to increase rather than decrease.

From the levelized cost calculations and subsequent sensitivity analysis, it is evident that levelized cost for domestic coal based sub-critical power plant is lowest amongst the options and hence selection of sub-critical technology based power plant as the baseline scenario has been found to be justified and also in line with the requirements of the applied methodology ACM0013.

4.4 Additionality

Additionality of the project activity has been assessed using the "Tool for the demonstration and assessment of additionality", version 5.2.

4.4.1 CDM consideration and continued action to secure CDM status

DNV could validate that the project proponent has undertaken continuing and real actions to secure CDM status for the project in parallel with its implementation and DNV also considers that CDM was a decisive factor for implementation of the project activity. The table below outlines how DNV's validation arrived at this conclusion.

Activity	Date	Documents verified
Initiative for Ultra Mega Power projects by Power Finance Corporation Ltd (A Govt. of India undertaking)	January 2006	http://pfc.gov.in/Tariff_Policy.pdf http://pfc.gov.in/selection_process.pdf
Preparation of detailed project report (technical) by TCE Consulting Engineers Ltd	July 2006	Detailed project report

Study on India's Ultra Mega Power Projects by Mott MacDonald (engaged by British High Commission)	October 2006	Final Report of Mott MacDonald on "Exploring the Use of Carbon Financing".
Communications with CDM consultants and internal communications of TPCL regarding the CDM potential of the Mundra UMPP	September-November 2006	E-mail communications between project proponent and E&Y. These communications clearly indicates that TPCL has tried to collect adequate information on CDM scheme prior to submission its bid for the proposed UMPP.
Board Meeting of Tata Power Company Ltd and decision regarding bidding for Ultra Mega Power Project using super-critical technology	2 December 2006	Certified true extracts of the Minutes of Meeting of Tata Power. The Board, in this meeting has directed to submit bid for the UMPP. It is imperative to mention here that the UMPP was to be awarded through tariff based bidding procedure. The minutes of the board meeting clearly indicates that potential benefit from CDM was considered to determine the tariff prior to submission of the bid.
Bid Submission for Coastal Gujarat Power Ltd by TPCL	7 December 2006	Cover letter of bid submission
Communications with CDM consultants regarding the Mundra UMPP	December 2006	Email Communications
Mundra UMPP awarded to TPCL	December 2006	http://timesofindia.indiatimes.com/articleshow/843633.cms
Power Purchase Agreement was signed for the project.	22 April 2007	Power purchase agreement
Submission to Ministry of Environment & Forests for Host Country Approval	20 November 2007	Letter to MoEF.
Start of validation and publishing of PDD on UNFCCC website for global stakeholder consultation	13 January to 11 February 2008	http://cdm.unfccc.int/Projects/Validation/index.html

4.4.2 Step 1: Baseline alternatives

Baseline has been identified as discussed in the section 4.3 above and subcritical technology based power plant has been identified as the baseline scenario.

4.4.3 Step 2: Investment analysis

4.4.3.1 Investment analysis: choice of approach

The PP has opted for a benchmark analysis in order to establish the project's additionality. To demonstrate the additionality of the project, the project proponent has calculated return on equity (ROE) of the project. The project generates revenues without CDM through sale of electricity and there was no other option available to the project proponent. Therefore, a benchmark analysis is considered suitable for demonstrating the additionality of the project.

4.4.3.2 Investment analysis: benchmark selection

Return on equity has been considered as the financial indicator. The project proponent has considered a benchmark of 14% which is the CERC, Govt of India approved ROE for coal based subcritical power projects in India. As per "Tool for the demonstration and assessment of additionality" Version 5.2, page 6, point 6e "*Discount rates and benchmarks shall be derived from Government/official approved benchmark where such benchmarks are used for investment decisions*." The 14% ROE (post tax) is the benchmark rate of return which is approved by CERC, Govt. of India and is the assured return which the project proponent would have got had the project proponent gone for a sub-critical coal based power plant. Thus, the project proponent has taken a benchmark ROE as 14%. It has been noted that the prime lending rate of State Bank of India was 12.75% in 2007 /57/. Country risk premium for India has been found to be 3.75% /60/. The PLR and the country risk premium indicates that for a project to payback the interest rate applicable, compounded with the country risk factor for investment should be having a return on equity of at least 16.50% for sustainable operation. The project activity is unique in the sense that the tariff for the project is not fixed by the grid operator but was determined through competitive bidding. For the normal case of implementation of a power plant the tariff is not fixed by competitive bidding but is determined by the grid operator considering a 14% ROE. Thus, any power sector utility providing electricity to the grid is supposed to get a 14% ROE. Also, given that the selection of this benchmark is deemed conservative, as it is lower than the benchmark as derived from the PLR+country risk premium which gives a benchmark of 16.5%, the expectations from the project proponent on the returns from the project is deemed justified. Hence DNV considers that selection of benchmark at 14% is conservative and is justified.

The tariff based bidding process has been initiated by the Government of India and the tariff policy 2006 states "Introducing competition in different segments of the electricity industry is one of the key features of the Electricity Act, 2003. Competition will lead to significant benefits to consumers through reduction in capital costs and also efficiency of operations. It will also facilitate the price to be determined competitively." Furthermore, the tariff policy also allows the PPs the opportunity for safeguarding their interests and state "Tariff fixation for all electricity projects (generation, transmission and distribution) that result in lower Green House Gas (GHG) emissions than the relevant base line should take into account the benefits obtained from the Clean Development Mechanism (CDM) into consideration, in a manner so as to provide adequate incentive to the project developers" /46/.

4.4.3.3 Investment analysis: calculation

Levelized cost of generation has been determined to be INR 1.81 per KWh and levelized tariff for the project is INR 2.26 KWh. The project proponent has submitted detailed calculation of IRR and return on equity in spreadsheet format. It gives a return on equity of 10.20% without CDM benefit. .

4.4.3.4 Investment analysis: sensitivity analysis

The sensitivity analysis has been carried out considering coal price, PLF and project cost. The chosen variations have been found to be realistic. DNV has verified the sensitivity analysis and the outcome has been presented in the table below.

It has been observed that the return on equity exceeds the benchmark value if the coal price is reduced by 9.43% or the project cost decreases by 10.79% or the O&M is reduced by 60%. The ROE remains less than 14% even if the PLF equals to 100%. However, DNV considers that occurrence of such variations are improbable due to the following factors:

a) The global increase in demand of coal will lead to increase in coal prices by the coal exporting countries like Indonesia. Also as per the power purchase agreement, only 45% of the coal cost component is escalable. DNV could also validate the fact that international coal price is on the rising trend /61/, It has been observed from the PPA that non-escalable part of fuel energy charges is quite substantial (USD 0.00705 per kWh) compared to the escalable component (USD 0.00585 per kWh). Hence it can be concluded that price volatility in international coal pricing might lead financial burden to the PP.
b) The supercritical power generation technology is new to India and there is a dearth of technology suppliers in India. Hence, decrease in project cost is also unlikely.

The return on equity exceeds the benchmark value considering CDM benefit for the project activity.

4.4.4 Step 3: Barrier analysis

The PP has also carried out a barrier analysis for establishing the additionality of the project activity.

Barrier due to prevailing practice: The project is a first-of-its-kind project in India. It has been validated from the official websites of the Ministry of Power, Government of India (www.powermin.nic.in) and CEA (www.cea.nic.in) that though coal based power plant is predominant in India (68% of total generation capacity is coal based), till date there is no power plant that is operated by supercritical technology. For a first of its kind technology, there is a dearth of availability of skilled manpower. In spite of the fact that India has skilled engineering manpower, it is clearly evident that for this technology where there is a foreign BTG (boiler turbine generator) supplier involved, lot of dependency on technical matters will be required. For a 'first of its kind' project in nature this is deemed to be even more a valid argument. Dependency on foreign suppliers is expected to come down when the technology will sufficiently penetrate in India. The barrier due to dearth of adequately skilled manpower for operating a completely new technology has been validated from the Mott MacDonald Report (/65/) However, this barrier does not apply to the baseline scenario of subcritical technology based power plant where the trained manpower and equipment suppliers are available locally. Thus DNV considers that lack of trained manpower poses a potential barrier to the implementation of the supercritical technology in India.

Technological barrier: Any fluctuation in the grid load can cause extreme thermal stress on the boiler tubes. During this time the load of the boiler will be reduced. Since the boiler will be operating at part-load during this time, the boiler operates in sub-critical pressure and acts as a once through evaporator. This design requires a high mass flux through the tubes to avoid departure from nucleate boiling (DNB) and subsequent overheating of the tube metal. A high mass flux design has an undesirable feature referred to as negative flow characteristics which causes tubes that experience higher than average heating to draw lower than average fluid flow. This can result in over-heating of tubes in the upper furnace and differential thermal expansion of the water-walls. This does not apply to sub-critical boilers which operate on a positive flow characteristic whereby tubes that experience higher than average heating tend to draw higher than average fluid flow. This has been validated from publicly available source: Report by Mott MacDonald, engaged by the British High Commission, on exploring the use of carbon financing /65/. DNV thus considers that the technological barrier as stated above is real and applicable to the project activity but do not pose a barrier to the baseline scenario.

Investment barrier: Cost over-run due to delay in implementation of the project has been identified as a barrier as it has the potential to increase the investment in the project. During the initial planning for the project, the project proponent observed that no EPC contractor was ready to do the project within the timeframe promised in the Power Purchase Agreement and the required cost parameters. Due to this, the project proponent decided to go for the package route. The entire project has been divided into several packages with each package being ordered separately to individual contractors. This exposes the project activity to potential risk on the integration issues of various packages. It is quiet understandable that delay made by one party may lead to potential risk of delaying the entire project resulting in cost over-run. The dearth of EPC contractor for setting up of supercritical power plants in India has been validated from the CRISIL report on "Power generation: equipment availability – a critical focus area" /26/. This report states that the Indian EPC contractors are familiar with the engineering, procurement and construction services primarily for the sub-critical units in the scale of 300MW, 400 MW etc. and up to 500 MW which is the highest installed unit capacity in India till date, but not with 800 MW super-critical units. This is also evident from the fact that the Indian power generation companies, both in Governmental and private sector, have not ventured in supercritical power generation technology till date. As described in section 4.3.2 of this report, CDM benefits have been considered for almost all of the supercritical technology based power plants, those have been determined for installation.

It has also been noted that the option of installing domestic coal based sub-critical power plants (baseline scenario) was open to the project proponent (TPCL) who currently is engaged for installing a number of domestic coal based sub-critical power plants in India, e.g., 1050 MW Maithon project in West Bengal, 2400 MW Dehrand project in Maharashtra *etc*. (Ref: 12 year CAPEX plan of TPCL /25/). Thus the stated investment risks do not stand valid for the baseline scenario. Thus DNV considers that investment barriers do exist for the project activity but does not prevent a power company to go for subcritical technology (baseline scenario).

However, in-spite of the above mentioned barriers, the project proponent has decided to take up the project activity considering that the CDM funds will provide additional coverage to the risks associated with the proposed project activity and help in mitigating the other technical risk factors as mentioned above and the fund will stimulate efforts in CGPL to find methods of mitigating risks and enhance replication of such advanced power generation technologies.

4.4.5 Step 4: Common practice analysis

The project activity is one of the first of its kind in India. Till date no thermal power plant in India is operated by supercritical technology. It has been observed from the official websites of the Ministry of Power, Government of India (www.powermin.nic.in) and CEA (www.cea.nic.in) that though coal based power plant is predominant in India (68% of total generation capacity is coal based), till date there is no power plant that is operated by supercritical technology. The project activity is one of first few supercritical power plants planned for installation in India. Hence it can be said that power generation through supercritical technology is not prevalent in India.

4.4.6 Conclusion

Further to the stated barriers as stated by the project proponent, DNV has observed that the fixation of tariff for this project through competitive bidding process is completely different to that normally practiced in India. Generally, power tariff is determined by the project proponent and the buyer (power distribution companies). The tariff based bidding process has been initiated by the Ministry of Power, Government of India and the tariff policy 2006 (/46/) states, "Introducing competition in different segments of the electricity industry is one of the key features of the Electricity Act, 2003. Competition will lead to significant benefits to consumers through reduction in capital costs and also efficiency of operations. It will also facilitate the price to be determined competitively."

Further the tariff policy also allows the project proponents the opportunity for safeguarding their interests and states, "Tariff fixation for all electricity projects (generation, transmission and distribution) that result in lower Green House Gas (GHG) emissions than the relevant base line should take into account the benefits obtained from the Clean Development Mechanism (CDM) into consideration, in a manner so as to provide adequate incentive to the project developers".

The bids for the ultra mega power projects were called for (on behalf of state owned distribution companies) after extensive deliberations on choice of technology, location, fuel and size. While deciding on the technology the procurers of power from this project had environmental impact and acceptable tariff as key considerations and accordingly after considering CDM benefits as a mitigating factor for the high cost of the new technology, invited bids with a clear precondition that bidders would have to use supercritical technology. At the same time they had also stated in offer documents that CDM benefits would be available to the bidders –ostensibly to offset the impact of higher costs. (page 7 of the UMPP tariff policy, /46/).

Had there been no CDM benefit there would be very little to attract bidders to even consider supercritical technology and take the risk of adopting a new technology within a low and competitive tariff regime. This is supported by the fact that the tariff fixed by GUVNL (electricity procurer of Gujarat, and the location of this project activity) through competitive bidding for some other power plants in the region are in the range of INR. 2.4 (GERC annual report page 10 /62/). These have been verified.

It has been clearly demonstrated that the flow of CDM revenue to the project was considered by the key lenders of the project (ADB and IFC /63//64/). Due to consideration of CDM revenue there is an impact on the cost of lending and the lenders agreed to finance the project at the desired interest rate. In absence of CDM consideration lenders could have charged higher interest rate (taking into consideration all the risks associated with this first of its kind

technology) thereby resulting in higher interest cost for CGPL. In absence of CDM revenue, lenders could have charged higher interest rate quite naturally on account of :

- Supercritical thermal power generation is a very new technology in India (first of its kind)
- The CGPL project was the first UMPP in India with a unique unit size of 800 MW. The rest of the UMPPs are of 660 MW unit size.

Therefore, in absence of CDM even if CGPL quoted a marginally higher tariff it can not be conclusively established that the entire project could become financially attractive (exceeding benchmark ROE).

It is DNV's opinion that this scenario is unique in nature and not analogous to that of a commonly practiced technology and the lender's risk perception is also lower in case of established technology option than a supercritical thermal power project of 4000 MW scale in India. This is due to the fact that:

- No supercritical power project of UMPP scale is operational so far
- Capital required (and hence lender's risk exposure) in case of UMPP supercritical project is much higher compared to any commonly practiced technology.

Financing institutions like IFC and ADB have been the prime lenders for the project. These institutions generally lend to climate friendly technology based projects in developing countries. The significant reduction in emissions making it eligible for CDM benefits was one of the key drivers for them to finance loan for this project (as said earlier). Letters from ADB and IFC clearly indicate that the revenues from Certified Emission Reductions for the Project will be an important part of the Project's cash flows. These evidences are verified /63//64/.

The above discussions clearly indicate that the project activity (supercritical power plant) was not the most economically attractive option among the available alternatives to the project proponent and is not common practise. Also there exist potential barriers those are not likely to occur for the baseline case (domestic coal based sub-critical power plant. Hence, it can be concluded that the project is additional.

4.5 Monitoring

Monitoring of parameters required for calculation of emission reductions have been identified in the PDD and found to be in line with the applied baseline and monitoring methodology ACM0013, version 2.

4.5.1 Parameters determined ex-ante

The following parameters have been defined *ex-ante*:

a) CO_2 baseline emission factor of the baseline fossil fuel type that has been identified as the most likely baseline scenario. IPCC default value (0.0961) has been used.

b) Energy efficiency of the power generation technology that has been identified as the most likely baseline scenario i.e., sub-critical power generation technology. The efficiency value has been taken as the higher efficiency between the efficiency (35.1%) calculated as per the station heat rate (of 2450 kCal/kWh) as given in the CERC order dated 22 May 2007 and the efficiency (30.06%) calculated as per the weighted average station heat rate of thermal power plants in India in 2006-07 published by CEA, Govt of India. This value applied is 0.351 and it is conservative.

c) CO_2 emission factor of the fossil fuel type consumed by the proposed project activity. IPCC default value for other bituminous coal (0.0946) has been applied for this.

d) Baseline emission factor in any year during crediting period have been calculated following the applied methodology and the lower value of the two options (in this case Option 2) has been used for calculation of baseline emissions. Calculation as per option 2 has been determined and published by CEA (http://www.cea.nic.in/planning/cdm.pdf) and the value stands at 0.941 tCO2/MWh. CEA has confirmed that the baseline emission factor has been calculated following the stipulation of ACM0013 and hence it can be concluded that conservativeness for calculation of baseline emission is maintained.

4.5.2 Parameters monitored ex-post

a) Net quantity of electricity generated in the project plant will be monitored on a daily basis by cumulative type kWh meter installed at the generator terminal of each power generation unit. The kWh meter will be calibrated on a regular interval by accredited agencies.

b) Quantity of fuel combusted in process will be monitored on a daily basis with the help of a weighing machine installed at each power generation unit. The weighing machine will be calibrated on a regular interval by accredited agencies.

c) Weighted average of mass fraction of carbon in fuel used will be monitored on regular basis.

4.5.3 Management system and quality assurance

The responsibilities for management of project including monitoring and review of data have been clearly defined in the PDD.

4.6 Estimate of GHG Emissions

Baseline emissions: Baseline emissions will be calculated as the product of electricity generated in the project activity and the baseline CO_2 emission factor. The baseline emission factor has been determined *ex-ante* as per the guidance provided by ACM0013. The following procedure has been adopted for estimation of baseline emission.

a) Net quantity of electricity ($EG_{PJ,y}$) generated in the project plant in year *y* (MWh) has been estimated considering 85% PLF and 7.50% auxiliary consumption. These assumptions have been validated by DNV as described in section 4.3.2 of this report.

b) The IPCC value for sub-bituminous coal which would have been used in the baseline scenario has been used for the CO_2 baseline emission factor of the baseline fossil fuel ($EF_{FF,BL,CO2,y}$).

c) The IPCC value for other bituminous coal which will be used in the project scenario has been used for the CO_2 emission factor of the fossil fuel type used in the project activity ($EF_{FF,PJ,CO2,y}$).

d) The generation efficiency of the power generation technology (η_{BL}) that has been identified as the most likely baseline scenario has been sourced from CERC order refer section 4.5.1 of this report).

As the value of $EF_{FF,PJ,CO2,y}$ (0.0946 tCO_2/GJ) has been found to be less than the value of $EF_{FF,BL,CO2,y}$ (0.0961 tCO_2/GJ), this has been used for calculation of the baseline emission factor in year y ($EF_{BL,CO2,y}$) as directed by the option 1 of ACM0013, version 2. The value of $EF_{BL,CO2,y}$ thus obtained was found to be 0.970 tCO_2/MWh. Baseline emission factor as per option 2 of the applied methodology has also been determined and published by CEA (http://www.cea.nic.in/planning/cdm.pdf) and the value was found to be 0.941 tCO_2/MWh. CEA has confirmed that the baseline emission factor has been calculated following the stipulation of ACM0013.

As the value of $EF_{BL,CO2,y}$ determined by CEA is more conservative between the two options, the same has been used for estimating baseline emissions as per the methodology. Thus DNV considers that calculation of baseline emission is conservative and complies with the requirements of the applied methodology.

Project emissions: In determining project emissions, the CO_2 emissions from electricity generation in the project plant (*PEy*) has been estimated using the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", as required by the applied methodology. The project emissions have been estimated as the product of fuel consumption in the project scenario and emission factor of the fuel in the following manner:

(i) Coal consumption per unit electricity generation has been estimated from the efficiency of the power plant as provided by Siemens (/66/). The efficiency value used was approximated to 43.7% which resulted in annual coal consumption of 10.214136 million tonnes. This has been conservatively approximated to 10.22 million tonnes as this approximation leads to higher project emissions.

(ii) the CO_2 emission coefficient has been calculated on the basis of carbon content of the fossil fuel (coal). The same has been obtained from coal sample analysis report.

Leakage emissions: There is no leakage emission associated with the project activity.

CER estimation: The estimated average GHG emission reduction per annum thus has been found to be 2 651 753 tCO_2e. DNV considers this estimation as correct and in compliance with the applied methodology

4.7 Environmental Impacts

The project proponent has performed an extensive environmental assessment (EIA) as required by the Environmental Protection Act 1986 of India. The EIA has been conducted by M/s TCE Consulting Engineers Limited and been submitted to Gujarat Pollution Control Board (GPCB) to obtain consent to establish for the proposed power plant. The Gujarat Pollution Control board has issued "consent to establish" for the project activity (/34/) under section 25 of the Water Act 1974 and under section 21 of the Air Act 1981 after due approval of the EIA.

The "consent to operate" will be obtained from GPCB once the EIA recommendations and the conditions stipulated in the consent to establish are implemented by CGPL.

4.8 Comments by Local Stakeholders

DNV has verified the environmental clearance for the project activity issued by MoEF /45/ and noted that public hearing with the neighbouring community was held on 19 September 2006. Apart from this, the project proponent has also consulted the local stakeholders like, i)

employees of CGPL, ii) Ministry of Environment & Forests, India, iii) Gujarat State Pollution Control Board, iv) Gujarat State Electricity Board, v) Ministry of Power, India, vi) Gujarat Maritime Board, vii) Consultants, viii) Equipment Suppliers. Comments received from local stakeholders have been compiled and documented in the PDD. In a nutshell, the local stakeholders expressed their views in favour of implementation of the project.

4.9 Comments by Parties, Stakeholders and NGOs

The PDD of 3 December 2007 was made publicly available on DNV's climate change website (www.dnv.com/certification/climatechange) and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 13 January 2008 to 11 February 2008.

Two comments were received and are given (in unedited form) in the below text boxes. How DNV has considered the comment received have also been depicted at relevant places of the comment itself.

Comment by: Raghu, CDM Future

☐ Accredited NGO ☐ Party ☒ Stakeholder

Inserted on: 15 January 2008

Subject: Comments on CGPL Project

Comment:

1. Project uses imported coal of high quality to achieve better efficiency and to produce power at competetive price without affecting its profitability. In addition there is standard revenues guaranteed based on the CEA guidelines. In this context, need for CDM revenue consideration for the project is questionable. DOE should look in to this aspect.

How DNV has considered the received comment in it's validation:

The competitive tariff decided for Mundra UMPP was INR 2.26/kWh and the levelized cost of generation stands at INR 1.86/kWh. DNV has noted from board notes that, CDM revenue was a key consideration in the decision making process of implementing the supercritical power plant and not the sub-critical power plant of same capacity. According to the tariff structure of the power to be sold from UMPP (Mundra) the coal cost (viz. 'Quoted Fuel Energy Charge' as mentioned in PPA) consists of two components: 55% is non-escalable and 45% is escalable. The 45% escalable component is the portion of coal cost which is not expected to increase with time and it is useful typically to cover the cost of acquisition of a mine / cost of signing a long term coal supply agreement on a fixed price. The escalable component of the coal cost increases with time as per an Escalation Index mentioned in the PPA which in turn is function of WPI and CPI.

The tariff mechanism takes care of the increase in the escalable component but not of the non-escalable component of the coal cost. Along with that, escalation of tariff is notified every six months. So there is a mismatch even in the escalable component and this will be translated to significant financial losses in case coal price increases in the international market. CDM revenue can provide a cover against the huge losses that the project proponent may incur due to increase in the capital and operating cost for the project.

2. Usage of imported coal means availability of otherwise would have used coal in local market to other users in the country. This leads to inefficieny in the systems that use local

poor quality coal and hence leakage due to the project activity. DOE should look look in to this aspect carefully.

How DNV has considered the received comment in it's validation:
The bid condition for the proposed project activity was the usage of imported coal and hence use of imported coal was a pre-condition for participation in the bidding for Mundra project. Furthermore, in India there exists significant demand-supply gap in electricity generation and even with the generation of 4000 MW by the project activity this demand-supply gap is not expected to be met. Domestic coal will be continued to remain as dominant fuel in the country and it will be combusted in the business-as-usual scenario. It is worth mentioning that the methodology ACM0013 does not consider any leakage emission for the project activity.

3. CDM revenue is likely to be realised only during 2012 and afterwards, provided Kyoto mechanism exists in its original form. PP should make it clear how he is going to manage the project without CDM, if project really faces barriers. Does this mean that Project is self sufficient with revenues from sale of power and guaranteed returns based on EA guidelines?. This indirectly indicates no requirement of CDM funds for the project.

How DNV has considered the received comment in it's validation:
The project proponent is hopeful that carbon financing will continue after 2012 in some form and he will get CDM benefits once the project activity starts operation. DNV has also verified the lenders document and found that CDM was a key consideration there.

4. The average efficiency of coal fired power plants (31%) is considered based on the 2004-05 dats of CEA. Most recent data should be used for calculation purpose and EB should recommedned to use baseline efficiency data for the year 2010-11 while calculating the emission reductions during first monitoring period.

How DNV has considered the received comment in it's validation:
The most recent data as available from the CEA during the validation of the project has been used to calculate emission reductions. As per the methodology ACM0013, version 02, while applying option 2 for calculating emission factor, the EF is not monitored annually but fixed at the start of the crediting period. Hence the most recent available data from CEA (2006-07) has been used to determine baseline efficiency and hence baseline emissions.

5. The fuel used in the project activity should be used in at least 50% of power generation plants in India. This value should also be checked based on the three years data before the commissioning of the plant and check for the applicability of the same. Considering the fact the popularity for cleaner fuel usage is increasing year after year, promotion of use of fuels like coal should be discouraged and EB should consider this aspect while registering this project and/or issuance of CERs. If percentage of power generation using coal as a fuel reduces less than 50% in any year, these projects should get zero credits.

How DNV has considered the received comment in it's validation:
As per the methodology ACM0013, version 02, latest available data should be used to check whether the fuel used in the project activity is used in at least 50% of power generation plants

in India. The proponent clearly established in the PDD with the help of publicly available data that coal is used as fuel in more than 50% of India's thermal power generation. Thus, coal is the baseline fuel and this has been verified with CEA database (a Government of India database).

6. PP should explain clearly why country is considered as geography than western regional grid in PDD to prove 50% geenration using coal.

How DNV has considered the received comment in it's validation:
The methodology ACM0013, version 02 states that "Step 1. Identify plausible baseline scenarios: The identification of alternative baseline scenarios should include all possible realistic and credible alternatives that provide outputs or services comparable with the proposed CDM project activity (including the proposed project activity without CDM benefits), i.e., all type of power plants that could be constructed as alternative to the project activity within the project boundary, as defined in the section "Project boundary" and in Step 2 of the section "Baseline emissions" below." The methodology also states "The geographical area to identify similar power plants should be chosen in a manner that the total number of power plants "N" in the sample group comprises at least 10 plants. As a default, the grid to which the project plant will be connected should be used. If the number of similar plants, as defined in Step 1, within the grid boundary is less than 10, the geographical area should be extended to the country." The western regional grid has only 1 power plant namely Vindhyachal STPS-8 which satisfies the criteria to be selected as a similar power plant." Since the project boundary has been expanded to include the entire country (India), hence the entire country is considered as the geographical area rather than the western regional grid to prove more than 50% power generation is done using coal.

7. Unit wise (as each unit is considered as one power plant) fuel consumption data availability on CEA website should be checked by DOE.

How DNV has considered the received comment in it's validation:
The requirement of unit wise coal consumption is not required since CEA (Govt of India) has calculated the baseline emission factor as per Option 2 of ACM0013, version 02, based on unit wise coal consumption and unit wise net electricity generation and published the same on their website (http://www.cea.nic.in/planning/cdm.pdf).

8. PP seems to fail to understand the analysis of baseline scenarios for the project activity. Power plants need not be of similar capacity to compare with but should provide similar services. In the western grid, there are quite a few most energy efficient large scale gas based power plants under construction or operation. PP should also compare with these large scale gas based power plants to conclude the baseline scenario. This is also considering vast potential of gas reserves and availability of gas in future as well in the region. Also, analysis is incomplete without mentioning efficiency and life time of each alternative chosen. PP presently failed to do thorough analysis of these aspects considering the scale of the project activity and should address all these aspects.

How DNV has considered the received comment in it's validation:

DNV confirms that the baseline scenario analysis has been performed in conformance with the methodological guidance.
As an alternative to the project activity, the project proponent could have opted for natural gas based power generation for providing similar services. In this case, the power plants will emit GHGs associated with combustion of natural gas. This alternative is in compliance with all applicable laws and regulations of the country. However, this alternative is associated with some barriers which will prevent the project proponent to implement this option. Given the deficit situation of natural gas supply and the projection of long-term natural gas price it is unlikely that any new thermal power generation capacity to the tune of 4000 MW will come up with natural gas as fuel. Furthermore, there is no gas supply infrastructure available in the existing project site at Mundra.
According to Planning Commission, Ministry of Power, Govt of India, "Although gas is relatively a clean fuel, at present there is uncertainty about the availability, period of availability and price of gas. Only 2,114 MW gas based capacity has been planned for 11th Plan where gas supply has already been tied up." /15/.
Due to the above-mentioned barriers like fuel supply constraint, higher cost of generation, lack of infrastructure etc this alternative can not be regarded as a possible realistic and credible baseline alternative for the project activity. Hence this alternative is not considered further for arriving at the baseline scenario.
The methodology does not require the project proponent to consider lifetime of the power plants. The efficiency of each power plant has been calculated as per the formula provided in the methodology.

9. It is surprised to see no investment analysis to arrive at levelised cost of electricity in PDD. DOE should check the levelised cost calculations as most of the people fail to understand the difference between levelised cost of generation and normal generation cost. Sensitivity analysis is also missing. Quality of this section of PDD is very poor and looks like it is written by very ordinary consultant without considering any guidelines mentioned in the methodology. For a scale of this kind, PDD quality should be of highest standard meeting all requirements.

How DNV has considered the received comment in it's validation:
The baseline selection has been performed using 'levelized cost of generation' criterion and the same is in accordance with methodology guidance. Detail computation of levelized cost of generation along with sensitivity analysis have been submitted by the project proponent in spreadsheet format and also appended in the PDD. DNV has verified the same and found to comply with the requirements of applied methodology.

10. When the investment analysis (to determine levelised cost) is used to identify baseline scenario, it is not clear why PP adopted barrier analysis to prove additionality. This indirectly hints at attractiveness of project without CDM consideration. Methodology also suggests to maintain consistency in the procedures adopted to arrive at baseline and to prove additionality. Entire revision of this particular section is required.

How DNV has considered the received comment in it's validation:
The methodology ACM0013, Version 02 states that "The latest version of the "Tool for the demonstration and assessment of additionality", agreed by the CDM Executive Board, should

be applied to assess the additionality of the proposed project activity. Ensure consistency with the procedure to determine the most likely baseline scenario as provided above. In the case option II (Investment comparison analysis) is applied in sub-step 2b, it should be demonstrated that the baseline alternative is available to the project participant(s)." Thus the methodology gives the guidance to follow the latest version of the additionality tool (version 5.2). The "Tool for the demonstration and assessment of additionality" gives the option to demonstrate additionality by investment analysis or barrier analysis. The project proponent has chosen barrier analysis to establish the additionality of the project activity in the initially submitted PDD. However, later the project proponent has opted for investment analysis route to demonstrate additionality of the project activity.

11. The additionality is not convincing at all. it is addressed as if PP is implementing some biomass based power plant. If it is correct Tata's bagged this project with promised power generation cost of Rs 2.264 or so which is about 20 paise less than sub critical power plant (as per cost mentioned in PDD) and with 10-15% improvement in the efficiency, it is not that difficult to manage the costs. Moreover, profits from the sale of fly ash to the cement manufacturers is not considered here. With the kind of investment flowing into Indian power sector at present and with kind of credibility Tata's have in the country, it is not at all difficult for them to raise the required investment. And any unexpected delays in project construction with well managed Tata's project team are rare. DOE should check the applicability of these issues thoroughly.

How DNV has considered the received comment in it's validation:

It is to be noted that 'levelized tariff' can not be termed as 'promised power generation cost'. INR 2.26/kWh is the levelized tariff at which the project proponent bagged the project through competitive bidding.

As mentioned earlier in this report, the estimated levelized cost of generation from the project activity works out to be INR 1.86/kWh. The additionality of the project activity is based on the fact that the ROE of the project is lower than the benchmark ROE expected for power generation projects in India.

It is also to be noted that as per the Fly ash Notification of Ministry of Environment & Forests, India (dated 14 September 1999, CWP No. 2145/99) fly ash cannot be sold but has to be given away freely to cement manufacturers in the surrounding region of the power plant. Therefore there is no reason to consider profits from sale of fly ash.

12. All technology barriers are superficial to the project activity. These are common and very general problems that 'may' occur, if at all. It is better for PP to rewrite this particular section of PDD considering the scale of the project.

How DNV has considered the received comment in it's validation:

The barrier analysis section has been revised and few barriers have been removed as those could not be substantiated properly.

13. Stakeholder consultation seems to be conducted improperly. There are no comments from pollution control board and other relavant Govt agencies. This raises question whether the meeting was conducted or not or all relevant stakeholders are invited or not. Evidence for the same should be included in PDD.

How DNV has considered the received comment in it's validation:
The stakeholder consultation was conducted by informing the stakeholders through letters about the proposed project activity and requesting them for their comments on the same. DNV has verified and found that the project proponent has received positive comments from the identified stakeholders. On further verification it has been found that the project proponent has obtained clearances from the Ministry of Forests & Environment to establish the project. No Objection Certificates from Defence Ministry, Air Head quarters and Gujarat Maritime Board have also been obtained for the project activity.

14. As the project start date is before the validation start date, PP should provide evidence for CDM consideration. DOE should check the complete minutes of meeting but not the extract of the board meeting.

How DNV has considered the received comment in it's validation:
DNV has checked the relevant part of the minutes of the meeting, where carbon credits were considered with respect to the proposed project activity, during the site validation.

Comment by: Naveen Sharma
☐ Accredited NGO ☐ Party ☒ Stakeholder
Inserted on: 11 February 2008
Subject: Comments Tata UMPP
Comment:
There is one clever thing you are trying to do by uploading an incomplete PDD, I know that after the comment period is over, and you will make the revisions and add the investment analysis just before you file for registration. This way no body can comment on the investment analysis which the most important part of such projects submitted for UN registration. The person who has written the PDD and the person who has reviewed seem to be completely ignorant, neither have they checked the basic information in the PDD nor is the PDD meets the ACM0013 requirements. The DOE also has not found it necessary to upload the Investment analysis for comments.

It seems that big players like Tata are looking at getting away with important issues which may result in putting a question mark at the accreditation of the DOE
DOE should wake up, before the EB takes note of such irresponsible piece of work, and letting a half cooked half baked PDD for global stakeholder consultation.
My request to the CDM Executive Board - is there any curative procedure that would sort of make an example of this project, the PP and most importantly the DOE, so that such incidences can be prevented in future. As you will notice from the comments, the PDD is nothing but a very cunning aggregation of lies and manipulated data. So much so that reading the PDD is nothing but a complete waste of time and effort. Most of the arguments are completely preposterous and any one with the slightest of understanding of the electricity sector will have only one opinion about the arguments in the PDD; they are at the best laughable.

How DNV has considered the received comment in it's validation:

DNV would like to emphasize the fact that DOEs have to accept all projects for validation and only the validation process itself will determine whether the DOE will request the registration of a project as a CDM project. The acceptance of a project for validation and the publication of the PDD is thus by no way any form of endorsement of the project by the DOE. It is DNV's opinion that, this ensures the transparency of the CDM, so that all interested parties can obtain information on all projects being suggested as CDM projects. The independent third party role of DNV implies that DNV cannot provide any suggestion for writing the PDD.
It is also to be noted that DNV is not the author of the PDD of the project activity and it's role is to, through the validation of the project, independently assess the correctness of the statements made in the PDD and in this regard comments from stake holders are appreciated.

I want to ask one question to Tata Power Company Limited (TPCL) and DOE, do you represent that everything mentioned in the PDD is correct? Now if the answer to that question is yes, what I can't believe is that how a company like Tata Power can agree to such lies. Some of the things mentioned in the PDD are completely ridiculous, I can sympathize with consultant responsible for writing the PDD, they are known to make profound displays of their ignorance. But TPCL has been in power sector for last 70 years and you present arguments like "sea water temperature being 30 degrees" are barriers to you for putting up power plants. I mean, do you expect people to be fools, what kind of ridiculous lines are these. My question is to the CDM team of Tata Power, does the board and senior management of Tata Power know that in the PDD, things like "packaged implementation, Sea water temperature being 30 degrees, Jetty being subject to vagaries of sea" have been presented as barriers. Don't you think any body from the power sector will find these arguments laughable? You have put all Indian projects to shame.

How DNV has considered the received comment in it's validation:
The 'additionality' section has been modified and presented in the revised PDD. These barriers have been removed from the PDD as these could not be substantiated.

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To the DOE, please at-least carry out a top level review before uploading the PDD. The PDD does not care about what is mentioned in ACM0013 and you have not bothered to check this. All key information in the PDD is missing; I know Tata Power won't be doing any such deals. DNV, please ensure that the PDD is re-web hosted for global stakeholder consultation after making: - All necessary corrections, after addressing the issues presented below: - Including investment analysis of the project and all other baseline alternatives, as mentioned in ACM0013. - Including the Power Purchase Agreement, since the PPA terms would have an impact on the investment analysis and barrier arguments that the PP has presented. **Section B.4. Description of Baseline Scenario** Under ACM0013, the baseline *alternatives need not consist solely of power plants of the same capacity, load factor and operational characteristics (i.e. several smaller plants, or the share of a larger plant may be a reasonable alternative to the project activity), however they should deliver similar services (e.g. peak vs. base load power). Note further that the baseline scenario candidates identified may not be available to project participants, but could be other*

stakeholders within the grid boundary (e.g. other companies investing in power capacity expansions).

What this means that the baseline scenarios should not only include the alternatives available to the project proponent but also should also include alternatives that are available to other power companies as well. Reliance Power is implementing a 4000 MW super critical project at Sasan, Madhya Pradesh which is implemented under the same UMPP programme as the project activity and in the same time period. Therefore the baseline alternative analysis should also include Reliance's Sasan UMPP as one of the plausible alternatives. The levelised cost of generation of Sasan UMPP is Rs. 1.19 [http://www.financialexpress.com/news/Sasan-project-goes-to-RPL-formally/209133/, I have also given the web link]. I am comparing the levelised costs given in page 16 of PDD and that of Sasan UMPP.

	Alternative 1: Project without CDM	Alternative 2: Sub-critical coal plant	Alternative 3: Sasan UMPP
Levelised Cost	2.48	2.05	1.19

Clearly, Sasan UMPP has the lowest cost among all alternatives and hence should be the baseline. Even if one assumes that Sasan could also go for CDM, the price would still be around Rs. 1.25 per unit (assuming 5 to 6 paise CDM benefits per unit). **Even after CDM benefits are factored out, Sasan super critical is still the cheapest source of power in the country.**

How DNV has considered the received comment in it's validation:

As per the methodology ACM0013, Version 02, the plausible baseline alternatives should be compared based on technology and fuel and not on basis of plants. DNV confirms that as per methodology guidance all the relevant power generation technologies, as provided in the power expansion plan of Govt. of India, have been taken into consideration for the assessment of baseline alternative. However, among all these alternatives, the coal based sub-critical power generation is found to be the most option not associated with any barrier (investment/ technological/ regulatory/ others).

Both Reliance Energy Ltd and Tata Power Company Ltd had participated in the bid for the Mundra Ultra Mega Power Project (UMPP). The tariff of INR 2.26/kWh was the lowest bid and thus the project was awarded to Tata Power. So for the Mundra UMPP, the tariff cannot be below INR 2.26/kWh.

The super-critical technology based power generation project to be implemented by other project developers like Sasan project of Reliance Energy Limited etc can not be considered as alternative for arriving at suitable baseline because all such mega projects and ultra mega projects are being implemented taking CDM into consideration.

The link given provides the competitive tariff of Reliance for Sasan UMPP and not actually the levelized cost of generation: "The project was later awarded to Reliance Power, a subsidiary of Reliance Energy Ltd, after it matched Lanco's lowest tariff bid of Rs 1.19 per unit."

You think you guys are very clever; the reason why your levelised cost is more is because you are using imported coal and not because you are using super critical technology. If you had used sub-critical plant for your imported coal, the cost would be even higher. And you are

projecting that because you are doing a super critical project, you are at a disadvantage because of higher levelised cost. And for proving this, you compare the levelised cost of a sub critical with Indian coal. You may have fooled the DOE, but you certainly can't fool all. I am sure the CDM Executive Board will see through your camouflage.

How DNV has considered the received comment in it's validation:

The detail computation of the levelized cost of generation for domestic coal based sub-critical, imported coal based sub-critical, domestic coal based supercritical and imported coal based super-critical power generation has been carried out in spreadsheet and also presented in the modified PDD in a transparent manner with all relevant assumptions. In this calculation, very clearly, the levelized cost of domestic coal based sub-critical power generation is the most economic alternative and hence it has been selected as the baseline option.

Alternative 2: Power generation using coal fired sub-critical power generation technologies.

Under case 2 bidding (Ultra Mega Projects) the location (Mundra), the technology (super critical) and the fuel (imported coal) were fixed. I am surprised, how can Tata Power argue that they had the alternative of putting up a sub critical plant using Indian coal. The only way you could have done this project was if you put up super critical, you could not have done sub critical even if you wanted to do, since the technology was specified in the tender. Still, how can you argue that setting up a 4000 MW sub critical coal plant was an alternative for you when the bidding condition in the RFP itself was that it should be super critical?

How DNV has considered the received comment in it's validation:

The participation in the tender was on invitation basis and was not mandatory. M/s Tata Power had the option of not participating in the competitive bidding process of UMPP and setting up sub-critical technology based capacity to the tune of a total of 4000MW. It has also been confirmed that Tata Power is currently engaged in installation of sub-critical power plants in India.

Moreover, the methodology ACM0013 further states that the baseline scenario candidates identified may not be available to project participants, but could be other stakeholders within the grid boundary. Following the same methodology guidance the project proponent has ensured that all relevant power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in official power expansion plans) are included as plausible alternatives and the identified baseline alternative (sub-critical coal based generation) conforms to all these baseline criteria.

Now if you are saying that you could have set up a 4000 MW plant elsewhere, in the last 70 years of your operation, you have managed to build only 2378 MW capacity and your turnover would be less than one third the investments required if you were to put up a 4000 MW sub critical plant. You are only doing this project because the UMPP programme came up and the benefits that are offered to UMPPs. Now, if in the absence of the UMPP programme, you would not have done any 4000 MW project, so, how can there be any baseline alternatives to the project.

How DNV has considered the received comment in it's validation:

Tata Power has an expansion plan in this year to add an aggregate domestic coal fired sub-critical capacity of around 4000 MW. This includes the 1050 MW domestic coal based power plant at Maithon, Jharkhand, 1000 MW domestic coal based power plant at Naraj Marthapur, Orissa, 500 MW domestic coal based power plant at Latehar, Jharkhand and 1000 MW domestic coal based power plant at Angul, Orissa. (Ref: Tata Power Company Limited – Annual Report: 2006-07 and 2007-08). The Capex Plan of TPCL for 2008-09 takes into account the expenditure for the above projects. Therefore, generation of 4000 MW using coal fired sub-critical technology was an option available to the project proponent in absence of the project activity.

Ask any power sector expert, he would say that land acquisition for new projects is the most difficult and time consuming process in setting up a new plant. Singur, Nandigram and the Posco site in Orissa are classic examples of how difficult the process can be and what could be the complications. In case of UMPPs, the Ministry of Power has undertaken the responsibility of acquiring land. Tata Power has tried and failed to acquire land in case of the Hirma Power Project in Orissa and had to shelve the project. If one assumes that Tata Power could have set up several smaller capacity (sub-critical) plants across various locations in the state/country. At all these locations Tata Power would have carry out acquisition of large areas of land. Acquiring 2750 acres at one location or 400-500 acres at 8 different locations for would be clearly very difficult for any company and as mentioned earlier Tata Power has already tried and failed in case of Hirma Project in Orissa. Further, availability of domestic coal for new projects is major problem now a days, there have been several instances where existing thermal plants have been asked by the CEA to buy imported coal to make up for the deficit in availability of domestic coal. Therefore one needs to ensure the availability of other resources like rail connectivity, water availability, coal linkage, only then can this alternative be a Alternative 1: Project without CDM Alternative 2: Sub-critical coal plant Alternative 3: Sasan UMPP Levelised Cost 2.48 2.05 1.19 plausible baseline alternative. Unfortunately, the PP has not bothered to present in the PDD whether it has the required capacity to execute a 4000 MW, ,single or distributed, sub critical project without the benefits given to Ultra Mega Power Projects (under the UMPP program). The DOE also has not bothered to check this information.

How DNV has considered the received comment in it's validation:

(i) The methodology clearly depicts that the baseline option will be the one which will be economically most attractive in terms of levelized cost of generation. The project proponent has submitted detailed computation of levelized cost of generation for sub-critical (domestic as well as imported coal based) and super-critical project. For all the cases levelized cost of generation for sub-critical technology is less than that of super-critical technology. However, it is worth mentioning that ACM0013 does not specify whether the baseline alternatives need to be assessed based on domestic coal/ imported coal. ACM0013 clearly specifies the fossil fuel category (e.g. coal, oil, natural gas etc).

As in case of UMPPs, the Ministry of Power has undertaken the responsibility of acquiring land, land acquisition has not been presented as a barrier. The Project proponent could have set up several sub-critical power plants in absence of the project activity. This is evident from the fact that Tata Power already has an expansion plan to add aggregate sub-critical capacity of about 4000 MW. This includes the 1050 MW domestic coal based power plant at Maithon, Jharkhand, 1000 MW domestic coal based power plant at Naraj Marthapur, Orissa, 500 MW

domestic coal based power plant at Latehar, Jharkhand and 1000 MW domestic coal based power plant at Angul, Orissa. Tata Power is in the advance stage of acquiring lands for Saraikala 1200 MW, Naraj Marthapur 2000 MW and Cosatal Maharashtra projects.

Moreover in the last 10 years, only one coal/lignite based project has been commissioned by the private sector in India. This project by ST-CMS is also based on lignite and not on coal. I therefore fail to understand on what grounds Tata Power is claiming that they would have set up a 4000 MW sub critical plant based on Indian coal.

Note to the PDD developer: Get your CDM fundamentals correct, I hope you guys understand the meaning of "plausible". How can 4000 MW sub critical coal plant based on Indian coal be an alternative for when:
- Indian coal is in short supply, so much so that existing plants are being asked to rely on imported coal. There are several news items in the media about this, if you still can't find any, I will be happy to point them to you [http://mjunction.in/market_news/coal_1/cea_comments_on_supply_of_coal.php].
- In the last 10 years not a single sub critical coal plant has come up in the private sector.
Moreover, can Tata Power demonstrate that it has capacity to acquire land (by showing sanctioned arrangements with state governments, farmers), Water and domestic coal (in the form of sanction coal linkage from Ministry of coal) for all eight projects.

How DNV has considered the received comment in it's validation:
The methodology ACM0013 defines "coal" as a category of fuel and does not differentiate between imported or domestic coal. Moreover the project proponent himself is in the process of setting up around 4000 MW subcritical technology based power project based on domestic coal.
The article as given by the link does not say that Indian coal is in short supply. It only highlights that there has been a short supply of coal to some of the thermal power stations in India.
It is DNV's opinion that in the last 10 years not a single sub-critical plant has come up in private sector is solely not due to the difficulties mentioned in the comment. Before Electricity Act 2003 was passed and subsequently electricity reforms initiated the entire policy and regulatory framework was not encouraging enough to generate sufficient private investment in generation. Overall viability of the sector was poor due to subsidized tariff, high percentage of Aggregate Transmission & Commercial (AT&C) losses, inadequate transmission infrastructure, capital scarcity and unavailability of low cost finance to fund large scale generation projects.

Alternative 3: Power generation using coal fired sub-critical power generation technologies.
The PDD states that Natural Gas based power generation is not a plausible baseline alternative because of two reasons: (i) Natural Gas based electricity generation is less than 50% of India's electricity generation, (ii) Deficit situation of natural gas supply and projection of long term natural gas prices.

First, it is not clear, what is the rationale of excluding NG based projects on the ground that the share of NG based electricity is less than 50%. No where in the methodology (ACM0013) it is mentioned that a fuel type should be excluded if its share is less than a certain threshold

limit. This is a classic example of goof up, you think you bend the rules the way you want to. How can you come up with such an interpretation of ACM0013. Can DNV clarify, which CDM EB document they have referred while drawing such conclusions about applicability of ACM0013. We would also request the CDM EB to make a note of this.

Please also read Page 3 of ACM00013: *for baseline determination, ensure that all relevant power plant technologies that have recently* ***been constructed or are under construction or are being planned (e.g. documented in official power expansion plans) are included as plausible alternatives.*** Note to DNV, go to the CEA website, there you will find the list of gas based projects under implementation. Since you have not done that, I am including the list below:

State	Particulars	MW	Status
Rajasthan	Dholpur	330	Under Const.
Gujarat	Dhuvaran	112	Under Const.
Gujarat	Uttran CCPP	374	Under Const.
Gujarat	Sujan Gas Based CCPP	1128	Under Const.
Gujarat	Hazira CCGT-Essar	1500	Planned
Gujarat	Kawas CCPP	1300	Planned
Gujarat	Jhanor Gandhar CCPP	1300	Planned
AP	Konaseema	445	Under Const.
AP	Gautami	464	Under Const.
Kerala	Kannur CCGT	513	Planned

Need I point it out to you that most of these gas based projects are in Gujarat and that Mundra also happens to be in Gujarat. I am appalled to note the callousness of the DOE, the requirement under ACM0013 is clearly spelt out, and the PDD clearly does not comply with these requirements. Still it has been web hosted for comments.

Moreover, considering the issues of land availability, water and coal linkage that inhibit the plausible baseline alternative of sub-critical coal, the possibility of natural gas based generation being the only plausible baseline alternative can not be ruled out. Do I need to drill such common sense? Please carry out further analysis of this alternative before re web hosting the PDD.

How DNV has considered the received comment in it's validation:

The natural gas power plants have been considered as plausible baseline alternatives. However, this alternative is associated with some barriers which will prevent the project proponent to implement this option. Given the deficit situation of natural gas supply and the projection of long-term natural gas price it is unlikely that any new thermal power generation capacity to the tune of 4000 MW will come up with natural gas as fuel. Furthermore, there is no gas supply infrastructure available in the existing project site at Mundra.

According to Planning Commission, Ministry of Power, Govt of India, "Although gas is relatively a clean fuel, at present there is uncertainty about the availability, period of

availability and price of gas. Only 2,114 MW gas based capacity has been planned for 11th Plan where gas supply has already been tied up." /15/.
Due to the above-mentioned barriers like fuel supply constraint, higher cost of generation, lack of infrastructure etc this alternative can not be regarded as a possible realistic and credible baseline alternative for the project activity. Hence this alternative is not considered further for arriving at the baseline scenario and it is justified.

All these issues should have been addressed by the DOE before web hosting the PDD for comments. Such is our misfortune that I have to spend time and energy to make up for the incompetence of the PP, their consultants and the DOE who have been accredited by the CDM EB for carrying out this function, specifically. The CDM EB may kindly note this.

Page 16 of the PDD, Step 2: Identify the economically most attractive baseline scenario alternative
I again quote verbatim the extracts of step 2 requirements set out in ACM0013.
The economically most attractive baseline scenario alternative is identified using investment analysis. The levelised cost of electricity production in $/kWh should be used as financial indicator for investment analysis. ***Calculate*** *the suitable financial indicator for all alternatives remaining after step 1. Include all relevant costs (including, for example, the investment cost, fuel costs and operation and maintenance costs), and revenues (including subsidies/fiscal incentives2, ODA, etc. where applicable), and, as appropriate, non-market cost and benefits in the case of public investors.*

The investment analysis should be presented in a transparent manner and all the relevant assumptions should be provided in the CDM-PDD, so that a reader can reproduce the analysis and obtain the same results. Critical techno-economic parameters and assumptions (such as capital costs, fuel price projections, lifetimes, the load factor of the power plant and discount rate or cost of capital) should be clearly presented. Justify and/or cite assumptions in a manner that can be validated by the DOE. In calculating the financial indicator, the risks of the alternatives can be included through the cash flow pattern, subject to project specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents). Where assumptions, input data, and data sources for the investment analysis differ across the project activity and its alternatives, differences should be well substantiated.

The CDM-PDD submitted for validation shall present a clear comparison of the financial indicator for all scenario alternatives. The baseline scenario alternative that has the best indicator (e.g. highest IRR) can be pre-selected as the most plausible baseline scenario.

It is really a sorry state of affairs that despite of the methodology being so clear, the PP thought it was not necessary to:
(i) carry out the investment analysis as required under the methodology;
(ii) present the investment analysis along with the web-hosted PDD
(iii) produce all key and relevant assumptions in the PDD
Instead only a table that shows values of levelised costs has been provided in the PDD. What is unfortunate is that the DOE has endorsed such blatant disregard for CDM rules and procedures by web-hosting an incomplete PDD for comments.

The methodology clearly states that the alternative with lowest cost of generation will be the baseline. It is interesting to note that in regard to the levelised cost of generation for sub critical coal plant, the levelised cost value has been taken from a published report by the Ministry of Power that is dated 2003, whereas the project is expected to be commissioned in 2012. Moreover, ACM0013 clearly states that the levelised cost should be calculated and all relevant assumptions should be provided in the PDD in detail, obviously the PP thought and the DOE agrees that these requirements of ACM0013 are redundant and their compliance is not necessary. I would like to know if such practices are endorsed by the CDM Executive Board also.

How DNV has considered the received comment in it's validation:

In the revised PDD, all the plausible alternatives, following methodological guidance, have been included for baseline assessment. The assessment of all the alternatives crystallize into the baseline alternative which is –'domestic coal fired sub-critical technology based power generation'. The levelized cost calculations for both sub-critical and supercritical power plants have been attached with the PDD as Appendix 1. All assumptions made to arrive at the final levelized cost of power generation figures have also been stated clearly and those found to be correct..

The story does not end here; the project activity involves electricity generation using **imported coal,** as one would note the levelised cost of sub critical plant has been carried out for domestic coal and not imported coal. It is common knowledge that the higher the coal price, the more would be the savings associated with higher efficiency of super critical plants. If imported coal prices are considered, the levelised cost of generation of a super critical plant would be significantly lower as compared to a sub critical plant. An investment analysis of both the alternatives would clearly show that Super critical (imported coal) has lower levelised cost as compared to sub critical (imported coal). The PP has conveniently ignored to carry out investment analysis of sub critical coal based on imported coal and has instead referred to a published data source that gives cost of generation based on Indian coal.

Sasan UMPP by Reliance Power also should be one of the plausible baseline alternatives. The cost of Sasan UMPP is Rs. 1.19 which is lowest among all alternatives. Therefore when imported coal is considered a Super critical would obviously be the baseline. And when Indian coal is considered, Sasan UMPP would obviously be the baseline.

The fact remains that a super critical project itself is the baseline.

How DNV has considered the received comment in it's validation:

The Sasan UMPP cannot be considered as a plausible baseline alternative since this power plant has also considered CDM benefits before going ahead with the project. An investment analysis has been carried out between subcritical imported coal based power plant and supercritical imported coal based power plant. The levelized cost of supercritical power generation remains higher than subcritical imported coal based generation in the base case as well as in all sensitivity cases. This computation has been submitted to DOE. This establishes that even considering imported coal based generation sub-critical technology remains economically more attractive than super-critical technology.

Section B.5 Assessment and demonstration of additionality

Before I discuss your exploits in this section, my advise to the PDD writer and to DNV would be that please get the fundamentals correct. Otherwise it will be wasting lot of valuable time of your clients and of people like us. Don't you understand the fundamental arguments of barrier analysis: (i) Barrier should be prohibitive (ii) At least one of the baseline alternatives should not be affected by the Barriers (iii) Barriers should be such that the CDM benefits alleviate them. **Now tell me, how does a CDM benefit alleviate Seismic activity barrier or how can packaged implementation and 30 degree sea water be prohibitive barriers. If you think these are prohibitive, my suggestion is that you should not be in power business.**

How DNV has considered the received comment in it's validation:
The barrier section has been modified to remove this barrier.

Investment Barrier: (i) You have argued that the 4000 MW super critical project is capital intensive, so much so that the capital cost exceeds the turnover and reserves of Tata Power. The baseline for this project has been identified by the PP as a 4000 MW sub critical plant. To my knowledge, the cost of a 4000 MW sub critical plant would also be in the range of Rs. 15,000 – 16,000 crores, in other words, substantially higher than the revenue and capital cost of TPCL. Or may be it is some special type of sub critical plant that is so cheap that these Investment Barriers are not applicable to the baseline alternative. In such a case, I request the PP to enlighten the world by sharing their knowledge of such a technology.

How DNV has considered the received comment in it's validation:
The per MW cost of a subcritical power plant of 4000MW would be in the range of INR 27.92 million (calculated as per cost estimates given in CERC order dated 22.05.2007). The per MW cost of a supercritical power plant of 4000MW is in the range of INR 42.50 million. It is also to be noted that unlike super critical technology, subcritical technology is a well established technology with negligible chances of failure in Indian condition and it is easier to receive low cost finance for subcritical power project.

(ii) You also writes that the project faces payment default risk on account of poor health of SEBs, in spite of risk mitigating mechanisms like escrow account, irrevocable Letter of Credit, exit clauses etc. Do you know that these are special privileges given to UMPPs, other projects do not have any such benefits. I would also like to ask one question; does the state SEBs suffer from selective financial disorder so much so that when it comes to a 4000 MW super critical coal, there is poor health, payment default that even special privileges like escrow, LC etc can not take care of; and when it comes to a 4000 MW sub critical plant (your suggested baseline alternative) the SEBs has such excellent financial health that the question of default don't arise.

How DNV has considered the received comment in it's validation:
The revenue would have been realized from some SEBs. Also, in case of a sub-critical power plant, the project proponent could have adopted merchant sale of power or power trading as per the provision of Indian Electricity Act 2003, or the power could have been traded through

upcoming commodity exchanges or through open access in addition to selling to SEBs. However in case of the 4000MW supercritical power plant (project activity), as per PPA conditions, the project proponent has to sell to the designated SEBs and therefore has to face delayed payment risks.

(iii) It is mentioned that the project faces financing risk as the technology is new. On the other hand, I find that there are several multi-lateral agencies from USA, Japan and Korea who are willing to provide funds for the project. Further, the debt : equity ratio of the project is 80:20 which is higher than the normative debt : equity ratio of 70:30 applicable for power sector projects. Financial Institutions typically set stringent debt : equity norms for riskier projects. It is surprising that despite of the project proponent's claims of the project being risky, there are: a. a number of financial institutions who are willing to lend to the project. b. especially when it is being implemented through an SPV and hence does not enjoy the backing of TPCL's balance sheet c. the project has managed to garner higher debt financing than is the norm for power sector projects in India. Can you please explain why you enjoy such extra ordinary favour from the multi-lateral agencies even when you say your project is difficult to finance.

How DNV has considered the received comment in it's validation:
The financial institutions were willing to fund the project taking into account the CDM revenue as is apparent from the letters given to CGPL from the lenders. The project is not difficult to finance provided the lenders are convinced of the potential CDM revenue from it. The debt: equity ratio has been revised to 75:25 instead of 80:20.

(iv) You write that because of multi-lateral financing, the project is exposed to a number of country specific macro-economic risk elements. Don't you think the same barrier would be applicable to any other alternative of 4000 MW size that has multi lateral financing.

How DNV has considered the received comment in it's validation:
A sub-critical power plant uses a proven technology whereas supercritical power plant is a new concept in the Indian scenario. So the chances of failure of the technology are higher and hence greater risks for a supercritical power plant which increases the risk perception of the project as compared to the time-tested sub-critical technology in Indian scenario. .

(v) You write that it is exposed a greater degree of risk since the project is being executed through package route and not through EPC. I find this argument laughable. You had the option of doing an EPC and doing it through package. You chose the package route because it was cheap for you, now you are saying packaged implementation is a barrier for you. How can you be so dense? Also don't you understand the meaning of the line **"Barriers should be prohibitive?"**

How DNV has considered the received comment in it's validation:
It has been noted from CRISIL report that there exists dearth of EPC contractor for supercritical power plants in India. Hence the project proponent decided to go on a package route where the entire project has been divided into several packages with each package being ordered separately. This exposes the project activity to a risk on the integration issues of

various packages and also delay made by one party can delay the entire project. Thus due to the project being implemented as a non-EPC project there are chances of a cost and time overrun on the project. Contrasted to single party EPC contract, in package contract the liability of the contractor (in the form of liquidated damage paid to the project developer) on account of delay is low but the project developer is exposed to high risks of non-completion even if a single contractor, who is supposed to deliver some critical job, defaults. This is associated with very high opportunity cost.

(vi) You have written that the levelised cost of generation of the project (using imported coal) would be higher than the levelised cost of generation of a sub critical plant (based on Indian coal). I am surprised with such inconsistency of argument, comparison should be made between super critical and sub critical using both imported coal, which the candidate CDM project proposes to use as fuel for power generation. As I have explained earlier, the fact is that when using imported coal, the levelised cost of a super critical plant would be substantially lower than the levelised cost of a sub critical plant and therefore while using imported coal setting up a super critical plant is business as usual. DNV, how could have missed such common sense?

How DNV has considered the received comment in it's validation:

The applied methodology ACM0013 defines "coal" as a category of fuel and does not differentiate between imported or domestic coal. It has been found in the economic analysis in the revised PDD that domestic coal based subcritical power generation technology is the most economic among the four alternatives namely:

1. (a) Domestic coal based supercritical power generation technology
(b) Imported coal based supercritical power generation technology
(a) Domestic coal based subcritical power generation technology
2. (b) Imported coal based subcritical power generation technology

As a result, imported coal based subcritical power generation technology cannot be the baseline alternative.

(vii) Again the barrier relating to uncertainty in international coal prices, issues with regard to firm supply of coal from Indonesia and Africa, issues with acquiring managing captive coal mine in Indonesia and geopolitical uncertainties between India and these countries would also affect any other sub critical plant that uses imported coal. Can there be more lame arguments than this? Are you seriously expecting me to believe that when never in the past has there been a situation of conflict between India, Indonesia and Africa, you have foreseen that in future there would be such a conflict that would jeopardize this project. How much more absurd you can get in your arguments. Seriously, are you playing some practical joke of testing the patience of global stakeholders?

How DNV has considered the received comment in it's validation:

The baseline for the project activity is a subcritical domestic coal fired power plant and not imported coal fired. Hence coal supply to a domestic coal fired power plant will not be jeopardized due to geopolitical tensions between India and the other coal exporting nations. Moreover for a subcritical power plant even if coal supply is not there for a few days, the power plant may comfortably operate on partial load without creating any operational problem for the project proponent. However, in case of a super-critical technology based coal

fired plant partial load operation results in technological/ operational barriers as elaborated in PDD. Moreover, for the proposed project activity, if power plant availability goes below 75% the project proponent has to pay a huge penalty (as per the PPA, the penalty to be paid is 20% of the simple average capacity charge in Rs/kWh for all months in the year applied on the energy (in kWh) corresponding to the difference between 75% and availability during such year). Thus the project activity is highly vulnerable to the non-availability of coal and coal price volatility in the international market.

Technological Barrier:
(i) You have written that the warmer temperature of sea water presents a technological barrier. The PP should have competence of the person writing the PDD. Obviously it has been drafted by some one who has no common sense, leave alone any knowledge of Power business and CDM. Everywhere in India water would be 30 degrees, unless you set up your project in Himalayas. Where in India do you think you would get water at 15 degrees (since you write that super critical projects in UK and Germany have this advantage). Didn't it come to you that all projects in India that have come up so far or that are going to come up in future will be affected by this.
Again, please think before writing, can this argument be termed a prohibitive barrier.

How DNV has considered the received comment in it's validation:
The above barrier has been removed form the revised PDD.

(ii) You write that the project faces significant barriers on account of lack of sufficient transmission capacity in India. Again don't you understand that any 4000 MW project in India will have similar problems. The baseline option that you have identified (4000 MW sub critical coal) also has to deal with this issue. Why are you writing such baseless statements?
Okay, can you tell me if there are any special privileges available to sub critical projects, so that if a 4000 MW sub critical project were to come up, which as per you is the baseline alternative, it would not face the same transmission constraints. Either you please enlighten the world by letting us know of such secret transmission systems that are dedicated to sub critical projects only or that can differentiate between the electricity that comes from a sub critical project from the electricity that comes from a super critical project or my request to you is that please refrain from using such innocuous arguments as barriers.

How DNV has considered the received comment in it's validation:
The above barrier has been removed form the revised PDD.

Other Barriers:
(ii) You write that since the evacuation agreement with PGCIL is not signed, the project faces technological barriers. I would like to draw the attention of CDM EB and the DOE to article 4.2 of the draft PPA, standard bid documents of UMPPs which clearly state that the Procurers of electricity (discoms) shall be responsible for procuring the Interconnection and Transmission Facilities to enable the Power Station to be connected to the Grid System not later than the Scheduled Connection Date; in spite of this you have presented this as a barrier to the project (whereas clearly it is the procurer's responsibility). Surely you don't expect the CDM EB/DOE to believe that it took the decision to make the largest single investment of your life (which is 3 times its turnover) without being assured of evacuation facilities.

How DNV has considered the received comment in it's validation:
The above barrier has been removed form the revised PDD.

(iii) **Jetty being affected by vagaries of sea:** Finally, a good laugh; the barrier due to the Jetty being exposed to vagaries of sea is quite amusing. I never imagined people can be so dense, the thought of a port being exposed to vagaries of sea is really something unseen and unheard of in the world and surely something very unique to this project, don't you think.
And how do you think CDM benefits would alleviate this barrier? Do you think the CERs would put some kind of protective wall around the jetty so that ships can come in?

How DNV has considered the received comment in it's validation:
The above barrier has been removed form the revised PDD.

(iv) You have written that the project faces technological barriers because of being located in a Seismic Zone. After all our discussions above, do you think I need to comment on this one again. I have three questions here:
- Can you tell me, how the project being in a seismic zone is a prohibitive barrier for the project, since you have gone ahead and executed the project
- How does this barrier not affect the baseline alternative identified you, 4000 MW sub critical plant.
- How does CDM alleviate the seismic zone impact?

How DNV has considered the received comment in it's validation:
The above barrier has been removed form the revised PDD.

(v) Moreover by giving this argument, you have reinforced my argument that land availability is a key determinant of the investment decision making process. Surely, if you had the choice you would have put up the plant somewhere else. The fact is that the 2,750 acres of land required for the project is identified and acquired by the Ministry of Power and handed over to TPCL. TPCL in its own capacity could not have galvanized such large areas of land. Needless to mention acquiring land in eight different locations (if one assumes that 8 plants of 500 MW in eight locations) would be near impossible for TPCL to achieve. Therefore in the absence of the project activity, no other comparable project would have come up. Hence the baseline alternative for the project activity is the project activity itself.

How DNV has considered the received comment in it's validation:
Land acquisition is a major barrier for any power project. This is not a barrier exclusive to a supercritical power plant. Moreover, the area required for a 4000MW supercritical power plant and a 4000MW subcritical power plant is almost the same. However TPCL is implementing projects to the tune of 4000 MW at different locations like Maithon, Angul, Latehar and Naraj Marthapur. TPCL had acquired the land for these projects on its own.

Common Practice Test, page 24
You have written that currently there are no projects in India that use super critical technology. Your project also is not going to be operational before 2012. The common

practice test therefore should consider capacity addition programs. In the 11th plan (2007 – 12), Government of India has targeted 88,000 MW thermal capacity addition. The capacity addition from super critical in the 11th plan is as follows:

	Capacity MW
9 UMPPs (9 x 4000 MW)	36,000
NTPC Sipat	1,980
NTPC Barh	1,980
Adani Power	1,320
IFFCO Chhatisgarh	1,320
APGENCO	1,600
Coastal Power Projects using imported/blended coal	10,000
Total	54,200

Out of 88,000 MW capacity planned, 54200 MW or 62% is expected to come from Supercritical projects. Still you have written that common practice analysis for the project is not necessary. I would request DNV to look into this in more detail.

How DNV has considered the received comment in it's validation:

The PDD clearly demonstrates that there are no supercritical power plants operating in India till now. The project activity is going to be the first single location super-critical technology based thermal power plant of 4000 MW scale. Even among the planned UMPPs only three have been awarded so far through competitive bidding. All the other supercritical power plants which are coming up in India are also considering potential CDM benefits – the fact which establishes there exists sufficient barriers in implementing super-critical technology based power generation in India. This is a technology which is still on paper in Indian context. Being the first UMPP to be operational, the project proponent will be subjected to considerable risk on account of poor knowledge of the operational risks of the supercritical technology.

APPENDIX A

CDM VALIDATION PROTOCOL

Table 1 Mandatory Requirement 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	OK ~~CAR 1~~
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	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	NA
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	Kyoto Protocol Art. 12.5c,	OK

Requirement	Reference	Conclusion
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 that would have occurred in the absence of the registered CDM project activity.	CDM Modalities and Procedures §43	~~CL 1~~ ~~CL 2~~ ~~CL 3~~ ~~CL 4~~ ~~CL 5~~
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. The project design document shall be in conformance with the UNFCCC CDM-PDD format.	CDM Modalities and Procedures Appendix B, EB Decision	OK
19. 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 * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
A. General Description of Project Activity *The project design is assessed.*					
A.1. Project Boundaries *Project Boundaries are the limits and borders defining the GHG emission reduction project.*					
A.1.1. Are the project's spatial boundaries (geographical) clearly defined?	/1/	DR/I	The project activity is proposed to be implemented at Tundawanda village in Mundra Taluk of Kutch district in the state of Gujarat in India.		OK
A.1.2. Are the project's system boundaries (components and facilities used to mitigate GHGs) clearly defined?	/1/	DR/I	The project's system boundaries encompass 5 numbers of super critical coal fired power generation units, each of 800 MW generation capacity and the Indian national grid to which power is delivered by the project activity.		OK
A.2. Participation Requirements *Referring to Part A, Annex 1 and 2 of the PDD as well as the CDM glossary with respect to the terms Party, Letter of Approval, Authorization and Project Participant.*					
A.2.1. Which Parties and project participants are participating in the project?	/1/	DR/I	The project participant is the private entity M/s Coastal Gujarat Power Limited (CGPL), a wholly owned subsidiary of Tata Power Company Limited. India is the host Party. No Annex–I Party is involved in this project.		OK
A.2.2. Have all involved Parties provided a valid and complete letter of approval and have all	/1/	DR/I	Host country approval is awaited from the Ministry of Environment & Forest (MoEF),	~~CAR 1~~	OK

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private/public project participants been authorized by an involved Party?			the DNA of India. The project proponent is requested to submit the Letter of Approval (LOA) from the DNA of India to the validator.		
A.2.3. Do all participating Parties fulfil the participation requirements as follows: - Ratification of the Kyoto Protocol - Voluntary participation - Designated a National Authority	/1/	DR/I	India has ratified the Kyoto protocol on 26 August 2002. The Ministry of Environment and Forests (MoEF), the DNA of India, confirms voluntary participation through the letter of approval.		OK
A.2.4. Potential public funding for the project from Parties in Annex I shall not be a diversion of official development assistance.	/1/	DR/I	No public funding from any Annex-I country has been received for the project.		OK
A.3. Technology to be employed *Validation of project technology focuses on the project engineering, choice of technology and competence/ maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is used.*					
A.3.1. Does the project design engineering reflect current good practices?	/1/	DR/I	The power plants will be designed & installed by manufacturers of reputation in the field of power generation. The supercritical technology employed in the project is first-of-it's-kind in India. Hence the project design reflects current good practice.		OK
A.3.2. Does the project use state of the art technology or	/1/	DR/I	At present there in no power plant in India		OK

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would the technology result in a significantly better performance than any commonly used technologies in the host country?			which operates on super critical power generation technology. Although a few such plants have been planned to be installed across the country, the project under validation is one of the front runners. Hence it can be concluded that the proposed project activity will contribute significantly in improving the power generation performance in India compared to commonly used sub-critical coal fired power plant technologies.		
A.3.3. Does the project make provisions for meeting training and maintenance needs?	/1/	DR/I	Yes, the project proponent has planned for necessary training for all operational and maintenance personnel before the commissioning of the project.		OK
A.4. Contribution to Sustainable Development *The project's contribution to sustainable development is assessed.*					
A.4.1. Has the host country confirmed that the project assists it in achieving sustainable development?	/1/	DR/I	The project proponent is yet to obtain confirmation on the project's contribution in India's sustainable development from the DNA of India.	~~CAR 1~~	OK
A.4.2. Will the project create other environmental or social benefits than GHG emission reductions?	/1/	DR/I	The project activity will help in improving socio-economic status of the locals by generating employment opportunities apart from it's envisaged reduction in environmental emissions like CO_2, SOX, NOX, SPM etc. through its better power generation efficiency compared to commonly		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			used sub-critical ones.		
B. Project Baseline *The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.*					
B.2. Baseline Methodology *It is assessed whether the project applies an appropriate baseline methodology.*					
B.1.1. Does the project apply an approved methodology and the correct version thereof?	/1/	DR/I	Approved consolidated methodology ACM0013, *"Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plant using a less GHG intensive technology"*, version 1 has been applied for the project activity.		OK
B.1.2. Are the applicability criteria in the baseline methodology all fulfilled?	/1/	DR/I	ACM0013 is applicable where the project activity involves construction and operation of a new fossil fuel fired grid-connected electricity generation plant that uses a more efficient power generation technology than what would otherwise be used with the given fossil fuel and the project activity is not a co-generation power plant. The project under discussion is for a super critical power plant in India, where at present all existing power plants are of sub-critical nature. The project activity is meant for power generation only and does not aim for cogeneration. The methodology, ACM0013, also demands that		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			data on fuel consumption and electricity generation of recently constructed power plants would be available and the identified baseline fuel is used in more than 50% of total generation by utilities in the defined geographical area or country. Fuel consumption and electricity generation data are publicly available from Central Electricity Authority (CEA) of India. It has been confirmed from CEA website that coal, the identified baseline fossil fuel, is used in more than 50% of total electricity generation facilities in India. Thus the methodology ACM0013 is appropriate for the project.		
B.3. Baseline Scenario Determination *The choice of the baseline scenario will be validated with focus on whether the baseline is a likely scenario, and whether the methodology to define the baseline scenario has been followed in a complete and transparent manner.*					
B.2.1. What is the baseline scenario?	/1/	DR/I	Coal based sub-critical power plant has been selected as the baseline scenario.		
B.2.2. What other alternative scenarios have been considered and why is the selected scenario the most likely one?	/1/	DR/I	Other baseline scenarios have been considered following the provision given in the baseline methodology ACM0013. **Step 1:** *Identify plausible baseline scenario:* The project proponent has identified the following alternatives:- i) *Implementation of the project activity*		

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			without CDM benefit: This alternative has been considered further in step 2 for arriving at baseline scenario. ii) *Power generation using coal fired sub-critical power generation technology*: This alternative has also been considered further analysis in step 2. iii) *Power generation using energy sources other than coal*: This alternative has not been considered for further analysis in step 2 citing the reason that coal being predominant fuel for power generation (> 50%) in India, other sources do not contribute significantly. It has also been argued that due to scarcity in natural gas supply and the projected long-term natural gas price, installation of 4000 MW gas based power plant is unlikely. However as per the methodology the levelized cost of all the relevant options should be determined and documented in the PDD along with all necessary assumptions to ascertain the baseline scenario. The project proponent is requested to modify the PDD accordingly. iv) *Import of electricity from connected grids, including the possibility of new interconnections*: Contribution of imported power is very insignificant (< 1%) to meet India's power demand. Hence this alternative	~~CAR 2~~	OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			has been discarded from further discussion in step 2. The methodology, ACM0013, requires inclusion of "all relevant power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in official power expansion plans)" as plausible alternatives. The project proponent has identified the power plant technologies those are in operation in India. It is DNV's opinion that the power plant technologies, those are planned to be installed e.g., other supercritical power plants planned under UMPP programme, are also required to be identified in the PDD as plausible baseline scenario. The project proponent is requested to include the same in the determination of the baseline scenario or adequately justify the exclusion of the same. **Step 2:** *Identify the economically most attractive baseline scenario alternative* Installation of sub-critical coal fired power plant has been identified as the economically most attractive baseline scenario through investment analysis considering levelized cost as financial indicator. It has been indicated in the PDD that levelized cost of the project activity without CDM benefit	~~CAR 3~~	OK

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			(INR 2.48 / KWh) is more than that of a sub-critical coal fire power plant (INR 2.05 / KWh). The project proponent is requested to present detailed investment analysis along with all relevant assumptions e.g., capital costs, fuel price projections, lifetimes, the load factor of the power plant and discount rate or cost of capital etc. in the PDD as required by the approved consolidated methodology ACM0013, version2.	~~CAR 4~~	OK
B.2.3. Has the baseline scenario been determined according to the methodology?	/1/	DR/I	Same as B.2.2.	~~CAR 2~~ ~~**CAR 3**~~ CAR 4	OK
B.2.4. Has the baseline scenario been determined using conservative assumptions where possible?	/1/	DR/I	Same as B.2.2.	~~CAR 2~~ ~~**CAR 3**~~ ~~CAR 4~~	OK
B.2.5. Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations?	/1/	DR/I	Yes.		OK
B.2.6. Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced?	/1/	DR/I	Same as B.2.2.	~~CAR 2~~ ~~**CAR 3**~~ ~~CAR 4~~	OK
B.2.7. Have the major risks to the baseline been identified?	/1/	DR/I	Same as B.2.2.	~~CAR 2~~ ~~**CAR 3**~~ ~~CAR 4~~	OK

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B.4. Additionality Determination *The assessment of additionality will be validated with focus on whether the project itself is not a likely baseline scenario.*					
B.3.1. Is the project additionality assessed according to the methodology?	/1/	DR/I	The project's additionality has been demonstrated using the "Tool for the demonstration and assessment of additionality" version 5.2. **Step 1:** The project proponent has identified four plausible alternatives to the proposed activity and the economically most attractive one i.e., installation of coal fired power plant using sub-critical technology has been identified for additionality demonstration (refer B.2.2). **Step 2:** The project proponent has not performed investment analysis **Step 3:** In order to establish additionality, the project proponent has considered the following barriers: *Investment Barrier:* It has been stated that the total investment is far more than the company's present turnover. The project proponent is requested to provide documentation for the cost of the project and also clarify how the financial status of the company poses a barrier towards the investment for the project since the total	~~CL 1~~	OK

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			investment is phased over the next 4 years. The project proponent is also requested to clearly describe with adequate database the basis of payment default risk associated with the 'poor health' of the state electricity boards, to whom the project proponent has agreed to supply generated power. In this connection the project proponent is requested to submit a copy of power purchase agreement (PPA) to the validator.	~~CL 2~~	OK
			It has also been stated that levelized cost of generation from super-critical technology based power plant (based on imported coal) is much higher vis-à-vis levelized cost of generation of sub-critical power plant (based on Indian coal). The project proponent is requested to compare the cost of power generation from super-critical and sub-sritical power plants using the same type and source of coal.	~~CL 3~~	OK
			In relation with investment barrier analysis depicted in the PDD, it has been stated that the potential risks associated with (i) integration of multiple project contractors in absence of a single EPC contractor, (ii) price index volatility international coal market and (iii) geo-political situation in coal exporting countries (to the project) impose barrier to the implementation of project activity. The	~~CL 4~~	OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			project proponent is requested to clarify with adequate financial data analysis how these act as prohibitive barrier to the project. *Technological barrier:* It has been stated that higher sea water temperature of Arabian sea with respect to that in UK & Holland will affect cooling efficiency adversely and been considered as technological barrier. This is always true for any installations. Variations in climatic conditions differ from one place to another across the globe and the same is generally taken care during design-development stage. Hence it is DNV's opinion that this variation in sea water water temperature does not impose any prohibitive technological barrier for this project. Negative flow characteristic and slagging has also been considered as technological barriers for the project activity. On the other hand absence of nation wide grid in India has been envisaged as potential barrier as it may lead the power plant to run at lower capacity. These concerns are equally true for coal based sub critical power plants. Hence it is DNV's opinion that these can not be considered as potential prohibitive barriers. *Other barriers:* The project proponent is requested to clarify why common factors like exposure of the jetty to the vagaries of the		

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			sea, design of a plant according to seismic zone etc. impose prohibitive barriers for the implementation of the project since these barriers are common for any coastal installation even with the baseline technology of sub-critical coal based power plant. *Barrier due to prevailing practice:* The project activity is one of the planned supercritical power plants in India. Till date, there are no power plants in operation in India with this technology. **Step 4:** *Common practice analysis:* The project activity is one of the planned supercritical power plants in India.	~~CL 5~~	OK
B.3.2. Are all assumptions stated in a transparent and conservative manner?	/1/	DR/I	Refer B.3.1	~~**CL 1**~~ ~~CL 2~~	OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
				~~CL 3~~ ~~CL 4~~ ~~CL 5~~	
B.3.3. Is sufficient evidence provided to support the relevance of the arguments made?	/1/	DR/I	Refer B.3.1	~~CL 1~~ ~~CL 2~~ ~~CL 3~~ ~~CL 4~~ ~~CL 5~~	OK
B.3.4. If the starting date of the project activity is before the date of validation, has sufficient evidence been provided that the incentive from the CDM was seriously considered in the decision to proceed with the project activity?	/1/	DR/I	The project proponent is requested to substantiate with documentary evidences that CDM was considered seriously prior to project implementation and also justify how CDM benefits will alleviate the barriers in implementing the project activity.	~~CL 6~~	OK
B.5. Calculation of GHG Emission Reductions – Project emissions *It is assessed whether the project emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.*					
B.4.1. Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR/I	The CO_2 emissions from electricity generation in the proposed project activity (PE_y) have been estimated using the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". The estimation found to be complete and transparent.		OK

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B.4.2. Have conservative assumptions been used when calculating the project emissions?	/1/	DR/I	Yes		OK
B.4.3. Are uncertainties in the project emission estimates properly addressed?	/1/	DR/I	Yes		OK
B.6. Calculation of GHG Emission Reductions – Baseline emissions *It is assessed whether the baseline emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.*					
B.5.1. Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR/I	The baseline emissions have been calculated in line with the approved consolidated methodology ACM0013. The baseline emission factor has been determined using the lower value between the emission factor of the sub-critical power generation technology and coal, the identified most likely baseline scenario and a benchmark emission factor determined based on the performance of the top 15% coal based power plants in India. Identification of top 15% performing power plants and calculation of baseline emission based upon CEA published data have been found to be in line with the applied methodology ACM0013. However, the project proponent is requested to provide the detailed calculations in excel	~~CL 7~~	OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			format.		
B.5.2. Have conservative assumptions been used when calculating the baseline emissions?	/1/	DR/I	Yes		OK
B.5.3. Are uncertainties in the baseline emission estimates properly addressed?	/1/	DR/I	Yes		OK
B.7. Calculation of GHG Emission Reductions – Leakage *It is assessed whether leakage emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.*					
B.6.1. Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner?	/1/	DR/I	No leakage emission is associated with the project activity.		OK
B.8. Emission Reductions *The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change.*					
B.7.1. Are the emission reductions real, measurable and give long-term benefits related to the mitigation of climate change.	/1/	DR/I	Yes, the emission reductions are measurable and have been estimated for a 10 years crediting period. The actual amount of emission reductions will be confirmed in the final validation report.		OK
B.9. Monitoring Methodology					

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It is assessed whether the project applies an appropriate monitoring methodology.					
B.8.1. Is the monitoring plan documented according to the approved methodology and in a complete and transparent manner?	/1/	DR/I	Yes, the monitoring plan has been prepared in line with the applied methodology ACM0013.		OK
B.8.2. 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/I	Yes, all monitored data will be archived for up to two years after the crediting period.		OK
B.10. Monitoring of Project Emissions *It is established whether the monitoring plan provides for reliable and complete project emission data over time.*					
B.9.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period?	/1/	DR/I	Yes, the monitoring plan has been presented in PDD. The project proponent has planned for monitoring of net electricity generation and coal consumption, The project proponent is requested to use monitored net calorific value of coal instead of IPCC default value.	~~CAR 5~~	OK
B.9.2. Are the choices of project GHG indicators reasonable and conservative?	/1/	DR/I	Yes.		OK
B.9.3. Is the measurement method clearly stated for each GHG value to be monitored and deemed appropriate?	/1/	DR/I	Yes.		OK
B.9.4. Is the measurement equipment described and	/1/	DR/I	Yes.		OK

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CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
deemed appropriate?					
B.9.5. Is the measurement accuracy addressed and deemed appropriate? Are procedures in place on how to deal with erroneous measurements?	/1/	DR/I	Yes.		OK
B.9.6. Is the measurement *interval* identified and deemed appropriate?	/1/	DR/I	Yes.		OK
B.9.7. Is the *registration, monitoring, measurement* and *reporting* procedure defined?	/1/	DR/I	Yes.		OK
B.9.8. Are procedures identified for *maintenance* of monitoring equipment and installations? Are the calibration intervals being observed?	/1/	DR/I	Yes.		OK
B.9.9. 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/I	Yes.		OK
B.11. Monitoring of Baseline Emissions *It is established whether the monitoring plan provides for reliable and complete baseline emission data over time.*					
B.10.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period?	/1/	DR/I	Yes, the monitoring plan has been presented in PDD found appropriate.		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
B.10.2. Are the choices of baseline GHG indicators reasonable and conservative?	/1/	DR/I	Yes.		OK
B.10.3. Is the measurement method clearly stated for each baseline indicator to be monitored and also deemed appropriate?	/1/	DR/I	Yes.		OK
B.10.4. Is the measurement *equipment* described and deemed appropriate?	/1/	DR/I	Yes.		OK
B.10.5. Is the measurement *accuracy* addressed and deemed appropriate? Are procedures in place on how to deal with erroneous measurements?	/1/	DR/I	Yes.		OK
B.10.6. Is the measurement *interval* for baseline data identified and deemed appropriate?	/1/	DR/I	Yes.		OK
B.10.7. Is the registration, *monitoring*, *measurement* and *reporting* procedure defined?	/1/	DR/I	Yes.		OK
B.10.8. Are procedures identified for *maintenance* of monitoring equipment and installations? Are the calibration intervals being observed?	/1/	DR/I	Yes.		OK
B.10.9. 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/I	Yes.		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
B.12. Monitoring of Leakage *It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.*					
B.11.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining leakage?	/1/	DR/I	As no leakage is associated with the project activity, monitoring is not applicable.		OK
B.13. Monitoring of Sustainable Development Indicators/ Environmental Impacts *It is assessed whether choices of indicators are reasonable and complete to monitor sustainable performance over time.*					
B.12.1. Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host country?	/1/	DR/I	Monitoring of sustainable development indicators is not mandatory in India.		OK
B.14. Project Management Planning *It is checked that project implementation is properly prepared for and that critical arrangements are addressed.*					
B.13.1. Is the authority and responsibility of overall project management clearly described?	/1/	DR/I	Yes, responsibility & authority delegation has been adequately defined.		OK
B.13.2. Are procedures identified for training of monitoring personnel?	/1/	DR/I	Yes.		OK
B.13.3. Are procedures identified for emergency preparedness for cases where emergencies can	/1/	DR/I	It has been learnt that procedure for emergency preparedness & response will be		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
cause unintended emissions?			formulated be implemented based upon recommendations from EIA.		
B.13.4. Are procedures identified for review of reported results/data?	/1/	DR/I	Yes.		OK
B.13.5. Are procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting?	/1/	DR/I	Yes		OK
C. Duration of the Project/ Crediting Period *It is assessed whether the temporary boundaries of the project are clearly defined.*					
C.1.1. Are the project's starting date and operational lifetime clearly defined and evidenced?	/1/	DR/I	The project starting date has been taken as 2 December 2006. The project proponent is requested to submit documents in support of this. Operational lifetime of the project has been taken as 25 years, which is reasonable.	~~CL 8~~	OK
C.1.2. Is the start of the crediting period clearly defined and reasonable?	/1/	DR/I	The project proponent has proposed for 10 years fixed crediting period starting from 1 January 2011 or the date of registration with UNFCCC, whichever is later. This is reasonable.		OK
D. Environmental Impacts *Documentation on the analysis of the environmental impacts will be assessed, and if deemed significant, an EIA should be provided to the validator.*					
D.1.1. Has an analysis of the environmental impacts of	/1/	DR/I	The project proponent has performed an		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
the project activity been sufficiently described?			extensive environmental assessment (EIA) as required by the Environmental Protection Act 1986 of India. The EIA has been conducted by M/s TCE Consulting Engineers Limited and been submitted to MoEF to obtain consent to establish for the proposed power plant.		
D.1.2. Are there any Host Party requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved?	/1/	DR/I	Refer D.1.1.		OK
D.1.3. Will the project create any adverse environmental effects?	/1/	DR/I	The EIA recommendations will be implemented to mitigate potential adverse environmental impacts identified.		OK
D.1.4. Are transboundary environmental impacts considered in the analysis?	/1/	DR/I	Yes.		OK
D.1.5. Have identified environmental impacts been addressed in the project design?	/1/	DR/I	Yes.		OK
D.1.6. Does the project comply with environmental legislation in the host country?	/1/	DR/I	The project proponent is requested to submit the copy of consent to establish to the validator.	~~CL 9~~	OK
E. Stakeholder Comments *The validator should ensure that stakeholder comments have been invited with appropriate media and that due account has been taken of any comments received.*					
E.1.1. Have relevant stakeholders been consulted?	/1/	DR/I	The project proponent has consulted the local		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			stakeholders like, i) employees of CGPL, ii) Ministry of Environment & Forests, India, iii) Gujarat State Pollution Control Board, iv) Gujarat State Electricity Board, v) Ministry of Power, India, vi) Gujarat Maritime Board, vii) Consultants, viii) Equipment Suppliers. Comments received from local stakeholders have been compiled and documented. The PDD has been hosted in the website inviting comments from stakeholders all over the world. Two comments have been received. The project proponent is requested to submit responses against those comments to the validator.	~~CL 10~~	
E.1.2. Have appropriate media been used to invite comments by local stakeholders?	/1/	DR/I	Refer E.1.1.	~~CL 10~~	OK
E.1.3. If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	/1/	DR/I	This is not mandated by law in India.		OK
E.1.4. Is a summary of the stakeholder comments received provided?	/1/	DR/I	Refer E.1.1.	~~CL 10~~	OK
E.1.5. Has due account been taken of any stakeholder comments received?	/1/	DR/I	Refer E.1.1.	~~CL 10~~	OK

Table 2b: Additional requirements checklist for VVM version 1 (EB 44)

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
A.5. Letter of approval					
A.1.1 Is the LoA received directly from the DNA or through the project participant.		DR/I	DNV has obtained copy of HCA from the project proponent. In addition to that DNV has also verified approval of the project by the DNA of India from the official website of MoEF (http://cdmindia.nic.in/).		OK
A.2. Project design					
A.2.1. Does the PDD describe the CDM project activity with all relevant elements in a transparent and accurate way?	/1/	DR/I	Yes. All relevant elements have been addressed in the PDD.		OK
A.2.2. Has the CDM project activity at the start of the validation been constructed or does the CDM project activity use existing facilities or equipment?	/1/	DR/I	Implementation of the project activity was in progress at the start of the validation.		OK
A.2.3. Is the project a large scale project, a small scale project with average annual emission reductions above 15 000 tonnes or a bundled small scale project? Has on-site visit been carried out?	/1/	DR/I	The project is a large scale project. The validation team has visited the project proponent's office at Mumbai on 14 February 2008 as construction was yet to start at that time.		OK
A.2.4. Does the project activity involved alteration of existing installations? If so, have the differences between pre-project and post-project activity been clearly described in the PDD?	/1/	DR/I	The project activity is a green field project for installation of a 4000 MW thermal power plant.		OK
A.3. Project emissions not addressed by the methodology					
A.3.1. Does the methodology describe all project emission source for the project activity that contributes all 1%	/1/	DR/I	The project emission has been estimated in accordance with the applied methodology		OK

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
of the emission reductions? Sources that the methodology considers not to take into account are not relevant (e.g. cement and iron consumption for building hydropower plants).			ACM0013. Version 02.		
A.4. Documentation of baseline emissions					
A.4.1. Documentation of the baseline determination: a. 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. b. All documentation is relevant as well as correctly quoted and interpreted. c. Assumptions and data can be deemed reasonable d. Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD. e. The methodology has been correctly applied to identify what would occurred in the absence of the proposed CDM project activity	/1/	DR/I	a. Yes. All assumptions and data used by in the project activity are listed in the PDD and related document will be submitted for registration. b. Yes. c. Yes. DNV could validate the data used for calculations. d. Yes. e. Yes.		OK
A.5. Documentation of the calculations					
Algorithms and/or formulae used to determine emission reductions a. 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 b. All documentation is correctly quoted and	/1/	DR/I	a. Yes. All assumptions and data used by in the project activity are listed in the PDD and related document will be submitted for registration. b. Yes. c. Yes. DNV could validate the data used for calculations.		

CHECKLIST QUESTION * MoV = Means of Verification, DR= Document Review, I= Interview		Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
	interpreted. c. All values used can be deemed reasonable in the context of the project activity d. 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.			d. Yes.		
A.6.	**Implementation of the monitoring plan**					
A.6.1	How were the plans for implementation of the monitoring plan, data management, QA/QC procedures assessed? To what extent can the emission reductions achieved by the project by monitored ex-post and verified later by a DOE?	/1/	DR/I	The monitoring plan has been found to be in compliance to the requirements of the applied methodology and the same will suffice the requirements for monitoring the emission reduction in a complete and conservative manner.		OK
A.7.	**CDM consideration prior to starting date**					
A.7.1	The prior consideration of CDM for the project activity complies with EB41 annex 46	/1/	DR/I	DNV could validate that the prior consideration of CDM for the project activity complies with EB41 annex 46		OK

Table 3 Resolution of Corrective Action and Clarification Requests

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CAR 1 Host country approval is awaited from the Ministry of Environment & Forest (MoEF), the DNA of India. The project proponent is requested to submit the Letter of Approval (LOA) from the DNA of India to the validator.	A.2.2	The Host Country Approval has been received and has been submitted to the DOE.	**OK.** MoEF, the DNA of India has issued the host country approval for the project activity vide letter no 4/24/2007-CCC dated 15 February 2008. CAR is closed.
CAR 2 It has been assumed that due to scarcity in natural gas supply and the projected long-term natural gas price, installation of 4000 MW gas based power plant is unlikely. However as per the methodology the levelized cost of all the relevant options should be determined and documented in the PDD along with all necessary assumptions to ascertain the baseline scenario. The project proponent is requested to modify the PDD accordingly.	B.2.2	As per Planning Commission, Ministry of Power, Govt of India, "Although gas is relatively a clean fuel, at present there is uncertainty about the availability, period of availability and price of gas. Only 2,114 MW gas based capacity has been planned for 11th Plan where gas supply has already been tied up."(Ref: Report of Working Group on Power for 11th Plan, Demand for Power and Generation Planning, Ministry of Power, Govt. of India) According to the report of Working Group on Petroleum and Natural Gas for XIth Plan (2007-12), [Ref: Planning Commission, Govt. of India] there has been a natural gas demand–supply gap (shortfall in supply) to the extent of 67.98 MMSCMD in 2007-08 which is	**OK**. The referred documents have been verified and based upon the same, DNV could validate the claim of the project proponent and conclude that installation of natural gas based 4000 MW power plant is unlikely as compared to coal based thermal power plants. This is mainly because of high installation cost leading to increased levelised cost of the power plant and also scarcity of natural gas as a fuel for a 4000 MW power plant. The same has also been expressed in the report of the working group on power for eleventh plan, published by the Ministry of Power, Government of India. Hence the option of installation of natural gas based power plant can be excluded from being a plausible and

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		projected to fall to 42.81 MMSCMD in 2008 – 09 in both the scenarios. According to the same projections from this level, the gap would increase steadily to 91.13 MMSCMD by 2011-12. The overall demand–supply balance has been presented in the modified PDD. At present in India, only the industries in Power and fertilizer sector and small-scale users deserve the supply of Government regulated natural gas under Administered Price Mechanism (APM). According to a policy document (L-12015/5/04-GP(i) of Ministry of Petroleum and Natural Gas the power and fertilizer sector and some other specific units will receive NG supply against their existing allocation. Also, in case of reduction in availability of this gas in future, the supplies to APM consumer would be reduced on a pro-rate basis. The project proponent – CGPL, although power sector player does not have any existing allocation of NG. Furthermore, considering the declining volume of APM gas supply in future (Ref: Crisil Research Natural Gas	realistic baseline alternative. The PDD has been revised accordingly and found satisfactory. CAR is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		Update – November 2007) it is highly unlikely that the 4000 MW power generation capacity would come up based on APM gas supply. Even if it is assumed that the project proponent will implement 4000 MW gas based power generation the gas supply required can be partially met through RIL KG D6 field (located in the eastern coast of India) which is expected to start production from 2008 onward. In Gujarat, the variable cost of generation of electricity from this gas is estimated to be Rs.1.76/kWh which is higher than the variable cost of generation from domestic coal. (Ref: CRISIL document: Impact of RIL's KG gas price on end-user segment). The power tariff being low in the merit order for Gujarat it will not be a viable option for the project proponent to generate power from KG basin gas supply. Hence, the project proponent concludes that generation of 4000 MW from natural gas sources is associated with barriers like fuel supply constraint, higher cost of generation etc and therefore this can not be regarded as a	

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		possible realistic and credible baseline alternative for the project activity. Therefore, following the methodology guidance the project proponent has not performed detail computation of levelized cost of generation for this alternative.	
CAR 3 The project proponent has identified the power plant technologies those are in operation in India. It is DNV's opinion that the power plant technologies, those are planned to be installed e.g., other supercritical power plants planned under UMPP programme, are also required to be identified in the PDD as plausible baseline scenario. The project proponent is requested to include the same in the determination of the baseline scenario or adequately justify the exclusion of the same.	B.2.2	As recommended by DOE the project proponent has identified in the modified PDD all relevant power plant technologies that have recently been constructed or are under construction or are being planned (according to the power expansion plan under 11th Five year Plan of Planning Commission, Govt. of India). Project Proponent also examined subsequently which of the alternatives can be considered to arrive at the plausible baseline alternatives. Relevant documentation has also been submitted to the DOE to justify exclusion of any particular alternative. Although the DOE mentioned about 'other supercritical power plants planned under UMPP it is worth mentioning that all the other supercritical power plants which are	**OK**. The project proponent has submitted documentary evidences which show that other super critical technology based power plants project owners are also considering CDM benefits. In this regard DNV has verified the following documents: (i) Letter of engagement of consultant for assisting Sasan Power Limited for registering 4000 MW Sasan UMPP with CDM-Executive Board, (ii) Letter from Ernst & Young to M/s Jas Infrastructure capital private Limited confirming the former's appointment for providing CDM advisory services for high efficiency power generation using steam at super critical condition in Bihar, India, (iii) Letter from Ernst & Young to M/s Jawaharlal Darda

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		coming up in India under the UMPP initiative of Ministry of Power (e.g Sasan or Krishnapatnam etc) or even other supercritical power plants not a part of UMPP are being implemented with consideration of CDM. This demonstrates that there exist credible prohibitive barriers and potential risk of failure which the developers of all such supercritical power projects intend to overcome with the help of CDM revenue. Therefore all the upcoming power plants of similar scale of operation and using supercritical technology have been excluded from the baseline scenario.	Yavatmal Energy Limited confirming the former's appointment for providing CDM advisory services for high efficiency power generation using steam at super critical condition in Maharashtra, India, (iv) Appointment of DOE (DNV) for validation Adani Power Limited's super critical power generation project at Mundra, Gujarat, India (the project is currently under validation stage), (v) Enquiry from M/s Adani Power Limited to DNV for appointment of DOE for validation of their second super critical power generation project in Gujarat, India, (vi) Contract agreement between M/s Andhra Pradesh Power Generation Corporation Limited and M/s Ernst & Young for CDM advisory services for new projects including the Krishnapatnam Thermal Power Plant (2x800 MW) and (vii) NM0217: "Grid-connected supercritical coal-fired power generation" submitted by NTPC Ltd, India. It is also true that there are few other supercritical technology based power plants of smaller scale in the planning

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
			stage and possibility of installation of these without CDM benefit can not be ruled out. However the above mentioned documents indicate that CDM benefits have been considered for almost all of the supercritical technology based power plants, those have been determined for installation, Hence it can be concluded that exclusion of these project from considering as plausible baseline options is in line with requirements of ACM0013 version 2 and therefore justified. CAR is closed.
CAR 4 The project proponent is requested to present detailed investment analysis along with all relevant assumptions e.g., capital costs, fuel price projections, lifetimes, the load factor of the power plant and discount rate or cost of capital etc. in the PDD as required by the approved consolidated methodology ACM0013, version 1.	B.2.2	The detailed investment analysis and all the relevant assumptions for levelized cost of power generation using (a) coal fired sub-critical technology and (b) coal fired supercritical technology has been submitted to the DOE and the same has been appended in the modified PDD.	**OK.** Investment analysis along with relevant assumptions for calculation of levelised cost has been included in the PDD. Levelized cost of power generation has been considered as the indicator for selection of baseline scenario. The analysis has also been submitted in excel worksheet format. It has been noticed that values applied for most of the assumptions have been taken from

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
			the orders from the Central Electricity Regulatory Commission of India, which is an authentic and designated source of data. The input values for the assumptions have been validated against the documents as referred in the PDD and found to be correct. In order to arrive at economically most attractive baseline scenario, the PP has presented calculations for levelized cost of power generation for both sub-critical and super-critical technology based power plants using domestic (Indian) or imported coal. It has been observed that levelized cost of power generation is lowest for subcritical technology based power plants using domestic coal as fuel. Hence the baseline scenario has been selected as per guideline provided in the applied methodology. CAR is closed.
CAR 5 The project proponent has planned for monitoring of net electricity generation and coal consumption, The project proponent is requested to use monitored net calorific value	B.9.1	The project proponent will use monitored values for % carbon in the coal to calculate project emissions. Since it is a proposed project activity, the project proponent has used	**OK.** The PDD has been revised to include monitoring of net calorific value to calculate project emissions. However, for ex-ante calculation of project

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
of coal instead of IPCC default value.		approximate % carbon values to calculate project emissions.	emissions, sample tested value of % carbon as provided in the detailed project report has been used. CAR is closed.
CL 1 It has been stated that the total investment is far more than the company's present turnover. The project proponent is requested to provide documentation for the cost of the project and also clarify how the financial status of the company poses a barrier towards the investment for the project since the total investment is phased over the next 4 years.	B.3.1	Capital blockage to the tune of Rs.17000 crore for 4 years will lessen the liquidity of the company and hence its debt servicing capability. Moreover, as per the 2006-07 Annual Report of Tata Power Company Limited, the net free cash flow generation was INR 1150.56 crores for 2006-07. This free cash flow generation is insufficient to meet TPCL's capital expenditure requirement which stands Rs.3214 crore for FY 2007-08 (a part of this CAPEX involves equity in CGPL project). The above-mentioned clarification substantiates the investment barrier issue mentioned in the subject CL. The lenders' letters provided to the DOE further substantiate the fact that the CDM revenue was considered by them seriously while taking the decision for financing the proposed project activity.	**OK.** It has been verified and found that both International Finance Corporation and Asian Development Bank have considered potential carbon credit revenues as part of their due diligence for sanctioning loans for CGPL project. Hence it can be concluded that an investment to the tune of INR 17000 crores poses a potential barrier for the project proponent. CL is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CL 2 The project proponent is requested to clearly describe with adequate database, the basis of payment default risk associated with the 'poor health' of the state electricity boards, to whom the project proponent has agreed to supply generated power. In this connection the project proponent is requested to submit a copy of power purchase agreement (PPA) to the validator.	B.3.1	The project proponent has submitted a copy of the Power Purchase Agreement (PPA) to the DOE. The project proponent had signed Power Purchase Agreement (PPA) with the State Electricity Boards of Gujarat, Maharashtra, Punjab, Haryana and Rajasthan for sale of power. The poor financial health of the SEBs in India is evident from the "State Power Sector Performance Ratings, Final Report to the Ministry of Power, Government of India, June 2006".1 Such poor performance of the SEBs is attributed to the cost inefficiency, mismanagement of assets, inability to pay the fuel suppliers and national generating companies etc which forced many of these SEBs to insurmountable financial distress. In the power sector performance rating mentioned above SEBs of Punjab and Haryana had shown extremely poor financial performance. For Haryana SEB, the cash loss levels for Discoms (Distribution Companies)	**OK.** The documents referred in the response by the PP have been verified and found that financial performances of the state electricity boards of Gujarat, Maharashtra, Punjab, Haryana and Rajasthan are not encouraging to rely upon. The state electricity boards, with whom CGPL has signed the power purchase agreement, are burdened with financial loses over the past years. So there are uncertainties in timely realization of revenues from the state electricity boards, which in turn may affect CGPL's financial performance. Hence it can be concluded that poor financial health of the state electricity boards poses potential barrier to the project activity. However this barrier is also likely to affect the baseline scenario as well and hence cannot be considered as a prohibitive barrier for the project. This barrier has hence been removed from the PDD.

[1] http://

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		and Transcos (Transmission Companies) have increased from Rs 13.23 billion (2001-02) to Rs 28.52 billion (2004-05). Further, interest payments are overdue to the state government as well as commercial banks. The receivable levels for the Discoms have increased to 215 days of annual sales in 2003-04 from 142 days in 2001-02. The Punjab SEB has reported a loss of Rs. 5.91 billion in 2004-05. The Board has not serviced its debt obligations in a timely fashion on loans from the state government. In terms of debtor days, there was a marginal decline of 4.3 per cent to 67 days as on March 31, 2005 from the base year (2002) level of 70 days (which is higher than the benchmark level of 60 days). There has been an overall deterioration in the standalone financials of the Rajasthan power utilities with no tariff increase, rising receivables and a greater dependence on state subsidies. Cash Cost coverage for the overall state sector net of subsidy from the state government is a low 77 per cent in FY05, which has declined	CL is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		from 83 per cent in FY02. As a result, the difference between Average Revenue Realised and Average Cost of Supply has been rising. The power sector debt levels have also increased substantially and there is a significant quantum of subsidy receivable from the state govt., which once taken out leads to a negative networth for the state utilities as a whole. Further, the receivable levels for the DISCOMs have increased to an average of 92 days of annual sales in FY05 from 68 days in FY02. Similarly, Maharashtra SEB (MSEB) had accumulated losses of Rs 19.08 billion as on March 31, 2005. Moreover, the poor collection efficiency is resulting in commercial losses. In addition, creditors for power and fuel (at 94 days) are higher than the prescribed benchmark of 60 days. As per another report "Report on The Performance of The State Power Utilities for the Years 2003-04 to 2005-06" published by Power Finance Corporation Ltd (A Govt. of India undertaking), all the SEBs who have signed PPA with the project proponent	

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		are commercially not viable without the support of Government subsidy. In fact some SEBs like Gujarat, Rajasthan, Haryana and Maharashtra are suffering losses even after considering the government subsidy. The risk of payment default on account of poor financial condition of the SEBs has been mentioned as an important risk factor in the risk assessment report performed by the prospective lenders of the project. This report has been shown to the DOE during the site validation. Furthermore, the same risk issue was deliberated in some of the investor's forum discussions pertaining to UMPP development and investors typically demanded payment security mechanisms as mitigation instrument for this risk.	
CL 3 It has also been stated that levelized cost of generation from super-critical technology based power plant (based on imported coal) is much higher vis-à-vis levelized cost of generation of sub-critical power plant (based		The levelized cost of generation using sub-critical power plant based on domestic coal, sub-critical power plant based on imported coal, supercritical power plant based on domestic coal and supercritical power plant based on	**OK.** The PP has provided separate calculations for levelized cost of power generation for both supercritical and sub-critical power plant using domestic as well as imported coal. The values

<table>
<tr><th>Draft report clarifications and corrective action requests by validation team</th><th>Ref. to checklist question in table 2</th><th>Summary of project owner response</th><th>Validation team conclusion</th></tr>
<tr><td>on Indian coal). The project proponent is requested to compare the cost of power generation from super-critical and sub-critical power plants using the same type and source of coal.</td><td></td><td>imported coal have been compared to arrive at the economically most attractive alternative. It has been found that the alternative of sub-critical power plant based on domestic coal is the economically most attractive option.
<table><tr><th>Option</th><th>Levelized cost of generation (INR/kWh)</th></tr><tr><td>1(a): Domestic coal based supercritical power generation technology</td><td>1.71</td></tr><tr><td>1 (b): Imported coal based supercritical power generation technology</td><td>1.86</td></tr><tr><td>2 (a): Domestic coal based subcritical power generation technology</td><td>1.61</td></tr><tr><td>2 (b): Imported coal based subcritical power generation technology</td><td>1.80</td></tr></table>It is also worth mentioning in case of</td><td>thus obtained have been presented in the response against CL 3 and also presented in the PDD. It has been observed that levelized cost of generation by supercritical technology using imported coal is more than that for domestic coal based supercritical/sub-critical power plants. However levelized cost for imported coal based sub-critical power plant is more than that for imported coal based supercritical plant. But DNV has verified and found from the official website of the Ministry of Power, Government of India that use of imported coal and supercritical technology were pre-requisites for participation in the bid for the project under consideration. The Power ministry of India has also called awarded other supercritical technology based UMPPs using both domestic and imported coal through tariff based international competitive bidding process. The projects were awarded to the entity offering lowest levelized tariff. DNV has compared Levelized tariff for similar UMPPs in India. It has</td></tr>
</table>

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		the project activity scenario, 4000 MW super-critical power generation using imported coal only was a bid condition.	been found that lowest levelized tariff for Krishnapatanam imported coal based UMPP was INR 2.33 per unit of electricity whereas the same for the project activity is INR 2.26. On the other hand, levelized cost for the Sasam UMPP (pit head project) was INR 1.19. This implies that imported coal based supercritical power generation is a costlier option than any power plant running on domestic coal. The PP as well as many other developers India are engaged in installation of domestic coal based sub-critical power plants. Hence it can be concluded that coal based sub-critical power generation is the most economical option for the PP had they been not involved in the project activity. CL is closed.
CL 4 In relation with investment barrier analysis depicted in the PDD, it has been stated that the potential risks associated with (i)	B.3.1	(i) The Indian EPC contractors are familiar with the engineering, procurement and construction services primarily for the subcritical units in the	**OK.** It is evident from the CRISIL report on "Power generation: equipment availability – a critical focus area" that

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
integration of multiple project contractors in absence of a single EPC contractor, (ii) price index volatility international coal market and (iii) geo-political situation in coal exporting countries (to the project) impose barrier to the implementation of project activity. The project proponent is requested to clarify with adequate financial data analysis how these act as prohibitive barrier to the project.		scale of 300MW, 400MW, 500MW etc. but not with 800 MW units2. For a single party EPC contractor, any delay in project implementation is charged to the EPC contractor. A liquidated damage (LD) charges (maximum of 10% of the total contract value) has to be paid by the EPC contractor. In case of the proposed project activity, there are multiple contractors. Even if a 200 crores contractor causes a delay, the implementation of the entire project activity gets delayed and the contractor pays only 20 crores as delay charges. Values of the single contracts are low. The liability of the contractor on account delay is low but the project proponent is exposed to high risks of non-completion or delay in the project completion schedule which is associated with very high opportunity cost. (ii) The increasing trend of coal price in the international coal market is clearly evident from the report published by Central Electricity regulatory	there is dearth of EPC contractor for setting up of supercritical power plants in India. DNV could also validate the fact that international coal price is on the rising trend, It has been observed from the PPA that non-escalable part of fuel energy charges is quite substantial (USD 0.00705 per KWH) compared to the escalable component (USD 0.00585 per KWH). Hence it can be concluded that price volatility in international coal pricing might lead financial burden to the PP. Regarding geo-political situation in the coal supplying countries (to the project), DNV agrees with the PP's argument. Any such instability may hinder coal supply and hence power generation performance of the project activity. It has also been noted that the option of installing domestic coal based power plants was open to the project proponent (TPCL) who currently is engaged for installing a nos. of domestic coal based sub-critical power plants in India.

[2] Source: CRISIL Research: "Power generation: Equipment availability- A critical focus area", Page 13

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		Commission. Minimum of the coal price between 2004 and 2006 (i.e. FOB price of USD 40/ton) have been considered for computation of levelized cost of generation. (iii) The countries from where the project proponent will procure coal includes Indonesia, Mozambique and other African countries which are geo-politically unstable. Any political crises in these countries will upset the coal supply to the project proponent. In absence of adequate coal supply, generation of power will be affected. The project proponent has to pay huge penalty if the power plant availability goes below 75% (as per the PPA, the penalty to be paid is 20% of the simple average capacity charge in Rs/kWh for all months in the year applied on the energy (in kWh) corresponding to the difference between 75% and availability during such year).	Hence, it is DNV's opinion that the stated barriers have the potential to be prohibitive in nature for the project activity, but unlikely for the sub-critical power plant (baseline scenario). CL is closed.
CL 5 The project proponent is requested to clarify why common factors like exposure of the	B.5.1	The above barriers have been deleted since the project proponent does not find the same relevant for the project	**OK.** As the stated factors could not be substantiated with appropriate

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
jetty to the vagaries of the sea, design of a plant according to seismic zone etc. impose prohibitive barriers for the implementation of the project since these barriers are common for any coastal installation even with the baseline technology of sub critical coal based power plant.		activity.	documents, the same have been excluded from the PDD. The PDD has been revised accordingly. CL is closed.
CL 6 The project proponent is requested to substantiate with documentary evidences that CDM was considered seriously prior to project implementation and also justify how CDM benefits will alleviate the barriers in implementing the project activity.	B.3.4	The excerpts of relevant board meeting (held on 2nd December 2006) has been taken as the documentary evidence to show that CDM was considered seriously prior to project implementation and that CDM benefits alleviate barriers in implementing the project activity.	**OK.** The PP has submitted excerpts of the minutes of the meeting of the executive committee of the board of TPCL dated 2 December 2006. This meeting was held prior to submission of TPCL's bid for the project activity under consideration. It has been noticed that the executive committee has considered the potential revenue from carbon emission reductions under clean development mechanism and identified the same as a prospective agent to offset the risks associated with the incremental cost and technology deployed for the project activity. CL is closed.
CL 7		The emission reduction calculations	**OK.**

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
The project proponent is requested to provide the detailed calculations in excel format.		have been provided in excel sheet.	The baseline emission factor has been calculated by Central Electricity Authority, Govt of India and published on their website (http://www.cea.nic.in/planning/cdm.pdf). It has been also confirmed from the same web site that the calculations are based on the approved consolidated methodology ACM0013 Ver 2. The baseline emission factor has been found to be 0.941 tCO_2/MWh. CL is closed.
CL 8 The project starting date has been taken as 2 December 2006. The project proponent is requested to submit documents in support of this.	C.1.1	The minutes of the relevant board meeting has been submitted to the DOE.	**OK.** DNV has verified extracts from the minutes of the meeting of the executive committee of the board of Tata Power Company Limited (TPCL), held on 2 December 2006 and found that the committee has recognized potential revenue stream available under clean development mechanism as an offsetting parameter for incremental costs and technological risks associated with the project. However, in line with the EB guidelines, the projects start date has now been chosen to be 1 September

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
			2007. This is the date for 'Notice to proceed' issued to Toshiba Corporation and Doosan Heavy Industries & Construction Company Ltd. (they are the major equipment suppliers for the project activity) CL is closed.
CL 9 The project proponent is requested to submit the copy of consent to establish to the validator.	D.1.2	The copy of consent to establish has been submitted to the DOE.	**OK.** CGPL has obtained consent to establish from Gujarat Pollution Control board vide letter no. PC/CCA-KUTCH-437/21029 dated 17 July 2007. CL is closed.
CL 10 The PDD has been hosted in the website inviting comments from stakeholders all over the world. Two comments have been received. The project proponent is requested to submit responses against those comments to the validator.	E.1.1	The responses to the stakeholders' comments have been submitted to the DOE.	**OK.** The project proponent has submitted their responses against the comments received through international stakeholders' consultation process. These responses are annexed with this report. CL is closed.

APPENDIX B

CERTIFICATES OF COMPETENCE

Ramesh Ramachandran

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-9-8-i1-CDMJI-i1

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas		Jan 2009	Jan 2009	Jan 2009		
Renewables	*Hydro power*	Jan 2009	Jan 2009		Jan 2009	Jan 2009
	Wind power	Jan 2009	Jan 2009			
	Other renewable	Jan 2009	Jan 2009			
Biomass		Jan 2009	Jan 2009			
Grid connection of isolated system		Jan 2009	Jan 2009			
Cement		Jan 2009	Jan 2009			
Waste-heat / waste-gas recovery		Jan 2009	Jan 2009			
Efficiency of thermal power plants		Jan 2009	Jan 2009			
Coal mine methane		Jan 2009	Jan 2009			
Fuel switch		Jan 2009	Jan 2009			
Manure management		Jan 2009	Jan 2009			
Waste / wastewater treatment		Jan 2009	Jan 2009	Jan 2009		
Energy efficiency		Jan 2009	Jan 2009			
N_2O		Jan 2009	Jan 2009			
HFCs		Jan 2009	Jan 2009			
Flare reduction		Jan 2009	Jan 2009			
PFCs		Jan 2009	Jan 2009			
Charcoal		Jan 2009	Jan 2009			
CO_2 recovery		Jan 2009	Jan 2009			
Transport		Jan 2009	Jan 2009			
Non-renewable biomass		Jan 2009	Jan 2009			
Biofuel		Jan 2009	Jan 2009			
Pipeline leakage reduction		Jan 2009	Jan 2009			
SF_6		Jan 2009	Jan 2009			

Høvik, 9 January 2009

Michael Lehmann

Technical Director, Climate Change Services

Soumik Biswas

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-9-8-i1-CDMJI-i1

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas		Jan 2009				
Renewables	*Hydro power*	Jan 2009				
	Wind power	Jan 2009	Jan 2009			
	Other renewable					
Biomass		Jan 2009	Jan 2009			
Grid connection of isolated system						
Cement		Jan 2009	Jan 2009			
Waste-heat / waste-gas recovery		Jan 2009	Jan 2009			
Efficiency of thermal power plants						
Coal mine methane						
Fuel switch				Jan 2009		
Manure management						
Waste / wastewater treatment						
Energy efficiency		Jan 2009	Jan 2009			
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery						
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

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Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-9-8-i1-CDMJI-i1

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas						
Renewables	*Hydro power*					
	Wind power					
	Other renewable					
Biomass						
Grid connection of isolated system						
Cement						
Waste-heat / waste-gas recovery						
Efficiency of thermal power plants						
Coal mine methane						
Fuel switch						
Manure management						
Waste / wastewater treatment						
Energy efficiency		Jan 2009	Jan 2009	Jan 2009		
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery						
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

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GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas		Jan 2009				
Renewables	*Hydro power*	Jan 2009			Jan 2009	Jan 2009
	Wind power	Jan 2009	Jan 2009			
	Other renewable					
Biomass		Jan 2009				
Grid connection of isolated system						
Cement						
Waste-heat / waste-gas recovery		Jan 2009	Jan 2009	Jan 2009		
Efficiency of thermal power plants				Jan 2009		
Coal mine methane						
Fuel switch				Jan 2009		
Manure management						
Waste / wastewater treatment		Jan 2009				
Energy efficiency		Jan 2009	Jan 2009	Jan 2009		
N_2O						
HFCs		Jan 2009	Jan 2009			
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery				Jan 2009		
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

Høvik, 9 January 2009

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Kumaraswamy Chandrashekara

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-9-8-i1-CDMJI-i1

GHG Auditor:		yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Renewables	*Hydro power*	Jan 2009	Jan 2009		Jan 2009	Jan 2009
	Wind power	Jan 2009	Jan 2009			
	Other renewable	Jan 2009	Jan 2009			
Biomass		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Grid connection of isolated system		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Cement		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Waste-heat / waste-gas recovery		Jan 2009	Jan 2009	Jan 2009	Jan 2009	Jan 2009
Efficiency of thermal power plants		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Coal mine methane		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Fuel switch		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Manure management		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Waste / wastewater treatment		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Energy efficiency		Jan 2009	Jan 2009	Jan 2009	Jan 2009	Jan 2009
N_2O		Jan 2009	Jan 2009		Jan 2009	Jan 2009
HFCs		Jan 2009	Jan 2009	Jan 2009	Jan 2009	Jan 2009
Flare reduction		Jan 2009	Jan 2009		Jan 2009	Jan 2009
PFCs		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Charcoal		Jan 2009	Jan 2009	Jan 2009	Jan 2009	Jan 2009
CO_2 recovery		Jan 2009	Jan 2009	Jan 2009	Jan 2009	Jan 2009
Transport		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Non-renewable biomass		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Biofuel		Jan 2009	Jan 2009		Jan 2009	Jan 2009
Pipeline leakage reduction		Jan 2009	Jan 2009		Jan 2009	Jan 2009
SF_6		Jan 2009	Jan 2009		Jan 2009	Jan 2009

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