# VALIDATION REPORT

# NATURAL GAS BASED COMBINED CYCLE POWER PLANT IN TRIPURA, INDIA

REPORT NO. 2010-1136

REVISION NO. 02

DET NORSKE VERITAS

# VALIDATION REPORT

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|---|---|
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| Approved by:<br>Edwin Aalders | Organisational unit:<br>DNV KEMA Energy & Sustainability, Accredited Climate Change Services |
| Client:<br>ONGC Tripura Power Company Limited (OTPC) | Client ref.:<br>Mr. A. B. Chakraborty |

DNV CLIMATE CHANGE SERVICES AS

Veritasveien 1,
1322 HØVIK, Norway
Tel: +47 67 57 99 00
Fax: +47 67 57 99 11
http://www.dnv.com
Org. No: NO 994 774 352 MVA

Summary:

**Project Name:** Natural gas based combined cycle power plant in Tripura, India
**Country:** India
**Methodology:** AM0029 **Version:** 3
**GHG reducing Measure/Technology:** Grid connected electricity generation using natural gas
**ER estimate:** 1 612 506 $tCO_2e$ per year (average)
**Size**
☒ Large Scale ☐ Small Scale
**Validation Phases:**
☒ Desk Review
☒ Follow up interviews
☒ Resolution of outstanding issues
**Validation Status**
☐ Corrective Actions Requested ☐ Clarifications Requested
☒ Full Approval and submission for registration ☐ Rejected

In summary, it is DNV's opinion that the project activity "Natural gas based combined cycle power plant in Tripura, India", as described in the PDD, version 7 of 6 December 2012, meets all relevant UNFCCC requirements for the CDM and correctly applies the baseline and monitoring methodology AM0029, version 3. Hence, DNV requests the registration of the project as a CDM project activity.

| | |
|---|---|
| Report No.:<br>2010-1136 | Subject Group:<br>Environment |
| Report title:<br>Natural gas based combined cycle power plant in Tripura, India | |
| Work carried out by:<br>Sasim Chattopadhyay, Kakaraparthi Venkata Raman, M V Srinivasan. | |
| Work verified by:<br>Chandrashekara Kumaraswamy; Syam Miriyala | |

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**Indexing terms**

Key words
Climate Change
Kyoto Protocol
Validation
Clean Development Mechanism

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## *Abbreviations*

| | |
|---|---|
| CAR | Corrective Action Request |
| CDM | Clean Development Mechanism |
| CER | Certified Emission Reduction(s) |
| $CH_4$ | Methane |
| CL | Clarification request |
| $CO_2$ | Carbon dioxide |
| $CO_2e$ | Carbon dioxide equivalent |
| CEA | Central electricity authority |
| DNV | Det Norske Veritas Climate Change Services AS (DNV) |
| DNA | Designated National Authority |
| FAR | Forward Action Request |
| GHG | Greenhouse gas(es) |
| GWP | Global Warming Potential |
| IPCC | Intergovernmental Panel on Climate Change |
| LoA | Letter of approval |
| $N_2O$ | Nitrous oxide |
| NGO | Non-governmental Organisation |
| NEWNE | North East West and North-East |
| ODA | Official Development Assistance |
| OTPC | ONGC Tripura Power Company Limited |
| PDD | Project Design Document |
| $tCO_2e$ | Tonnes of $CO_2$ equivalents |
| UNFCCC | United Nations Framework Convention on Climate Change |

# 1 EXECUTIVE SUMMARY – VALIDATION OPINION

*DNV Climate Change Services AS (DNV) has performed a validation of the project activity "Natural gas based combined cycle power plant in Tripura, India". The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism 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. India fulfils the participation criteria and have 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 the baseline methodology AM0029, version 3 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas" and approved monitoring methodology AM0029 version 3 "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel".*

*The project activity involves installation of two Combined Cycle Gas Based Turbines (CCGT), each having generation capacity of 363.3 MW electricity (232.39 MW Gas Turbine and 130.91 MW Steam Turbine Generator). As a result, the project results in reductions of $CO_2$ emissions, compared to what would have been from the grid electricity which is predominantly supplied from coal based power plant, 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 1 612* 506 *$tCO_2e$ per year over the selected 10 year fixed crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.*

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

*In summary, it is DNV's opinion that the project activity "Natural gas based combined cycle power plant in Tripura, India", as described in the PDD, version 7, dated 6 December 2012, meets all relevant UNFCCC requirements for the CDM and correctly applies the baseline and monitoring methodology AM0029, version 3. Hence, DNV requests the registration of the project as a CDM project activity.*

Bangalore and Oslo, 10 December 2012

K.V. Raman
*CDM Validator*
DNV Bangalore, India

Edwin Aalders
*Approver,*
DNV Climate Change Services AS

# 2 INTRODUCTION

ONGC Tripura Power Company Limited (OTPC) has commissioned DNV Climate Change Services AS (DNV) to perform a validation of the Natural gas based combined cycle power plant in Tripura, India project in India (hereafter called "the project"). 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 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 AM0029 (version 3). The validation was based on the recommendations in the Validation and Verification Manual /24/.

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

# 3 METHODOLOGY

The validation consisted of the following three phases:

I a desk review of the project design documents

II follow-up interviews with project stakeholders

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

The following sections outline each step in more detail.

## 3.1 Desk review of the project design documentation

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

### 3.1.1 Documentation provided by the project participants

| | |
|---|---|
| /1/ | OTPC: *CDM-PDD for project activity "*Natural gas based combined cycle power plant in Tripura, India", version 02 dated 23 Mar 2010, version 6 dated 6 December 2012 and version 07 dated 6 December 2012. |
| /2/ | OTPC: *Emission reductions Ver04.xls* |
| /3/ | OTPC: *OTPC benchmark ver 03.xls* |
| /4/ | OTPC: : *Supercritical coal based plant IRR Ver 03.xls, Subcritical coal based plant Ver 03.xls, OTPC IRR sheet Ver 04 without CDM.xls, OTPC IRR sheet Ver 04 with CDM.xls* |
| /5/ | Fichtner Consulting Engineers (India) Pvt. Ltd.: *Detailed project report dated October 2005* |
| /6/ | OTPC: Contracts:-<br>i) *Notification of award of turnkey EPC contract dated 23 June 2008*<br>ii) Supply and Services Contract between OTPC and BHEL dated 11 August 2008 |
| /7/ | ONGC: *Long term gas profile dated 13 February 2008* |
| /8/ | OTPC: *The affirmation dated 13 September 2010 that official development assistance is not involved.* |
| /9/ | OTPC: *The minutes of meeting of the Board of Directors of OTPC dated 06/02/2006, dated 27 June 2007 and dated 23 June 2008* |
| /10/ | IL&FS: L*etter from IL&FS dated 13 October 2005 on CDM revenue consideration to improve financial viability* |
| /11/ | OTPC: Gas sale and purchase agreement dated 29 September 2008 |
| /12/ | OTPC: *Appointment letter for CDM consultant dated 18 October 2005 and amended dated 9 June 2009* |
| /13/ | Tripura State Pollution Control Board (MoEF):*Consent to establish dated 18 December 2008* |
| /14/ | MoEF: *Environmental clearance dated 7 February 2007* |
| /15/ | The Tripura Observer: *News coverage dated 11 March 2010 on OTPC's local stakeholders' meeting* |

| | |
|---|---|
| /16/ | The Tripura Times: *News coverage dated 11 March 2010 on OTPC's local stakeholders' meeting* |
| /17/ | OTPC: *Attendance sheet and minutes of the local stakeholders' meeting dated 10 March 2010* |
| /18/ | Ghose, Bose and Associates: *Rapid environmental impact assessment of combined cycle gas turbine power project, March 2006* |
| /19/ | Ministry of Power, Government of India: *Power allocation letter dated 25 November 2008* |
| /20/ | OTPC: *Power purchase agreement with the Government of,*<br>*i) Arunachal Pradesh dated 7 November 2009*<br>*ii) Assam dated 12 April 2009*<br>*iii) Manipur dated 17 July 2009*<br>*iv) Meghalaya dated 19 May 2009*<br>*v) Mizoram dated 24 March 2009*<br>*vi) Nagaland dated 24 February 2009*<br>*vii) Tripura dated 20 May 2009* |
| /21/ | Power Finance Corporation Limited: *Letter dated 16 June 2011 confirming that the DPR was submitted to them for approval of finance. This related to validation of PLF.* |
| /22/ | Power Finance Corporation Limited: *Loan Sanction letter dated 31 August 2009* |

### 3.1.2 Letters of approval

| | |
|---|---|
| /23/ | Ministry of Environment & Forest (DNA of India): Host Party l*etter of approval no. 4/2/2007-CCC* dated 12 July 2010 |

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

| | |
|---|---|
| /24/ | CDM Executive Board: *Validation and Verification Manual*, version 1.2 |
| /25/ | CDM Executive Board: *Baseline and monitoring methodology for grid connected electricity generation plants using natural gas AM0029, version 3* |
| /26/ | CDM Executive Board: *Guidance on the demonstration and assessment of prior consideration of the CDM, version 4, EB62 Annex 13* |
| /27/ | CDM Executive Board: *Guidelines on the assessment of investment analysis, version 5* |
| /28/ | CDM Executive Board: *Tool to calculate the emission factor for an electricity system_version 2.pdf* |
| /29/ | CDM Executive Board: *Tool for the demonstration and assessment of additionality (Version 06.0.0).* |

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

| | |
|---|---|
| /30/ | CEA: *Database for power plants in India* http://www.cea.nic.in/ |
| /31/ | CERC: CERC Tariff Order dated 26 March 2004 |
| /32/ | CEA: Report of the Expert Committee on Fuels for Power Generation, February 2004 |
| /33/ | CEA: *CEA CO2 Baseline Database Version 5.0* |

| | |
|---|---|
| /34/ | Ministry of Power, Government of India: *Hydro power policy, 2008* |
| /35/ | CEA Summary 2007-08 document: http://cea.nic.in/reports/yearly/hyd_perfm_review(summ)_rep/HPR(S)%2007-08.pdf - review covers the performance of Hydro-Electric Stations |
| /36/ | Ministry of Power, Government of India: *Report of the working group on power for the eleventh plan (2007 – 2012)* |
| /37/ | Reserve Bank of India Annual Report 2005-06, Table 7.5 |

Following are the significant changes made in the final PDD from the version webhosted for global stakeholders' consultation:

1) Estimated annual GHG emission reduction is changed from 1 475 842 $tCO_2e$ to 1 612 506 $tCO_2e$
2) Section B.4 has been revised to include all possible baseline scenarios
3) Assumptions for IRR calculations have been included in PDD
4) Details of benchmark IRR calculations is included in PDD
5) Sensitivity analysis is included in the PDD
6) Common practice analysis has been revised to comply with the CDM-EB guidance
7) Details of local stakeholders' consultation process is included in the PDD

## 3.2 Follow-up interviews with project stakeholders

On 5 July 2010, DNV visited the Delhi office of the project proponent and performed interviews with project stakeholders. The actual project site visit was not conducted, as in July 2010, at the time of starting the validation, the site preparation was only in progress and none of the machinery had arrived at the site. All the documentation being available at the head office of the project proponent, visit to assess the project was deemed adequate. Further a second visit was also carried out on 6 July 2011 for follow-up discussion on validation issues. The following personnel were present during the discussion during both occasions.

| | Name | Organization | Designation | **Topic** |
|---|---|---|---|---|
| /38/ | Mr. Alok Mukherjee | OTPC | Director & CEO | ➢ Proof of CDM consideration<br>➢ Determination of baseline<br>➢ Assessment of project additionality and discussed barriers<br>➢ Uniqueness of project activity<br>➢ Emission reduction calculations and data used<br>➢ Review of project design and technology used<br>➢ Review of monitoring and verification procedure of the organisation and management structure of the organization for the project activity.<br>➢ Environmental consents and permits<br>➢ Review of the stakeholder consultation process. |

| | | | | |
|---|---|---|---|---|
| /39/ | Mr. A. B. Chakraborty | ONGC | Executive Director | |
| /40/ | Mr. S. C. Dhingra | OTPC | Sr. Advisor | |
| /41/ | Mr. G. R Nagendran | OTPC | CFO & CS | |
| /42/ | Mr. S. C. Dhingra | OTPC | Sr. Advisor – Commercial | |
| /43/ | Mr. Shree Narayan | OTPC | DGM-Contract & Material | |
| /44/ | Mr. Rajat Kumar | OTPC | Sr. Executive | |
| /45/ | Dr. Satish Chand Gupta | ONGC | DGM (Chem.) | |
| /46/ | Mr. Shantanu Dasgupta | ONGC | Chief Chemist | |
| /47/ | Mr. Satendra Mohan | ONGC | Sup. Engr. (Prod.) | |
| /48/ | Mr. Rajat Kumar Singh | OTPC | Executive | |
| /49/ | Mr. Sandip Keswani | E&Y | Associate Consultant | |
| /50/ | Mr. Rahul Garg | E&Y | Sr. Consultant | |
| /51/ | Mr. I. Guha | E&Y | Associate Director | |

## 3.3 Resolution of outstanding issues

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

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

The validation protocol consists of four tables. The different columns in these tables are described in the figure below. The completed validation protocol for the project activity "Natural gas based combined cycle power plant in Tripura, India" is enclosed in Appendix A to this report.

Table 2 of the validation protocol documents the findings of the desk review of the project design documentation and follow-up interviews with project stakeholders. Any findings

raised in Table 2 are listed in Table 3 of the protocol, and changes to the description of the project design as a result of these findings will be addressed in Table 3. Table 2 thus may not reflect all aspects of the project as described in the final PDD submitted for registration.

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

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

(b) The CDM requirements have not been met;

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

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

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

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

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

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

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

**Figure 1: Validation protocol tables**

## 3.4 Internal quality control

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

## 3.5 Validation team

| | | | | ***Type of involvement*** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Role*** | ***Last Name*** | ***First Name*** | ***Country*** | Desk review | Site visit / Interviews | Reporting | Supervision of work | Technical review | TA 1.1 competence | Financial expertise |
| Team leader (Validator) | Kakaraparthi | Venkata Raman | India | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| Validator | Sasim | Chattopadhyay | India | ✓ | ✓ | ✓ | | | | |
| Financial Expert | Srinivasan | M. V. | India | | | | | | | ✓ |
| Technical reviewer | Chandrashekara | Kumaraswamy | India | | | | | ✓ | | |
| TA competent assisting technical reviewer | Miriyala | Syam | | | | | | | ✓ | |

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

# 4 VALIDATION FINDINGS

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

The final validation findings relate to the project design as documented and described in the PDD, version 7 dated 6 December 2012 /**1**/.

## 4.1 Participation requirements

The project participants from the host Party are ONGC Tripura Power Company Limited (OTPC) and ONGC (Oil and Natural Gas Commission). The host Party (India) meets all relevant participation requirements. This is a unilateral project and no Annex-I Party is involved.

A letter of approval (LoA) /23/ was issued by DNA of India on 12 July 2010, authorizing ONGC Tripura Power Company Limited (OTPC) & ONGC of host Party as project participants and confirming that the project assists in achieving sustainable development.

The copy of letter of approval was received from the project participant. DNV has verified the LoA against the original document and hence does not doubt the authenticity of the letters of approval. DNV considers the letter is in accordance with paragraphs 45- 48 of the VVM /24/.

## 4.2 Project design

The project activity involves installation of two Combined Cycle Gas Based Turbine (CCGT) each having generation capacity of 363.3 MW electricity (232.39 MW Gas Turbine and 130.91 MW Steam Turbine Generator). The power plant will be located in Pallatana in Tripura in India /**5**/. The geographical co-ordinates of the physical location of the plant are 23º 29’ 59.2” N latitude and 91º 26’ 13.7” E longitude /**5**/. A major portion (86.5%) of the electricity generated will be sold to the North Eastern states viz. Assam, Tripura, Manipur, Meghalaya, Nagaland, Arunachal Pradesh, Mizoram that are connected to the NEWNE grid and a minor part (13.5%) will be sold to the connected grid of NEWNE for consumption by private entities. This is at the discretion of the project proponent /**20**/.

The basic process in generation of power through combined cycle power plant (CCPP) comprises firing of natural gas and using the higher pressure of the expanding hot gases to drive the gas turbine generator (GTG). A gas turbine operates on the thermodynamic principle of Brayton cycle and is coupled with generator, which produces electricity. The exhaust gases from the gas turbine at a substantial temperature of more than 550 degrees centigrade are fed into a Heat Recovery Steam Generator (HRSG), which produces steam. The steam is fed into a steam turbine which when coupled with generator produces electricity. A gas turbine when coupled with a steam turbine produces more electricity with the same quantity of fuel and hence CCPP has a higher efficiency as compared to the average coal fired rankine cycle based thermal power plant.

The project activity is yet to be implemented. The expected date of commissioning of the first unit is July 2012 and the second unit is October 2012. Hence visit to the actual project site was not deemed necessary. The project description mentioned above have been verified from the detailed project report (DPR) /5/ and technical specification provided thereof.

Start date of the project activity has been defined to be 23 June 2008 /6/, the date of notification of "Award of Turnkey EPC Contract to Bharat Heavy Electricals Limited". Hence selection of start date of the project activity is justified as it is found to be the earliest form of commitment for expenditure for implementation of the project activity.

Validation did not reveal involvement of any official development fund in the project activity. The project proponent has also submitted an affirmation dated 13 September 2010 that official development assistance is not involved in the project activity /**8**/.

The operational life of the project has been taken to be 25 years. This is verified from the DPR /5/ and found to be correct and reasonable.

The project proponent has opted for 10 years fixed crediting period starting from 1 January 2013, the expected date of commissioning of power plant or date of registration of the project as a CDM project, whichever is later. This is found justified.

DNV considers the project description of the project contained in the PDD to be complete and accurate. The PDD complies with the relevant forms and guidance for completing the PDD.

## 4.3 Application of selected baseline and monitoring methodology

The project activity applies approved baseline methodology AM0029, "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas", version 3 in conjunction with approved monitoring methodology AM0029, "Grid Connected Electricity Generation Plants using Non-Renewable and Less GHG Intensive Fuel", version 3. The applied versions are pertinent at the time of validation.

DNV has assessed applicability criteria of the applied baseline and monitoring methodologies and the same are depicted below:

1) *The project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant*

   The project activity is a green-field natural gas fired grid-connected electricity generation plant. This was verified from the DPR /5/. This has also been confirmed from the CEA database of gas based power plants in India /30/ and found to be correct. The project activity uses fuel as natural gas, and no other fuels are consumed. Hence it satisfies the applicability condition of other fuels usage to be within 1%.

2) *The geographical/physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available*

   The baseline grid is the NEWNE regional electricity grid and its boundary is clearly identified by the Ministry of Power of India, The emission reductions are based on the grid emission factor of the NEWNE grid, and the PPAs /**20**/ signed for supply of power to the North-East states of India which also form a part of the NEWNE grid of India. The information pertaining to this grid are publicly available through the database maintained by the Central Electricity Authority, Ministry of Power, Government of India.

3) *Natural gas is sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity*

   DNV has verified the long term gas profile of ONGC /7/, who is eventually the principal supplier of natural gas in the region including the proposed project activity,

and noted that ONGC has planned for production of 6.0 MMSCMD of natural gas from fiscal year 2012-2013 onwards, whereas the total gas demand in the region including the project plant is anticipated at 4.93 MMSCMD. The projects demand of natural gas is 2.65 MMSCMD as evidenced from the gas sale agreement /11/. This document also clarifies that ONGC has planned for increasing natural gas production to 7.5 MMSCMD in a phased manner. This establishes that sufficient gas is available for the project at present and also sufficient natural gas will be available in future to cater to other users.

The assessment of the project's compliance with the applicability criteria of AM0029 (version 3) are documented in detail in section B.2 of Table 2 in the validation protocol in Appendix A to this report.

Based on the assessment mentioned above, DNV concludes that the project activity complies with the applicability criteria of the applied baseline and monitoring methodologies.

## 4.4 Project boundary

The system boundary of the project activity encompasses the gas turbine & generator, waste heat recovery boiler & steam turbine and the NEWNE grid.

$CO_2$ and $CH_4$ are the source of GHG from the project activity and this is in accordance with the applied methodology.

The identified boundary and selected sources and gases are justified for the project activity. The validation of the project activity did not reveal other greenhouse gas emissions occurring within the proposed CDM project activity boundary as a result of the implementation of the proposed project activity which are expected to contribute more than 1% of the overall expected average annual emission reduction, which are not addressed by AM0029 (version 3).

## 4.5 Baseline identification

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

**Sub-step 1a. Define alternatives to the project activity**

As per the applied methodology, it is required to identify realistic and credible alternative(s) that were available to project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

The methodology also requires that the alternatives to be analysed should include, inter alia:

a) The project activity not implemented as a CDM project;
b) Power generation using natural gas, but technologies other than the project activity;
c) Power generation technologies using energy sources other than natural gas;
d) Import of electricity from connected grids, including the possibility of new interconnections.

The following plausible options have been identified by the project proponent:

**Project Option 1 – Present Grid Mix (No project activity)**

In this scenario the end user would get electricity from the current grid mix which consists of a mix of thermal (coal and diesel), hydro, nuclear and other renewable energy based power plants and an equivalent amount of carbon dioxide would be emitted at the generation end.

**Project Option 2 – Power generation using Coal (fossil fuel) through sub-critical 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, majority of 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.. In line with the methodological requirements the lifetime of the sub-critical coal based technology has been considered at 25-30 years at a heat rate of 2450 Kcal/kWh (an efficiency of 35.1%). This is in DNVs opinion reasonable. This alternative is considered for further analysis in step 2.

**Project Option 3 – Power generation using Coal (fossil fuel) through super-critical technology**

In this scenario the project proponent would have set up a coal based power plant based on super-critical technology of the closest comparable capacity i.e. 500 MW. In line with the methodological requirements the lifetime of the super-critical coal based technology has been considered at 25-30 years at a heat rate of 2403 Kcal/kWh (an efficiency of 35.79%). This is in DNVs opinion reasonable. This alternative is considered for further analysis in step 2.

**Project Option 4 – Project activity not undertaken as CDM project activity**

This is a plausible alternative, but as discussed in detail in the additionality section, this alternative is not financially viable.

**Project Option 5 – Power generation using hydro power**

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. However, DNV has reviewed the hydro power policy of the Ministry of Power, Government of India /34/, 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. The hydro power plants are dependent on the seasonal flow of water and the nature of operation of hydro power plants in India is mainly as peaking stations rather than base load stations. The methodology requires analysis of alternatives that deliver services similar to the project activity. The OTPC project activity has a plant load factor of 80% whereas hydro power plants generally have an average PLF of 38.1% /35/ (http://www.cea.nic.in/hydro/Hydro%20Performance%20Review%20(Summary)%2007-08.pdf). During lean seasons, when the flow of water is low, hydro power plants are unable to provide the optimum generation which can otherwise be expected from a natural gas power plant that operates consistently throughout the year. And hence this option is excluded from further assessment.

**Project Option 6 – Power generation using wind energy**

Wind energy based power generation projects do not qualify for "base-load firm power" because wind power projects are not subject to the dispatch rules like the coal or gas based projects and hence cannot be compared with the proposed project activity in terms of the services that it delivers. Hence this option has been excluded as a baseline scenario.

**Project Option 7 – Power generation using nuclear power**

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 cannot be a feasible baseline alternative to the project activity.

**Project Option 8 – Power generation using diesel/naphtha**

Power generation using liquid fossil fuel, e.g., diesel, fuel oil, naphtha etc. has not been found to be a plausible baseline alternative considering the location of the project and the higher cost of fuel. 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) /36/. 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.

Considering above mentioned constraints with respect to delivery of output & services and fuels used, this alternative is not considered further for arriving at the baseline scenario.

**Project Option 9 – Power generation using natural gas as fuel and open cycle technology**

The turbine's energy conversion efficiency typically remains low (@35%-42%[*]) when utilized as an Open (simple) cycle. The efficiency has been verified from the literature available on public domain (http://www.etsap.org/E-techDS/PDF/E02-gas_fired_power-GS-AD-gct.pdf Page 4). This very low efficiency makes open cycle gas turbine based power generation less attractive as compared to a combined cycle gas turbine based power generation. Consequently, this option is not a plausible baseline scenario and has not been discussed any further in the PDD.

From the above assessment we may conclude that the project activity has three other project options available

Project Option 2 – Power generation using Coal (fossil fuel) through sub-critical technology

Project Option 3 – Power generation using Coal (fossil fuel) through super-critical technology

Project Option 4 – Project activity not undertaken as CDM project activity.

**Step 2: Identification of the economically most attractive baseline scenario alternative**

As required by the applied methodology, detailed financial analysis of the identified feasible alternatives has been carried out using the same power tariff. The methodology prescribes to use investment analysis to identify the economically most attractive baseline scenario alternative. The project IRR (%) of the alternatives are calculated and used as the financial

[*] http://www.etsap.org/E-techDS/PDF/E02-gas_fired_power-GS-AD-gct.pdf Page 4

indicators for comparison in the investment analysis. DNV has assessed the financial analysis in the following manner:

**Input parameters**

| Assumptions | Gas based Power Plant | Assessment | Coal based Power Plant | Assessment |
|---|---|---|---|---|
| Project costs of alternatives. | INR 23,588 million | Cost of the project has been sourced from the Detailed project report (DPR) dated October 2005, and the same has been cross checked with the 23rd Meeting of Board of Directors on 18.12.2008, where the revised estimate of the project cost was indicated to be 342,90 million INR. Hence, the DPR cost was deemed conservative for the analysis of financial calculations | Sub critical INR 40,000 million and Super critical INR 45,300 million. | **Cost of Subcritical coal based power plant** has been sourced from the Report of the Expert Committee on Fuels for Power Generation Appendix I /32/. The same is cross checked with registered CDM project (Regn. No.4334 http://cdm.unfccc.int/Projects/DB/SIRIM1294135064.04/view) which indicates that the cost of sub critical at 40 INR Million/MW. In the project case it is taken as 40 INR Million/MW hence stands justified for comparison of IRR.<br><br>**Cost of Supercritical coal based power plan** has been sourced from the Report of the Expert Committee on Fuels for Power Generation Appendix I /32/. The same is crosschecked with another registered |

| | | | | |
|---|---|---|---|---|
| | | | | CDM project (Regn. No.2915 http://cdm.unfccc.int/Projects/DB/BVQI1250060108.72/view) which indicates that the cost of super critical is 45.3 INR million/MW). In the analysis the same has been considered and hence accepted. |
| Heat Rate | 1,850 kcal/kWh | This has been validated from the DPR /5/ and cross checked from the technical specification provided with Notification of award of turnkey EPC contract /**6**/. As provided in the section B.5 of the PDD the DPR was prepared in October 2005 and the board decision for implementing the project activity considering the CDM benefits taken on 06 Feb 2006, hence it was available at the time of the decision making. Further as elaborated in page 18 of the validation report the heat rate has been cross checked with the CERC regulation dated 26th March 2004 which provides the value at 1,850 kCal/kWh. | 2,450 kcal/ kWh for sub critical and<br>2,403 kcal/ kWh for Super critical | The Heat rate of Sub critical has been sourced from the CERC order dated 26th March 2004 which is published by the CERC, a Government of India organization /31/. The values were cross checked with the latest CERC order dated 4th November, 2008 and the values were found to tally. http://cercind.gov.in/October08/Report-CERC-norms-CEA-Final-04-11-08.pdf. This is in line with the VVM version 01.2 para 111. |
| Calorific Value | 9,100 kcal/s $m^3$ | This value has been sourced from the DPR dated October 2005 /5/, and has been validated / crosschecked from the Gas Sale & Purchase Agreement /**11**/ which | 5,400 kcal/kg | Calorific value of coal has been sourced from CEA expert committee report dated Feb 2004 /32/. The value was cross checked |

| | | | | |
|---|---|---|---|---|
| | | was signed after the decision making in 06/02/2006. | | with another registered CDM project (Regn. No.2915), which uses the same value and source. |
| Fuel price | 2.5 USD/MM BTU | This value has been sourced from the DPR dated October 2005 /5/, and has been validated / crosschecked from the Gas Sale & Purchase Agreement /**11**/ which was signed after the decision making in 06/02/2006. | INR 538 per tonne | Report of the Expert Committee on Fuels for Power Generation /32/ |
| Capacity of plant | 726.6 MW | This has been validated from the DPR /5/ and cross checked from the technical specification provided with Notification of award of turnkey EPC contract /**6**/ | 1000 MW | This has been assumed in accordance to the assumptions in the Report of the Expert Committee on Fuels for Power Generation /32/ |
| O&M cost | 0.608 Million INR per MW with 4% escalation per year. | This has been validated from the DPR /5/.which is in accordance with the CERC Tariff Order dated 26 March 2004 /**31**/ | INR 1.232 million INR per MW with 4.0% escalation per year | This has been validated from the CERC Tariff Order dated 26 March 2004 /31/ which is published by the CERC, a Government of India organization |
| Interest on INR loans | 9% pa | This has been validated from the DPR. | 9% pa | This is taken same as the project activity. |
| Depreciation : The rate of depreciation for gas based project has been taken from the DPR available at the time of investment decision and for the coal based project has been taken from the appendix II of the CERC order dated 26th March 2004. Hence different rates were applied for coal and gas based projects. | | | | |
| Plant & Machinery | 15% pa | As per IT Act (referred in DPR) | 3.60% pa | http://www.cercind.gov.in/070104/appendix_2.doc |
| Civil Works | 10% pa | | | |

| | | | | |
|---|---|---|---|---|
| Auxiliary consumption | 26.6 MW | Auxiliary consumption of the project plant has been taken from the Detailed Project Report (DPR) dated October 2005 which was available at the time of the investment decision. Auxiliary consumption taken for the project is 26 MW (3.68%) as per the technical specification sheet the same is cross checked with the CERC order dated 4th November 2008 and found to be 3%. http://cercind.gov.in/October08/Report-CERC-norms-CEA-Final-04-11-08.pdf It is seen that considering 3% instead of 3.68% does not affect the baseline determination. | 9% % | Auxiliary consumption of the coal power plant has been taken from Tariff Order dated 26 March 2004 (9%) the same is cross checked with the CERC order dated 4th November 2008 and found to in between 7.5%-9% and hence found comparable. http://cercind.gov.in/October08/Report-CERC-norms-CEA-Final-04-11-08.pdf / |
| Plant Load factor | 80 % | Technical Specifications. This is also confirmed from the letter from the Power Finance Corporation of India /**21**/ that this value has been submitted to them for loan sanction purpose. | 80 % | CERC Tariff Order dated 26 March 2004 |
| Levellised Tariff, INR/kWh | 2.02 | The project sells power to more than one state hence the tariff for the same is determined in accordance with applicable CERC regulations available at the time of investment decision. The requirement of | 1.44 for Sub Critical plant and 1.55 for super-critical power | As per CERC Tariff Order of 26/03/2004, the tariff is determined on cost plus basis, wherein the cost includes O&M cost, interest on term loan, |

| | | | | |
|---|---|---|---|---|
| | | adherence to CERC is stated in the PPA for the project. As per CERC Tariff Order of 26/03/2004, the tariff is determined on cost plus basis, wherein the cost includes O&M cost, interest on term loan, working capital, depreciation, income tax and return on equity Tariff has been computed by incorporating all the above costs. The details of tariff estimation forms part of the worksheet. The application of the same tariff is considered appropriate as at the time of the preparation of DPR (October 2005) and the board decision for implementing the project activity considering CDM benefits (06-Feb-06) it was envisaged that 100% of the electricity generated will be sold as per the levellised tariff norms prescribed by CERC. However at a later stage OTPC has signed PPA for sale of its generated electrical power (86.5%) to the North Eastern states viz. Assam, Tripura, Manipur, Meghalaya, Nagaland, Arunachal Pradesh, Mizoram that are connected to the NEWNE grid. The plant is yet to start its | plant. | working capital, depreciation, income tax and return on equity Tariff has been computed by incorporating all the above costs. The details of tariff estimation forms part of the worksheet. |

| | | | | |
|---|---|---|---|---|
| | | commercial operations and there is no provision (no PPA has been signed yet) through which 13.5 % of electricity generation can be sold to any entity in the country. Further there is no provision of selling power through short term open access (STOA) since long term open access (LTOA) customers will be given preference. Moreover there is no provision of evacuation beyond 200 MW at the peak and 150 MW at off leak due to the constraints in the existing transmission network at Pallatana (PSOCL letter dated 17/10/2012) hence there is a major uncertainty for selling the power through STOA and OTPC can sell the power to only North eastern states based on CERC regulations. | | |

DNV has assessed and found that the calculation methodology is justified. The IRR calculation revealed the following IRRs:

For gas based power plant 9.85%
For coal based sub-critical plant 10.92%
For coal based super critical plant 10.87%

The applied methodology requires that a sensitivity analysis shall be performed for all alternatives, to confirm that the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions (e.g. fuel prices and the load factor). The investment analysis provides a valid argument in selecting the baseline scenario only if it consistently supports (for a realistic range of assumptions) the conclusion that the pre-selected baseline scenario is likely to remain the most economically and/or financially attractive. In this line, DNV has verified and found that with – 10% to +10% variation in fuel price, PLF,

project cost and heat rate, the IRR for the subcritical based power plant remains the highest. The sensitivity calculations are presented in the respective excell worksheets /**4**/ and DNV found the calculations to be correct.

From the above analysis it is found that the coal based sub-critical power plant is the most economical option and hence selected as the baseline option. This satisfies the methodological requirement which demands that If sensitivity analysis confirms the result, then select the most economically attractive alternative as the most plausible baseline scenario.

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

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

DNV confirms that all the assumptions and data used for the baseline identification are justified appropriately, supported by evidence in the PDD and hence deemed reasonable as per VVM v1.2 paragraphs 87 ( C ).

## 4.6 Additionality

### 4.6.1 Evidence for prior CDM consideration and continuous actions to secure CDM status

Start Date of project activity:

Start date of the project activity has been defined to be 23 June 2008 /6/, the date of notification of "Award of Turnkey EPC Contract to Bharat Heavy Electricals Limited". DNV considers that selection of start date of the project activity is justified as it is the earliest date of commitment for expenditure for implementation of the project activity.

Prior consideration of CDM:

The minutes of meeting of the Board of Directors of OTPC dated 06/02/2006 /**9**/ indicates that the benefits of the CDM were considered. Further DNV has verified the letter from IL&FS (a partner in the joint venture company of OTPC) dated 13 October 2005 /**10**/ and found that CDM revenue was considered as a means to improve the project IRR as indicated in the DPR and thus the financial viability of the project activity. Thus DNV considers that CDM revenue was part of the agenda for taking decision for implementation of the project activity.

The "Guidance on the demonstration and assessment of prior consideration of the CDM, version 4 adopted at EB62 Annex 13" /26/ in Para 6(a) states that "*The project participant must indicate awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project. Evidence to support this would include, inter alia, minutes and/or notes related to the consideration of the decision by the Board of Directors, or equivalent, of the project participant, to undertake the project as a CDM project activity.*"

Thus DNV considers that the project activity satisfies the requirements of prior consideration of CDM as stipulated by the CDM-EB.

Efforts to secure CDM status

DNV was able to verify by reviewing relevant evidence that the following events occurred between the starting date and commencement of validation as efforts to secure CDM status:

| Event | Date | Assessment |
|---|---|---|
| Notice of Award to BHEL (NoA) | 23-Jun-08 (start date) | This has been validated from the OTPC Letter Ref. No. OTPC/EPC/GEN/2008 /6/ |
| Resolution for changes in Project Boundary (project to not include transmission component) | 23-Jun-08 | This has been validated from the minutes of 21st Board Meeting held on 23/06/2008 /**9**/ |
| Execution of Supply and Services Contract between OTPC and BHEL | 11-Aug-08 | This has been validated from the contract Ref. No. OTPC/EPC/GEN/002 /6/ |
| Signing of Gas sale and Purchase agreement with ONGC | 29-Sep-08 | This has been validated from the agreement Ref. No. M479685 dated 29/09/2008 /**11**/ |
| Amendment of Engagement with CDM consultant | 9-Jun-09 | This has been validated from the amendment Letter dated 09.06.2009 with CDM consultant /**12**/ |
| PDD published for Global Stakeholder Consultation Process | 28 Apr 10 - 27 May 10 | http://cdm.unfccc.int/Projects/Validation/DB/1PI7WNZZJO04NEOQ8N0VRKFR1KMN79/view.html |
| Receipt of revised Host Country Approval from National CDM Authority (MoEF) | 12-Jul-10 | This has been validated from the revised HCA No. 4/2/2007-CCC dated 12/07/2010 /23/ |

It is further observed that there are no gaps of more than two years between two consecutive events demonstrating efforts to secure CDM status.

Thus, in accordance to the "Guidance on the demonstration and assessment of prior consideration of the CDM, version 4 adopted at EB62 Annex 13" /**26**/, It is DNV's opinion that continuing and real actions were taken to secure CDM status for the project activity.

### 4.6.2 Identification of alternatives to the project activity

This has been discussed in the baseline determination section as required by the methodology.

DNV considers the listed alternatives to be credible and complete.

### 4.6.3 Investment analysis – Step 1 of the methodology

**Choice of approach**

The methodology demands "Demonstrate that that the proposed CDM project activity is unlikely to be financially attractive by applying Sub-steps 2b (Option III: Apply benchmark analysis), Sub-step 2c (Calculation and comparison of financial indicators), and 2d (Sensitivity Analysis) of the latest version of the "Tool for demonstration assessment and of additionality" /29/ agreed by the CDM Executive Board."

Hence the investment analysis has been carried out by benchmark analysis.

**Benchmark selection**

Weighted Average Cost of Capital (WACC) has been selected for determination of the project-IRR (after tax) benchmark. As per the "Guidelines on the assessment of investment analysis, version 05" /27/, weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR and hence DNV considers that the project proponent's benchmark selection (WACC) is justified.

In order to determine the benchmark, the reference companies selected are leading power sector companies in India and contribute to majority of power supply in the country. The power sector in India is dominated by the selected companies and thus selection of power sector companies for WACC determination is justified.

BSE 500 index was evolved in 9 August 1999 because the rapid growth of the market necessitated compilation of a new broad-based index series reflecting the market trends in a more effective manner and providing a better representation of the increased equity stocks, market capitalization as also to the new industry groups. Thus selection of BSE 500 index for determination of market return is also justified as this comprises of 500 most widely traded companies with large market capitalization and hence is an accurate representation of overall market return.

A five year time period, prior to decision making for the project activity, has been chosen to determine the beta values as well as the market return. In the Crisil Advisory Services report on "Cost of Capital for Central Sector Utilities", it is suggested that the cost of capital formulation should remain applicable for a time period of 5 years to reduce the uncertainty to investors. Hence DNV found 5 years period justified.

The project proponent has carried out the WACC calculations by using the asset beta of the companies. Company wise equity beta values have been obtained from Bloomberg. Subsequently these have been unlevered to determine asset beta by using the asset, debt and tax components of the respective companies using the following formula:

$\beta_a = \beta_e / \{1 + (1-T) * (D/E)$

Where, $\beta_a$ = Asset beta of the company

$\beta_e$ = Equity beta of the company

T = Marginal tax rate of the company

D/E is the Debt-equity ratio of the company

The debt:equity ratio (D/E) has been determined from the total loan amount (secured + unsecured loans) and the total sources of fund (share capital + reserve & surplus) for the respective companies. DNV considers that this method is correct to determine the D/E ratio. The input values have been obtained from the annual reports of the respective companies, web links have been clearly depicted in the excel worksheet for benchmark calculations. DNV checked the input values from the respective annual reports and found correct.

Marginal tax rate of the company and debt-equity ratio values have been obtained from the annual reports of respective companies and found to be correct. These have been clearly depicted in the Excel worksheet for benchmark calculations.

Risk free rate of return (6.11%) has been obtained from the database of the Reserve Bank of India Annual Report 2005-06, Table 7.5 /**36**/. The interest has been considered to be 10.50%, the prime lending rate as obtained from the Reserve bank of India database.

The average asset beta thus found to be 0.7071 and the benchmark for the project-IRR has been found to be 11.72%.

Thus DNV considers that the benchmark determination for investment analysis is appropriate and justified at the time of taking investment decision and in line with the VVM version 01.2 para 114 (b). The benchmark calculations as provided in the excel worksheet /3/ have been verified to be correct.

**Input parameters**

This has been discussed in the baseline determination section.

**Calculation and conclusion**

This has been discussed in the baseline determination section. The project IRR is found to be 9.85%.

**Sensitivity analysis**

A sensitivity analysis has been carried out for the major parameters PLF, capital cost, O7M cost and fuel cost which contribute to more than 20% of revenues or costs to check the robustness of the financial analysis. The tariff structure is determined as per the CERC guidelines and hence a function of all the above mentioned parameter. So tariff is not taken as a parameter for sensitivity analysis. The level of variation assumed for the sensitivity analysis has been suitably justified with relevant documents pertaining to the presented analysis and has been verified by DNV, such as:

- **Plant load factor (PLF):** It has been noted that with an increase of 363% in the PLF, the project IRR reaches the benchmark of 11.72%, which is not possible in any case as the maximum PLF could be 100%. Hence increase in PLF by 363% over the lifetime is deemed unlikely. It is therefore deemed unlikely that the annual generation/plant load factor would increase to the level required to cross the benchmark.
- **Capital cost:** The capital cost assumed for the financial analysis was based on the DPR. The benchmark will be reached if there is a decrease of 90%. which is never a realistic scenario.
- **Operation and maintenance (O&M) cost**: DNV has checked and found that the project IRR for the project activity reaches the benchmark by increase of O&M cost by 3870%. This is because the tariff is a function of O&M cost. This increase is not realistic and hence it is DNV's opinion that this scenario is highly unlikely.
- **Fuel cost:** DNV has checked and found that the project IRR for the project activity reaches the benchmark by increase of fuel cost by 363%. This is because the tariff is a function of fuel cost. This increase is not realistic and hence it is DNV's opinion that this scenario is highly unlikely

The sensitivity analysis shows that even with likely variations of the key input parameters, the post-tax project IRR of the proposed project is lower than the benchmark. In conclusion, the assessment of the arguments presented is deemed to sufficiently demonstrate that the project is not financially attractive.

### 4.6.4 Barrier analysis

This is not required by the applied methodology.

### 4.6.5 Common practice analysis – Step 2 of the methodology

The common practice analysis has been demonstrated according to the requirements of "Tool for the demonstration and assessment of additionality version 6". In doing so, applicable output range is selected to be +/- 50% of the design output or capacity of the proposed project activity. Therefore for the proposed project activity applicable output range is 363.3 MW to 1089.9 MW.

The above mentioned tool recommends identification of all plants in the applicable geographical area that delivers the same output or capacity, within the applicable output range calculated above as the proposed project activity and have started commercial operation before the start date of the project. Hence, all plants in the applicable geographical area (India) that deliver the same output or capacity, within the applicable output range (363.3 MW to 1089.9 MW ) calculated , as the proposed project activity and have started commercial operation before the start date of the project (23/06/2008).

According to the Tool for the demonstration and assessment of additionality version 6, registered CDM projects are not to be included in this step. None of the projects mentioned in the PDD is registered CDM project as on the start date of the project. Hence, $N_{all}$= 89.

The additionality tool recommends identification of plants those apply technologies different from that the technology applied in the proposed project activity.

According to additionality tool, different technologies are defined as are technologies that deliver the same output and differ by at least one of the following

- Energy source/fuel
- Feed stock;
- Size of installation (power capacity):
  - Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
  - Small (as defined in paragraph 28 of Decision 1/CMP.2);
  - Large;
- Investment climate in the date of the investment decision, inter alia:
  - Access to technology;
  - Subsidies or other financial flows;
  - Promotional policies;
  - Legal regulations;
- Other features, inter alia:
  - Unit cost of output (unit costs are considered different if they differ by at least 20 %);

For the plants identified in the PDD, 45 plants are coal based, 26 plants are hydro, 10 are gas based, 5 are nuclear plants, 2 plants are lignite based, and one plant is oil based. As the proposed project activity is gas based plant, hence, on the basis of Energy source / fuel all plants excluding 10 gas based have been classified as based on different technology.

For evaluating the gas based plants on the basis of Investment climate in the date of the investment decision, inter alia:

- Access to technology;

- Subsidies or other financial flows;
- Promotional policies;
- Legal regulations;

It is to be noted that the Electricity Act came into effect on 10 June 2003 and this act has introduced a uniform regulation for determination of tariff for generation & sale of power. Thus the projects that got commissioned before the introduction of the Electricity Act 2003 are considered to have a different investment climate, and considered under different technology. Thus all identified gas based plants excluding VEMAGIRI CCCP (CDM registered) those has been commissioned before 10 June 2003, have reasonably classified under different technology as per the additionality tool.

Hence, $N_{diff}$ = 88 (89- 1)

Thus the factor F is calculated as 1- ($N_{diff}$/ $N_{all}$) and for the proposed project activity,

F= 1- (88/89) = 0.011.

According to the additionality tool, the proposed project activity is a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}$-$Nd_{iff}$ is greater than 3.

As evaluated before for the proposed activity within India (applicable geographic area) F= 0.011 and $N_{all}$-$Nd_{iff}$ = 1, hence it can be observed that proposed project activity is not a common practice.

4.6.6 Impact of CDM registration

The registration of the project activity The IRR computations along with its sensitivity analysis demonstrated in Step 1 clearly show that the 'project activity is financially nonviable' even with reasonable variations in the critical assumptions. The impact of CDM registration is determined with respect to possible realistic future development in the power sector. The legal framework governing the sector is Electricity Act-2003. As per the act the bulk purchase of power across the country should be done through competitive bidding process. This will have serious implication on financial parameters of all the NG based power plants in India. The principal aspects of concerns are described below.

As per this act, going forward, bulk purchase of power by State Electricity Board's (SEB) should be routed through tendering process with selection of power supplier offering lowest rate on competitive basis. Since this act supports the power generation with lower tariff, the power generated by the cheaper but carbon emissive fossil fuels like coal and lignite will be purchased by the SEB's and individual bulk consumer with preference. As a result, the power generated using cleaner fuels like natural gas will get the second priority from the buyers as its generation cost is higher than the generation cost with conventional fuels like coal and lignite. Without CDM benefit this cost has to be borne by the customer. CDM fund will partially absorb this cost and will help to make the power tariff comparatively competitive.

The present direction of power sector reforms indicates further opening up of the power sector and a gradual shift towards more competitive environment. So in future to be in the competition the developers of NG based power plant may face serious pricing pressure. In this futuristic scenario, where the promoter may be forced to offer lower tariff than the present agreed prices, CDM funds will help to reduce the gap between the tariff offered by the proposed project activity and the other power generators/suppliers which generate power with cheaper but high carbon emissive fuels like coal and lignite. This justifies the need of CDM

funds for the project activity. The project activity meets the requirements of all the three steps as described in the approved methodology and thereby is additional and not a business as usual case.

The IRR of the project activity on considering CDM improves to 15.07%.

In conclusion, it is DNV's opinion that it has been adequately demonstrated that the project activity does not represent a common practice and thus the emission reductions achieved by the project are additional to any would happen in absence of the project.

## 4.7 Monitoring

The project applies the approved monitoring methodology AM0029, version 3 /25/.

The monitoring plan will give opportunity for a real measurement of achieved emission reductions. The project monitoring plan is in compliance with the monitoring methodology AM0029 (version 3).

The Ministry of Environment and Forest (MoEF), the DNA of India, has defined that 2% of CER revenues would be incurred as expenditure for sustainable development activities. The project proponent has included an action plan in the PDD defining proposed mode of expenditure. The expenditure will be provided in the annual report of the company for verification purposes.

It is DNV's opinion, OTPC is able to implement the monitoring plan.

### 4.7.1 Parameters determined ex-ante

1. Oxidation factor of natural gas used to estimate project emissions: This has been obtained from the CEA CO2 Baseline Database Version 5.0 /33/. The CEA database is the official database from the Ministry of Power Government of India and hence the applied value is found to be correct.
2. Emission factor of natural gas used to estimate project emissions: The national value of 49.4 $tCO_2/TJ$ provided in the CEA $CO_2$ Baseline database Version 5.0 has been used conservatively. This is compared to the gas analysis report of Tripura asset installations which indicates a value of 58.51 $tCO_2/TJ$ /11/.
3. Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution: The default value is used in absence of published database and this is justified.
4. Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in electricity generation in the project plant: This value has been calculated based on consumption of coal, lignite, natural gas and naphtha in Build Margin Plants using the fugitive emission factors provided in table 2 of AM0029 Version 3. The calculation in PDD has been found to be correct (0.0006 $tCH_4/MWh$).
5. Global warming potential of methane: IPCC default value of 21 is correctly considered.

### 4.7.2 Parameters monitored ex-post

1. Net electricity exported to grid by the project activity: This will be monitored by energy meters of 0.2 accuracy class. The net electricity exported to the grid will be

determined from the joint meter readings. The estimated generation of 4 904 627 MWh has been found to be correct /5/.

2. Annual quantity of fuel consumed in project activity: Gas flow meter will be used for monitoring of fuel consumed. The estimated gas quantity of 966 175 thousand SCM (TSCM) has been found to be correct /5/.
3. Net calorific value of fuel: This will be monitored at the plant level.
4. $CO_2$ emission coefficient of natural gas: This will be calculated based on IPCC default data and actual calorific value of natural gas used in project activity.
5. Baseline $CO_2$ emission factor: As per the methodology the baseline emission factor has chosen as the minimum of the following three:
    a. Option 1: The build margin, calculated according to ACM0002; and
    b. Option 2: The combined margin, calculated according to ACM0002, using a 50/50 OM/BM weight.
    c. Option 3: The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario" above, and calculated as follows:

    The CEA calculates Combined Margin and Build Margin Emission Factor as per 'Tool to calculate the emission factor for an electricity system", version 02 for each year. It also provides the data to calculate emission factor for power generation from coal using sub-critical technology. The applied method is justified and in compliance to the methodology requirements.
6. Energy efficiency of power generation in the baseline scenario from coal using sub-critical technology: This will be obtained from the CEA $CO_2$ Baseline Database or other third party publicly available documentation.
7. Emission factor of coal: The national value obtained from the CEA $CO_2$ baseline database will be used. However, as a conservative measure, the lower of national value or IPCC default value would be used for determination of baseline emission factor.

All data monitored will be archived electronically and will be kept at least for 2 years after the crediting period.

### 4.7.3 Management system and quality assurance

OTPC, being an organisation of the Government of India, has established procedures for management of the power plant. It is DNV's opinion that, the quality management system of OTPC will be placed and monitoring will be managed as per OTPC's internal procedure.

## 4.8 Algorithms and/or formulae used to determine emission reductions

The emission reductions due to implementation of the project activity will be determined in line with the requirements of the applied monitoring methodology AM0029 version 3.

**Project emissions:**

The project activity is on-site combustion of natural gas to generate electricity and the CO2 emissions from electricity generation (PEy) are calculated as follows:

$$PE_y = \sum FC_{f,y} * COEF_{f,y} \quad (1)$$

Where:

$FC_{f,y}$ = Total volume of natural gas or other fuel 'f' combusted in the project plant or other start-up fuel ($m^3$ or similar) in year(s) 'y'
$COEF_{f,y}$ = $CO_2$ emission coefficient ($tCO_2/m^3$ or similar) in year(s) for each fuel and is obtained as:

$$COEF_{f,y} = \sum NCV_y * EF_{CO2,f,y} * OXID_f \quad (2)$$

Where:

$NCV_y$ = Net calorific value (energy content) per volume unit of natural gas in year 'y' ($GJ/m^3$) as determined from the fuel supplier, wherever possible, otherwise from local or national data;
$EF_{CO2,f,y}$ = $CO_2$ emission factor per unit of energy of natural gas in year 'y' ($tCO_2/GJ$) as determined from the fuel supplier, wherever possible, otherwise from local or national data;
$OXID_f$ = Oxidation factor of natural gas

**Baseline emissions:**

Baseline emissions are calculated by multiplying the electricity generated in the project plant ($EG_{PJ,y}$) with a baseline $CO_2$ emission factor ($EF_{BL,CO2,y}$), as follows:

$$BE_y = EG_{PJ,y} * EF_{BL,CO2,y} \quad (3)$$

As per the methodology the Baseline emission factor is chosen as the minimum of the following three

Option 1: The build margin, calculated according to ACM0002; and

Option 2: The combined margin, calculated according to ACM0002, using a 50/50 OM/BM weight.

Option 3: The emission factor of the technology (and fuel) identified as the most likely baseline scenario under "Identification of the baseline scenario" above, and calculated as follows:

$$EF_{BL,CO2}\,(tCO_2/MWh) = \frac{COEF_{BL}}{\eta_{BL}} * 3.6\,GJ/MWh \quad (4)$$

Thus

BEF = lowest of (BM, CM, $EF_{BL,CO2}\,(tCO_2/MWh)$) (5)

The baseline emissions are calculated as per the assumptions (efficiency of sub-critical technology of 33%) provided in the CEA database version 5 (November 2009) which was available at the time of PDD preparation, whereas the baseline identification (efficiency of the technology as 35.1%) is done based on the assumptions (CERC Tariff Order dated 26 March 2004) available at the time of investment decision. DNV observes that this does not have any effect on the estimated emission reductions as the emission factor is to be calculated by the three options as per the methodology and the option of the Build Margin is the lowest in either cases. The efficiency of the prevalent technology is used in the option 3.

The data the calculation of the baseline emission factor will be obtained from the baseline calculations published by the CEA, *$CO_2$ Baseline Database for the Indian Power Sector – Version 5*, which uses "Tool to calculate the emission factor for an electricity system" Version 02. The relevant parts of the calculations are referenced in the methodology outline below, with detailed data provided in Annex 3.

***Step 1: Identify the relevant electricity systems***

For the purpose of determining the emission reductions achieved by the project the "Tool to calculate the emission factor for an electricity systems" (Version 2) states that the "*project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints*". On this basis the Central Electricity Authority, *$CO_2$ Baseline Database for the Indian Power Sector - Version 5.0* defines the project electricity systems within India in two regional grids. This is justified "*as electricity continues to be produced and consumed largely within the same region, as is evidenced by the relatively small volume of net transfers between the regions, and consequently it is appropriate to assume that the impacts of CDM project will be confined to the regional grid in which it is located*". The project as per the CEA's grid definitions is within the NEWNE regional grid as hence justified.

***Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)***

The methodology allows the project participant to choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

The project participant has chosen Option I for the calculation of the operating and build margin emission factor.

***Step 3: Select a method to determine the operating margin (OM)***

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

For the proposed project activity, simple OM method (option a) has been chosen to calculate the operating margin emission factor ($EF_{grid, OM, y}$). However, the simple OM method can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. The low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

***Step 4: Calculate the operating margin emission factor according to the selected method***

The OM value will be obtained from the CEA database which is justified as it is published on behalf of the Ministry of Power, Government of India and follows the tool to calculate the emission factor for an electricity systems and hence accepted. The three years OM value used in PDD has been obtained from the CEA database and found to be correct.

***Step 5: Identify the group of power units to be included in the build margin***

The sample group of power units *m* used to calculate the build margin consists of either:

a) The set of five power units that have been built most recently, or
b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project proponents should use the set of power units that comprises the larger annual generation.

Since in India, the installed capacity and corresponding annual generation from power plants is quite high, the sample group containing set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently comprise the sample group with the larger annual generation. Thus the sample group *m* consisting of option (b) is used for the estimation of build margin.

In terms of vintage of data, project proponents can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The project proponent opted for option 2.

***Step 6: Calculate the build margin emission factor***

The build margin emissions factor is the generation-weighted average emission factor ($tCO_2/MWh$) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,OM,simple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

| | | |
|---|---|---|
| $EF_{grid,\ BM,\ y}$ | = | Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| $EG_{m,y}$ | = | Net quantity of electricity generated and delivered to the grid by power unit *m* in year y (MWh) |
| $EF_{EL,\ m,\ y}$ | = | $CO_2$ emission factor of power unit *m* in year y ($tCO_2/MWh$) |
| m | = | Power units included in the build margin |
| Y | = | Most recent historical year for which power generation data is available |

Calculations for the Build Margin emission factor $EF_{gid,\ BM,\ y}$ is based on the most recent information available on the plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20 % of the system generation and that have been built most recently.

In India, the Central Electricity Authority (CEA) has estimated the baseline emission factor for the power sector. ***Step 7: Calculate the combined margin emissions factor***

The combined margin emissions factor is calculated as follows:

$$EF_{CO_2} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

| | | |
|---|---|---|
| $EF_{grid,BM,y}$ | = | Build margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| $EF_{grid,OM,y}$ | = | Operating margin $CO_2$ emission factor in year y ($tCO_2/MWh$) |
| $w_{OM}$ | = | Weighting of operating margin emissions factor (%) |
| $w_{BM}$ | = | Weighting of build margin emissions factor (%) |

The BM factor will be obtained from the CEA database and is justified, as this is the most authentic information available in the public domain for Indian electricity system.

Since,

BEF = lowest of (BM, CM, $EF_{BL,CO2}\ (tCO_2 / MWh)$) (5)

Emission factor as per Option 1: Build margin calculated according to ACM0002

Build Margin for NEWNE Grid ($EF_{CO2}$) = 0.6752 $tCO_2e$ / MWh

Emission factor as per Option 2: Combined margin calculated according to ACM0002

Combined Margin for NEWNE Grid ($EF_{CO2}$) = 0.8401 $tCO_2e$ / MWh

Emission factor as per Option 3: Baseline Technology - Coal based power plant (sub-critical)

Emission factor of the Baseline Technology = 0.9943 $tCO_2e$ / MWh

Baseline Emission factor ($EF_{BL,CO2,y}$) = lowest of (BM, CM, $EF_{BL,CO2}\ (tCO_2 / MWh)$)

Baseline Emission factor ($EF_{BL,CO2,y}$) = Min (0.6752, 0.8401, 0.9943) = 0.6752 $tCO_2e$ / MWh

Thus the determination of baseline emission factor has been found to be correct.

**Leakage:**

As per the applied methodology, leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive $CH_4$ emissions and $CO_2$ emissions from associated fuel combustion and flaring. For the project activity, the following leakage emission sources have been considered.

Fugitive $CH_4$ emissions associated with fuel extraction, processing, liquefaction, transportation, regasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.

In case LNG is used in the project plant: the $CO_2$ emissions would be from fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression into a natural gas transmission or distribution system.

Thus, leakage emissions are calculated as:

$$LE_y = LE_{CH_4,y} + LE_{LNG,CO_2,y} \quad (4)$$

Where,

| | | |
|---|---|---|
| $LE_y$ | = | Leakage emissions during the year y in $tCO_2e$ |
| $LE_{CH4,y}$ | = | Leakage emissions due to fugitive upstream CH4 emissions in the year y in $tCO_2e$ |
| $LE_{LNG,CO2,y}$ | = | Leakage emissions due to fossil fuel combustion/electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in $tCO_2e$ |

There will be no LNG consumption in the project activity, and hence $LE_{LNG,CO2,y}$ will be zero.

Fugitive methane emissions

For the purpose of estimating fugitive $CH_4$ emissions, project participants should multiply the quantity of natural gas consumed by the project in year y with an emission factor for fugitive $CH_4$ emissions ($EF_{NG,upstream,CH4}$) from natural gas consumption and subtract the emissions occurring from fossil fuels used in the absence of the project activity, as follows:

$$LE_{CH4,y} = \left[FC_y * NCV_y * EF_{NG,upstream,CH4} - EG_{PJ,y} * EF_{BL,upstream,CH4}\right] * GWP_{CH4} \quad (5)$$

Where

| | | |
|---|---|---|
| $LE_{CH4,y}$ | = | Leakage emissions due to fugitive upstream CH4 emissions in the year y in t $CO_2e$ |
| $FC_y$ | = | Quantity of natural gas combusted in the project plant during the year y in $m^3$ |
| $NCV_{NG,y}$ | = | Average net calorific value of the natural gas combusted during the year y in $GJ/m^3$ |
| $EF_{NG,upstream,CH4}$ | = | Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution, and, in the case of LNG, liquefaction, transportation, re-gasification and compression into a transmission or distribution system, in $tCH_4$ per GJ fuel supplied to final consumers |
| $EG_{PJ,y}$ | = | Electricity generation in the project plant during the year in MWh |
| $EF_{BL,upstream,CH4}$ | = | Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in $tCH_4$ per MWh electricity generation in the project plant, as defined below |
| $GWP_{CH4}$ | = | Global warming potential of methane valid for the relevant commitment period |

The emission factor for upstream fugitive $CH_4$ emissions occurring in the absence of the project activity ($EF_{BL,\ upstream,\ CH4}$) has been calculated consistently with the baseline emission factor ($EF_{BL,CO2}$) used in before. The lowest baseline emission factor has been found to be the one calculated as per

build margin method, so the same calculation procedure has been adopted to calculate $EF_{BL,\ upstream,\ CH4}$. The same has been described below.

$$EF_{BL,upstream,CH4} = \frac{\sum_j FF_{j,k} * EF_{k,upstream,CH4}}{\sum_j EG_j} \quad (8)$$

Where:

$EF_{BL,upstream,CH4}$ = Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in t $CH_4$ per MWh electricity generation in the project plant

j = Plants included in the build margin

$FF_j$ = Quantity of fuel type k (a coal or oil type) combusted in power plant j included in the build margin

$EF_{k,upstream,CH4}$ = Emission factor for upstream fugitive methane emissions from production of the fuel type k (a coal or oil type) in t $CH_4$ per MJ fuel produced

$EG_j$ = Electricity generation in the plant j included in the build margin in MWh/a plant included in the operating margin

The default values used from the methodology in the project activity are as follows:

| Sl. No | Parameter | Default Value | Remarks |
|---|---|---|---|
| 1 | Emission factor for fugitive $CH_4$ upstream emissions for coal | 0.8 $tCH_4$/kt coal | Most of the coal production in India comes from open pit mines contributing over 81% of the total production. A number of large open pit mines of over 10 million tonnes per annum capacity are in operation. Underground mining currently accounts for around 19% of national output. (http://www.mbendi.co.za/indy/ming/coal/as/in/p0005.htm). Hence 0.8 $tCH_4$/kt coal value is used for surface mining |
| 2 | Emission factor for fugitive $CH_4$ upstream emissions for Oil | 4.1 $tCH_4$/PJ | As per the Table 2 of the methodology. This value includes for oil production, transport, refining and storage. |
| 3 | Emission factor for fugitive $CH_4$ upstream emissions for Natural Gas | 160 $tCH_4$/PJ | As per the Table 2 of the methodology |
| 4 | Oxidation factor of natural gas | 1.000 | CEA $CO_2$ Baseline Database Version 5.0 |

**Emission Reductions:**

To calculate the emission reductions the project participant shall apply the following equation:

$$ER_y = BE_y - PE_y - LE_y$$

Based on the calculations and results presented in the sections above the implementation of the project activity will result in an average *ex-ante* estimation of emission reduction conservatively calculated to be 1 612 506 tCO2e per year for the selected crediting period.

All assumptions and data used by the project participants are listed in the PDD and/or supporting documents, including their references and sources. All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD. All values used in the PDD are considered reasonable in the context of the proposed CDM project activity. The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions. All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in the PDD.

## 4.9 Environmental impacts

In order to obtain statutory consent to establish from the Ministry of Environment & Forest (MoEF), Government of India, the project proponent submitted Rapid Environmental Impact Assessment (REIA) /**18**/. The MoEF has approved the REIA and accordingly issued the consent to establish the power plant /**13**//**14**/.

The REIA identified potential environmental impacts due to the project activity. Summary of the same are depicted in the PDD. The consent to establish has recommended environmental management programmes (EMP) which are to be implemented by the project proponent as per recommendation. The MoEF will monitor implementation status of the EMPs.

## 4.10 Comments by local stakeholders

OTPC had conducted a stakeholder consultation meeting on 10 March 2010 /**17**/. The meeting was attended by the representatives of the stakeholders as identified in the PDD. DNV has confirmed the conducting of the meeting from the news published in the Tripura Observer and also in The Tripura Times on 11 March 2010 /**15**//**16**/. In both the news coverage, it is clearly mentioned that the project has been welcome by the attendees. DNV has also verified the minutes of the meeting /**17**/ and found that no adverse comment was received.

## 4.11 Comments by Parties, stakeholders and NGOs

5 The PDD, version 02 dated 23 Mar 2010, was made publicly available on the CDM website (http://cdm.unfccc.int/Projects/Validation/DB/1PI7WNZZJO04NEOQ8N0VRKFR1KMN79/view.html) and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 28 Apr 2010 to 27 May 2010.

No comment was received.

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# APPENDIX A

## CDM VALIDATION PROTOCOL

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

| Requirement | Reference | Conclusion |
|---|---|---|
| **About Parties** | | |
| 1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3. | Kyoto Protocol Art.12.2 | OK |
| 2. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC. | Kyoto Protocol Art.12.2. | OK |
| 3. The project shall have the written approval of voluntary participation from the designated national authority of each Party involved. | Kyoto Protocol<br>Art. 12.5a,<br>CDM Modalities and Procedures §40a | OK |
| 4. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof. | Kyoto Protocol Art. 12.2,<br>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,<br>CDM Modalities and Procedures<br>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 absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those | Kyoto Protocol Art. 12.5c,<br>CDM Modalities and Procedures §43 | OK |

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

## Table 2 Requirements checklist

| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
|---|---|---|---|---|---|
| **A General description of project activity** | | | | | |
| **A.1 Title of the project activity (VVM para 55-57)** | | | | | |
| A.1.1 Does section A.1 of the PDD include a clearly identifiable project title, version number of the PDD and date of the PDD? | /**1**/ | DR | ☒ Clearly identifiable title of the project activity<br>☒ Version number of the PDD is included<br>☒ Date of the PDD is included. | | OK |
| A.1.2 Is the PDD is in accordance with the applicable requirements for completing PDDs? | /**1**/ | DR | ☒ Yes<br>*If no, list where the PDD is not in accordance:* | | OK |
| **A.2 Description of the project activity (VVM para 58-64 and VVM para 135 and 136 (a) & (c) for small-scale project activities, as applicable)** | | | | | |
| A.2.1 How was the design of the project assessed? | /**1**/ | DR | *What type is the project?*<br>☐ Project in existing facility or utilizing existing equipment(s)<br>☒ Large scale project<br>☐ bundled small scale projects, each with emission reductions not exceeding 15 000 $tCO_2e$ per year<br>☐ individual small scale project activity with emission reductions not exceeding 15 000 $tCO_2e$ per year<br>☒ Greenfield project<br><br>*How was the design of the project assessed?*<br>☐ Physical site inspection<br>☒ Reviewing available designs and feasibility | | OK |

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

| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
|---|---|---|---|---|---|
| | | | studies<br>The project activity is yet to be implemented. Power generating equipment are yet to be received at the site. Hence visit to the actual project site was not deemed necessary. Review of documents was done in the corporate offices of OTPC in New Delhi. | | |
| A.2.2 If a greenfield project, describe the physical implementation of the project when the validation was commenced. | /**1**/ | DR | It's a green field project and the power generating equipment are yet to be received at the site due to logistic problems. The turbines have been dispatched from the manufacturers works (USA). Logistics were being planned in terms of transporters, building/strengthening of roads, route plans etc. Since the state location is in the North East part of India and the state of Tripura is bordered on three sides by Bangladesh, talks were in progress for the laying of a road through Bangladesh to facilitate faster and safer equipment movement to the site (mountainous region). | | OK |
| A.2.3 Is the description of the proposed CDM project activity as contained in the PDD sufficiently covers all relevant elements, is accurate and that it provides the reader with a clear understanding of the nature of the proposed CDM project activity? | /**1**/ | DR | Yes. The project activity involves installation of a natural gas based power plant. | | OK |
| A.2.4 Does the project activity involve alteration of existing installations? If so, have the differences between pre-project and post-project activity been clearly described in the PDD? | /**1**/ | DR | No, it's a Greenfield project. | | OK |
| A.2.5 Does the project design engineering reflect current | /**1**/ | DR | Yes, however, the project proponent is to | ~~CL 1~~ | OK |

| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
|---|---|---|---|---|---|
| good practices? | | | submit technical specifications of the power generating and monitoring equipment to the validator. | | |
| A.2.6 Would the technology result in a significantly better performance than any commonly used technologies in the host country? Is any transfer of technology from any Annex-I Party involved? | /**1**/ | DR | The technology being used is stated to be the most improved version. Technical specification sheets are to be provided. | ~~CL 1~~ | OK |
| **A.3 Participation requirements (VVM para 51-54, 125-127)** | | | | | |
| A.3.1 Do all participating Parties fulfil the participation requirements as follows: | /**1**/ | DR | | | OK |
| | India (host) | | | | |
| a) Party has ratified the Kyoto Protocol | ☒ Yes ☐ No | | | | |
| b) Party has designated a Designated National Authority | ☒ Yes ☐ No | | | | |
| c) The assigned amount has been determined | ☐ Yes ☒ No | | | | |
| A.3.2 Do the letters of approval meet the following requirements? | /**1**/ | DR | The project proponent is to provide copies of LoA issued by the DNA of India. | ~~CAR 1~~ | OK |
| | India (host) | | | ~~CAR 1~~ | OK |
| a) LoA confirms that Party has ratified the Kyoto Protocol | ☐ Yes ☐ No | | | | |
| b) LoA confirms that participation is voluntary | ☐ Yes ☐ No | | | | |
| c) The LoA confirms that the project contributes to the sustainable development of the host country? | ☐ Yes ☐ No | | | | |
| d) The LoA refers to the precise project activity title in the PDD | ☐ Yes ☐ No | | | | |
| e) The LoA is unconditional with respect to (a) to (d) above | ☐ Yes ☐ No | | | | |
| f) The LoA is issued by the respective Party's DNA | ☐ Yes ☐ No | | | | |
| g) The LoA was received directly by the DNA or the PP | ☐ DNA ☐ PP | | | | |
| h) In case of doubt regarding the authenticity of the letter of approval, describe how it was verified that the letter of | | | | | |

| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
|---|---|---|---|---|---|
| approval is authentic | | | | | |
| A.3.3 Have all private/public project participants been authorized by an involved Party? | /**1**/ | DR | The project proponent is to provide copies of LoA issued by the DNA of India. | ~~CAR 1~~ | OK |
| **A.4 Technical description of the project activity (VVM para 58-64)** | | | | | |
| A.4.1 Is the project's location clearly defined? | /**1**/ | DR | Yes. The power plant will be located in Pallatana in Tripura in India. The geographical co-ordinates of the physical location of the plant are 23º 29' 59.2" N latitude and 91º 26' 13.7" E longitude. | | OK |
| **A.5 Public funding of the project activity** | | | | | |
| A.5.1 In case public funding from Parties included in Annex I is used for the project activity, have these Parties provided an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of these Parties? | /**1**/ | DR | The project proponent is to provide the funding breakup for the project activity. | ~~CAR 2~~ | OK |
| **B Application of a baseline and monitoring methodology** | | | | | |
| **B.1 Methodology applied (VVM para 65-76 and VVM para 136 (b) for small-scale project activities, as applicable)** | | | | | |
| B.1.1 Does the project apply an approved methodology and the correct and valid version thereof? | /**1**/ | DR | Yes. The project activity applies approved methodology AM0029, "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas", version 3. The applied version was pertinent at the time of web hosting of the PDD. | | OK |
| B.1.2 If applicable, has any specific guidance provided by the CDM EB in respect to the applied methodology been | /1/ | DR | No such specific guidance has been | | OK |

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| considered? | | | recommended in the methodology. | | |
| **B.2 Applicability of methodology (and tools) (VVM para 65-76)**<br>*Insert a row for each applicability criteria of the applied methodology (and tools)* | | | | | |
| B.2.1 How was it validated that project complies with the following applicability criteria: *The project activity is the construction and operation of a new natural gas fired grid-connected electricity generation plant*? | /**1**/ | DR | The project activity is a green-field natural gas fired grid-connected electricity generation plant. This has been confirmed from the CEA database of gas based power plants in India. This was also verified from the DPR (part 1). | | OK |
| B.2.2 How was it validated that project complies with the following applicability criteria: *The geographical/physical boundaries of the baseline grid can be clearly identified and information pertaining to the grid and estimating baseline emissions is publicly available*? | /**1**/ | DR | The baseline grid is the NEWNE regional electricity grid and its boundary is clearly identified by the Ministry of Power of India, The emission reductions are based on the grid emission factor of the NEWNE grid, and the PPAs signed for supply of power to the North-East states of India which also form a part of the NEWNE grid of India. The information pertaining to this grid are publicly available through the database maintained by the Central Electricity Authority, Ministry of Power, Government of India. | | OK |
| B.2.3 How was it validated that project complies with the following applicability criteria: *Natural gas is sufficiently available in the region or country, e.g. future natural gas based power capacity additions, comparable in size to the project activity, are not constrained by the use of natural gas in the project activity*? | /**1**/ | DR | The project proponent has not adequately demonstrated availability of sufficient natural gas in Tripura through accounting of present and future projected production of natural gas vis-à-vis present and planned/projected | ~~CAR 3~~ | OK |

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| | | | demand of the same. | | |
| B.2.4 Is the selected baseline on of the baseline(s) described in the methodology and this hence confirms the applicability of the methodology? | /**1**/ | DR | Conclusion on applicability of the methodology will be arrived after satisfactory closure of CAR 3. | | |
| **B.3 Project boundary (VVM para 78-80)** | | | | | |
| B.3.1 What are the project's system boundaries (components and facilities used to mitigate GHGs)? Are they clearly defined and in accordance with the methodology? | /1/ | DR | The system boundary of the project activity encompasses the gas turbine & generator, waste heat recovery boiler & steam turbine and the NEWNE grid. | | OK |
| B.3.2 Which GHG sources are identified for the project? Does the identified boundary cover all possible sources linked to the project activity? Give reference to documents considered to arrive at this conclusion. | /**1**/ | DR | $CO_2$ is the only source of GH from the project activity and this is in accordance with the applied methodology. | | OK |
| B.3.3 Does the project involve other emissions sources not foreseen by the methodologies that may question the applicability of the methodology? Do these sources contribute with more than 1% of the estimated emission reductions of the project? | /**1**/ | DR | No, the project activity does not involve any such GHG sources. | | OK |
| **B.4 Baseline scenario determination (VVM para 81-88, 105-107)**<br>*Ensure that the evaluation of all alternatives provided in the PDD and required by the methodology and also possible alternatives/offshoots of alternatives are discussed. Check that all alternatives required to be considered by the methodology are included in the final PDD. If baseline alternatives required to be considered by the methodology are considered not applicable, please assess the justification for this.* | | | | | |
| B.4.1 Which baseline scenarios have been identified? Is the list of baseline scenarios complete? | /**1**/ | DR | The project proponent has identified three alternatives of a) electricity from the grid b) a | ~~CAR 4~~ | OK |

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| | | | coal fired power plant and c) project without CDM revenues. The unit cost of generation has been calculated for the two options.<br>The project proponent has not identified power generation using natural gas, but technologies other than the project activity, power generation technologies using energy sources other than natural gas, like hydro and import of electricity from connected grids, including the possibility of new interconnections.<br>The project proponent has not considered all similar power plants which are capable of delivering similar services (e.g. peak vs. base load power) and to 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 baseline alternatives.<br>In order to determine economically most attractive baseline alternatives, the project proponent is to calculate levelized cost for all realistic and credible baseline alternatives and carry out sensitivity analysis for all alternatives, to confirm that the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions as required by the applied methodology. | | |

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| B.4.2 How have the other baseline scenarios been eliminated in order to determine the baseline? | /**1**/ | DR | The project proponent is requested to provide appropriate explanation in the PDD for the alternatives eliminated from being plausible baseline scenario and submit documentation to support the exclusion of such scenario(s). | ~~CAR 4~~ | OK |
| B.4.3 What is the baseline scenario? | /**1**/ | DR | Refer B.4.1 & B.4.2. | ~~CAR 4~~ | OK |
| B.4.4 Is the determination of the baseline scenario in accordance with the guidance in the methodology? | /**1**/ | DR | Refer B.4.1 & B.4.2. | ~~CAR 4~~ | OK |
| B.4.5 Has the baseline scenario been determined using conservative assumptions where possible? | /**1**/ | DR | The project proponent is to provide the following evidences of<br>a) Technical specifications of the heat rate of different options<br>b) Gas sale purchase agreement<br>c) Loan application and approval note for the interest rate<br>d) Evidence for the project cost<br>e) Evidence for the debt-equity ratio of the project | ~~CL 2~~ | OK |
| B.4.6 Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations? | /**1**/ | DR | Refer B.4.1 & B.4.2. | ~~CAR 4~~ | OK |
| B.4.7 Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced? | /**1**/ | DR | Refer B.4.1 & B.4.2. | ~~CAR 4~~ | OK |
| B.4.8 Is the baseline determination adequately documented in the PDD?<br>• 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 | /**1**/ | DR | Refer B.4.1 & B.4.2. | ~~CAR 4~~ | OK |

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| referenced.<br>• All documentation is relevant as well as correctly quoted and interpreted.<br>• Assumptions and data can be deemed reasonable<br>• Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD.<br>• The methodology has been correctly applied to identify what would occurred in the absence of the proposed CDM project activity | | | | | |
| **B.5 Additionality determination (VVM para 94-121 and VVM para 137 for small-scale project activities, as applicable)** | | | | | |
| B.5.1 What approach/tool does the project use to assess additionality? Is this in line with the methodology? | /1/ | DR | As per the methodological requirements, benchmark investment analysis has been applied for demonstration of additionality of the project activity. | | OK |
| B.5.2 Have the regulatory requirements correctly been taken into account to evaluate the project activity and the alternatives? | /1/ | DR | Refer B.4.8. | ~~CAR 4~~ | OK |
| B.5.3 Is sufficient evidence provided to support the relevance of the arguments made? | /1/ | DR | Refer B.4.8. | ~~CAR 4~~ | OK |
| B.5.4 What is the project additionality mainly based on (Investment analysis or barrier analysis)? | /1/ | DR | The project additionality has been demonstrated on the benchmark investment analysis. | | OK |
| **Prior consideration of CDM (VVM para 98-103)** | | | | | |
| B.5.5 What is the evidence for serious consideration of CDM prior to the time of decision to proceed with the project activity? | /1/ | DR | The board note of 6 February 2006 was provided. However serious consideration of CDM was not evident from the board note. While the board note mentions CDM, and the | ~~CAR 5~~ | OK |

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| | | | appointment of consultants and that additional revenues can be generated through CDM, the decisiveness of the CDM revenues for the project to go ahead is not evident. The working note to the board on the project activity is to be provided. The project proponent is further requested to substantiate serious consideration of CDM prior to project implementation.<br>While the DPR (part 1 (technical)) has been evidenced, the part of the DPR on financial analysis is to be provided to the validator.<br>The letter from IL&FS (equity of 26%) in OPTC states that the project IRR is less than industry standards. This is to be substantiated with figures. | ~~CL 3~~ | |
| B.5.6 If the starting date is after 2 August 2008 and before the global stakeholder consultation, has the DNA and UNFCCC confirmed that the project participants have informed in writing of the project's intention to seek CDM status? | /1/ | DR | The start date of the project activity has been defined as 23 June 2008, the date of notification of Award of Turnkey EPC Contract to Bharat Heavy Electricals Limited. | | OK |
| **Continuous efforts to secure CDM status** (only to be completed if starting date is before 2 August 2008) | | | | | |
| B.5.7 What initiatives where taken by the project participants from the starting date of the project activity to the start of validation in parallel with the physical implementation of the project activity? | /1/ | DR | The project proponent is to substantiate to confirm that continuous actions have been taken to secure CDM status of the project activity. | ~~CL 4~~ | OK |
| B.5.8 When did the construction of the project activity start? | /1/ | DR | The construction (installation of the equipment) is yet to start. The project | ~~CL 5~~ | OK |

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| | | | proponent is requested to provide copy of the project timeline chart to the validator. | | |
| B.5.9 When was the project commissioned? | /1/ | DR | The project is expected to be commissioned in October 2010. | ~~CL 5~~ | OK |
| B.5.10Does the timeline of the project confirm that continuous actions in parallel with the implementation were taken to secure CDM status? | /1/ | DR | Refer B.5.7. | ~~CL 4~~ | OK |
| **Investment analysis (VVM para 108-114)**<br>*The list of questions below must be adjusted to the parameters in the investment analysis relevant to the project under validation. <u>All</u> input parameters need to be assessed.* | | | | | |
| B.5.11Does the project activity or any of the remaining alternatives generate revenues apart from CDM? Is this reflected in the PDD? | /1/ | DR | The project activity will generate revenue from selling of electricity to the NE states (NEWNE grid). This is defined in the PDD | | OK |
| B.5.12Do any of the alternatives to the project activity involve investment? Is this reflected in the PDD? | /1/ | DR | Yes. The project proponent is requested to identify baseline as per the methodology requirements. | ~~CAR 4~~ | OK |
| B.5.13Is the choice of benchmark analysis, investment comparison or simple cost analysis correct? | /1/ | DR | Yes. Benchmark investment analysis has been opted as required by the methodology. | | OK |
| B.5.14Is the benchmark/discount rate the latest available at the time of decision? | /1/ | DR | Weighted average cost of capital at 13.99% has been chosen as the benchmark. In determining this, beta values for other power sector companies (enlisted in equity market) in India have been obtained from Bloomberg. Beta values have been taken for a period of 5 years period. However the project proponent is requested to use asset Beta for calculation of WACC. This is required since the risk | ~~CAR 6~~ | OK |

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| | | | premium calculated using the beta value should be independent of the financial loading of an individual company. The project proponent is also requested to present calculation of WACC in the PDD. | | |
| B.5.15What is the financial indicator? Is it on equity/project basis? Before/after tax? Is the financial indicator in correspondence with the benchmark? | /1/ | DR | The financial indicator is the project (IRR) internal rate of return. This is as per the methodology. | | OK |
| B.5.16Are the underlying assumptions appropriate, e.g. what is considered as waste in the baseline is considered to have zero value? | /1/ | DR | The project proponent is requested to mention all assumptions and input parameters used for IRR calculations in the PDD and also provide evidences for the same for assessment. | ~~CAR 7~~ | OK |
| B.5.17Does the income tax calculation take depreciation into account? Is the depreciation year in accordance with normal accounting practice in the host country? | /1/ | DR | Yes. The depreciation has been calculated as per the provisions under the law of India. | | OK |
| B.5.18Is the time period of the investment analysis and operating time of the project realistic? Has salvage value been taken into account? Is working capital returned in the last year of operation? | /1/ | DR | The operational life of the project activity has been taken as 25 years. This is justified. | | OK |
| B.5.19When a feasibility study report or similar approved by the government is used as the basis for the investment analysis: Can it be confirmed that the values used in the PDD are fully consistent with the FSR and is the period of time between finalization of the FSR and the investment decision adequate? | /1/ | DR | While the DPR (part 1 (technical)) has been evidenced, the part 1 (on financial analysis) is to be provided<br>As stated in the B.5.5, the working note to the board on the project activity is to be provided. The input values in the financials are to be substantiated with evidences. | ~~CL 3~~ | OK |
| B.5.20How was the amount of output (e.g. sales of electricity) assessed? Remember to include all the data sources used and list all the projects that have been used for | /1/ | DR | ☐ The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the | | OK |

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| cross-checking in accordance with VVM paragraph 95. | | | government while applying the project activity for implementation approval<br>☐ The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)<br>☐ Other approach.<br>Provide details on how the load factor was validated::<br>In the IRR calculation, 73% PLF has been considered. However the DPR assumes 80% PLF, which is also as per CERC guidelines. Hence the project proponent is requested to calculate IRR considering 80% PLF of the power plant.<br>The PLF provided to the banks when applying for loan is also to be provided with evidences. The split up of the power sale to each NE state is also to be provided to the validator. | ~~CAR 8~~ | |
| B.5.21How was the output price (e.g. electricity price) assessed? Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM paragraph 95. | /1/ | DR | ☐ Cross-check against third-party or publicly available sources (e.g. invoices or price indices)<br>☐ Review of feasibility reports, public announcements and annual financial reports related to the project and the project participants<br>Provide details on how the output price was validated:<br>The electricity tariff will be as per the CERC guidelines as per the PPA signed between the | ~~CL 6~~ | OK |

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| | | | PP and the NE states. Copies of the PPA are to be provided. | | |
| B.5.22How were the investment costs assessed? Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM paragraph 95. | /1/ | DR | ☐ Cross-check against third-party or publicly available sources (e.g. invoices or price indices)<br>☐ Review of feasibility reports, public announcements and annual financial reports related to the project and the project participants<br>Provide details on how the investment costs were validated:<br>The project proponent is requested to provide evidences for all assumptions and input parameters used for IRR calculations..<br><br>The gas price of 4845 INR/TSCM used in the financial analysis is seen to be sourced from the agreement between ONGC (Gas generator) and OTPC (agreement of 29 September 2008). Considering that ONGC holds 50% equity in OTPC, the reasonableness of the gas price is to be demonstrated against the gas price in open market. The gas price breakup in the agreement is also to be justified to add up to the price in the PDD. | ~~CL 7~~ | OK |
| B.5.23How were the O&M costs assessed? Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM | /1/ | DR | ☐ Cross-check against third-party or publicly available sources (e.g. invoices or price indices) | ~~**CAR 7**~~ | OK |

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| paragraph 95. | | | ☒ Review of feasibility reports, public announcements and annual financial reports related to the project and the project participants<br>Provide details on how the O&M costs were validated:<br>The project proponent is requested to provide evidences for all assumptions and input parameters used for IRR calculations. | | |
| B.5.24Describe the assessment of the other input parameters. Were the data available and valid at the time of decision? Remember to include all the data sources used and list all the projects that have been used for cross-checking in accordance with VVM paragraph 95. | /1/ | DR | ☒ Cross-check against third-party or publicly available sources (e.g. invoices or price indices)<br>☐ Review of feasibility reports, public announcements and annual financial reports related to the project and the project participants<br>Provide details on how other input parameters were validated:<br>The project proponent is requested to provide evidences for all assumptions and input parameters used for IRR calculations. | ~~CAR 7~~ | OK |
| B.5.25Was the financial calculation spreadsheet verified and found to be correct? | /1/ | DR | The method of calculations of project IRR has been found to be logical. However the same will further be assessed while assessing responses against the related validation findings. | ~~CAR 7~~ | OK |
| B.5.26Sensitivity analysis: Have the key parameters contributing to more than 20% of the revenue/costs during operating or implementation been identified? Has possible correlation between the parameters been considered? | /1/ | DR | The sensitivity analysis has been done for the parameters of fuel price, project cost, tariff and heat rate. The selection of the parameters | ~~CAR 7~~ | OK |

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| | | | is OK. | | |
| B.5.27Sensitivity analysis: Is the range of variations is reasonable in the project context? | /1/ | DR | Sensitivity analysis has been carried out for a variation of +/- 10%. The project proponent is requested to carry out sensitivity analysis to the extent where the project IRR crosses the benchmark value and justify probability of occurrence of the same. | ~~CL 8~~ | OK |
| B.5.28Have the key parameters been varied to reach the benchmark and the likelihood of this to happen been justified to be small? | /1/ | DR | No, The project proponent is requested to carry out sensitivity analysis to the extent where the project IRR crosses the benchmark value and justify probability of occurrence of the same. | ~~**CL 8**~~ | OK |
| **Barrier analysis (VVM para 115-118)** | | | | | |
| B.5.29Are the barriers identified complimentary to a potential investment analysis? Does the barrier have a clear impact on the financial returns so that it can be assessed in an investment analysis? Each barrier is discussed separately. | /1/ | DR | This is not required as per the requirements of the applied methodology. | | OK |
| **Common practice analysis (VVM para 119-121)** | | | | | |
| B.5.30What is the geographical scope of the common practice analysis? Is this justified? | /1/ | DR | The common practice analysis has not been done in accordance with the CDM-EB guidelines. | ~~CAR 9~~ | OK |
| B.5.31What is the scope of technology and size (e.g. capacity of power plant) for the common practice analysis and how has this been justified? | /1/ | DR | Refer B.5.30 | ~~**CAR 9**~~ | OK |
| B.5.32What is the data source(s) used for the common practice analysis? | /1/ | DR | Refer B.5.30 | ~~**CAR 9**~~ | OK |
| B.5.33How many similar non-CDM-projects exist in the region within the scope? | /1/ | DR | Refer B.5.30 | ~~**CAR 9**~~ | OK |
| B.5.34How were possible essential distinctions between the | /1/ | DR | Refer B.5.30 | ~~**CAR**~~ | OK |

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| | project activity and similar activities assessed? | | | | ~~9~~ | |
| | B.5.35What is the conclusion of the common practice analysis? | /1/ | DR | Refer B.5.30 | ~~CAR 9~~ | OK |
| | **Conclusion** | | | | | |
| | B.5.36What is the conclusion with regard to the additionality of the project activity? | /1/ | DR | Conclusion on additionality of the project will be arrived only after satisfactory closure of the identified CARs & CLs. | ~~CAR 7~~ ~~CAR 8~~ ~~CAR 9~~ ~~CL 4~~ | OK |
| **B.6** | **Calculations of GHG emission reductions** | | | | | |
| | **Data and parameters that are available at validation and that are not monitored (VVM para 199-203)** | | | | | |
| | B.6.1 How was the "Oxidation factor of natural gas used to estimate project emissions" verified? | /1/ | DR | IPCC default value (0.9950) has been used for this parameter. | | OK |
| | B.6.2 How was the "Emission factor of natural gas used to estimate project emissions" verified? | /1/ | DR | IPCC default value (56.1 tCO2/TJ) has been used for this parameter. It needs to be justified on the conservativeness of using this with respect to the local values/national values | ~~CL 9~~ | OK |
| | B.6.3 How was the "Emission factor for upstream fugitive methane emissions of natural gas from production, transportation, distribution" verified? | /1/ | DR | As per the methodology (160 tCH4/TJ). | | OK |
| | B.6.4 How was the "Baseline $CO_2$ emission factor" verified? | | | The value used as per data provided by CEA CO2 Baseline Database for the Indian Power Sector – Version 5.0<br>In line with the methodology the baseline emission factor has been selected as the | | OK |

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| | | | minimum of the three options of a) Build Margin b) combined margin and c) EF,BL, CO2. The minimum value of 0.6752 t CO2/MWh corresponds to that of the Build margin. The option 1 and 2 are sourced from the CEA database version 5 is found to be correct.<br>In determining emission factor in accordance with option 3, default IPCC emission factor for coal (94.6 tCO2/TJ) has been considered. Selection of this value is to be justified over local/national values. The project proponent is requested to further justify the assumption for energy efficiency of power generation with coal (35%). Detailed calculation for the option 3 is to be provided in the PDD.<br>The PDD indicates that this value is fixed ex-ante, however as per the methodology this is to be monitored ex-post for option-2. The PDD is to be revised to address this. | ~~CAR 10~~ | |
| B.6.5 How was the "Emission factor for upstream fugitive methane emissions occurring in the absence of the project activity in electricity generation in the project plant" verified? | /1/ | | This has been calculated as per the provisions made in the applied methodology. | | OK |
| B.6.6 How was the "Global warming potential of methane" verified? | /1/ | | This is as per IPCC, FAR WG I Technical Summary, page 33, Table TS.2. | | OK |
| **Baseline emissions (VVM para 89-93)** | | | | | |
| B.6.7 Are the calculations documented according to the approved methodology and in a complete and transparent manner? | /1/ | DR | Yes. The baseline emissions have been calculated as per the methodological requirements. | ~~CL 10~~ | OK |

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| | | | However it has been noticed that 85% PLF has been considered for CER calculations which is contrary to that used for financial analysis (73%). The project proponent is requested to justify this.<br>The project proponent is also requested to substantiate the assumptions used for calculation of emission reductions e.g., internal (auxiliary consumption), average efficiency of power generation, calorific value of natural gas. | | |
| B.6.8 Have conservative assumptions been used when calculating the baseline emissions? | /1/ | DR | Refer B.6.7. | ~~CL 10~~ | OK |
| B.6.9 Are uncertainties in the baseline emission estimates properly addressed? | /1/ | DR | There are no uncertainties envisaged in the baseline emissions. | | OK |
| **Project emissions (VVM para 89-93)** | | | | | |
| B.6.10Are the calculations documented according to the approved methodology and in a complete and transparent manner? | /1/ | DR | Yes. The project emissions have been calculated as per the methodological requirements.<br>However it has been noticed that 85% PLF has been considered for CER calculations which is contrary to that used for financial analysis (73%). The project proponent is requested to justify this.<br>The project proponent is also requested to substantiate the assumptions used for calculation of emission reductions e.g., internal (auxiliary consumption), average efficiency of power generation, calorific | ~~CL 10~~ | OK |

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| | | | value of natural gas. | | |
| B.6.11Have conservative assumptions been used when calculating the project emissions? | /1/ | DR | Refer B.6.7. | ~~CL 10~~ | OK |
| B.6.12Are uncertainties in the project emission estimates properly addressed? | /1/ | DR | There are no uncertainties envisaged in the project emissions. | ~~CL 10~~ | OK |
| **Leakage (VVM para 89-93)** | | | | | |
| B.6.13Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner? | /1/ | DR | Yes. The leakage emissions have been calculated as per the methodological requirements.<br>However it has been noticed that 85% PLF has been considered for CER calculations which is contrary to that used for financial analysis (73%). The project proponent is requested to justify this.<br>The project proponent is also requested to substantiate the assumptions used for calculation of emission reductions e.g., internal (auxiliary consumption), average efficiency of power generation, calorific value of natural gas. | ~~CL 10~~ | OK |
| B.6.14Have conservative assumptions been used when calculating the leakage emissions? | /1/ | DR | Refer B.6.7. | ~~CL 10~~ | OK |
| B.6.15Are uncertainties in the leakage emission estimates properly addressed? | /1/ | DR | There are no uncertainties envisaged in the leakage emissions. | ~~CL 10~~ | OK |
| **Emission Reductions (VVM para 89-93)** | | | | | |
| B.6.16Algorithms and/or formulae used to determine emission reductions:<br>• All assumptions and data used by the project participants are listed in the PDD and related document submitted for | /1/ | DR | Yes | | OK |

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| registration. The data are properly referenced<br>• All documentation is correctly quoted and interpreted.<br>• All values used can be deemed reasonable in the context of the project activity<br>• 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. | | | Yes<br>Yes<br>Yes | | |
| **B.7 Monitoring plan (VVM para 122-124)** | | | | | |
| **Data and parameters monitored** | | | | | |
| B.7.1 Do the means of monitoring described in the plan comply with the requirements of the methodology? | /1/ | DR | Yes. The monitoring plan complies with the applied methodology. | | OK |
| B.7.2 Does the monitoring plan contains all necessary parameters, and are they clearly described? | /1/ | DR | Yes. The monitoring plan contains all the parameters. | | OK |
| B.7.3 In case parameters are measured, is the measurement equipment described? Describe each relevant parameter. | /1/ | DR | The project proponent is requested to describe metering details including type, measurement capability, accuracy and calibration frequency of the meters for measurement of energy generation and fuel flow. | ~~CAR 11~~ | OK |
| B.7.4 In case parameters are measured, is the measurement accuracy addressed and deemed appropriate? Describe each relevant parameter. | /1/ | DR | Refer B.7.3. | ~~**CAR 11**~~ | OK |
| B.7.5 In case parameters are measured, are the requirements for maintenance and calibration of measurement equipment described and deemed appropriate? Describe each relevant parameter. | /1/ | DR | Refer B.7.3. | ~~**CAR 11**~~ | OK |
| B.7.6 Is the monitoring frequency adequate for all monitoring parameters? Describe each parameter. | /1/ | DR | In general yes, but the frequency of monitoring the NCV of natural gas it to be 15 days as per the methodology. This needs to | ~~CAR 12~~ | OK |

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

| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
|---|---|---|---|---|---|
| | | | be corrected.<br>The electricity generation is stated to be monitored. Need to be made clear on the Net and the equation for transparency. | | |
| B.7.7 Is the recording frequency adequate for all monitoring parameters? Describe each parameter. | /1/ | DR | Refer B.7.3. | ~~CAR 11~~ | OK |
| **Ability of project participants to implement monitoring plan** | | | | | |
| B.7.8 How has it been assessed that the monitoring arrangements described in the monitoring plan are feasible within the project design? | /1/ | DR | The project is yet to be implemented. All the monitoring parameters as required have been identified in the PDD. | | OK |
| B.7.9 Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)? | /1/ | | Project is yet to be implemented. Considering that ONGC (major equity holder) has adequate experience in plant operations, these would be properly implemented. Procedures are to be developed and implemented. | ~~CL 11~~ | OK |
| B.7.10Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified? | /1/ | DR | Procedures are to be developed and implemented. | ~~CL 11~~ | OK |
| B.7.11Will 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 | This has been mentioned in the monitoring plan of the PDD.. | | OK |
| **Monitoring of sustainable development indicators/ environmental impacts** | | | | | |
| B.7.12Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host country? | /1/ | DR | The monitoring of sustainable development indicators is not warranted by the legislation. | ~~CL 12~~ | OK |

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| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
|---|---|---|---|---|---|
| | | | The approval of the REIA study to be provided to check on monitoring of any special parameters.<br>The project proponent is requested to provide an action plan in the PDD for 2% CER usage in sustainability development programmes as stipulated by the MoEF. | | |
| B.7.13Does the monitoring plan provide for the collection and archiving of relevant data concerning environmental, social and economic impacts? | /1/ | DR | This is not warranted by the methodology or the regulations. | | OK |
| B.7.14Are the sustainable development indicators in line with stated national priorities in the host country? | /1/ | DR | Yes. | | OK |
| **C Duration of the project activity / crediting period** | | | | | |
| **C.1.1 Start date of project activity (VVM para 99-100, 104)** | | | | | |
| C.1.2 How has the starting date of the project activity been determined? What are the dates of the first contracts for the project activity? When was the first construction activity? | /1/ | DR | Start date of the project activity has been Defined to be 23 June 2008, the date of notification of Award of Turnkey EPC Contract to Bharat Heavy Electricals Limited. The project proponent is requested to submit copy of the notification to the validator. | ~~CAR 13~~ | OK |
| C.1.3 Is the stated expected operational lifetime of the project activity reasonable? | /1/ | DR | Yes. The operational life of the project has been taken to be 25 years. This is reasonable as per the tool on remaining lifetime. | | OK |
| C.1.4 Is the start date, the type (renewable/fixed) and the length of the crediting period clearly defined and reasonable? | /1/ | DR | The project proponent has been opted for 10 years fixed crediting period starting from 1 | | OK |

| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
|---|---|---|---|---|---|
| | | | September 2010. The project proponent is requested to revised the start date of crediting period to a realistic one. | | |
| **D Environmental Impacts (VVM para 131-133 and VVM para 136 (d) for small-scale project activities, as applicable))** | | | | | |
| D.1.1 Are there any host country requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved? Does the approval contain any conditions that need monitoring? For small-scale project activities, is an assessment of the environmental impacts of the proposed CDM project activity is required by the host Party? | /1/ | DR | In order to obtain the required clearance from the Ministry of Environment & Forest (MoEF), Government of India (GoI), an REIA report is a statutory prerequisite and the project proponent is requested to submit the EIA to the validator. | ~~CL 13~~ | OK |
| D.1.2 Does the project comply with environmental legislation in the host country? | /1/ | DR | The project proponent is requested to submit copy of the consent to establish issued by the MoEF to the validator. | ~~CL 14~~ | OK |
| D.1.3 Will the project create any adverse environmental effects? | /1/ | DR | Refer D.1.1. | ~~**CL 13**~~ | OK |
| D.1.4 Have identified environmental impacts been addressed in the project design? | /1/ | DR | The project proponent is requested to include the significant environmental impacts, as identified by the REIA, in the PDD. | ~~CAR 14~~ | OK |
| D.1.5 Has an analysis of the environmental impacts of the project activity been sufficiently described? | /1/ | DR | Refer D.1.1. | ~~**CL 13**~~ | OK |
| D.1.6 Are transboundary environmental impacts considered in the analysis? | /1/ | | Refer D.1.1. | ~~**CL 13**~~ | OK |
| **E Stakeholder Comments (VVM para 128-130)** | | | | | |
| E.1.1 Have relevant stakeholders been consulted? | /1/ | DR | Yes. The following parities have been identified as the stakeholders IL&FS | | OK |

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| Checklist Question | Ref | MoV | Assessment by DNV | Draft Concl. | Final Concl. |
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| | | | ONGC<br>Government of Tripura<br>Electricity Regulatory Commissions<br>Elected body of representatives administering the local area (village Panchayat)<br>Statutory environmental and pollution boards of government.<br>Non-Governmental Organisations (NGOs)<br>Consultants<br>Equipment Suppliers/Contractors | | |
| E.1.2 Have appropriate media been used to invite comments by local stakeholders? | /1/ | DR | The project proponent is requested to submit copies of communications made with the stakeholders to the validator. The minutes of the meeting is also to be provided. | ~~CL 15~~ | 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 | Stakeholders' consultation is not mandated by the Indian legislations. | | OK |
| E.1.4 Is a summary of the stakeholder comments received provided? | /1/ | DR | Yes. | | OK |
| E.1.5 Has due account been taken of any stakeholder comments received? | /1/ | DR | The project proponent is requested to submit copies of stakeholders' comments to the validator. | ~~**CL 15**~~ | OK |

## Table 3 Resolution of corrective action requests and clarification requests

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| CAR 1<br>The project proponent is to provide copy of LoA issued by the DNA of India. | A.3.2 | The Host Country Approval from National CDM Authority is being provided. | OK.<br>The project proponent has submitted the HCA (F. No. 4/2/2007-CCC dated 12 July 2010 for the project activity.<br><br>CAR 1 is closed. |
| CAR 2<br>The project proponent is to provide the funding breakup for the project activity. | A.5.1 | An affirmation from OTPC that funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of India is being provided. | OK.<br>The affirmation by the PP dated 13 September 2010 has been received and verified, found okay.<br><br>CAR 2 is closed. |
| CAR 3<br>The project proponent has not adequately demonstrated availability of sufficient natural gas in Tripura through accounting of present and future projected production of natural gas vis-à-vis present and planned/projected demand of the same. | B.2.4 | Oil and Natural Gas Corporation Ltd. (ONGC) is the principal supplier of natural gas in the region as well as for the proposed project. They had formed a multi disciplinary team (MDT) in February 2008 to establish the feasibility of augmenting the production of natural for supply to OTPC. The long term gas profile from ONGC is being provided.<br>The present customers of ONGC have a total demand of 1.78 MMSCMD as shown below:<br>**Customer** \| **Demand** | OK.<br><br>DNV has verified the long term gas profile of ONGC, who is eventually the principal supplier of natural gas in the region including the proposed project activity, and noted that ONGC has planned for production of 6.0 MMSCMD of natural gas from 2012-'13 onwards, whereas the project demand is 4.93 MMSCMD including the demand of the project activity. This document also clarifies that ONJC has planned for increasing natural gas |

<table>
<tr><th>Corrective action and/ or clarification requests</th><th>Reference to Table 2</th><th>Response by project participants</th><th>Validation conclusion</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th></th><th>(MMSCMD)</th></tr>
<tr><td>NEEPCO RC Nagar</td><td>0.75</td></tr>
<tr><td>TSECL Rokhia</td><td>0.58</td></tr>
<tr><td>TSECL Baramura</td><td>0.4</td></tr>
<tr><td>TNGC City</td><td>0.025</td></tr>
<tr><td>TNGC Brick kiln</td><td>0.002</td></tr>
<tr><td>TNGC – IGC</td><td>0.016</td></tr>
</table>
In the future, NEEPCO Monarchak is expected to draw 0.5 MMSCMD gas from 2013-14 onwards. OTPC is envisaged to draw another 1.325 MMSCMD in 2011-12 and 2.65 MMSCMD from 2012-13 onwards. Hence, the total demand for natural gas is expected to be 4.93 MMSCMD in the future.<br>
Considering this demand for natural gas, ONGC has taken the decision to augment its gas production potential to cater to the needs of different consumers in the state. They are expanding their gas handling facilities to a capacity of 7.5 MMSCMD in a phased manner.<br>
Thus, it can be concluded that natural gas will be sufficiently available in the region and future natural gas based power capacity additions will not constrained by the use of natural gas in</td><td>production to 7.5 MMSCMD in a phased manner. This establishes that sufficient gas is available for the project at present and in future to cater to other users.<br><br>CAR 3 is closed.</td></tr>
</table>

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| | | the project activity. | |
| CAR 4<br>The project proponent has identified three alternatives of a) electricity from the grid b) a coal fired power plant and c) project without CDM revenues. The unit cost of generation has been calculated for the two options.<br>The project proponent has not identified power generation using natural gas, but technologies other than the project activity, power generation technologies using energy sources other than natural gas, like hydro and import of electricity from connected grids, including the possibility of new interconnections.<br>The project proponent has not considered all similar power plants which are capable of delivering similar services (e.g. peak vs. base load power) and to 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 baseline alternatives.<br>In order to determine economically most attractive baseline alternatives, the project proponent is to calculate levelized cost for all realistic and credible baseline alternatives and carry out sensitivity analysis for all alternatives, to confirm that the conclusion | B.4.1 | The other baseline alternatives are also being discussed in the revised PDD. Investment analysis for all realistic and credible baseline alternatives has also been carried out to confirm the baseline scenario for the project activity. | OK.<br>The PDD has been revised to include baseline alternatives like power generation using coal on both sub-critical and super critical technology, hydro power generation, wind power generation, nuclear power generation, power generation using diesel/naptha, and power generation using natural gas in open cycle technology. Levelized cost of power generation has been calculated for all plausible scenarios. The list of baseline alternatives found to be complete.<br><br>CAR 4 is closed. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| regarding the financial attractiveness is robust to reasonable variations in the critical assumptions as required by the applied methodology. | | | |
| CAR 5<br>The board note of 6 February 2006 was provided. However serious consideration of CDM was not evident from the board note. While the board note mentions CDM, and the appointment of consultants and that additional revenues can be generated through CDM, the decisiveness of the CDM revenues for the project to go ahead is not evident. The working note to the board on the project activity is to be provided. The project proponent is to substantiate serious consideration of CDM prior to project implementation | B.5.5 | The decisiveness of the CDM revenues for the project can be gauged from the working note from Mr. Haziq Beg of IL&FS to the CEO of Tripura Power Development Company Pvt. Ltd. dated 13 Oct 2005 that refers to the economic attractiveness of the project. The note describes how the IRR calculated in the financial analysis as per the data from DPR is below the industry/business hurdle rate and revenue from CDM be explored to make it financially viable.<br>It was based on this financial analysis that the board later took the decision on 06 Feb 2006 to implement the project activity only after considering CDM benefits.<br>As per the "Guidance on the demonstration and assessment of prior consideration of the CDM" Version 03, for project activities with start date before 02 August 2008, the project proponent has demonstrated the serious consideration of CDM as described below:<br>The minutes of meeting of the Board of | OK.<br>DNV has verified the letter from IL&FS dated 13 October 2005 and found that CDM revenue was considered as a means to improve the project IRR as indicated in the DPR and thus the financial viability of the project activity. Thus DNV considers that the project activity satisfies the requirements of prior consideration of CDM as stipulated by the CDM-EB.<br><br>CAR 5 is closed. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| | | Directors of OTPC dated 06 Feb 2006 clearly show that the benefits of the CDM were considered in the decision to implement the project activity. This demonstrates awareness of the CDM prior to project activity start date.<br>The project participant also took continuing and real actions to secure CDM status for the project activity in parallel with its implementation and at no point of time has the interval between these events exceeded two years. This has been demonstrated through a timeline of events and actions taken for CDM registration and project implementation provided in section B.5 of the PDD. | |
| CAR **6**<br>Weighted average cost of capital at 13.99% has been chosen as the benchmark. In determining this, beta values for other power sector companies (enlisted in equity market) in India have been obtained from Bloomberg. Beta values have been taken for a period of 5 years period. However the project proponent is requested to use asset Beta for calculation of WACC. This is required since the risk premium calculated using the beta value should be independent of the financial loading of an individual company. The project | B.5.14 | The benchmark for the project activity has now being revised in the PDD and takes into consideration asset beta for calculation of WACC. The working calculations have also been presented in the PDD.<br>Mr. Haziq Beg, Vice President, Infrastructure Leasing & Financial Services Limited (IL&FS) had informed the CEO of Tripura Power Development Company Pvt. Ltd. (now ONGC Tripura Power Company Limited) in his letter dated 13th October | OK.<br>The revised benchmark calculations has been reviewed by the financial expert and found to be okay.<br><br>CAR 6 is closed. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| proponent is also requested to present calculation of WACC in the PDD. | | 2005 that based on the analysis given in the DPR prepared by FICHTNER Consultants, the financial projections for the project were below the industry/business hurdle rate. This rate was the CERC defined Return on Equity prevalent at the time i.e. 14% per annum and was the benchmark considered by the Board of Directors for decision making for implementation of the project activity. However, it was later realized from the guidance given by the Executive Board in its 40th meeting that the use of this value as a benchmark for proposed CDM project activities was not appropriate. Therefore, a new benchmark was calculated using WACC approach which was again found to be in the same range and was used for investment analysis in the webhosted PDD.<br>During validation of the project activity, based on the suggestions of the DOE regarding the use of asset beta values and applicability at the time of the investment decision i.e. 06 February 2006, the WACC benchmark was again revised and calculated as 11.72%. It can be observed that even after these revisions, the project IRR continues to | |

<table>
<tr><th>Corrective action and/ or clarification requests</th><th>Reference to Table 2</th><th>Response by project participants</th><th>Validation conclusion</th></tr>
<tr><td></td><td></td><td>be below the benchmark rate of return expected from similar project activities and hence unattractive for the project proponent.</td><td></td></tr>
<tr><td>CAR 7<br>The project proponent is requested to mention all assumptions and input parameters used for IRR calculations in the PDD and also provide evidences for the same for assessment.</td><td>B.5.16</td><td>All assumptions and input parameters used for IRR calculations have been included in the PDD and supporting documents for the same are also being provided for assessment.</td><td>OK.<br>The PDD has been revised to include details of all relevant parameters.<br><br>CAR 7 is closed.</td></tr>
<tr><td>CAR 8<br>In the IRR calculation, 73% PLF has been considered. However the DPR assumes 80% PLF, which is also as per CERC guidelines. Hence the project proponent is requested to calculate IRR considering 80% PLF of the power plant.<br>The PLF provided to the banks when applying for loan is also to be provided with evidences.<br>The split up of the power sale to each NE state is also to be provided to the validator.</td><td>B.5.20</td><td>In accordance with the “Guidelines for the reporting and Validation of Plant Load Factors”, Version 01 (EB48, Annex 11), the Plant Load Factor (PLF) has been defined ex-ante in the PDD according to option II (b), stating, ‘The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)’. The PLF value of 80% has thus been sourced from the Detailed Project Report prepared by a reputed third party engineering consultancy, FICHTNER Consulting Engineers (India) Pvt. Ltd., Chennai, India.<br>The split up of the power sale to each of the north-eastern states is provided below:
<table>
<tr><th>State</th><th>Share (MW)</th></tr>
<tr><td>Assam</td><td>240</td></tr>
</table>
</td><td>OK.<br>The calculation is rectified using 80% PLF, which is obtained from the DPR.<br><br>CAR 8 is closed.</td></tr>
</table>

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| | | <table><tr><td>Manipur</td><td>42</td></tr><tr><td>Meghalaya</td><td>79</td></tr><tr><td>Nagaland</td><td>27</td></tr><tr><td>Tripura</td><td>196</td></tr><tr><td>Arunachal Pradesh</td><td>22</td></tr><tr><td>Mizoram</td><td>22</td></tr><tr><td>IL&FS/OTPC</td><td>98</td></tr><tr><td>TOTAL</td><td>726</td></tr></table> The supporting document for the same from Ministry of Power is also being provided.<br><br>A letter from Power Finance Corporation Ltd. is being submitted which confirms that the DPR Volume I & II dated October 2005 prepared by Fichtner Consulting Engineers (India) Pvt. Ltd. was used by PFC for loan appraisal at the time of sanction. | |
| CAR **9**<br>The common practice analysis has not been done in accordance with the CDM-EB guidelines. | B.5.30 | The common practice analysis is now being revised in the PDD considering CDM-EB guidelines. | OK.<br>The common practice analysis is found to be okay.<br><br>CAR 9 is closed. |
| CAR 10<br>In determining emission factor in accordance with option 3, default IPCC emission factor for coal (94.6 $tCO_2/TJ$) has been considered. Selection of this value is to be justified over | | The emission factor has been revised to the value as per the CEA CO2 Baseline database Version 5.0. | OK<br>The PDD is revised to include calculation for emission factor. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| local/national values. The project proponent is requested to further justify the assumption for energy efficiency of power generation with coal (35%). Detailed calculation for the option 3 is to be provided in the PDD.<br>The PDD indicates that this value is fixed ex-ante, however as per the methodology this is to be monitored ex-post for option-2. The PDD is to be revised to address this. | | The emission factor has been selected as Build Margin (Option – 2) and has now been changed to an ex-post monitored parameter. | CAR 10 is closed. |
| CAR 11<br>The project proponent is requested to describe metering details including type, measurement capability, accuracy and calibration frequency of the meters for measurement of energy generation and fuel flow. | | The project activity is under implementation and the monitoring equipment has not been installed as yet. However, the type of meters, accuracy class and calibration frequency has been mentioned in the PDD. | OK.<br>Metring details are included in the PDD.<br>CAR 11 is closed. |
| CAR 12<br>The frequency of monitoring the NCV of natural gas it to be 15 days as per the methodology. This needs to be corrected in the PDD.<br>The electricity generation is stated to be monitored. It is required to be made clear on the net generation and the equation for transparency. | | The frequency of monitoring the NCV of natural gas has been mentioned as fortnightly in the monitoring plan as per the methodology.<br>The net electricity exported to the grid has been included as a parameter in the revised PDD. | OK.<br>Corrected in the PDD.<br><br>CAR 12 is closed. |
| CAR **13**<br>Start date of the project activity has been Defined to be 23 June 2008, the date of notification of Award of Turnkey EPC Contract to Bharat Heavy Electricals Limited. | | The notification of Award of Turnkey EPC Contract to Bharat Heavy Electricals Limited is being provided. | OK.<br>DNV has verified the notification of award of turnkey EPC dated 23 June 2008 to M/s Bharat Heavy Electricals Limited. Scope of work covers “Design, |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| The project proponent is requested to submit copy of the notification to the validator. | | | engineering, manufacture, procurement, supply, insurance, transportation to site, storage of materials, loading/unloading, handling, project management, civil works, erection, testing, commissioning, performance testing and putting into successful commercial operations.<br><br>CAR 13 is closed. |
| CAR **14**<br>The project proponent is requested to include the significant environmental impacts, as identified by the REIA, in the PDD. | | The environmental impacts of the project activity as identified in the REIA have been included in the revised PDD. | OK<br>PDD has been revised to include significant impacts.<br><br>CAR 14 is closed. |
| CL 1<br>The project proponent is to submit technical specifications of the power generating and monitoring equipment to the validator. | A.2.5 | The technical specifications of the power generating equipment are being provided. Since the project is under implementation, the monitoring equipment is yet to be installed; however their technical specifications have been included in the PDD. | OK.<br>The project proponent has submitted copy of the detailed project report with technical specifications.<br><br>CL 1 is closed. |
| CL **2**<br>The project proponent is requested to provide the following evidences of<br>a) Technical specifications of the heat rate of different options<br>b) Gas sale purchase agreement<br>c) Loan application and approval note for the interest rate | B.4.5 | The evidence for the following parameters are available in Volume II: Financial of the DPR that was prepared by FICHTNER Consulting Engineers (India) Pvt. Ltd:<br>• Heat rate of plant<br>• Interest rate<br>• Project cost | OK.<br>The mentioned documents have been submitted to the validator.<br><br>CL 2 is closed. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| d) Evidence for the project cost<br>e) Evidence for the debt-equity ratio of the project | | • Debt-equity ratio<br>Additionally extracts of the Gas Sale and Purchase Agreement is also being provided. | |
| CL **3**<br>While the DPR (part 1 (technical)) has been evidenced, the part of the DPR on financial analysis is to be provided to the validator. | B.5.5 | The Volume II: Financial of the DPR prepared by FICHTNER Consulting Engineers (India) Pvt. Ltd., Chennai, India is being provided. | OK.<br>DPR volume II has been submitted to validator.<br><br>CL 3 is closed. |
| CL 4<br>The project proponent is to substantiate to confirm that continuous actions have been taken to secure CDM status of the project activity. | B.5.7 | As per the "*Guidance on the demonstration and assessment of prior consideration of the CDM"* Version 03, for project activities with start date before 02 August 2008, the project participant has demonstrated that CDM was seriously considered in the decision to implement the project activity as below:<br>(a) The minutes of meeting of the Board of Directors of OTPC dated 06/02/2006 clearly show that the benefits of the CDM were considered in the decision to implement the project activity. This demonstrates awareness of the CDM prior to project activity start date.<br>(b) The project participant took continuing and real actions to secure CDM status for the project activity | OK.<br>Sequence of events taken place after the start of the project activity has been demonstrated in the revised PDD and the same has been found to be satisfactory. The project proponent has also provided supporting documents to substantiate the occurrence of the events.<br><br>CL 4 is closed. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| | | in parallel with its implementation and at no point of time has the interval between these events exceeded two years. This is demonstrated through a timeline of events and actions taken for CDM registration and project implementation provided in the PDD. | |
| CL 5<br>The construction (installation of the equipment) is yet to start. The project proponent is requested to provide copy of the project timeline chart to the validator. | B.5.8 | The project is under implementation. The first unit is expected to be commissioned by December 2011 and second unit by March 2012. The project timeline chart is being provided. | OK.<br>The timeline chart has been submitted to DNV.<br><br>CL 5 is closed. |
| CL 6<br>The electricity tariff will be as per the CERC guidelines as per the PPA signed between the PP and the NE states. Copies of the PPA are to be provided. | B.5.21 | Copies of the PPA executed with the north-eastern states are being provided. | OK.<br>PPA copy is received.<br><br>CL 6 is closed. |
| CL **7**<br>The project proponent is requested to provide evidences for all assumptions and input parameters used for IRR calculations.<br><br>The gas price of 4845 INR/TSCM used in the financial analysis is seen to be sourced from the agreement between ONGC (Gas generator) and OTPC (agreement of 29 September 2008). Considering that ONGC | B.5.22 | Supporting documents for all assumptions and input parameters used for IRR calculations have been included in the PDD.<br><br>The pricing of the gas was arrived at as per the ONGC EC decision taken in their 319th meeting held from 12-13 Feb 2008. Since an augmentation of gas production from Tripura Asset was to | OK.<br>The DPR has calculated the tariff for sale of power as per the Central Electricity Regulatory Commission (CERC) norms and comprises of three components:<br>○ Fixed cost (Power plant)<br>○ Variable Cost (Power Plant)<br>○ Transmission Service Charges |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| holds 50% equity in OTPC, the reasonableness of the gas price is to be demonstrated against the gas price in open market. The gas price breakup in the agreement is also to be justified to add up to the price in the PDD. | | take place following the formation of the OTPC and commitment of gas supply, ONGC had formed a multi disciplinary team (MDT) to establish feasibility of augmenting the production and formalize the strategy thereof including gas pricing. It was decided that the gas pricing be done on cost plus basis, based on the actual cost to be incurred in the augmented production.<br>Thus the gas price for OTPC was arrived at and a contract (Gas Sale and Purchase Agreement) for the same was executed with OTPC.<br><br>The base price for gas in the Gas Sale and Purchase Agreement has been fixed as ` 4177/1000 SCM for base year 2008-09 at an NCV of 8000 kCal/SCM. The escalation in price has been fixed as 4% per annum.<br>The gas price in the PDD had been determined for natural gas of NCV 8250 kCal/SCM in the year 2011-12 as:<br>$4177*(8250/8000)*(1+4\%)^3$ = `4845.39/1000 SCM<br>However, for the investment analysis in the PDD, the price of natural gas available in the DPR has been used. | (Transmission line component)<br>However, the project boundary was revised in June 2008 to exclude the transmission component. This is the reason for the difference in levelised tariff calculated in the DPR and the levelised tariff calculated in the project IRR sheet that does not consider the transmission component.<br>CL 7 is closed. |
| CL 8 | B.5.28 | The sensitivity analysis is being revised | OK. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| Sensitivity analysis has been carried out for a variation of +/- 10%. The project proponent is requested to carry out sensitivity analysis to the extent where the project IRR crosses the benchmark value and justify probability of occurrence of the same. | | to the extent where the project IRR crosses the benchmark value. | The sensitivity analysis has been revised as discussed in the CL 8.<br><br>CL 8 is closed. |
| CL 9<br>IPCC default value (56.1 tCO2/TJ) has been used for this parameter. It needs to be justified on the conservativeness of using this with respect to the local values/national values | | The emission factor has been revised to the value as per the CEA $CO_2$ Baseline database Version 5.0. | OK<br>The revised value is accepted.<br>CL 9 is closed. |
| CL 10<br>The baseline emissions have been calculated as per the methodological requirements.<br>However it has been noticed that 85% PLF has been considered for CER calculations which is contrary to that used for financial analysis (73%). The project proponent is requested to justify this.<br>The project proponent is also requested to substantiate the assumptions used for calculation of emission reductions e.g., internal (auxiliary consumption), average efficiency of power generation, calorific value of natural gas. | | The PLF has now been considered as 80% in the CER calculations as per the DPR that was prepared by an experienced engineering consultant and was also the basis of decision making for the company.<br>The assumptions used for calculation of emission reductions have been included in the emission reductions calculation sheet. | OK.<br>Revised CER calculation is found to be okay.<br>CL 10 is closed. |
| CL 11<br>Project is yet to be implemented. Considering that ONGC (major equity holder) has adequate experience in plant operations, these | | The project activity is under implementation. However, the monitoring of net electricity generation shall be done as per the executed Power | OK.<br>The response is found to be adequate.<br>CL 11 is closed. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| would be properly implemented. Procedures are to be developed and implemented. | | Purchase Agreements.<br>The total fuel consumption will be monitored both at supplier and project end for cross verification and measured in standard cubic meters. Natural gas supply metering to the project will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be cross-checked by the gas company.<br>The calorific value of the gas would be provided by the supplier and recorded and verified by the project participant. Measurements would be taken on a fortnightly basis. | |
| CL **12**<br>The monitoring of sustainable development indicators is not warranted by the legislation. The approval of the REIA study to be provided to check on monitoring of any special parameters.<br>The project proponent is requested to provide an action plan in the PDD for 2% CER usage in sustainability development programmes as stipulated by the MoEF. | | The environmental clearance from MoEF is being provided.<br>The action plan for commitment of 2% of CERs towards sustainability development programmes has been included in the PDD. | OK.<br>The action plan has been found to be adequate.<br>CL 12 is closed. |
| CL **13**<br>In order to obtain the required clearance from | | The Rapid Environmental Impact Assessment report is being provided. | OK.<br>Copy of REIA is received. |

| Corrective action and/ or clarification requests | Reference to Table 2 | Response by project participants | Validation conclusion |
|---|---|---|---|
| the Ministry of Environment & Forest (MoEF), Government of India (GoI), an REIA report is a statutory prerequisite and the project proponent is requested to submit the EIA to the validator. | | | CL 13 is closed. |
| CL 14<br>The project proponent is requested to submit copy of the consent to establish issued by the MoEF to the validator. | | A copy of the consent to establish issued by the Tripura State Pollution Control Board is being provided. | OK.<br>Copy of consent to establish is received.<br>CL 14 is closed. |
| CL 15<br>The project proponent is requested to submit copies of communications made with the stakeholders to the validator. The minutes of the meeting is also to be provided. | | The invitation letter, photographs and minutes of the local stakeholder meeting are being provided. | OK.<br>The documents are received.<br>CL 15 is closed. |

## Table 4 Forward action requests

| Forward action request | Reference to Table 2 | Response by project participants |
|---|---|---|
| No FAR is raised. | | |

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# APPENDIX B

## CURRICULA VITAE OF THE VALIDATION TEAM MEMBERS

***Kakaraparthi Venkata Raman*** *holds a bachelor degree (B.Tech) in Chemical Engineering and a Diploma in Management. He has an overall experience of 18 years in the Chemical Process Industry - Fertilisers and Chemicals industry (FACT). His main areas of work include a) Technical Services (for Ammonia, Urea, Co-generation thermal power plants (captive), and complex fertilizers plants)- 10 years b) Erection, commissioning and hands-on operation of state of art HTAS Ammonia plant - 4 years c) Management and operation of Sulphuric acid plant as Plant Manager- 2 years and d) two years in management Information System operation and assisting of top management in planning of operations.*

*While in FACT he has completed the ISO14001 EMS LA course and also involved in implementation of Environmental Management Systems and in conducting internal audits*

*Experience prior to joining Fertiliser industry include six months experimental work on charcoal manufacture in Karnataka Regional Engineering college.*

*He has experience of around 5 years in validation and verification of numerous CDM projects. His qualification, industrial experience and experience in CDM demonstrate him sufficient sectoral competence in areas of (a) 1.1 Thermal energy generation from fossil fuels and Biomass as well as thermal electricity from solar (b) 1.2 Energy Generation from renewable energy sources (c) 5.1/4.13/11.1/12.1 Chemical Processes Industries and (d) 13.1 Waste handling and disposal.*

*At present he is Technical Manager, South Asia, DNV, India.*

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

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

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

**Kumaraswamy Chandrashekara** holds a Bachelor's Degree in Chemical Engineering and has an overall experience of around 24 years. Prior to joining DNV, has worked for 11 years in the Chemical Process Industry covering Plant Operations, Technical Services and Process Design activities, primarily in the fertilisers and chemicals manufacturing sector. During this tenure of 11 years in the industry, responsibilities included production, process optimization, energy efficiency improvements, environmental performance, process design, energy auditing and technical auditing.

He has experience of around six years in the validation and verification of numerous CDM projects both in India and abroad. His qualification, industrial experience and experience in CDM sufficiently demonstrate his sectoral competence in the areas of chemical process industries, energy generation from renewable sources and waste handling & disposal.

***Syam Miriyala*:** Holds a Bachelor's Degree in Electrical and Electronics Engineering. Having an overall experience of around five years. Prior to joining DNV having around four years experience in co-generation power plants covering erection, commissioning, operation and maintenance.
He has experience of one year in validation and verification of CDM projects. His qualification, industrial experience and experience CDM demonstrate his sufficient sectoral competence in areas of (a) 1.1 Thermal energy generation from fossil fuels and Biomass including thermal electricity from solar (b) 1.2 Energy generation from renewable energy sources (c) 2.1 Electricity Distribution (d) 4.5 Electrical equipment.

**M V Srinivasan** has a management account degree with specialization in Finance. He is a FCA (Fellow Member of the Institute of Chartered Accountants of India), CISA (Certified Information systems Auditor (ISACA – USA) and member of ISACA) and CIMA (Management Accountant from Chartered Institute of Management Accountants (UK)), having 18 years of professional experience in Industry in areas of Finance, Accounting and Systems and 5 years of professional experience in areas of Internal and Systems Audit. His professional focus areas are:

- Internal Audits
- Information Systems Audit
- Business Process Consulting
- Software design and implementation
- Cost Control & Cost Reduction