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

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Title: Energy Efficient Power Generation by Nabha Power Limited
Version: 04
Date: 05/05/2011

A.2. Description of the project activity:

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Nabha Power Limited (hereafter referred to as NPL) is a 100% subsidiary of L&T Power Development Limited (LTPDL), which is again a 100% subsidiary of Larsen & Toubro Limited (L&T). L & T is an engineering, construction and manufacturing company, and is one of the largest and most respected companies in India's private sector. The organization covers almost all the sectors of crucial significance to the economy – power, steel, chemical, fertilizer, petrochemical, refineries, oil & gas, electrical & electronics. NPL is the project proponent of this project activity.

NPL was incorporated by PSEB to execute the power project activity. The project activity involves the installation and operation of 1,400 MW (2 units of 700 MW each) super-critical technology based thermal power plant. The commissioning of this project will be carried out in stages and the first of two units is expected to be commissioned in the fourth quarter of fiscal 2013-14. The project is estimated to be fully commissioned in the first quarter of fiscal 2014-15. The contracted power generated from this project is to be sold to the Punjab State Electricity Board (PSEB). Coal required for the project would be supplied by SECL (South Eastern Coalfields Limited, a subsidiary of Coal India Limited). Letter of Assurance for long-term coal linkage received from SECL vide letter dated 11/12/2008. The water source for the proposed project is Rajpura distributory, of sub-branch of Bhakhra main line, at a distance of about 1.0 km which has been confirmed by Chief Engineer/canal Irrigation Works Punjab vide his letter No.4730 dated 09/05/2008.

Scenario existing prior to start of implementation of project activity & Baseline:
This is a greenfield project activity and no power generation equipment or technology was present at the site prior to this. The project activity will generate power in a more efficient manner than subcritical power plants, and this power will be supplied to national electricity grid which is majorly fed by conventional power plants implementing comparatively lower efficiency technology. The state electricity grid referred to above is a part of the North-East-West-North East (NEWNE) grid of India. As on September 2010, the total installed capacity of the NEWNE grid is 119,267.4 MW of which 57.6%[1] is accounted for by coal based thermal power plants. The average net efficiency for the 10 most efficient coal based units, included in the baseline sample group, is 34.78% (further described in Section B.6.1). These units are based on conventional subcritical technology and use sub-bituminous coal which has been identified as the baseline technology and fuel respectively.

Project Scenario
The project activity will employ coal fired super-critical technology for thermal power generation which has higher efficiency compared to the prevailing coal fired sub-critical technology. This results in a net project efficiency of 40.49% which is almost 6% higher than the average baseline efficiency of the most

[1] CEA Monthly Review of Power Sector, September 2010, pg 28-34 (http://www.cea.nic.in/reports/monthly/executive_rep/sep10/28-34.pdf)

efficient plants included in the baseline sample group (further addressed in Section A.4.3) and 4% higher than the efficiency of the baseline selected (36.63% as mentioned in Section B.6.1 of this PDD). This will lead to lower consumption of coal and subsequently lower Carbon Dioxide (GHG) emissions (identified as the major source of GHG both in baseline & project scenario in Section B.3) for producing equivalent amount of power as compared to the conventional/sub-critical coal based power plants. Hence, the sub-critical technology has been taken as the baseline to the project activity as further demonstrated in Section B.4 of this document. Emission reductions will be claimed on the net electrical energy that is supplied to grid which will be metered using electrical meters. Further details of monitoring of emission reductions and their calculation have been provided in Section B.7.2 & Section B.6.1 of this document. NPL is developing this project keeping in consideration of the funding available under the Clean Development Mechanism (CDM) of the United Nations Framework Convention on Climate Change.

Views of the project proponent on contribution of the project activity to sustainable development:

The Designated National Authority (DNA) for the Government of India (GoI) on the Ministry of Environment and Forestry (MoEF), called the National CDM Authority (NCDMA), has stipulated four indicators on sustainable development for Clean Development Mechanism (CDM) projects structured in India. The project proponent's view on the contribution of this project activity towards sustainable development follows these four indicators as explained below:

Environmental sustainability

The proposed project activity would reduce the requirement of coal consumed compared to sub-critical power plants and will result in reduced emissions of CO_2 and other air pollutants (SPM, SOx) in the atmosphere due to higher efficiency of power generation.

Economic sustainability

The 1,400 MW super-critical power plant will result in huge amount of investment in power generation and other associated infrastructure which will contribute to the economic growth of the region. The proposed project activity will also result in increased availability of coal, which is a depleting non renewable resource. The proposed project activity will reduce the demand-supply gap of electricity in India and local industrial growth will be accelerated due to increased availability of power in the region. The proposed project activity will also generate employment for the local populace for the purposes of construction, commissioning, operation and maintenance. The technical consultants and equipment suppliers would also be benefited economically because of the proposed project activity.

Technological sustainability

The project activity will promote capacity building and development of new skills and knowledge base in the industry. The technology to be adopted for the project activity has wide replication potential in various upcoming thermal power plants of India. Innovation of technology being crucial for industrial development, the proposed project activity will demonstrate an excellent example of technology transfer in thermal power generation sector of India which will translate into further investment and initiatives in terms of technology development and deployment.

Social sustainability

The proposed project activity will be beneficial to the local rural community by providing employment opportunities and strengthening social infrastructure in the region. This will improve quality of life and facilitate accelerated implementation of rural electrification initiatives in India.

NPL is committed to sustainable development. NPL will contribute 2% of the net revenues accrued from the sale of Certified Emission Reductions (CERs) on an annual basis towards achieving the sustainable

development goals. If the activity undertaken involves capital expenditure exceeding the minimum requirement of 2%, the additional expenditure made would be set off against the requirements for the subsequent years. Such expenditure would be made within one year after the realization of revenues from the sale of the CERs. Monitoring plan proposed for the expenditure is included in Annex 4 of the PDD.

A.3. Project participants:

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

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party (ies):

>>

India

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

>>

Punjab

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

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Village: Nalash
District: Patiala

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

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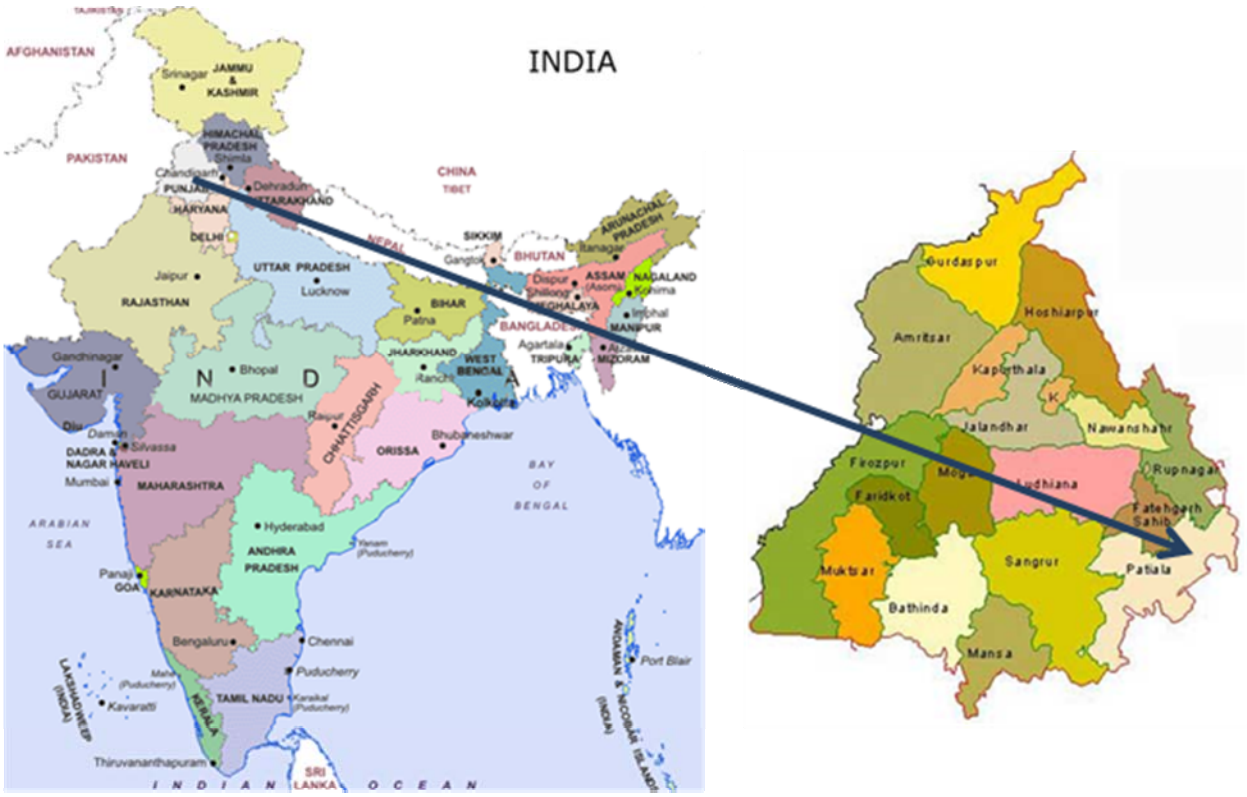
The site is located in Rajpura, near Nalash village of Patiala district in Punjab. The nearest railway station is Sarai Banjara located at a distance of 5 km from the site. The location map is provided below:



Latitude: 30°32’36’’N to 30°33’51’’ N **Longitude**: 76°33’42’’E to 76°35’05’’ E

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

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Sectoral Scope 01: Energy Industries (renewable/non-renewable sources.)

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

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The project activity will employ coal fired super-critical technology for thermal power generation which has higher efficiency compared to the prevailing coal fired sub-critical technology. Both technologies are capable of providing similar services; however, the supercritical technology consumes lesser coal leading to lower GHG emissions.

Super-critical Technology: Synopsis

The term “critical point” is a thermodynamic term which describes the state of a substance where water and steam coexist. Up to an operating pressure of around 22.1 MPa in the evaporator part of the boiler, the cycle is sub-critical. This means, that there is a non-homogeneous mixture of water and steam in the evaporator part of the boiler. In this case a drum-type boiler is used because the steam needs to be separated from water in the drum of the boiler before it is superheated and led into the turbine. Above an operating pressure of 22.1 MPa in the evaporator part of the boiler, the cycle is supercritical. Hence, the two phases of water, liquid and steam coexist as a homogeneous mixture and cannot be separated from each other. In the present project activity, the operating pressure is 25.2 MPa which signifies the supercritical nature of the operating steam. The cycle medium is a single phase fluid with homogeneous properties and there is no need to separate steam from water in a drum. Once-through boilers are therefore used in supercritical cycles.

Scenario existing prior to the project activity

Existing & Forecasted Installed Capacities
As further described in Section B.2 of this document, India meets it energy demands primarily through coal based thermal power stations involving subcritical technology. As per the publication by Central Electrical Authority (CEA) version 6, dated 01/04/2011, the details of these coal-based thermal power plants are as follows:

No.	Size (MW)	Details		Total Installed Capacity	
		Number	% of total	MW	% of total
1	600	1	0.31%	600	0.80%
2	500	41	12.89%	20,500	27.41%
3	490	1	0.31%	490	0.66%
4	330	2	0.63%	660	0.88%
5	300	10	3.14%	3,000	4.01%
6	250	36	11.32%	9,000	12.03%
7	210	130	40.88%	27,300	36.50%
8	200	23	7.23%	4,600	6.15%
9	195	2	0.63%	390	0.52%
10	130	6	1.89%	780	1.04%
11	125	2	0.63%	250	0.33%
12	120	24	7.55%	2,880	3.85%
13	110	29	9.12%	3,190	4.26%
14	105	11	3.46%	1,155	1.54%

Based on above justification, it could be concluded that scenario existing prior to implementation of project activity relies on 500 MW or 210 MW plant size with sub-critical technology. However, considering 500 MW subcritical units as comparable to the project unit capacity, it may be concluded that 500 MW units are generally relied upon for thermal power plants in the country.

Efficiencies & Load factors
As also described in Section A.2 above, the most efficient of these plants (included in baseline sample group in Section B.6.1 of the PDD) have a net efficiency of 34.78%. As per Thermal Performance Review 2008-09[2], published by Central Electricity Authority, weighted average station heat rate of sub-critical technology power plants operating in India is 2618.2 kcal/kWh which corresponds to a net efficiency of 32.19% (at 5.5% auxiliary consumption).

Technical Description
As per the standard technical specifications for the Main Plant Package of sub-critical thermal Power Projects (for 500 MW units)[3], arrangements of (steam generator, turbine generator) are as follows:

Boiler

Sl. No.	Parameter	Rating

[2] Thermal Performance Review, 2008-09 by CEA (http://www.cea.nic.in/reports/yearly/thermal_perfm_review_rep/0809/Highlights.pdf)
[3] Source: Standard Technical Specification For Main Plant Package Of Sub-Critical Thermal Power Projects (http://www.cea.nic.in/reports/standard_tech_spec.pdf)

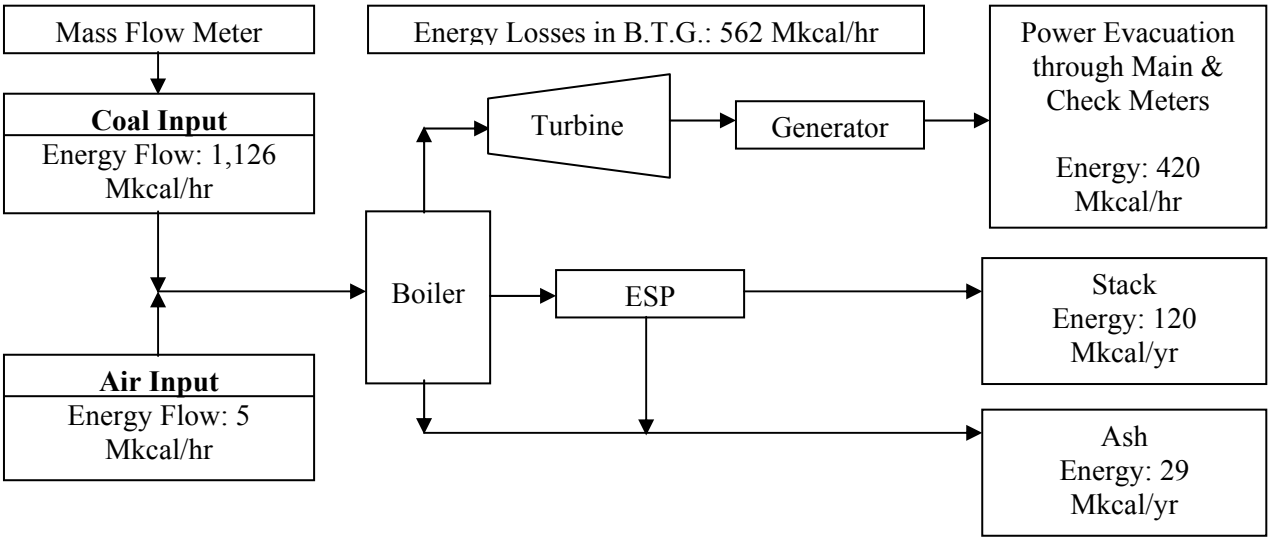
1	Pressure at super-heater outlet	179 kg/cm^2[4]
2	Temperature at SH outlet (minimum)	540°C[5]
3	Steam temperature at re-heater outlet (minimum)	568°C

Steam Turbine

Sl. No.	Parameter	Rating
1	Output under Economic Maximum Continuous Rating	500 MW
2	Turbine throttle steam pressure	170 kg/cm^2
3	Turbine throttle steam temperature(minimum)	537°C
4	Reheat Steam temperature (minimum)	565°C

Emission Sources and Greenhouse Gases involved
Major Greenhouse gas emission source in the existing scenario is CO_2 as indicated in Section B.3. As a result of higher station heat rates, emissions from sub-critical technology are significantly higher than the project activity.

Energy Balance Diagram
A typical energy balance diagram for the existing scenario, as per the technical parameters mentioned above, is as follows (please note 1Mkcal = 10^9 calories, where 1 calorie = 4.1867 Joule):



Project Scenario
This is a greenfield project activity and no power generation equipment or technology was present at the site prior to this. The project activity will employ coal fired super-critical technology for thermal power generation which has higher efficiency compared to the conventional coal fired sub-critical technology.

Adopted Technology
The power generating equipment considered for the station comprises of once-trough steam generator using pulverized coal as fuel, reheat type turbine generator set using steam parameters within supercritical range, the condenser, conventional condensate extraction and boiler feed system along with all regenerative feed heating equipment like HP and LP heaters, gland steam condenser and deaerator. The

[4] 1 kg/cm^2 = 98066.50 Pascal (Pa)
[5] 1°C = 273.16 Kelvin (K)

lifetime of the project activity is 25 years (as provided in Section C.1.2 while detailed information of gases & emission sources in baseline & project activity have discussed in Section B.3 of this document.

Project parameter monitoring
Net electrical energy that is supplied to grid will be metered using meters (Main & Check meters). Since these meters are not designed to measure high voltages and currents as generated in the STG, the generated output is connected to these meters via transformers (CT/PT) for stepping down the generated voltage and current to ranges which the meters can record. As such, these meters have a multiplying factor which when multiplied to the meter reading provides the actual amount of electricity generated. Details of monitoring of emission reductions and their calculation have been provided in Section B.7.2 & Section B.6.1 of this document.

Technical Description
The proposed project activity will involve setting up of two super-critical coal fired power generation units. Each unit will be of 700 MW (Nominal); thus, the total installed capacity will be 1,400 MW (Nominal). The technical parameters of the major equipment involved are as follows[6]:

Boiler

Parameter	Value
Superheater outlet steam flow (tph[7])	2,322
Steam pressure at Superheater outlet (kg/cm^2)	257.15
Steam temperature at Superheater outlet (°C)	568
Re-heater outlet steam flow (tph)	1,886.2
Steam pressure at Re-heater outlet (kg/cm^2)	61.47
Steam temperature at Re-heater outlet (°C)	596
Feedwater inlet temperature to economizer (°C)	311.9

Steam Turbine

Sl. No.	Parameter	Value
1	Rated Output (MW)	700
2	Main steam pressure at main stock valve inlet (kg/cm^2)	247
3	Main steam temperature at main stock valve inlet (°C)	565
4	Re-heat steam temperature at main stock valve inlet (°C)	593

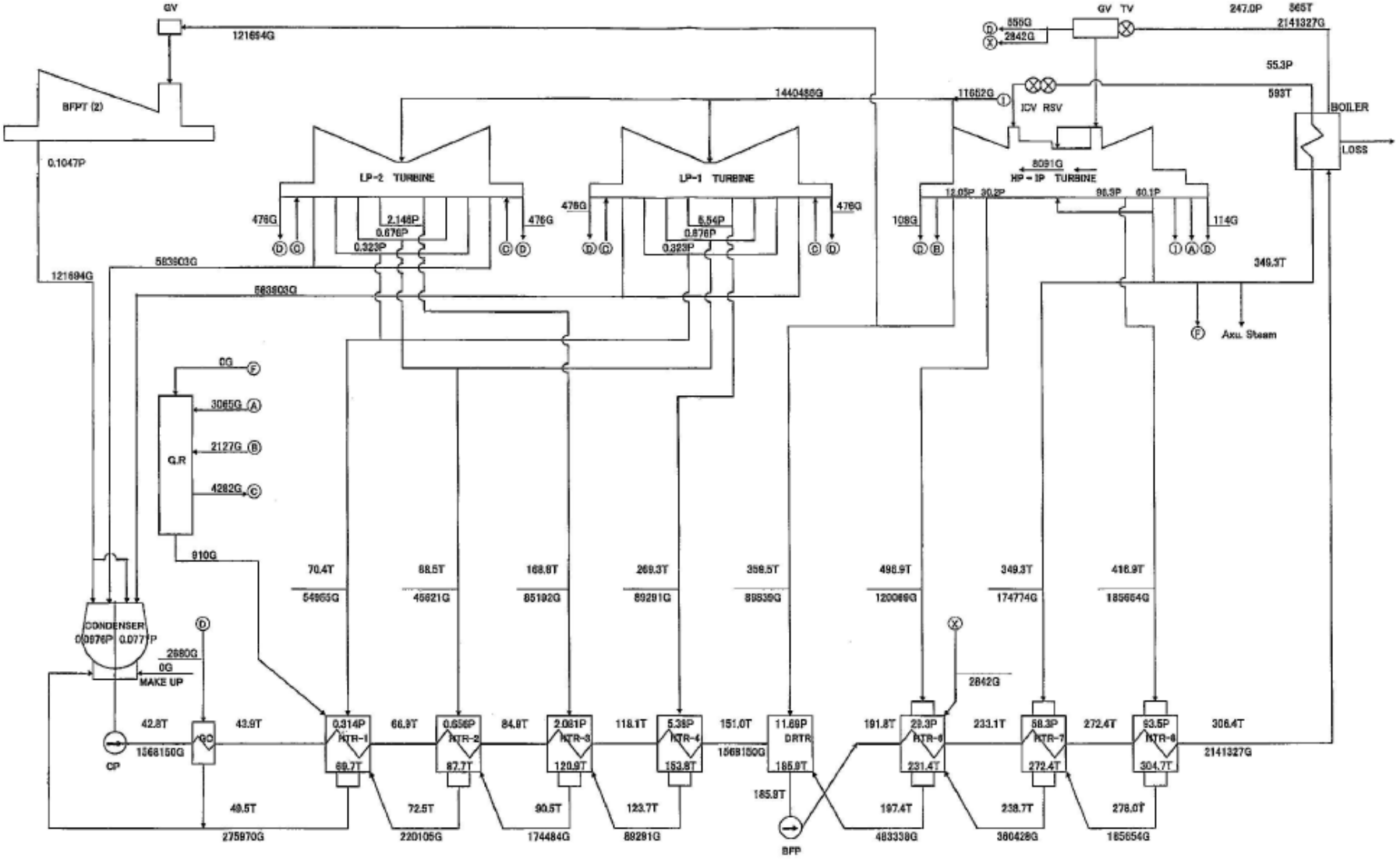
Generator

Sl. No.	Parameter	Value
1	Rated Power (MW)	700
2	Rated Capacity (MVA)	828
3	Power Factor	0.85 lag - 0.95 lead
4	Rated Terminal Voltage (kV)	20
5	Rated Speed (rpm[8])	3000
6	Cooling for Stator winding	Water
7	Cooling for Rotor winding	Hydrogen

[6] EPC Contract dated 16/07/2010
[7] 1 tph = 0.28 kg/s
[8] 1 rpm = 0.105 radians/sec

As also described in Section A.2 above, the plant will have a net efficiency of 40.49%. CO_2 is the GHG emitted by the project activity as a result of electricity generation. However as a result of improved efficiency, CO_2 emissions from project activity are significantly lesser than identified baseline scenario. Super- critical parameters result in lesser specific coal consumption and lesser specific GHG emissions.

Energy Balance Diagram for the project
Energy balance diagram (heat balance diagram) of the project activity is as follows:



LEGEND :
P = Pressure
T = Temperature
G = Flow

UNIT :
kg/cm2a
deg C
kg/h

RAJPURA PROJECT 2 x 700MW

HEAT BALANCE DIAGRAM

700,000kW

After analysis of the technical description, energy mass flow diagrams, and other presented data, the following conclusions may be drawn:

1. India's electricity supply is majorly from coal-fired subcritical units
2. The technical parameters justify that these units run on base load though their efficiency is less than the technology adopted in the project activity
3. This difference in efficiency is caused on account of the use of steam at higher pressure in supercritical systems
4. Since output is similar, this increase in efficiency is attributed to reduced coal consumption in the project activity
5. Coal consumption leads to CO_2 emission. Using lesser coal would reduce CO_2 emissions for delivering similar services/outputs.

Hence, it could be concluded that super-critical technology deployed in project activity is superior to identified baseline technology and the scenario existing prior to implementation of project activity.

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

>>

Years	Annual estimation of emission reductions in tonnes of CO_2e
May 2014 - March 2015	857,709
April 2015 - March 2016	938,246
April 2016 - March 2017	935,683
April 2017 - March 2018	935,683
April 2018 - March 2019	935,683
April 2019 - March 2020	938,246
April 2020 - March 2021	935,683
April 2021 - March 2022	935,683
April 2022 - March 2023	935,683
April 2023 - March 2024	938,246
April 2023 - May 2024	77,972
Total estimated reductions (tonnes of CO_2e)	**9,364,517**
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	936,451

A.4.5. Public funding of the project activity:

>>

No public funding has been used in this project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Title: Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology

Reference: ACM0013, Version 3, EB 53

The methodology also refers to the latest approved versions of:

- "Tool for the demonstration and assessment of additionality", Version 05.2, EB 39
- "Tool to calculate the emission factor for an electricity system", Version 02, EB 50

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

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The adopted baseline methodology has been chosen for the project activity based on the fulfilment of the applicability conditions as described below:

Sr. No.	Applicability Conditions as per ACM0013	Applicability to this Project Activity
1.	The project activity is the construction and operation of a new fossil fuel fired grid-connected electricity generation plant that uses a more efficient power generation technology[9] than what would otherwise be used with the given fossil fuel	The project activity is the installation and operation of a new 1,400 MW coal-fired thermal power plant employing super-critical technology which is a more efficient power generation technology than a subcritical coal fired thermal power plant. The baseline has been identified in Section B.4. The baseline net efficiency is 36.63% (calculated in Section B.6.1) while project net efficiency is 40.49%[10] (considering gross station heat rate on GCV basis (GSHR) of 2,082 kcal/kWh[11] and auxiliary consumption of 5.50%). Thus, the net efficiency of the project is almost 4% higher than that of the baseline and hence, this applicability criterion is met.
2.	The project activity does not include the construction and operation of a co-generation power plant	The project activity is not a co-generation power plant.
3.	Data on fuel consumption and electricity generation of recently constructed power plants are available	The publicly available relevant data/ information on electricity generation are available with Central Electricity Authority (CEA), Govt. of India. The specific emission factors of the plants (tCO_2/MWh) and the generation figures are sourced thereby, while

[9] A possible project activity could be, e.g., the construction and operation of a supercritical coal fired power plant.

[10] $\text{Efficiency} = \frac{3600 \times \{1 - \text{Auxiliary}(= 5.5\%)\}}{\text{GSHR}(= 2082\text{kcal/kWh}) \times \text{NCV} : \text{GCVratio}(= 0.964) \times 4.1867}$

[11] EPC Contract dated 16/07/2010

<table>
<tr><th>Sr. No.</th><th>Applicability Conditions as per ACM0013</th><th>Applicability to this Project Activity</th></tr>
<tr><td></td><td></td><td>the weighted average operating gross calorific values (kcal/kg[12]) of the recently constructed power plants are published by the relevant Electricity Regulatory Commissions.</td></tr>
<tr><td>4.</td><td>The identified baseline fuel is used in more than 50% of total generation by utilities in the geographical area within the country, or in the entire host country. To demonstrate this applicability condition data from the latest three years shall be used. Maximum value of same fossil fuel generation estimated for three years should be greater than 50%.</td><td>The baseline fuel (sub-bituminous coal), which is identified further in Section B.4, constitutes more than 50% of total generation by utilities in India (host country) as per the data provided below:
<table>
<tr><th>Time</th><th>Total Generation (GWh)</th><th>Total Generation - Coal Based (GWh)</th><th>% share of coal based utilities</th></tr>
<tr><td>2009-10[13]</td><td>222,397</td><td>145,342</td><td>65.35%</td></tr>
<tr><td>2008-09[14]</td><td>296,075</td><td>217,492</td><td>73.46%</td></tr>
<tr><td>2007-08[15]</td><td>362,071</td><td>271,557</td><td>75.00%</td></tr>
</table>
The baseline fuel may be classified as follows:
Fossil Fuel Category: SOLID fuel
Fossil Fuel Type: Sub-bituminous coal</td></tr>
<tr><td>5.</td><td>This methodology is only applicable to new electricity generation plants.</td><td>The project activity is a new electricity generation plant.</td></tr>
<tr><td>6.</td><td>The methodology is only applicable if the most plausible baseline scenario is the construction of (a) new power plant(s) using the same fossil fuel category as used in the project activity</td><td>The present project is a greenfield activity. As per the outcome of Section B.4 in this document, the fossil fuel category of both project as well as baseline is SOLID fuel. Also, the fossil fuel type of both project and baseline in Sub-bituminous coal.</td></tr>
</table>

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

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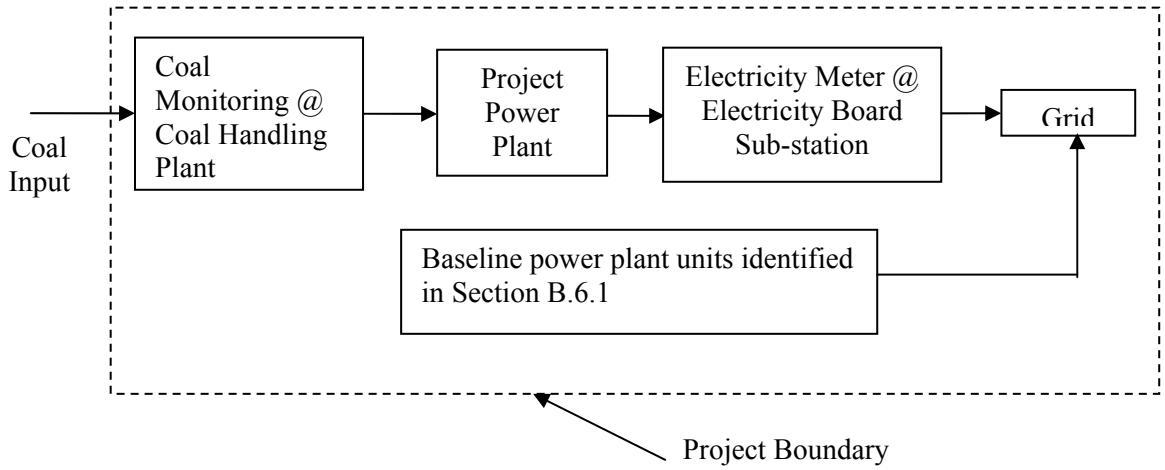
As per the approved methodology, "*The spatial extent of the project boundary includes the power plant at the project site and all power plants considered for the calculation of the baseline CO_2 emission factor.*"

[12] 1 kcal/kg = 4.1867 kJ/kg
[13] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)
[14] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)
[15] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

The project boundary includes the electricity generation equipment at the site and the transport through the electricity grid to the substation. Hence, project boundary is considered within these terminal points. The project boundary, as per monitoring layouts involving the project activity, is portrayed as follows:



The greenhouse gases included in or excluded from the project boundary are as follows:

	Source	Gas	Included?	Justification
Baseline Scenario	Power generation in baseline	CO_2	Yes	Main Emission source
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	On-site fuel combustion in the project plant	CO_2	Yes	Main Emission source
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.

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

>>

As per the version 3 of the approved methodology, following steps are performed for arriving at the baseline scenario:

Step 1: Identification of plausible baseline scenarios

It is required to identify realistic and credible alternative(s) that were available to NPL or similar project developers that provide output or services comparable with the project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.

Sub-step 1a: Define alternatives to the project activity

The following plausible alternatives have been analysed as prescribed by the baseline methodology (ACM0013):

- The project activity not implemented as a CDM project
- The construction of one or several other power plants instead of the proposed project activity, including:

- Power generation using the same fossil fuel category as in the project activity, but technologies other than that used in the project activity;
- Power generation using fossil fuel categories other than that used in the project activity;
- Other power generation technologies, such as renewable power generation.

- Import of electricity from connected grids, including the possibility of new interconnections

The plausible baseline scenarios among the above alternatives have been identified using the following eligibility criteria as recommended by ACM0013:

- ***Realistic and credible:*** These include:
  - Those alternatives for which technology is commercially established and available
  - Those alternative technologies that are prevailing: Power plant technologies that have recently been constructed or are under construction or are being planned

- ***Provide outputs or services comparable with the CDM project activity:*** These include:
  - Those alternatives that provide similar output in terms of the PLF, peak versus base load power and power quality
  - In compliance with all applicable legal and regulatory requirements

Alternatives	Eligibility / Plausibility
The project activity not implemented as a CDM project by NPL	
Supercritical technology based coal fired power generation without CDM Net Efficiency: 40.49% (project activity) Lifetime: 25 years[16] Fuel Category: SOLID fuel Fuel Type: Sub-bituminous coal	*Availability of technology*: As there are no super-critical technology projects operational in India, delivery of output & services is not available in current scenario. However in parts of the world where super-critical technology is deployed, reliability is at par with sub-critical technology[17]. *Regulatory compliance:* Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary *Conclusion:* Plausible baseline alternative, considered for further analysis.
Power generation using the same fossil fuel category as in the project activity, but technologies other than that used in the project activity	
Subcritical technology based coal fired power generation at pit-head Net Efficiency: 34.78% (average of	*Availability of technology*: The sub-critical technology is predominant in India. As established previously in Section B.2, coal based thermal power plants accounts for more than 50%, which is fully based on sub-

[16] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[17] Page 23, Report of the committee to recommend next higher size of Coal fired thermal power station, CEA, GoI 2003 (http://www.cea.nic.in/reports/articles/thermal/committee_recommend_thermal.pdf)

<table>
<tr>
<td>most efficient plants in India included in baseline sample group)
Lifetime: 25 years[18]

Fuel Category: SOLID fuel
Fuel Type: Sub-bituminous coal</td>
<td>critical technology

Regulatory compliance:
Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary

Similar services:
Pit-head coal fired projects utilizing sub-critical technology are base load plants (>3,000 hrs. /year or > 34.25% Load factor). Generation[19] and load factor achieved by the alternative during the following 3 financial years in the NEWNE grid boundary is as follows:

<table>
<tr><th></th><th>2007-08</th><th>2006-07</th><th>2005-06</th></tr>
<tr><td>Generation in NEWNE (GWh)</td><td>177,865</td><td>164,671</td><td>154,159</td></tr>
<tr><td>Load factor in NEWNE (%)</td><td>67.06%</td><td>69.21%</td><td>68.08%</td></tr>
</table>

Hence the alternative is credible and realistic in terms of output & services

Conclusion: Plausible baseline alternative, considered for further analysis.</td>
</tr>
<tr>
<td>Subcritical technology based coal fired power generation using linkage coal

Net Efficiency: 34.78% (average of most efficient plants in India included in baseline sample group)
Lifetime: 25 years[20]

Fuel Category: SOLID fuel
Fuel Type: Sub-bituminous coal</td>
<td>Availability of technology:
The sub-critical technology is predominant in India. As established previously in Section B.2, coal based thermal power plants accounts for more than 50% which is fully based on sub-critical technology

Regulatory compliance:
Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary

Similar services:</td>
</tr>
</table>

[18] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[19] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)
[20] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

<table>
<tr>
<td></td>
<td>Linkage coal fired projects utilizing sub-critical technology are base load plants (>3,000 hrs. /year or > 34.25% Load factor). Generation[21] and load factor achieved by the alternative during the following 3 financial years in the NEWNE grid boundary is as follows:

<table>
<tr><th></th><th>2007-08</th><th>2006-07</th><th>2005-06</th></tr>
<tr><td>Generation in NEWNE (GWh)</td><td>177,865</td><td>164,671</td><td>154,159</td></tr>
<tr><td>Load factor in NEWNE (%)</td><td>67.06%</td><td>69.21%</td><td>68.08%</td></tr>
</table>

Hence the alternative is credible and realistic in terms of output & services

Conclusion: Plausible baseline alternative, considered for further analysis.</td>
</tr>
<tr>
<td>Subcritical technology based coal fired power generation using imported coal

Net Efficiency: 34.78% (average of most efficient plants in India included in baseline sample group)
Lifetime: 25 years[22]

Fuel Category: SOLID fuel
Fuel Type: Sub-bituminous coal</td>
<td>Availability of technology:
The sub-critical technology is predominant in India. As established previously in Section B.2, coal based thermal power plants accounts for more than 50% which is fully based on sub-critical technology

Regulatory compliance:
Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary

Similar services:
Linkage coal fired projects utilizing sub-critical technology are base load plants (>3,000 hrs. /year or > 34.25% Load factor). Generation[23] and load factor achieved by the alternative during the following 3 financial years in the NEWNE grid boundary is as follows:

<table>
<tr><th></th><th>2007-08</th><th>2006-07</th><th>2005-06</th></tr>
<tr><td>Generation in NEWNE (GWh)</td><td>177,865</td><td>164,671</td><td>154,159</td></tr>
<tr><td>Load factor in</td><td>67.06%</td><td>69.21%</td><td>68.08%</td></tr>
</table>
</td>
</tr>
</table>

[21] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)
[22] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[23] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

<table>
<tr>
<td></td>
<td>
<table>
<tr><td>NEWNE (%)</td><td></td><td></td><td></td></tr>
</table>

Hence the alternative is credible and realistic in terms of output & services

Further considerations: Though at a first glance it may appear that imported coal may be plausible baseline alternative, however, it may please be noted that this is actually not credible considering the following facts:
a. The project location had been pre-decided and the PP does not have an independence to choose the project location
b. The pre-decided project location is in the state of Punjab in India which is more than 1,500 km from the nearest sea-port.

In the light of the above considerations, it may safely be concluded that selection of imported coal as a plausible baseline alternative is extremely unlikely and not credible

Conclusion: Not a plausible baseline alternative
</td>
</tr>
<tr>
<td>Subcritical technology based lignite fired power generation at pit-head

Net Efficiency: 34.78% (average of most efficient plants in India included in baseline sample group)
Lifetime: 25 years[24]

Fuel Category: SOLID fuel
Fuel Type: Lignite</td>
<td>Availability of technology:
Though the sub-critical technology is predominant in India there are only 8 lignite-fired power plants running in India which are concentrated at Neyveli (4 nos.) and at Gujarat (3 nos.) near India’s lignite reserves.

Regulatory compliance:
Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary

Similar services:
Pit-head lignite fired projects utilizing sub-critical technology are generally base load plants (>3,000 hrs. /year or > 34.25% Load factor). Generation[25] and load factor achieved by the alternative during the following 3 financial years in the NEWNE grid boundary is as follows:

<table>
<tr><th></th><th>2007-08</th><th>2006-07</th><th>2005-06</th></tr>
<tr><td>Generation in NEWNE (GWh)</td><td>2,313</td><td>1,894</td><td>4,101</td></tr>
</table>
</td>
</tr>
</table>

[24] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[25] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

	Load factor in NEWNE (%) | 43.09% | 34.06% | 59.21% Though, in 2006-07, a load factor of 34.25% was not achieved, yet the gap is marginal. Hence the alternative is credible and realistic in terms of output & services *Availability of Lignite:* However, the only mineable reserve of Lignite within the grid boundary is at Gujarat and it is developed by the Gujarat Mineral Development Corporation Limited. The pit-head prices (with effect from 01/03/2011) as reported are as follows: **Mine** | **Price (INR/MT)[26]** Matano-madh | 1,615.97 Tadkeshwar | 1,728.04 Rajpardi | 2,382.25 Bhavnagar | 1,465.27 There is no appreciable difference of capital costs between setting up a thermal power plant based on coal or lignite as both are based on subcritical technology. However, considering the lower GCV & the higher price of lignite compared to coal, it may be concluded that lignite will not be source of power cheaper than coal. Hence, this alternative is not undertaken for further analysis. *Conclusion*: Not a plausible baseline scenario
Power generation technologies using energy sources other than that used by NPL	
Natural Gas based power plant Efficiency: 40-45%[27] Lifetime: 25 years[28] Fuel Category: GAS fuel Fuel Type: Natural Gas	*Availability of technology:* After sub-critical technology, gas based thermal power plants form the more widely observed thermal power plants in India *Regulatory compliance:* Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary *Similar services:* Gas fired projects are majorly operating as base load plants (>3,000 hrs. /year or > 34.25% Load factor). Generation[29] and load factor achieved by the alternative during the following 3

[26] GMDC Lignite prices (http://www.gmdcltd.com/showpage.aspx?contentid=1051)
[27] http://www.ge-energy.com/content/multimedia/_files/downloads/gas_turbines_cat.pdf
[28] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[29] CEA database version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

<table>
<tr><td></td><td>financial years in the NEWNE grid boundary is as follows:

<table><tr><th></th><th>2007-08</th><th>2006-07</th><th>2005-06</th></tr><tr><td>Generation in NEWNE (GWh)</td><td>23,670</td><td>22,934</td><td>21,800</td></tr><tr><td>Load factor in NEWNE (%)</td><td>48.41%</td><td>42.54%</td><td>35.21%</td></tr></table>
Hence the alternative is credible and realistic in terms of output & services

Conclusion: Plausible alternative scenario, considered for further analysis.</td></tr>
<tr><td>Power generation using energy sources (diesel/ fuel oil/naphtha) other than coal

Efficiency: 35-40%
Lifetime: 25 years[30]

Fuel Category: LIQUID fuel
Fuel Type: Diesel/Residual Fuel Oil/Naptha</td><td>Regulatory compliance:
Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary.

Availability of technology:
The highest capacity power plant running on diesel in India is of 175 MW (Pampore DG) only.

Availability of fuel:
India’s cumulative production of diesel for the year 2006-07 after reckoning the requirement of the transport sector is estimated at 26.54 Million tons[31]. Project requirement of diesel to operate as a base-load plant in order to deliver services comparable to project activity is approximately 1,683 million tons (considering CEA standard values for station heat rate of 1,975 kcal/kWh, density of diesel of 830 kg/m^3 and GCV of diesel at 10,500 kcal/m^3). As the required quantum of diesel for project activity is 64 times more than India’s domestic availability and with no further diesel manufacturing capacity enhancement underway, the option is not realistic and credible.

With increase in global Naphtha prices, and prevailing price differential between export price and domestic price, Naphtha is a predominantly exported commodity[32] as follows:

<table><tr><th>Year</th><th>Production (‘000 tonnes)</th><th>Export (‘000 tonnes)</th><th>% Export</th></tr></table></td></tr>
</table>

[30]CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[31] Point 8 & 10, Page II: Energy Statistics 2007 Highlights (http://mospi.nic.in/es07_highlights.pdf)
[32] Petroleum Statistics Page 16 (http://petroleum.nic.in/petstat.pdf)

	2005-06 | 14,509 | 5,066 | 34.92 2006-07 | 16,660 | 8,411 | 50.49 2007-08 | 16,440 | 9,297 | 56.55 2008-09 | 14,826 | 7,601 | 51.27 2009-10 | 14,812 | 9,911 | 66.91 *Similar services:* Additionally, as per CEA publication, load factor achieved by this alternative is less than 34.25% (i.e., less than 3,000 hours/year). *Conclusion*: Not a plausible baseline scenario.
Power generation using energy sources (renewable energy sources) other than coal PLF (wind): 20-25% Lifetime (wind): 25 years PLF (hydro): 40-50% Lifetime (hydro): 35 years[33] PLF (solar): 20% Lifetime (solar): 25 years[34]	*Regulatory compliance:* Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary. In this alternative scenario, the project proponent could have considered generation of power using renewable energy sources which includes hydro power, wind power, biomass energy etc. In this option there would be no GHG emissions and this alternative is in compliance with all applicable laws and regulations of the country. *Availability of technology:* Generation of power to the tune of 1,400MW (which would be running on a base load) using renewable resources like hydro, wind, biomass etc is not a technically and economically feasible proposition on account of inconsistent availability of renewable resources as wind, river water and biomass are seasonal in nature. *Similar services:* Due to its seasonal nature, renewable resource based power generating stations are typically used for peak load services. Wind & hydro power projects are not used for meeting the base load services. As regards to biomass based power generation, the efficiency of the plant ranges between 24%-30%[35]. As regards solar power, the life expectancy of the projects is estimated at 25 years. For the above reasons, renewable energy projects cannot be considered as plausible alternatives.

[33]CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[34] CERC Tariff Guidelines for Renewable Energy, Page 11 (http://www.cercind.gov.in/2010/November/Signed_Order_256-2010_RE_Tariff_FY_11-12.pdf)
[35] Article 7.31, pg 11, Tariff Order for procurement of power biomass based generation (http://www.mperc.org/Biomass-order-7-8-07.pdf)

	Conclusion: Not a realistic baseline scenario.
Power generation using Nuclear reactor based technology	*Regulatory compliance:* Though "The Indian Atomic Energy Act - 1962[36]" permits private participation in a Government Company for atomic power generation, so far, no private entity has entered or has been entertained. Since, a private sector Company cannot setup a nuclear power plant without majority Government participation, this alternative is not a realistic or credible baseline alternative. *Conclusion*: Not a plausible baseline scenario
Electricity Imports from other grids	*Regulatory compliance* Electricity generation is de-licensed in India. Neither the Indian Electricity Act 2003 nor any regulation promulgated by the relevant authority restricts the alternative. The alternative is in compliance with applicable legal and regulatory requirements of the Govt. of India and is available to other stakeholders within the NEWNE grid boundary. *Availability of technology:* Electricity Import from other regional grids in India is not an alternative which will deliver outputs similar to the project activity, as these grids are suffering from shortages to meet their energy demand and in particular the peak demand. The average energy deficit for the past 3 years are as follows: **Region** | **2007-08[37]** | **2008-09[38]** | **2009-10[39]** Northern | 10.8% | 11.1% | 11.6% Eastern | 4.9% | 4.4% | 4.4% North-Eastern | 12.3% | 13.5% | 11.1% Southern | 3.2% | 7.5% | 6.4% Western | 15.8% | 16.0% | 13.7% All India | 9.9% | 11.1% | 10.1% As far as other countries are concerned, the Indian National Grid is connected to Nepal & Bhutan only. The following table[40] provides the amount of electricity imported (in GWh) from these countries in the past 3 years:

[36] Indian Atomic Energy Act - http://www.dae.gov.in/rules/aeact.pdf
[37] CEA published executive summary of Power Sector (2007-08) (http://www.cea.nic.in/archives/exec_summary/apr08.pdf)
[38] CEA published executive summary of Power Sector (2008-09) (http://www.cea.nic.in/archives/exec_summary/apr09.pdf)
[39] CEA published executive summary of Power Sector (2009-10) (http://www.cea.nic.in/reports/monthly/executive_rep/apr10/25-26.pdf)
[40] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

Sl. No.	Country	2007-08	2008-09	2009-10
1.	Bhutan	5,230	5,897	5,341
2.	Nepal	-289	-90	0

The above table reveals that the Nepal grid is power deficit itself. Though India has been importing grid from Bhutan, the average amount of electricity being imported (approx. 5,500 GWh) is half of the total energy being generated by the project (approx. 10,000 GWh).

Similar services:
It can be concluded from the above that imports do not deliver base-load power and therefore do not have output and services comparable to the project activity.

Conclusion: Not a realistic baseline scenario

Sub-step 1b: Consistency with mandatory laws and regulations
As discussed above, the following alternatives are plausible baseline scenarios and they meet mandatory laws and regulations:
1. Supercritical technology based coal fired power generation without CDM
2. Subcritical technology based coal fired power generation at pit-head
3. Subcritical technology based coal fired power generation using linkage coal
4. Natural Gas based power plant

Step 2: Investment Analysis
Sub-step 2a: Identification of the economically most attractive baseline scenario alternative
The methodology prescribes to use investment analysis to identify the economically most attractive baseline scenario alternative. The levelized unit cost of electricity, (in INR/kWh) of the alternatives summarized in Sub-step 1b, is calculated to identify the most attractive baseline scenario for the project activity. The assumptions for calculating levelized unit cost of electricity of the identified plausible baseline options have been listed below:

General Assumptions - Common for all alternatives

Parameter	Unit	Value	Source
Project Duration	years	25	Request for Qualification (RfQ) issued by PSEB dated 10/06/2009
Debt – Equity Ratio		75:25	Letter from lenders dated 26/04/2011
Rate of interest on loan capital	%	10.50	Letter from lenders dated 26/04/2011
Rate of interest on working capital	%	11.75	Prime Lending Rate of State Bank of India[41] (as per CERC Tariff

[41] SBAR historical values (http://in.mobile.reuters.com/article/article/idINSGE6930CG20101004?ca=rdt)

			Regulation 2009)
Depreciable Amount	%	95	Considering terminal value of non-depreciable assets namely land
Loan Repayment Period	years	12	Letter from lenders dated 26/04/2011
Depreciation up to 12th year	%	5.28	CERC Tariff Guidelines dated 19/01/2009[42], and Appendix III[43] to the same
Depreciation beyond 12th year	%	2.05	CERC Tariff Guidelines dated 19/01/2009[44]
PLF	%	93	Review of performance of Thermal Power Stations, 2008-09[45]
Discounting Rate	%	10.19	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009
Estimation of Working Capital: Receivables	months	1	A value of 2 months is suggested by CERC Tariff Guidelines dated 19/01/2009[46]. However, 1 month has been adopted considering timely payment of bills
Estimation of Working Capital: O&M	months	1	CERC Tariff Guidelines dated 19/01/2009[47]
Estimation of Working Capital: Maintenance Spares	% of O&M cost	30% (only for NG)	CERC Tariff Guidelines dated 19/01/2009[48]
Estimation of Working Capital: Fuel	months	2 months for project and linkage based options	CERC Tariff Guidelines dated 19/01/2009[49]

[42] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[43] Appendix III to the CERC Tariff Guidelines dated 19/01/2009 (http://www.cercind.gov.in/2009/Whats-New/tariff-pdf/Appendix-III.pdf)
[44] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[45] As per the review, overall operating availability of generating stations under private sector utilities was 92.73% which was the highest among different sectors. Hence, PLF has been assumed as 93%
[46] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[47] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[48] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[49] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

		1 month for pit-head coal 1 month for NG	
Estimation of Working Capital: Secondary Fuel	months	2	CERC Tariff Guidelines dated 19/01/2009[50]
Rates of Taxation	%	16.995% for Minimum Alternate Tax 33.99% for Corporate Tax	Tax rates prevailing at the time of decision making
Terminal Value	INR	5% of project cost escalated at 5% over project duration	Considered

Alternative 1: Supercritical technology based coal fired power generation without CDM

Parameter	Unit	Value	Source
Project Cost	INR million	95,000	Board note dated 17/03/2010
Project Capacity	MW	1,400	Board note dated 17/03/2010 and PSEB approved capacity dated 13/04/2010
O&M	INR million	0.85	O&M Solutions letter dated 18/09/2009
Escalation in O&M	%	5.00	O&M Solutions letter dated 18/09/2009
Auxiliary Consumption	%	5.50	CERC Tariff Guidelines dated 19/01/2009[51] (6%). However, as per the EPC Contract, auxiliary consumption has been reduced to 5.50% which is conservative.
Unit Heat Rate	kcal/kWh	2,082	Consideration of financial institutions based on the EPC Guarantee
Coal Gross Calorific Value	kcal/kg	4,080	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009
Coal Price	INR/MT	520	Communication from Punjab State Electricity

[50] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[51] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

			Board (PSEB) dated 11/09/2009
Escalation in Coal Price	%	6.12	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009
Coal Transportation Cost	INR/MT	1,204	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009
Escalation of Coal Transportation Cost	%	2.39	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009
Requirement of secondary fuel	ml/kWh[52]	0.28	Recommendation on operating norms for thermal power plants by CEA[53]
Price of Secondary Fuel	INR/litre[54]	23.94	Spot prices of FO as on 18/09/2009 listed on NCDEX archives[55]
Escalation of price of secondary fuel	%	6.78	CAGR of price index of FO published on the website of the Office of the Economic Advisor, India[56]
Ash content of coal	%	37.5	PSEB Communication dated 16/09/2009
Saleable ash	%	80	MoEF Notification dated 06/11/2008
Sale price of ash	INR/MT	341	ACC Annual Report
Escalation in sale price of ash	%	5	Inflation rate for host country

Alternative 2: Subcritical technology based coal fired power generation at pit-head

Parameter	Unit	Value	Source
Project Cost	INR million	48,223	Average of project cost for all TPP of 2x600 MW capacity for which orders were placed in 2008 - Sourced from CEA Report

[52] 1 ml = 10^{-6} m^3
[53] Recommendation on Operating Norms for Thermal Power Plants (http://www.cercind.gov.in/October08/Report-CERC-norms-CEA-Final-04-11-08.pdf)
[54] 1 litre = 10^{-3} m^3
[55] NCDEX Spot price, Archive 2009 (http://www.ncdex.com/Market_Data/hist_spot_price_2009.aspx)
[56] Office of the Economic Advisor, India (http://www.eaindustry.nic.in) - Yearly index figures for furnace oil (five year period from 2005 to 2009)

			July 2009
Project Capacity	MW	1,200	CEA Report, July 2009
O&M	INR million	0.85	Considered similar to project activity
Escalation in O&M	%	5.00	Considered similar to project activity
Auxiliary Consumption	%	5.50	Considered similar to project activity
Unit Heat Rate	kcal/kWh	2,301	Gross Heat Rate of most efficient operating unit in India as defined under Option 1 in Section B.6.1[57]
Coal Gross Calorific Value	kcal/kg	4,080	Considered similar to project activity
Coal Price	INR/MT	520	Considered similar to project activity
Escalation in Coal Price	%	6.12	Considered similar to project activity
Requirement of secondary fuel	ml/kWh	0.28	Considered similar to project activity
Price of Secondary Fuel	INR/litre	23.94	Considered similar to project activity
Escalation of price of secondary fuel	%	6.78	Considered similar to project activity
Ash content of coal	%	37.5	Considered similar to project activity
Saleable ash	%	80	Considered similar to project activity
Sale price of ash	INR/MT	341	Considered similar to project activity
Escalation in sale price of ash	%	5	Considered similar to project activity

Assumptions for Alternative 3: Subcritical technology based coal fired power generation using linkage coal

Parameter	Unit	Value	Source
Project Cost	INR million	48,223	Average of project cost for all TPP of 2x600 MW capacity for which orders were placed in 2008 - Sourced from CEA Report July 2009
Project Capacity	MW	1,200	CEA Report, July 2009
O&M	INR million	0.85	Considered similar to project activity

[57] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

Escalation in O&M	%	5.00	Considered similar to project activity
Auxiliary Consumption	%	5.50	Considered similar to project activity
Unit Heat Rate	kcal/kWh	2,301	Gross Heat Rate of most efficient operating unit in India as defined under Option 1 in Section B.6.1[58]
Coal Gross Calorific Value	kcal/kg	4,080	Considered similar to project activity
Coal Price	INR/MT	520	Considered similar to project activity
Escalation in Coal Price	%	6.12	Considered similar to project activity
Coal Transportation Cost	INR/MT	1,204	Considered similar to project activity
Escalation of Coal Transportation Cost	%	2.39	Considered similar to project activity
Requirement of secondary fuel	ml/kWh	0.28	Considered similar to project activity
Price of Secondary Fuel	INR/litre	23.94	Considered similar to project activity
Escalation of price of secondary fuel	%	6.78	Considered similar to project activity
Ash content of coal	%	37.5	Considered similar to project activity
Saleable ash	%	80	Considered similar to project activity
Sale price of ash	INR/MT	341	Considered similar to project activity
Escalation in sale price of ash	%	5	Considered similar to project activity

Alternative 4: NG based power plant

Parameter	Unit	Value (NG Technology)	Source
Project Cost	INR million	51,958.1	Project Capacity of Pragati Power - III - Sourced from CEA Report, July 2009
Project Capacity	MW	1500	CEA Report, July 2009
O&M	INR million	1.849	CERC Tariff Guidelines dated 19/01/2009[59]
Escalation in O&M	%	5.72	CERC Tariff Guidelines

[58] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)
[59] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

			dated 19/01/2009[60]
Auxiliary Consumption	%	3	CERC Tariff Guidelines dated 19/01/2009[61]
Unit Heat Rate	kcal/kWh	2,000	CERC Tariff Guidelines dated 19/01/2009[62]
NG Gross Calorific Value	kcal/scm[63]	8,500	Transportation tariff for HVJ Pipeline system[64]
NG Price	US$/MMBTU[65]	4.20	KG6 basin price as per Oil & Gas Sector report 2009
Escalation in NG Price	%	1.31	CERC Notification dated 03/07/2009[66]
NG Transportation Price	INR/scm	1.15	Transportation tariff for HVJ Pipeline system[67]
Escalation in NG Transportation Price	%	3.13	CERC Notification dated 03/07/2009[68]

Based on the above assumptions, the levelized unit cost of electricity by the identified alternatives is as follows:

1. Supercritical technology based coal fired power generation without CDM: 2.41 INR/kWh
2. Subcritical technology based coal fired power generation at pit-head: 1.31 INR/kWh
3. Subcritical technology based coal fired power generation using linkage coal: 2.27 INR/kWh
4. Natural Gas based power plant: 3.44 INR/kWh

Sub-step 2b: Sensitivity Analysis

As per the approved methodology, "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." Further as per paragraph 17 of "Guidelines on the Assessment of Investment Analysis" Version 3.1 (EB 51), "*Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation.*" Here, such an analysis has been performed by applying a sensitivity of ±10% to the following identified parameters:

1. Project Cost
2. PLF
3. O&M
4. GCV

[60] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[61] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[62] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[63] 1 scm = 1 m^3
[64] Transportation tariff for HVJ Pipeline system (http://www.gailonline.com/gailnewsite/businesses/gastransmissiontariff.html)
[65] 1 MMBTU = 0.00105506 J
[66] CERC Notification for Escalation Rates (http://www.cercind.gov.in/Escalation-rate/Notification-dated-3.7-9.pdf)
[67] Transportation tariff for HVJ Pipeline system (http://www.gailonline.com/gailnewsite/businesses/gastransmissiontariff.html)
[68] CERC Notification for Escalation Rates (http://www.cercind.gov.in/Escalation-rate/Notification-dated-3.7-9.pdf)

5. Fuel Price
6. Fuel Transportation

The results in (INR/kWh) obtained for this analysis is as follows:

Parameter Varied	Variation	Sub Critical-Linkage	Sub Critical-Pithead	Super Critical	NG
Project Cost	+ 10%	2.31	1.35	2.47	3.48
	- 10%	2.24	1.27	2.34	3.41
PLF	+ 10%	2.21	1.25	2.32	3.37
	- 10%	2.35	1.38	2.51	3.52
O&M	+ 10%	2.29	1.32	2.42	3.48
	- 10%	2.26	1.30	2.39	3.40
GCV	+ 10%	2.13	1.26	2.28	3.20
	- 10%	2.44	1.37	2.56	3.74
Fuel Price	+ 10%	2.34	1.38	2.47	3.67
	- 10%	2.21	1.24	2.34	3.21
Fuel Transportation Price	+ 10%	2.37	1.31	2.49	3.48
	- 10%	2.18	1.31	2.32	3.40

The variations of ±10% may be considered to be appropriate as follows:

1. Project Cost: The actual project cost, as appraised by the financial institutions (INR 96,000 million), is more than the project cost (INR 95,000 million), assumed in the financial indicator calculation. The EPC contract has been signed and the project has made substantial investments and therefore, the cost considered and the variation, to which it has been subjected, is appropriate. The subcritical project cost has been arrived by considering the average of the capital cost of the projects which have released orders during 2008. Similarly for the natural gas alternative, the latest available capital cost (pertaining to the Pragati Power III Project) has been used. All these values represent finalized contracts and hence variation above the range of ±10% is unlikely.

2. O&M: The operation & maintenance costs for natural gas alternative have been sourced from the applicable CERC Tariff Guidelines dated 19/01/2009[69] which is based on data collated from all operating plants in India. Hence, the values provided in this regulation is an average justified from a large pool of data which includes expected escalation. For the project activity, O&M costs and its escalation is based on the estimate provided by a reputed O&M contractor. This assessment is expected to provide a similar result for the subcritical options also and is conservative as compared to the CERC estimate of INR 1.462 mill/MW for the year 2013-14. Hence variation above the range of ±10% is unlikely. In any case, any amount of variation in O&M costs does not impact the difference between the cost of power generation from the project and the linkage options.

3. PLF: The PLF values have been based on the load factors achieved by private sector thermal power plants as published in the Thermal Performance Review by CEA. It may be noted that this value is conservative over and above the CERC recommended estimate of 85%. Further, even at 100% PLF, the supercritical option is still costlier.

[69] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

4. GCV: The project has been assured 'F' Grade coal by South Eastern Coalfields Limited. The likely variation in the GCV, as per the Coal Analysis results provided to all the prospective bidders by PSEB, is in the range of 3,900 - 4,260 kcal/kg. The base value of the GCV (4,080 kcal/kg) is the average of this range as provided by PSEB to all prospective bidders for bidding. It can be seen that the likely variation on the value of 4,080 kcal/kg is only ±4.42%. Thus, variation to the extent of ±10% is highly unlikely. The GCV of NG has been sourced from the website of Gas Authority of India Limited (GAIL) which is the central authority in India for NG and its transmission.

5. Fuel & its Transportation Price: The prices & escalation of fuel and its transportation for coal based options (subcritical/supercritical) had been provided by PSEB to all prospective bidders and have also been cross-checked with publicly available values provided on the website of the Coal Company and CERC. The fuel cost of NG has been sourced from publicly available value.

In all of the scenarios, the pit-head option is the cheapest. Though this may entitle it to be the baseline option, however, it may be noted here that the exclusion of fuel transportation cost therein automatically makes it the cheapest option. Thus, for inland project activities, like this project itself, pit-head options may not be a correct indicative of the baseline even though it is available to other project developers within the grid boundary. Therefore, the subcritical linkage option is the baseline scenario for the project activity.

Further, it is mentioned in the methodology that, "*If the type of power plant identified as the baseline scenario is different from the power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in official power expansion plans), the project participants shall provide explanations to this apparent discrepancy between observations and what should be considered as rational economic behaviour.*"

As per the publicly available data[70] on Programmed / Commissioned Thermal Power projects during 11th Five Year Plan of India (2007-12), 6,620 MW of power plants have been added in 2007-08 of which 5,620 MW (approx. 85%) is based on subcritical technology running on coal. Similarly in the year 2008-09, 2,484.7 MW has been added of which 2,102.2 MW (approx. 84.5%) is also based on subcritical technology fired by coal. In 2009-10, a total of 6,790 MW (approx. 75%) is based on subcritical coal-fired technology out of the total addition of 9,106 MW. The remaining installed capacity is attributed to gas based projects.

As far as the installations planned in 2010-11 is concerned, 17,793 MW of capacity addition is planned of which 15,188 MW (approx. 85%) will be coal based using subcritical technology. In light of this data, it may be safely concluded that the identified baseline scenario is not different from the power plant technologies that have recently been constructed or are under construction or are being planned (e.g. documented in official power expansion plans).

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

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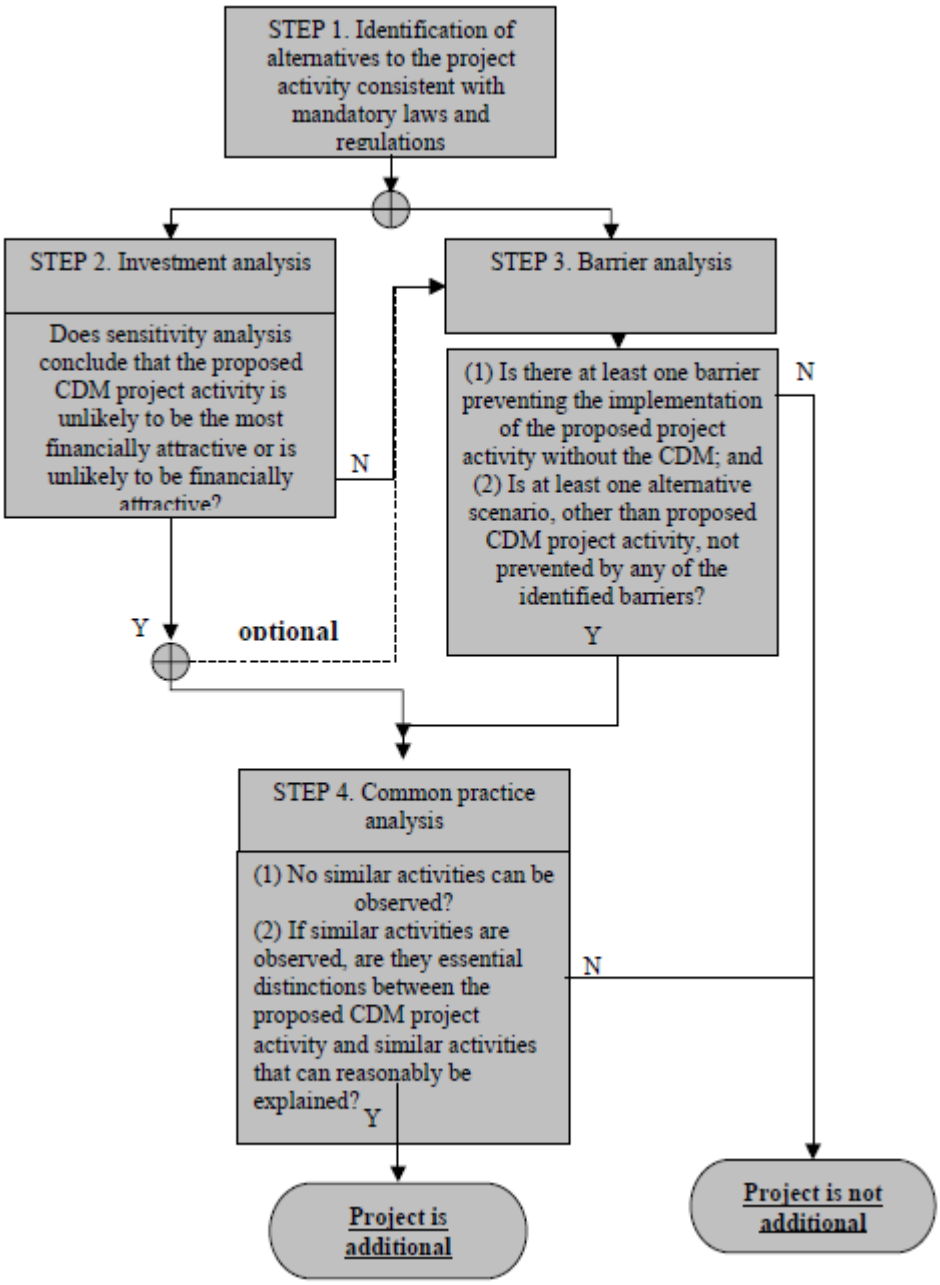
[70] Programmed / Commissioned Thermal Power projects during 11th Plan (http://www.cea.nic.in/reports/proj_mon/tpp_11plan.pdf)

As per the approved methodology ACM0013, Version 03, additionality is demonstrated using the following steps adopted from the latest version of the "Tool for demonstration and assessment of additionality":



Serious Consideration of CDM benefits:
The investment decision was taken by the Board of Directors of LTPDL on 22/09/2009 based on which the bid was submitted to PSEB. The project signed the EPC contract 16/07/2010. A brief chronological sequence of events pertaining to the project activity is as follows:

Sl. No.	Event	Date
1.	CDM consideration - Board Resolution to bid for the project	22/09/2009

2.	Intimation to UNFCCC & DNA	21/01/2010
3.	CDM Local Stakeholders' Meeting	30/03/2010
4.	Appointment of DOE	28/05/2010
5.	Signing of EPC Contract (CDM Project Start Date)	16/07/2010
6.	Obtaining Host Country Approval	14/03/2011

The PDD was webhosted for GSC from 14/09/2010. Since, the PDD was webhosted after the start date and that the start date of the project is post 02/08/2008, the project falls under "New Project Activity" as per paragraph 2 of EB49, Annex 22. Such projects are required to intimate UNFCCC and DNA within six months, from the start date, about their intention to register the project as CDM activity. Accordingly, UNFCCC and DNA were intimated on 21/01/2010 (even before the start date) about the intention to get the project registered as CDM activity. Therefore, the project conforms to the conditions stipulated vide paragraph 2 of EB 49, Annex 22.

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

This step has already been demonstrated in Section B.4 of this document. Referring the outcome of Sub-step 1b above, it may be summarized that the plausible alternatives to the project activity which meet mandatory laws and regulations, are as follows:

1. Supercritical technology based coal fired power generation without CDM
2. Subcritical technology based coal fired power generation at pit-head
3. Subcritical technology based coal fired power generation using linkage coal
4. Natural Gas based power plant

It may be noted here that though Integrated Energy Policy of India recognizes importance of reducing GHG emissions, no comparative advantage and/or incentives were offered to lesser emission intensive technologies such as super-critical technology deployed in the project activity. Sub-critical technology would continue to be the preferred technology for the establishment of sub-bituminous coal based power generation projects in India. Hence the baseline as per *sectoral policies and circumstances in baseline scenarios, described in EB-22 CDM M&P (decision 17/CP.7, 11/11/2001)*, is identified as E+. In the project boundary, power plants based on higher emission intensive sub-critical technology are observed.

Step 2: Investment Analysis

Sub-step 2a: Determine appropriate analysis method

As per the latest version of the "Tool for the demonstration and assessment of additionality", the possible analysis methods are:

Option I: Simple cost analysis
Option II: Investment comparison analysis
Option III: Benchmark analysis

As per the same tool," *If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis.*" Since the project generates revenue due to the sale of power, this option cannot be used for demonstrating additionality.

Further, as per guidance provided in paragraph 16 of the Guidelines on the Assessment of Investment Analysis (Version 3.1, EB 51), since the baseline identified in Section B.4 above "*leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services*", the Investment Comparison Analysis has been mandated.

However, the approved consolidated methodology ACM0013 (version 3) also stipulates that Investment Comparison Analysis may be used if it is "*demonstrated that the baseline alternative is available to the project participant(s)*". As the baseline option was not available to the PP at the time of time of bidding, the benchmark analysis has been adopted.

Further, the Internal Rate of Return (IRR) of the project activity serves as the indicator to assess the financial attractiveness of the project activity. This is because IRR is one of the known financial indicators used by banks, lending institutions and project developers for decision making.

Sub-step 2b: Option II: Apply benchmark analysis

As per paragraph 12 of the latest version of the "Guidelines on the Assessment of Investment Analysis", "*Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR.*" Accordingly the project participant has selected Prime Lending Rate (PLR) of the Reserve Bank of India (RBI), which is the local commercial lending rate, as the benchmark. At the time of CDM consideration (22/09/2009), the range of PLR was 11.00-12.00%[71]. Hence, the average value of 11.50% has been adopted as the benchmark for the project activity.

The following assumptions have been used in the computation of the project IRR:

Parameter	Unit	Value	Source - 1	Source - 2 (if any)
Project Cost	INR million	95,000	Board Note dated 17/03/2010	Letter from lenders dated 26/04/2011
Project Capacity	MW	1,400	Board Note dated 17/03/2010	PSEB approved capacity dated 13/04/2010
O&M	%	0.85	O&M Solutions letter dated 18/09/2009	-
Escalation in O&M	INR million	5.00	O&M Solutions letter dated 18/09/2009	-
Auxiliary Consumption	%	5.50	CERC Tariff Guidelines dated 19/01/2009[72] (6%). However, as per the EPC Contract, auxiliary consumption has been reduced to 5.50% which is conservative.	-
Unit Heat Rate	kcal/kWh	2,082	EPC Contract dated 16/07/2010	Consideration of financial institutions based on the EPC Guarantee
Coal Gross Calorific Value	kcal/kg	4,080	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009	-
Coal Price	INR/MT	520	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009	Price of 'F' Grade coal from South Eastern Coalfields Limited

[71] Prime Lending Rate of Reserve Bank of India (http://www.rbi.org.in/scripts/WSSView.aspx?Id=14022)
[72] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

				prevailing at the time of decision making
Escalation in Coal Price	%	6.12	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009	CERC Notification dated 27/03/2009[73]
Coal Transportation Cost	INR/MT	1,204	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009	Explanation to CERC Notification dated 03/07/2009[74] and assuming mine to plant distance of 1,487 km (=INR 1,617.2 x 1,487/2,000)
Escalation of Coal Transportation Cost	%	2.39	Communication from Punjab State Electricity Board (PSEB) dated 11/09/2009	CERC Notification dated 03/07/2009[75]
Requirement of secondary fuel	ml/kWh	0.28	Recommendation on operating norms for thermal power plants by CEA[76]	-
Price of Secondary Fuel	INR/litre	23.94	Spot prices of FO as on 18/09/2009 listed on NCDEX archives[77]	-
Escalation of price of secondary fuel	%	6.78	CAGR of price index of FO published on the website of the Office of the Economic Advisor, India[78]	-
Project Duration	years	25	Request for Qualification (RfQ) issued by PSEB dated 10/06/2009	CERC Tariff Guidelines dated 19/01/2009[79]
Debt – Equity Ratio		75:25	Letter from lenders dated 26/04/2011	Note to Board dated 15/03/2010
Rate of interest on loan capital	%	10.50	Letter from lenders dated 26/04/2011	Note to Board dated 15/03/2010
Rate of interest on working	%	11.75	Prime Lending Rate of State Bank of India[80] (as per	-

[73] CERC Notification of Escalation rates dated 27/03/2009 (http://www.cercind.gov.in/Escalation-rate/Notification-dated-27-3-09.pdf)
[74] Explanation to CERC Notification for Escalation rates dated 03/07/2009 (http://www.cercind.gov.in/Escalation-rate/Revised-Methodology-dated-3.7-9.pdf)
[75] CERC Notification for Escalation rates dated 03/07/2009 (http://www.cercind.gov.in/Escalation-rate/Notification-dated-3.7-9.pdf)
[76] Recommendation on Operating Norms for Thermal Power Plants (http://www.cercind.gov.in/October08/Report-CERC-norms-CEA-Final-04-11-08.pdf)
[77] NCDEX Spot price, Archive 2009 (http://www.ncdex.com/Market_Data/hist_spot_price_2009.aspx)
[78] Office of the Economic Advisor, India (http://www.eaindustry.nic.in) - Yearly index figures for furnace oil (five year period from 2005 to 2009)
[79] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[80] SBAR historical values (http://in.mobile.reuters.com/article/article/idINSGE6930CG20101004?ca=rdt)

capital			CERC Tariff Regulation 2009)	
Depreciable Amount	%	95	Considering terminal value of non-depreciable assets namely land	-
Loan Repayment Period	years	12	Letter from lenders dated 26/04/2011	-
Depreciation up to 12th year	%	5.28	CERC Tariff Guidelines dated 19/01/2009[81], and Appendix III[82] to the same	-
Depreciation beyond 12th year	%	2.05	CERC Tariff Guidelines dated 19/01/2009[83]	-
IT Depreciation Rate	%	15% on WDV with an additional 20% in the year of commissioning of a unit	Income Tax of India, 1961	-
PLF	%	93	Review of performance of Thermal Power Stations, 2008-09[84]	-
Estimation of Working Capital: Receivables	months	1	A value of 2 months is suggested by CERC Tariff Guidelines dated 19/01/2009[85]. However, 1 month has been adopted considering timely payment of bills	-
Estimation of Working Capital: O&M	months	1	CERC Tariff Guidelines dated 19/01/2009[86]	-
Estimation of Working	months	2	CERC Tariff Guidelines dated 19/01/2009[87]	-

[81] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[82] Appendix III to the CERC Tariff Guidelines dated 19/01/2009 (http://www.cercind.gov.in/2009/Whats-New/tariff-pdf/Appendix-III.pdf)
[83] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[84] As per the review, overall operating availability of generating stations under private sector utilities was 92.73% which was the highest among different sectors. Hence, PLF has been assumed as 93%
[85] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[86] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)
[87] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

Capital: Fuel				
Estimation of Working Capital: Secondary Fuel	months	2	CERC Tariff Guidelines dated 19/01/2009[88]	-
Ash content of coal	%	37.5	PSEB Communication dated 16/09/2009	-
Saleable ash	%	80	MoEF Notification dated 06/11/2008	-
Sale price of ash	INR/MT	341	ACC Annual Report	-
Escalation in sale price of ash	%	5	Inflation rate for host country	-
Terminal Value	INR	5% of project cost escalated at 5% over project duration	Considered	-
Quoted Tariff (INR/kWh)			Final quoted tariff	PSERC tariff approval dated 14/07/2010

Year	**Capacity Charges**	**Energy Charges**	**Total Charges**
2013-14	1.225	1.116	2.341
2014-15	1.363	1.141	2.504
2015-16	1.465	1.183	2.648
2016-17	1.549	1.227	2.776
2017-18	1.522	1.272	2.794
2018-19	1.466	1.320	2.786
2019-20	1.373	1.370	2.743
2020-21	1.326	1.422	2.748
2021-22	1.286	1.477	2.763
2022-23	1.418	1.534	2.952
2023-24	1.740	1.594	3.334
2024-25	1.513	1.657	3.169
2025-26	1.227	1.723	2.949
2026-27	1.230	1.792	3.022
2027-28	1.235	1.864	3.099
2028-29	1.226	1.940	3.166
2029-30	1.246	2.020	3.266
2030-31	1.229	2.103	3.332
2031-32	1.225	2.191	3.416
2032-33	1.232	2.283	3.515
2033-34	1.231	2.380	3.611
2034-35	1.230	2.482	3.712

[88] CERC Tariff Guidelines dated 19/01/2009 (http://cercind.gov.in/Regulations/Terms-and-Conditions-of-Tariff-Regulations_2009-2014.pdf)

2035-36	1.231	2.589	3.819
2036-37	1.230	2.701	3.931
2037-38	1.244	2.819	4.063
2038-39	1.515	2.927	4.443
Levelized Quoted Tariff			**2.89**

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

Based on the above assumptions, the project IRR is 10.50% which is lower than the selected benchmark (11.50%). Therefore, the project is not a business-as-usual scenario and hence, additional. Some additional information on the bidding process may be discussed here:

1. The bidding process required all bidders to bid for a supercritical project capable of having a saleable power capacity (also known as Contracted Capacity) of 1,200±10% MW.

2. LTPDL had placed a bid for a project with an installed capacity of 1,320 MW which would have a Contracted Capacity of 1,234.20 MW. This bid was based on cost estimates for 1,320 MW supercritical project received from an Engineering, Procurement & Construction (EPC) Contractor

3. After LTPDL had won the bid and the EPC Contractor was being considered for placing the final order, the following coal-based supercritical power plant credentials of the Original Equipment Manufacturer (OEM[89]) of the EPC Contractor were evaluated:

Sl. No.	***Capacity of power unit (MW)***	***No. of operational units of this capacity (as on December, 2010)***	***% total units***
1.	1,000	3	15.00
2.	900	1	5.00
3.	700	5	25.00
4.	600	10	50.00
5.	500	1	5.00

   Thus, even though the OEM has an in-house design system meant for designing & supplying power units of various capacities, LTPDL, based on the expertise of the OEM, decided to select the standard configuration nearest to the one quoted in the bid, i.e., two 700 MW units, for the present project activity.

4. Two such units will help the project have a total installed capacity of 1,400 MW with a Contracted Capacity of 1,320 MW (i.e., 1,200+10% MW and hence allowable as per the bid)

5. NPL (now a 100% subsidiary of the winner of the bid, i.e., LTPDL) raised this issue to the management on 15/03/2010 which was approved on 17/03/2010 pending authorization from PSEB. NPL requested PSEB on 23/03/2010 for this change in installed capacity to 1,400 MW and change in contracted capacity to 1,320 MW. This was approved by PSEB on 13/04/2010 after which the EPC Contract was signed on 16/07/2010 for 2 units of 700 MW each. It may please be noted here that all other technical parameters of the project remained unchanged.

As such, the project financials have been re-visited and the changes between the two capacities have been listed down as follows:

[89] OEM refers to L&T-MHI Boilers Private Limited & L&T-MHI Turbine Generators Private Limited

Sl. No.	*Parameter*	*Unit*	*Case 1: Value during Bidding*	*Case 2: Value during signing of EPC Contract*
1.	Project Capacity	MW	1,320	1,400
2.	Project Cost	INR Mill	90,000	95,000
3.	IRR	%	10.44	10.50

As evident from the above results, though in Case 2, the project IRR has improved marginally over Case 1, the necessity of CDM remains. Further, as Case 2 provides a more conservative approach to demonstration of additionality and also, since it is the project activity, Case 2 has been taken up for further analysis.

Sub-step 2d: Sensitivity analysis

This conclusion, namely, that the project is additional has been tested by subjecting critical parameters to reasonable variations, as required, vide paragraph 17 & 18 of the "Guidelines on the Assessment of Investment Analysis" Version 3.1 (EB 51). As per paragraph 17 of "Guidelines on the Assessment of Investment Analysis" Version 3.1 (EB 51), "*Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation.*" In this context, the parameters of capital cost and fuel-related costs (both fuel cost and its transportation) contribute to more than 80% of total costs. However, though the O&M costs constitute less than 20% of project cost/revenue, it was considered appropriate to subject the O&M cost also, to sensitivity analysis, as it is the only stand-alone expenditure in the financial indicator estimation.

In the context of revenue streams, the only source of revenue is sale of power which is dependent on the quantum of saleable power (based on the PLF achieved) and the tariff for sale of power. It may please be noted here that since this project activity was based on a competitive tariff-based bidding process, the tariff that has been bid and been selected, remains fixed during the entire project lifetime. This may be corroborated with the following extract of the adoption of this tariff by the Punjab State Electricity Regulatory Commission by Order dated 14/07/2010, which states:
"*Accordingly, in terms of Section 63 of the Act, the Commission adopts the evaluated levelized tariff of Rs. 2.890 per kWh for supply of power to the procurer by NPL.*"

In view of the above information, there is no possible sensitivity on the tariff and hence, only the PLF has been identified as the parameter which contributes to more than 20% of the project revenues. The results of the sensitivity analysis are as follows:

Parameter Varied	Variation	IRR
Normal	0%	10.50%
Project Cost	+ 10%	9.45%
	- 10%	11.69%
PLF	+ 10%	10.80%
	- 10%	10.03%
O&M	+ 10%	10.35%
	- 10%	10.64%
GCV	+ 10%	10.40%
	- 10%	10.61%
Fuel Price	+ 10%	10.50%
	- 10%	10.49%

Fuel Transportation Price	+ 10%	10.50%
	- 10%	10.49%

The sensitivity analysis further proves that power generation using super-critical coal-fired power generation technologies is not economically attractive even when the critical parameters are subjected to reasonable variations. The variations of ±10% may be considered to be appropriate as follows:

1. Project Cost: The actual project cost, as appraised by the financial institutions (INR 96,000 million), is more than the project cost (INR 95,000 million), assumed in the financial indicator calculation. The EPC contract has been signed and the project has made substantial investments and therefore, the cost considered and the variation, to which it has been subjected to, is appropriate. This value represents finalized contracts and hence variation above the range of ±10% is unlikely.

   Further analysis reveals that the project is likely to lose its additionality if the project cost drops down by 8.5%. However, such a situation is unlikely as the project cost is INR 96,000 million as against INR 95,000 million assumed in the calculation of the financial indicator, and that a substantial investment has already been made in the project which reveals that the project cost is unlikely to be less than INR 96,000 million.

2. O&M: For the project activity, O&M costs and its escalation is based on the estimate provided by a reputed O&M contractor. This assessment is expected to provide a similar result for the subcritical options also and is conservative as compared to the CERC estimate of INR 1.462 mill/MW for the year 2013-14. Hence, in any case, variation above the range of ±10% is unlikely.

   Further analysis reveals that the project is likely to lose its additionality if the O&M cost drops down by 71%. However, such a situation is unlikely as the O&M cost represents mainly, manpower cost, stores, consumables, spares and other administrative costs which are all subject to inflationary pressures. Hence, any reduction in the O&M cost is highly hypothetical. .

3. PLF: The PLF values have been based on the load factors achieved by private sector thermal power plants as published in the Thermal Performance Review by CEA. It may be noted that this value is conservative over and above the CERC recommended estimate of 85%

   Further analysis reveals that the project is likely to lose its additionality if the PLF goes up by 33%. This will tantamount to the project achieving a PLF of 124%, for the next 25 years, on a sustained basis. In this context, it may be stated that the maximum PLF achieved by any thermal power plant in India was only 105%. Therefore, achieving PLF of 124% for the next 25 years is impossible.

4. GCV: The project has been assured 'F' Grade coal by South Eastern Coalfields Limited. The likely variation in the GCV, as per the Coal Analysis results provided to all the prospective bidders by PSEB, is in the range of 3,900 - 4,260 kcal/kg. The base value of the GCV (4,080 kcal/kg) is the average of this range as provided by PSEB to all prospective bidders for bidding. It can be seen that the likely variation on the value of 4,080 kcal/kg is only ±4.42%. It may be further noted that GCV value also forms a part of the variable component of tariff for sale of power. In other words, it may be noted that the fuel & its transportation charges are reimbursed

by the procurer of electricity.[90] In this regard, the value of GCV has minimal impact on the project IRR.

5. Fuel & its Transportation Price: The prices of fuel transportation and escalation of fuel & its transportation for coal based options (subcritical/supercritical) have been provided by PSEB to all prospective bidders and have also been cross-checked with publicly available values provided on the website of the Coal Company and CERC. Further, the prices of fuel, its transportation & escalation form the variable component of tariff for sale of power. In other words, it may be noted that the fuel & its transportation charges are reimbursed by the procurer of electricity.[91] Hence, any variation in these costs will have no effect on the IRR.

Step 4: Common practice analysis
As per the approved methodological tool, common practice analysis includes:

"*Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis.*"

Sub-step 4a: Analyzing other activities similar to the proposed project activity:
The supercritical coal based power generation technology is of recent addition in India. As per the latest version of the additionality tool, it is required to provide "*an analysis of any other activities that are* ***operational*** *and that are* ***similar*** *to the proposed project activity.*" During decision making, there was no operating super-critical power plant in India at this scale (installed capacity of 1,400 MW) which is running on coal and supplying electricity to the grid. Further, it is only recently that Adani Power Limited has commissioned the first supercritical unit[92] coal-fired thermal power plant of India. This project is already a registered CDM project activity (UNFCCC Ref ID: 2716[93]).

However, considering the host country as the region, an analysis of super-critical technology based power plants under planning/implementation has been performed. It is observed that in all till 31/03/2011, there are 52 similar projects are underway. Of this 49 projects have applied or intend to apply for CDM, while the bids for 3 projects are underway. The list of commissioned/ under implementation/ planned supercritical projects is as follows:

No.	Project Developer	Capacity (MW)	CDM Status
1	Nabha Power Limited	1,400	Present project activity
2	Nabha Power Limited - Phase II	700	Under validation[94]
3	NCC Power	1,980	Yes[95]

[90] Article 1.2.3 of Schedule 7 of the draft Power Purchase Agreement by PSEB dated 10/06/2009
[91] Article 1.2.3 of Schedule 7 of the draft Power Purchase Agreement by PSEB dated 10/06/2009
[92] Business Standard Article (http://www.business-standard.com/india/news/adani-synchronises-660-mw-supercritical-plant/120093/on)
[93] Adani Power Limited - Registered CDM project activity (http://cdm.unfccc.int/Projects/DB/DNV-CUK1245932980.89/view)
[94] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/GPMNO6PFM436Z56FHKLPQI6252LKNO/view.html)

4	East Coast Energy	1,320	Under validation[96]
5	KPCL	1,600	Yes[97]
6	KPCL	800	Yes[98]
7	Adani Power Limited, Mundra - Phase III	1,320	CDM Registered[99]
8	Adani Power Limited, Mundra - Phase IV	1,980	Under validation[100]
9	Adani Power Maharashtra Limited, - Phase I	1,320	CDM Registered[101]
10	Adani Power Maharashtra Limited, - Phase II	1,980	Under validation[102]
11	Adani Pench Power Limited	1,320	Under validation[103]
12	Adani Power Dahej Limited	2,640	Under validation[104]
13	Adani Power Rajasthan Limited	1,320	Under validation[105]
14	Jaiprakash Power - Nigrie	1,320	Under validation[106]
15	Jaiprakash Power - Bara	3,300	Yes[107]
16	Jaiprakash Power - Karchana	1,980	Yes[108]
17	Sasan Power Limited	3,960	CDM Registered[109]
18	Coastal Andhra Power Limited	3,960	Undergoing completeness check[110]
19	Jharkhand Integrated Power Limited	3,960	Undergoing completeness check[111]
20	Coastal Gujarat Power Limited	4,000	CDM Rejected[112]
21	Jhajjar Power Limited	1,320	Under validation[113]

[95] Prior CDM consideration to Climate Change Secretary dated 14/08/2009
[96] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/489OIT5R8XWMVB5OR4Q4A6EMS7UE8Q/view.html)
[97] Prior CDM consideration to Climate Change Secretary dated 12/06/2009
[98] Prior CDM consideration to Climate Change Secretary dated 12/06/2009
[99] Registered CDM project activity (http://cdm.unfccc.int/Projects/DB/DNV-CUK1245932980.89/view)
[100] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/HPNQ8XG7LERF11EI9CG7M3Z07VJWJD/view.html)
[101] Registered CDM project activity (http://cdm.unfccc.int/Projects/DB/SGS-UKL1260815245.04/view)
[102] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/ZY3Q22OL7GTRMSYHQ61OVQJQ1DIY36/view.html)
[103] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/H7FKNCM9J2PSNS395D1N6QNE8J8OXK/view.html)
[104] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/LTETSDLLVXGU306ZECFIISO11STV8P/view.html)
[105] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/XC26GA5QGNW4SFQ1NHL2T3TKEOKLMF/view.html)
[106] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/DDW5T9HBKRGWHNQI6GQEVLLOH6XOU0/view.html)
[107] Slide 19, Investor Presentation, JPVL-August 2009 (www.jhpl.com/communication/2009/jhpl_presentation_aug_09.pdf)
[108] Slide 19, Investor Presentation, JPVL-August 2009 (www.jhpl.com/communication/2009/jhpl_presentation_aug_09.pdf)
[109] CDM Registered (http://cdm.unfccc.int/Projects/DB/RWTUV1273484238.56/view)
[110] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/LPO4J94DXL2LNO8XQDHFU4QKRAFEXX/view.html)
[111] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/P9G37AMXPS6H6C5M1WUXBFQR5T20PH/view.html)
[112] CDM Rejected (http://cdm.unfccc.int/Projects/DB/DNV-CUK1254830678.73/view)

22	Talwandi Sabo Power Limited - Phase I	1,980	Under validation[114]
23	Talwandi Sabo Power Limited - Phase II	660	Under validation[115]
24	Gudur Thermal Power Plant	1,320	Under validation[116]
25	Thoothukudi Thermal Power Plant	1,320	Under validation[117]
26	GMR Chhattisgarh Energy Limited	1,370	Under validation[118]
27	MSPGCL	1,600	Yes[119]
28	MSPGCL	660	Yes[120]
29	Shapoorji Pallonji Energy (Gujarat) Pvt. Ltd.	1,320	Under validation[121]
30	Thermal Powertech Corporation Pvt. Ltd.	1,320	Yes[122]
31	Udangudu Power Corporation Limited	1,600	Yes[123]
32	Welspun Energy Madhya Pradesh Limited	1,320	Yes[124]
33	Welspun Energy Anuppur Private Limited	1,320	Yes[125]
34	DB Power (Madhya Pradesh) Limited	2,640	Yes[126]
35	Buxar Bijlee Company Pvt. Ltd.	1,320	Bid underway[127]
36	Lakhisarai Bijlee Company Pvt. Ltd.	1,320	Bid underway[128]
37	Pirpainti Bijlee Company Pvt. Ltd.	1,320	Bid underway[129]
38	Sri Damodaram Sanjivaiah TPS	1,600	Yes[130]
39	Electrosteel Thermal Limited	1,320	Yes[131]
40	IFFCO Chhattisgarh Power Limited	1,320	Yes[132]
41	Jas Infra. Capital Private Limited	2,640	Yes[133]
42	Jawaharlal Darda Yavatmal Energy Limited	2,640	Yes[134]

[113] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/3IKF29S0E5VI6ELUC27KHIPNG4MSSH/view.html)
[114] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/YLALJWWS51SLNVKYIDRNEGJ5P0NLKD/view.html)
[115] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/66HZA5KMB7X8AJHNHVE1KKN9GD0GUC/view.html)
[116] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/NYEJZROOGYIYVGNSEWLTRULVUL9TG9/view.html)
[117] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/DWC93HW8RIYY97PIFLRUVHAH69PHKY/view.html)
[118] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/AT40Y0M8IZSOVYCKBC1FVNK7VTMDMX/view.html)
[119] Prior CDM consideration to Climate Change Secretary dated 19/03/2010
[120] Prior CDM consideration to Climate Change Secretary dated 24/12/2009
[121] CDM Validation (http://cdm.unfccc.int/Projects/Validation/DB/F8DUAEC9G5GTIWR17NLDECZA3FJ5TK/view.html)
[122] Prior CDM consideration to Climate Change Secretary dated 05/05/2010
[123] Prior CDM consideration to Climate Change Secretary dated 23/03/2009
[124] Engagement letter/Services offer of CDM consultant
[125] Engagement letter/Services offer of CDM consultant
[126] Engagement letter/Services offer of CDM consultant
[127] Bid under process (http://bseb.bih.nic.in/NewProjects.htm)
[128] Bid under process (http://bseb.bih.nic.in/NewProjects.htm)
[129] Bid under process (http://bseb.bih.nic.in/NewProjects.htm)
[130] Engagement letter/Services offer of CDM consultant
[131] Engagement letter/Services offer of CDM consultant
[132] Engagement letter/Services offer of CDM consultant
[133] Engagement letter/Services offer of CDM consultant
[134] Engagement letter/Services offer of CDM consultant

43	JV between KPCL & BHEL	2,640	Yes[135]
44	JV between MPPGCL & BHEL	1,600	Yes[136]
45	GSECL	800	Yes[137]
46	Godawari Energy	1,320	Yes[138]
47	Banas Thermal Power Project	1,320	Yes[139]
48	VSF	350	Yes[140]
49	Ind-Barath Energy (Utkal) Limited	1,980	Yes[141]
50	Ind-Barath Energy (Madras) Limited	660	Yes[142]
51	Chitrangi Power	4,000	Yes[143]
52	SJK Powergen Limited	1,320	Yes[144]

The above list does not include projects by NTPC as NTPC being a public sector organization is subject to different regulatory & investment climate and frameworks.

Sub-step 4b: Discuss any similar options that are occurring:
As there are no similar activities observed, the need for demonstrating any claim of contradiction does not arise.

Based on the findings from above steps it is established that project activity itself is not the baseline scenario and meets the additionality requirements.

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

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Baseline Emissions:

Baseline Emissions Calculations:

As per equation (2) of ACM0013 version 3, the baseline emissions are to be calculated using the following formula

Baseline Emissions (BE_y) = $EF_{BL,CO2} \times EG_{PJ,y}$

Where,

$EG_{PJ,y}$	Net quantity of electricity generated in the project plant in year y (MWh)
$EF_{BL,CO2}$	Baseline emission factor (tCO_2/MWh)

Method of calculation of baseline emission factor

$EF_{BL,CO2}$ is determined using the lower value between the emission factor of the technology and fuel type that has been identified as the most likely baseline scenario and a benchmark emission factor determined based on the performance of the top 15% power plants that use the same fuel as the project plant and any

[135] CDM consideration (http://www.bhel.com/press_release/press_pop.php?press_id=389)
[136] CDM consideration (http://www.bhel.com/press_release/press_pop.php?press_id=389)
[137] Prior CDM consideration to Climate Change Secretary dated 23/09/2010
[138] Prior CDM consideration to Climate Change Secretary dated 12/10/2010
[139] Prior CDM consideration to Climate Change Secretary dated 18/12/2010
[140] Prior CDM consideration to Climate Change Secretary dated 16/02/2011
[141] Prior CDM consideration to Climate Change Secretary dated 02/11/2010
[142] Prior CDM consideration to Climate Change Secretary dated 02/11/2010
[143] Prior CDM consideration to Climate Change Secretary dated 11/09/2009
[144] Prior CDM consideration to Climate Change Secretary dated 01/11/2010

technology available in the geographical area. It is the minimum of the emission factors as derived from the following options:

Option 1: The emission factor of the technology and fuel identified as the most likely baseline scenario under "Identification of the baseline scenario" section above, and calculated using equation (3) of the methodology:

$$EF_{BL,CO2} = \frac{\min(EF_{FF,BL,CO2}, EF_{FF,CO2})}{\eta_{BL}} \times 3.6$$

Where,

$EF_{FF,BL,CO2}$	CO_2 emission factor of the fossil fuel type that has been identified as the most likely baseline scenario (tCO_2/GJ)
$EF_{FF,CO2}$	CO_2 emission factor for fossil fuel use in the project and the baseline (tCO_2/GJ)
η_{BL}	Energy efficiency of the power generation technology that has been identified as the most likely baseline scenario (%)

The operating efficiencies of all coal-based subcritical power units (η_k) have been computed as follows:

$$\eta_k = \frac{3.6 \times EF_i \times OX_i}{NGR \times SE_k \times 1000}$$

where,

EF_i	CO_2 emission factor of the fuel *i* based on GCV (= 92.47 tCO_2/TJ)[145]
OX_i	Oxidation factor of the fuel *i* (= 0.98)[146]
SE_k	Specific emission of plant 'k', on GCV basis, operating in the most recent year prior to the start of the project activity, as made available by CEA
NGR	Conversion factor from GCV to NCV for Indian Coal (= 0.964 tCO_2/TJ)[147]

The baseline efficiency (η_{BL}) has been calculated as follows:

$$\eta_{BL} = max(\eta_k), \forall k$$

This ensures conservativeness in as much as the most efficient subcritical plant operating in the country is likely to be selected as the baseline to the project activity. For the present project activity, η_{BL} = 36.63%, for which '*k*' refers to the TORANGALLU EXT - 1. Thus, this unit has been selected to be "*most likely baseline scenario*" that would have come up in the absence of the project activity. Further, this baseline efficiency will result in a Gross Station Heat Rate (GSHR) on GCV basis of 2,301 kcal/kWh (assuming auxiliary similar to the project activity, i.e., 5.5% and using formula provided in Footnote 10 of this PDD) which had been earlier used for the identification of the baseline alternative in Section B.4 of this document.

Additionally, as per the approved methodology,
$EF_{FF,BL,CO2}$ = 0.0928 tCO_2/GJ (for sub-bituminous coal)

[145] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)
[146] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)
[147] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

$EF_{FF, CO2}$ = 0.0928 tCO_2/GJ (for sub-bituminous coal)

Thus, the value calculated from Option 1 is 0.9120 tCO_2/MWh.

Option 2: The average emissions intensity of all power plants j, corresponding to the power plants whose performance is among the top 15 % of their category, using equation (4) of the methodology:

$$EF_{BL,CO2} = \frac{\sum_j FC_j \times NCV_j \times EF_{FF,CO2}}{\sum_j EG_j}$$

Where,

FC_j	Amount of fuel consumed by power plant j in the most recent year prior to the start of the project activity for which they are available (Mass or volume unit)
NCV_j	Average net calorific value of the fossil fuel type consumed by power plant j in the most recent year prior to the start of the project activity for which they are available (GJ / Mass or volume unit)
$EF_{FF,CO2}$	CO_2 emission factor for fossil fuel use in the project and the baseline (tCO_2/GJ)
EG_j	Net electricity generated and delivered to the grid by power plant j in the most recent year prior to the start of the project activity for which they are available (MWh)
j	The top 15% performing power plants (excluding cogeneration plants and including power plants registered as CDM project activities), as identified below, among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity

For determination of the top 15% performer power plants j, the following step-wise approach is used:

Step 1: Definition of similar plants to the project activity

The sample group of similar power plants consists of all power plants (except for cogeneration power plants):

- Those use the same fossil fuel category (SOLID fuel: Sub-bituminous coal) as the project activity - It may be noted here that as per CEA database publication Version 6, there are 417 subcritical units complying to this methodological requirement
- Those have been constructed in the previous five years - Of the 417 units short-listed above, only 57 units have commissioned in the period of 5 years (financial years 2005-06 to 2009-10) prior to the start of the project activity (16/07/2010, as detailed in Section C.1.1 of this PDD). They are as follows:

Sl. No.	Name	Unit No.	Size (MW)	Commissioning Date	Grid
1	KAHALGAON	5	500	31/03/2007	NEWNE
2	KAHALGAON	6	500	16/03/2008	
3	KAHALGAON	7	500	31/07/2009	
4	JOJBERA	4	120	23/09/2005	
5	CHANDRAPURA	7	250	04/11/2009	
6	CHANDRAPURA	8	250	31/03/2009	
7	MEJIA	5	250	31/03/2007	
8	MEJIA	6	250	01/10/2007	

9	SANTALDIH	5	250	07/11/2007	
10	BAKRESWAR	4	210	23/12/2007	
11	BAKRESWAR	5	210	07/06/2009	
12	D.P.L.	7	300	24/11/2007	
13	SAGARDIGHI TPP	1	300	21/12/2007	
14	SAGARDIGHI TPP	2	300	20/07/2008	
15	GHTP (LEH.MOH.)	3	250	03/01/2008	
16	GHTP (LEH.MOH.)	4	250	31/07/2008	
17	KOTA	7	195	30/05/2009	
18	SURATGARH	6	250	29/08/2009	
19	PARICHA	3	210	29/03/2006	
20	PARICHA	4	210	28/12/2006	
21	RIHAND	4	500	24/09/2005	
22	UNCHAHAR	5	210	28/09/2006	
23	DADRI (NCTPP)	5	490	29/01/2010	
24	YAMUNANAGAR TPP	1	300	13/11/2007	
25	YAMUNANAGAR TPP	2	300	13/11/2007	
26	KORBA-V	7	250	30/03/2007	
27	KORBA-V	8	250	12/12/2007	
28	AMAR KANTAK EXT	5	210	15/06/2008	
29	SANJAY GANDHI	5	500	27/08/2008	
30	VINDH_CHAL STPS	9	500	27/07/2006	
31	VINDH_CHAL STPS	10	500	08/03/2007	
32	PARAS	2	250	31/03/2008	
33	PARAS	3	250	27/03/2010	
34	PARLI	6	250	16/02/2007	
35	PARLI	7	250	10/02/2010	
36	TROMBAY_Coal	8	250	30/09/2009	
37	SIPAT STPS	1	500	27/05/2007	
38	SIPAT STPS	2	500	27/12/2008	
39	RAIGARH TPP	1	250	08/12/2007	
40	RAIGARH TPP	2	250	06/03/2008	
41	RAIGARH TPP	3	250	10/02/2007	
42	RAIGARH TPP	4	250	17/06/2008	
43	BHILAI TPP	1	250	20/04/2008	
44	BHILAI TPP	2	250	12/07/2009	
45	RAJIV GANDHI TPS HISAR	1	600	31/03/2010	
46	CHHABRA TPS	1	250	30/10/2009	
47	ROSA TPP PH - 1	1	300	10/02/2010	
48	PATHADI TPS PH -I	1	300	04/06/2009	
49	PATHADI TPS PH -I	2	300	25/03/2010	
50	MUNDRA TPP PH-I	1	330	04/08/2009	
51	MUNDRA TPP PH-I	2	330	17/03/2010	
52	RAYAL SEEMA	3	210	25/01/2007	
53	RAYAL SEEMA	4	210	20/11/2007	
54	BELLARY TPS	1	500	03/12/2007	South
55	VIJAYWADA TPP-IV	1	500	08/10/2009	
56	TORANGALLU EXT	1	300	27/04/2009	

57	TORANGALLU EXT	2	300	24/08/2009	

- Those have a comparable size to the project activity, defined as the range from 50% to 150% of the rated capacity of the project plant (i.e., from 350 MW to 1,050 MW);

Sl. No.	Name	Unit No.	Size (MW)	Commissioning Date	Grid
1	VINDH_CHAL STPS	9	500	27/07/2006	NEWNE
2	VINDH_CHAL STPS	10	500	08/03/2007	
3	KAHALGAON	5	500	31/03/2007	
4	KAHALGAON	6	500	16/03/2008	
5	KAHALGAON	7	500	31/07/2009	
6	RIHAND	4	500	24/09/2005	
7	SIPAT STPS	1	500	27/05/2007	
8	SIPAT STPS	2	500	27/12/2008	
9	DADRI (NCTPP)	5	490	29/01/2010	
10	RAJIV GANDHI TPS HISAR	1	600	31/03/2010	
11	SANJAY GANDHI	5	500	27/08/2008	
12	BELLARY TPS	1	500	03/12/2007	South
13	VIJAYWADA TPP-IV	1	500	08/10/2009	

- Those are operated in the same load category, i.e. at peak load (defined as a load factor of less than 3,000 hours per year) or base load (defined as a load factor of more than 3,000 hours per year) as the project activity; and

The units of KAHALGAON-7, RAJIV GANDHI TPS HISAR and VIJAYWADA TPP-IV have operated at loading conditions lower than 3,000 hours per year or 34.25%. Hence, the units short-listed are as follows:

Sl. No.	Name	Unit No.	Size (MW)	Commissioning Date	Grid
1	VINDH_CHAL STPS	9	500	27/07/2006	NEWNE
2	VINDH_CHAL STPS	10	500	08/03/2007	
3	KAHALGAON	5	500	31/03/2007	
4	KAHALGAON	6	500	16/03/2008	
5	DADRI (NCTPP)	5	490	29/01/2010	
6	RIHAND	4	500	24/09/2005	
7	SIPAT STPS	1	500	27/05/2007	
8	SIPAT STPS	2	500	27/12/2008	
9	SANJAY GANDHI	5	500	27/08/2008	
10	BELLARY TPS	1	500	03/12/2007	South

- Those have operated (supplied electricity to the grid) in the year prior to the start of the project activity.

All of the above short-listed units have operated in the year prior (financial year 2009-10) to the start date of the project activity (16/07/2010, as defined in Section C.1.1 of this PDD).

Sl. No.	Name	Unit No.	Size (MW)	Commissioning Date	Grid
1	VINDH_CHAL STPS	9	500	27/07/2006	NEWNE
2	VINDH_CHAL STPS	10	500	08/03/2007	
3	KAHALGAON	5	500	31/03/2007	
4	KAHALGAON	6	500	16/03/2008	
5	DADRI (NCTPP)	5	490	29/01/2010	
6	RIHAND	4	500	24/09/2005	
7	SIPAT STPS	1	500	27/05/2007	
8	SIPAT STPS	2	500	27/12/2008	
9	SANJAY GANDHI	5	500	27/08/2008	
10	BELLARY TPS	1	500	03/12/2007	South

The sample group of plants identified consists of coal based sub-critical power plants that have a capacity between 350 MW to 1,050 MW, have been constructed in last 5 years, operate at base load and have supplied electricity to the grid before start of the proposed project activity.

As per CEA publications, the following subcritical thermal power units meet the above criteria:

Sl. No.	Name	Unit No.	Size (MW)	Grid
1	VINDH_CHAL STPS	9	500	NEWNE
2	VINDH_CHAL STPS	10	500	NEWNE
3	KAHALGAON	5	500	NEWNE
4	KAHALGAON	6	500	NEWNE
5	DADRI (NCTPP)	5	490	NEWNE
6	BELLARY TPS	1	500	South
7	RIHAND	4	500	NEWNE
8	SIPAT STPS	2	500	NEWNE
9	SIPAT STPS	1	500	NEWNE
10	SANJAY GANDHI	5	500	NEWNE

Step 2: Definition of the geographical area

As per the methodology ACM0013, Version 3, the geographical area to identify similar power plants is chosen in a manner that the total number of power plants "n" in the sample group comprises at least 10 plants. As a default, the grid to which the project plant will be connected should be used. As the number of similar plants, as defined in Step 1, within the NEWNE grid boundary is less than 10, the geographical area is extended to India. The number of similar plants is now equal to 10.

Step 3: Identification of the sample group

The proposed supercritical units that are proposed to be installed for the project activity have an installed capacity of 700 MW. Therefore, according to conditions for selection of sample group given in step 1 above (50% to 150% criteria), CEA publications has selected unit sizes above 350 MW up to 1,050 MW and has listed them as follows:

Sl. No.	Name	Unit No.	Size (MW)
1	VINDH_CHAL STPS	9	500
2	VINDH_CHAL STPS	10	500

3	KAHALGAON	5	500
4	KAHALGAON	6	500
5	DADRI (NCTPP)	5	490
6	RIHAND	4	500
7	BELLARY	1	500
8	SIPAT STPS	2	500
9	SIPAT STPS	1	500
10	SANJAY GANDHI	5	500

Step 4: Determination of plant efficiencies

The operational efficiency of each power plant "n" in the sample group is calculated as follows:

$$\eta_{n,x} = \frac{EG_{n,x}}{(FC_{n,x} \times NCV_{n,x})} \times 3.6$$

Where,

$EG_{n,x}$	Net electricity generated and delivered to the grid by the power plant *n* in the most recent year prior to the start of the project activity for which data are available (MWh)
$FC_{n,x}$	Quantity of fuel consumed in the power plant *n* in the most recent year prior to the start of the project activity for which data are available (Mass or volume unit)
$NCV_{n,x}$	Average net calorific value of the fuel type fired in power plant *n* in the most recent year prior to the start of the project activity for which data are available (GJ/mass or volume unit)
$\eta_{n,x}$	Operational efficiency of the power plant *n* in the most recent year prior to the start of the project activity for which data are available (%)
n	All power plants in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity

Step 4.1: Determination of EG_n

Unit-wise net electricity generation is provided by CEA for all power plants in India. The electricity generation for the most recent year prior to the start of the project activity (2009-10) is available in CEA publication Version 6[148].

Step 4.2: Determination of NCV_n

The net calorific value of a plant is calculated as follows:

$$NCV_n = GCV_n \times NGR$$

where,

GCV_n	Weighted average gross calorific value of the fuel type fired in power plant *n* in the most recent year prior to the start of the project activity for which data are available (GJ/mass or volume unit)

Step 4.3: Determination of FC_n

As per CEA Publication Guide version 6[149], "*Unit-level CO_2 emissions were only calculated for units falling in the build margin*". All the 10 plants selected above fall in the build margin and hence there unit-

[148] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

[149] CEA database publication Version 6 (http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip)

level specific emissions (SE_n), on GCV basis, are provided by CEA. The formula used by CEA for this calculation is as follows:

$$SE_n = \frac{FC_n \times GCV_n \times EF_i \times OX_i}{EG_n}$$

Thus, FC_n may be calculated as follows:

$$FC_n = \frac{SE_n \times EG_n}{GCV_n \times EF_i \times OX_i}$$

Hence, the summary of efficiencies of the 10 identified subcritical thermal power units are as follows:

Sl. No.	Name	Unit No.	SE_n (tCO_2/MWh)	FC_n (MT)	EG_n (MWh)	NCV_n (GJ/MT)	η_n (%)
1	BELLARY TPS	1	0.9390	1,782,731.72	2,704,789.4	15.16[150]	36.04%
2	SIPAT STPS	2	0.9439	2,831,232.12	3,885,532.2	13.78[151]	35.85%
3	SIPAT STPS	1	0.9439	2,791,335.85	3,830,779.3	13.78[152]	35.85%
4	VINDH_CHAL STPS	9	0.9581	2,807,493.18	4,213,668.3	15.30[153]	35.32%
5	VINDH_CHAL STPS	10	0.9581	2,535,901.99	3,806,046.5	15.30[154]	35.32%
6	RIHAND	4	0.9553	2,525,362.79	3,572,841.4	14.38[155]	35.42%
7	DADRI (NCTPP)	5	0.9788	276,937.44	395,330.71	14.86[156]	34.58%
8	KAHALGAON	6	0.9828	2,365,616.39	2,763,390.3	12.21[157]	34.43%
9	KAHALGAON	5	0.9828	2,154,268.45	2,516,504.6	12.21[158]	34.43%
10	SANJAY GANDHI	5	1.1095	2,770,454.28	3,173,661.0	13.52[159]	30.50%

Step 5: Identification of the top 15% performer plants j

Top 15% of a sample size of 10 units indicates the top 2 most efficient units. Accordingly, two units of 500 MW i.e. BELLARY TPS - 1 and SIPAT STPS - 2 are identified top performing units. The combined

[150] CEA default value of 3,755 kcal/kg (equivalent to 15.16 GJ/MT) http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip

[151] Approval of tariff for Sipat Super Thermal Power Station, Stage-II (1,000 MW) for the period 20/06/2008 to 31/03/2009 (http://www.cercind.gov.in/2009/December09/Signed_Order_in_Pet_No_63-2009_and_140-2009.pdf)

[152] Approval of tariff for Sipat Super Thermal Power Station, Stage-II (1,000 MW) for the period 20/06/2008 to 31/03/2009 (http://www.cercind.gov.in/2009/December09/Signed_Order_in_Pet_No_63-2009_and_140-2009.pdf)

[153] Approval of provisional tariff for Vindhyachal STPS Stage-III (1,000 MW) from date of commercial operation to 31/03/2009 (http://www.cercind.gov.in/03022007/order_Pet_83-2007.pdf)

[154] Approval of provisional tariff for Vindhyachal STPS Stage-III (1,000 MW) from date of commercial operation to 31/03/2009 (http://www.cercind.gov.in/03022007/order_Pet_83-2007.pdf)

[155] Approval of tariff in respect of Rihand Super Thermal Power Station Stage – II (2 x 500 MW) for the period 15/08/2005 to 31/03/2009 (http://www.cercind.gov.in/03022007/Pet_106-2006%20RihandSTPS-II.pdf)

[156] Approval of tariff of National Capital Thermal Power Plant, Dadri for period from 01/04/2004 to 31/03/2009 (http://cercind.gov.in/050606/162_2004.pdf)

[157] Approval of provisional tariff of Unit - I of Kahalgaon Super Thermal Power Station, Stage-II from its date of commercial operation till 31/03/2009 (http://www.cercind.gov.in/03022007/Order_in_Pet-101-07.pdf)

[158] Approval of provisional tariff of Unit - I of Kahalgaon Super Thermal Power Station, Stage-II from its date of commercial operation till 31/03/2009 (http://www.cercind.gov.in/03022007/Order_in_Pet-101-07.pdf)

[159] Generation Tariff of Sanjay Gandhi (1x500MW) Thermal power Station for FY 09

generation by these units is 6,590,321.6 MWh which is 21.35% of total generation of all plants in sample group.

Hence, the baseline emission factor (as per Option 2) has been computed based on the following parameters:

Name	Unit No.	j	FC_j (MT)	EG_j (MWh)	NCV_i (GJ/MT)
BELLARY TPS	1	1	1,782,731.72	2,704,789.4	15.16
SIPAT STPS	2	2	2,831,232.12	3,885,532.2	13.78

Computation of $EF_{BL,CO2}$ under Option 2:

$$EF_{BL,CO2} = \frac{(FC_1 \times NCV_1 + FC_2 \times NCV_2) \times EF_{FF,CO2}}{(EG_1 + EG_2)}$$

The value of $EF_{BL,CO2}$ as per option 2 is 0.9298 tCO_2/MWh

Hence, $EF_{BL,CO2}$ = min (Option 1, Option 2) = 0.9120 tCO_2/MWh.

Thus, the baseline emission factor is calculated ex-ante and fixed for the entire crediting period of 10 years.

Project Emissions

As per the approved methodology, project emissions due to on-site combustion of fossil fuel, is to be computed as follows:

Project emissions (PE_y) = $\left[\sum_i FF_{i,y} \times NCV_{i,y}\right] \times EF_{FF,CO2}$

Where,

$NCV_{i,y}$	Weighted average net calorific value of fuel type i in year y (GJ/mass or volume unit)
$FF_{i,y}$	Quantity of fuel type i combusted in the project plant in year y (Mass or volume unit)

Leakage Emissions

As per the approved methodology, no leakage emissions are to be considered.

Hence, Emission Reductions (ER_y) = $BE_y - PE_y$

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

Data / Parameter:	$EF_{FF,BL,CO2}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of the fossil fuel type that has been identified as the most likely baseline scenario
Source of data used:	IPCC default values for the respective fuel type (sub-bituminous coal) at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National

	GHG Inventories
Value applied:	0.0928
Justification of the choice of data or description of measurement methods and procedures actually applied :	Obtained from IPCC default values for the respective fuel type (sub-bituminous coal) at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Any comment:	Data will be archived for crediting period +2 years

Data / Parameter:	η_{BL}
Data unit:	-
Description:	Net energy efficiency of the power generation technology that has been identified as the most likely baseline scenario
Source of data used:	This parameter is determined as part of the baseline scenario selection procedure
Value applied:	36.63 %
Justification of the choice of data or description of measurement methods and procedures actually applied :	This parameter is determined as part of the baseline scenario selection procedure provided in approved methodology ACM0013 Version 03
Any comment:	Data will be archived for crediting period +2 years

Data / Parameter:	FC_n
Data unit:	MT
Description:	Amount of fuel consumed by power plant n in the most recent year prior to the start of the project activity for which data are available, where: n are all power plants (including power plants registered as CDM project activities) in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Section B.6.1
Source of data used:	CEA database version 6
Value applied:	
Justification of the	The above power plants fulfil all the criteria to be included in the sample group

Sl. No.	Name	Unit No.	FC_n (MT)
1	BELLARY TPS	1	1,782,731.72
2	SIPAT STPS	2	2,831,232.12
3	SIPAT STPS	1	2,791,335.85
4	VINDH_CHAL STPS	9	2,807,493.18
5	VINDH_CHAL STPS	10	2,535,901.99
6	RIHAND	4	2,525,362.79
7	DADRI (NCTPP)	5	276,937.44
8	KAHALGAON	6	2,365,616.39
9	KAHALGAON	5	2,154,268.45
10	SANJAY GANDHI	5	2,770,454.28

choice of data or description of measurement methods and procedures actually applied :	(n).
Any comment:	Data will be archived for crediting period +2 years

Data / Parameter:	**FC_j**
Data unit:	kg/kWh
Description:	Amount of fuel consumed by power plant j in the most recent year prior to the start of the project activity for which data are available, where: j are the top 15% performer plants among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Section B.6.1
Source of data used:	CEA database version 6
Value applied:	

Name	Unit No.	j	FC_j (MT)
BELLARY TPS	1	1	1,782,731.72
SIPAT STPS	2	2	2,831,232.12

Justification of the choice of data or description of measurement methods and procedures actually applied :	The above power plants fulfil the criteria to be included in the sample group (n). Out of these, the top 15% plants include BELLARY TPS-1 (j=1) and SIPAT STPS-2 (j=2).
Any comment:	Data will be archived for crediting period +2 years

Data / Parameter:	**NCV_n**
Data unit:	GJ/MT
Description:	Average net calorific value of the fossil fuel type consumed by power plant n in the most recent year prior to the start of the project activity for which data are available, where: n are all power plants (including power plants registered as CDM project activities) in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Section B.6.1
Source of data used:	Tariff Orders approved by the Central Electricity Regulatory Commission for all the 10 power plant (CEA database version 6 is used wherever tariff orders are not available)
Value applied:	

Sl. No.	Name	Unit No.	NCV_n (GJ/MT)
1	BELLARY TPS	1	15.16[160]
2	SIPAT STPS	2	13.78[161]

[160] CEA default value of 3755 kcal/kg (equivalent to 15.16 GJ/MT)
http://www.cea.nic.in/reports/planning/cdm_co2/Database_publishing_ver6.zip

		3	SIPAT STPS	1	13.78[162]
		4	VINDH_CHAL STPS	9	15.30[163]
		5	VINDH_CHAL STPS	10	15.30[164]
		6	RIHAND	4	14.38[165]
		7	DADRI (NCTPP)	5	14.86[166]
		8	KAHALGAON	6	12.21[167]
		9	KAHALGAON	5	12.21[168]
		10	SANJAY GANDHI	5	13.52[169]
Justification of the choice of data or description of measurement methods and procedures actually applied :	The above power plants fulfil all the criteria to be included in the sample group (n). As per the methodology, NCV data of all these power plants is to be taken from a publicly available source.				
Any comment:	Data will be archived for crediting period +2 years				

Data / Parameter:	**NCV_j**
Data unit:	GJ/MT
Description:	Average net calorific value of the fossil fuel type consumed by power plant j in the most recent year prior to the start of the project activity for which data are available, where: j are the top 15% performer plants among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Section B.6.1
Source of data used:	Tariff Orders approved by the Central Electricity Regulatory Commission for all the 10 power plant (CEA database version 6 is used wherever tariff orders are not available)
Value applied:	

Name	Unit No.	j	NCV_j (GJ/MT)
BELLARY TPS	1	1	15.16
SIPAT STPS	2	2	13.78

[161] Approval of tariff for Sipat Super Thermal Power Station, Stage-II (1,000 MW) for the period 20/06/2008 to 31/03/2009 (http://www.cercind.gov.in/2009/December09/Signed_Order_in_Pet_No_63-2009_and_140-2009.pdf)
[162] Approval of tariff for Sipat Super Thermal Power Station, Stage-II (1,000 MW) for the period 20/06/2008 to 31/03/2009 (http://www.cercind.gov.in/2009/December09/Signed_Order_in_Pet_No_63-2009_and_140-2009.pdf)
[163] Approval of provisional tariff for Vindhyachal STPS Stage-III (1,000 MW) from date of commercial operation to 31/03/2009 (http://www.cercind.gov.in/03022007/order_Pet_83-2007.pdf)
[164] Approval of provisional tariff for Vindhyachal STPS Stage-III (1,000 MW) from date of commercial operation to 31/03/2009 (http://www.cercind.gov.in/03022007/order_Pet_83-2007.pdf)
[165] Approval of tariff in respect of Rihand Super Thermal Power Station Stage – II (2 x 500 MW) for the period 15/08/2005 to 31/03/02009 (http://www.cercind.gov.in/03022007/Pet_106-2006%20RihandSTPS-II.pdf)
[166] Approval of tariff of National Capital Thermal Power Plant, Dadri for period from 01/04/2004 to 31/03/2009 (http://cercind.gov.in/050606/162_2004.pdf)
[167] Approval of provisional tariff of Unit - I of Kahalgaon Super Thermal Power Station, Stage-II from its date of commercial operation till 31/03/2009 (http://www.cercind.gov.in/03022007/Order_in_Pet-101-07.pdf)
[168] Approval of provisional tariff of Unit - I of Kahalgaon Super Thermal Power Station, Stage-II from its date of commercial operation till 31/03/2009 (http://www.cercind.gov.in/03022007/Order_in_Pet-101-07.pdf)
[169] Generation Tariff of Sanjay Gandhi (1x500MW) Thermal power Station for 2008-09

Justification of the choice of data or description of measurement methods and procedures actually applied :	The above power plants fulfil the criteria to be included in the sample group (n). Out of these, the top 15% plants include BELLARY TPS-1 (j=1) and SIPAT STPS-2 (j=2). As per the methodology, NCV data of all these power plants has been taken from a publicly available source.
Any comment:	Data will be archived for crediting period +2 years

Data / Parameter:	$EF_{FF,CO2}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor for fossil fuel use in the project and the baseline
Source of data used:	IPCC default values of the fuel type used in the project plant (sub-bituminous coal) at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. In the case that several fuel types are used in the project plant, use the fuel type with the lowest IPCC default value at the lower limit of the uncertainty
Value applied:	0.0928
Justification of the choice of data or description of measurement methods and procedures actually applied :	Obtained from IPCC default values of the fuel type used in the project plant (sub-bituminous coal) at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. In the case that several fuel types are used in the project plant, use the fuel type with the lowest IPCC default value at the lower limit of the uncertainty
Any comment:	Data will be archived for crediting period +2 years

Data / Parameter:	EG_n
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant n in the most recent year prior to the start of the project activity for which data are available, where: n are all power plants (including power plants registered as CDM project activities) in the defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Section B.4
Source of data used:	CEA database version 6
Value applied:	

Sl. No.	Name	Unit No.	EG_n (MWh)
1	BELLARY TPS	1	2,704,789.4
2	SIPAT STPS	2	3,885,532.2
3	SIPAT STPS	1	3,830,779.3
4	VINDH_CHAL STPS	9	4,213,668.3
5	VINDH_CHAL STPS	10	3,806,046.5
6	RIHAND	4	3,572,841.4
7	DADRI (NCTPP)	5	395,330.71
8	KAHALGAON	6	2,763,390.3

		9	KAHALGAON	5	2,516,504.6	
		10	SANJAY GANDHI	5	3,173,661.0	
Justification of the choice of data or description of measurement methods and procedures actually applied :	The above power plants fulfil all the criteria to be included in the sample group (n). As per the methodology, energy generation data of all these power plants has been taken from a publicly available source.					
Any comment:	Data will be archived for crediting period +2 years					

Data / Parameter:	**EG_j**
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant j in the most recent year prior to the start of the project activity for which data are available, where: j are the top 15% performer plants among all power plants in a defined geographical area that have a similar size, are operated at similar load and use a fuel type within the same fuel category as the project activity and any technology available within the geographical area, as defined in Section B.4
Source of data used:	CEA database version 6
Value applied:	**Name** | **Unit No.** | **j** | **EG_j (MWh)** BELLARY TPS | 1 | 1 | 2,704,789.4 SIPAT STPS | 2 | 2 | 3,885,532.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	The above power plants fulfil the criteria to be included in the sample group (n). Out of these, the top 15% plants include BELLARY TPS-1 (j=1) and SIPAT STPS-2 (j=2). As per the methodology, energy generation data of all these power plants has been taken from a publicly available source.
Any comment:	Data will be archived for crediting period +2 years

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

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Sl. No.	Parameters	Value	Unit	Source
a.	Capacity of Supercritical Plant	1,400	MW	Project Activity
b.	Operating Hours	8,760	hrs	Number of hours in a year[170]
c.	PLF	93%	-	Review of performance of Thermal Power Stations, 2008-09[171]
d.	Auxiliary Consumption	5.50%	-	EPC Contract
e.	Annual Net Generation ($EG_{PJ,y}$)	10,778,216.40	MWh	(= a X b X c X (1 – d))
f.	Baseline Emission Factor ($EF_{BL,CO2}$)	0.9120	tCO_2/MWh	Calculated in Section

[170] For a non-leap year, there are 8760 hours per annum. For a leap year, there 8784 hours per annum

[171] As per the review, overall operating availability of generating stations under private sector utilities was 92.73% which was the highest among different sectors. Hence, PLF has been assumed as 93%

				B.6.1
g.	Supercritical Gross SHR	2,082	kcal/kWh	Consideration of financial institutions based on the EPC Guarantee
h.	Gross Calorific Value of Coal	4,080	kcal/kg	Communication from PSEB dated 11/09/2009
i.	Annual Quantity of Coal ($FF_{i,y}$)	5,820,169.76	MT	(= g X e / h / (1 – d))
j.	Ratio of NCV:GCV of Coal	0.964	-	CEA publication Version 6
k.	Net Calorific Value of Coal ($NCV_{i,y}$)	16.47	GJ/MT	(= h X k)
l.	Emission Factor ($EF_{FF,CO2}$)	0.0928	tCO_2/GJ	IPCC 2006 Vol. 2 Ch. 2
m.	Baseline Emissions (BE_y)	9,829,592	tCO_2	(= e X f)
n.	Project Emissions (PE_y)	8,893,909	tCO_2	(= i X k X l)
o.	Emission Reductions (ER_y)	935,683	tCO_2	(= m – n)

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

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Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
May 2014 - March 2015	8,152,750	9,010,459	0	857,709
April 2015 - March 2016	8,918,276	9,856, 522	0	938,246
April 2016 - March 2017	8,893,909	9,829,592	0	935,683
April 2017 - March 2018	8,893,909	9,829,592	0	935,683
April 2018 - March 2019	8,893,909	9,829,592	0	935,683
April 2019 - March 2020	8,918,276	9,856, 522	0	938,246
April 2020 - March 2021	8,893,909	9,829,592	0	935,683
April 2021 - March 2022	8,893,909	9,829,592	0	935,683
April 2022 - March 2023	8,893,909	9,829,592	0	935,683
April 2023 - March 2024	8,918,276	9,856, 522	0	938,246
April 2023 - May 2024	741,160	819,132	0	77,972
Total (tonnes of CO_2e)	**89,012,192**	**97,967,143**	**0**	**9,364,517**

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

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B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{PJ,y}$**
Data unit:	MWh
Description:	Net quantity of electricity generated in the project plant and fed into the grid in year y
Source of data to be used:	Joint Meter Reading records of energy meters by Punjab State Power Company Limited (PSPCL) & NPL. Net electricity computed after deduction of imports from the exports of project activity. Net electricity generated is arrived from net

	of export (export less imports) rather than net of auxiliary consumption (gross generation less auxiliary)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	10,778,216.40
Description of measurement methods and procedures to be applied:	Monitoring: Electrical Energy Meters which are electronic tri-vector meters of accuracy class 0.2 (Main & check meters) Data type: Measured & Calculated Archiving: Paper/ Electronic Recording Frequency: Continuous Responsibility: The Planning & Performance Engineer shall be responsible for the regular recording of data. Calibration Frequency: The meters shall be calibrated annually
QA/QC procedures to be applied:	Net quantity of electricity generated by project activity is monitored through main meter and check meters installed on all outgoing feeders. The meters installed will be of accuracy class 0.2s in accordance with the Regulations (Installation and Operation of Meters) 2006[172]. Meter calibration shall be conducted annually and internal audit system is in place as mentioned in Section B.7.2. The metered net electricity generation will be cross-checked with receipts from sales.
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**$FF_{i,y}$**
Data unit:	MT/year
Description:	Quantity of fuel type i combusted in the project plant in year y
Source of data to be used:	Gravimetric Feeder at the pulveriser feeding
Value of data applied for the purpose of calculating expected emission reductions in section B.5	5,820,169.76
Description of measurement methods and procedures to be applied:	Monitoring: Gravimetric Feeder at the pulveriser feeding Data type: Measured Archiving: Paper/Electronic Recording Frequency: Continuous Responsibility: The Planning & Performance Engineer shall be responsible for the regular recording of data. Calibration Frequency: The meters shall be calibrated annually
QA/QC procedures to be applied:	• The consistency of metered fuel consumption quantities will be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. • The metered fuel consumption quantities will also be cross-checked with

[172] Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 (http://www.powermin.nic.in/whats_new/pdf/Metering_Regulations.pdf)

	available purchase invoices from the financial records. • Meter calibration shall be conducted annually and internal audit system is in place as mentioned in Section B.7.2
Any comment:	The data will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	GJ / MT of coal
Description:	Weighted average net calorific value of fuel type i in year y
Source of data to be used:	Any of the following sources, in the decreasing order of preference, will be used as per availability:

Data Source	Conditions for using the source
a) Values provided by fuel supplier in invoices	Preferred source
b) Measurements by the project proponent	If (a) is not available
c) Regional or national default values	If (a) is not available. These sources can only be used for liquid fuels and should be based on well documented, reliable sources (such as national energy balances).
d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	If (a) is not available

Value of data applied for the purpose of calculating expected emission reductions in section B.5	16.47
Description of measurement methods and procedures to be applied:	Monitoring: For (a) and (b): Measurements will be undertaken in line with national or international fuel standards Data type: Measured & Calculated Archiving: Paper/Electronic Recording Frequency: Every fuel carrying rake Responsibility: The Planning & Performance Engineer shall be responsible for the regular recording of data. Calibration Frequency: Not Applicable
QA/QC procedures to be applied:	It will be verified if the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range, additional information will be collected from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) will have ISO17025 accreditation or justify that they can comply with similar quality standards.
Any comment:	The data will be kept for two years after the end of the crediting period or the last

	issuance of CERs for this project activity, whichever occurs later.

B.7.2. Description of the monitoring plan:

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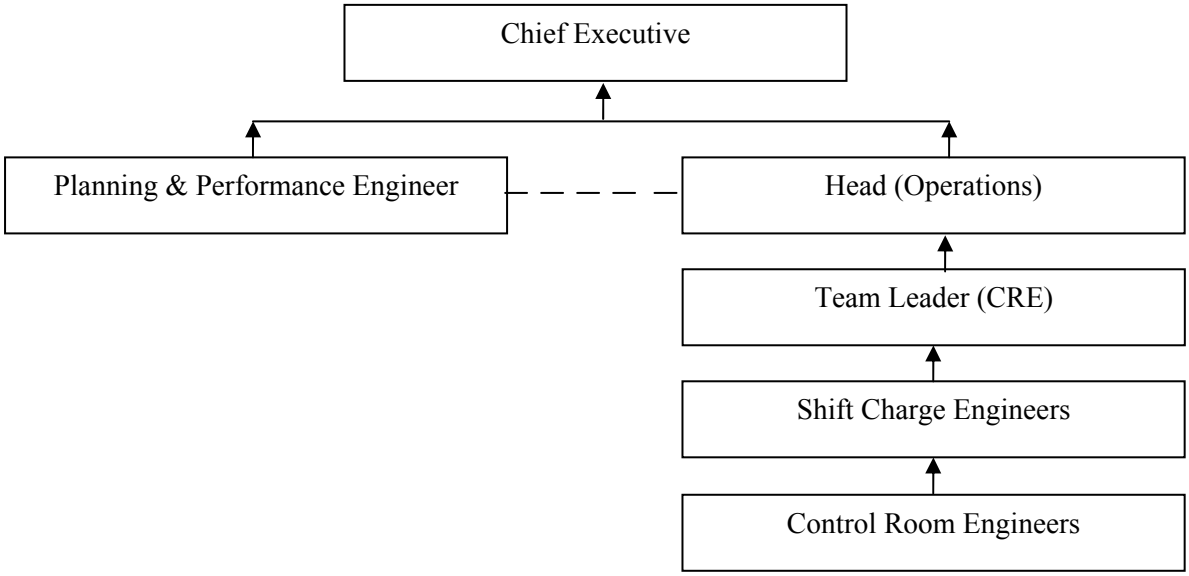
The operational and management structure that will monitor the project activity is described below:



The roles and responsibilities of the plant personnel are as follows:

Sl. No.	Designation	Roles & Responsibilities
1.	Chief Executive	• Ensuring implementation of monitoring procedures
2.	Planning & Performance Engineer	• Internal audit and project conformance reviews • Organizing and conduct training programs on CDM • Implementing all monitoring control procedures • Associating with the Maintenance Department towards maintenance and calibration of equipments • Has the overall responsibility for record handling and maintenance. • Reviewing of records and dealing with monitored data • Organizing internal audit for checking the data recorded • Has the overall responsibility for closing project non-conformances and implementing corrective actions before the verification
3.	Head (Operations)	• Supervising and training the operators and maintaining training records. • Has the overall responsibility of monitoring measurements and reporting
4.	Team Leader (Control Room Engineer)	• Will assist the Planning & Performance Engineer in record handling, records checks and review and during internal audit and check the data recorded by the Shift Operators in the individual sections
5.	Shift Charge Engineer / Control	• Collection and recording appropriate data of the project

	Room Engineer	activity represented in the monitoring tables of Section B 7.1 based on the monitoring frequency and as per the instructions of his seniors

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

>>

Nabha Power Limited and their associate consultants.

Person Responsible: Mr. S. K. Narang
Date of Completion: 10/08/2010

The detailed information is provided in Annex I.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>16/07/2010 (Signing of the Engineering, Procurement & Construction Contract)

As per EB 41, paragraph 67, "*the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. This, for example, can be the date on which contracts have been signed for equipment or construction/operation services required for the project activity*." Hence, the date of signing the Engineering, Procurement & Construction Contract has been chosen as the start date for the project activity

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

>>25 years 00 months

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

>>Not Applicable

C.2.1.2. Length of the first crediting period:

>>Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>01/05/2014

(If the registration of the project is after 01/05/2014, the date of registration would be considered as the start date for the entire crediting period.)

C.2.2.2. Length:

>>10 years 00 months

SECTION D. Environmental impacts

>>

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

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In order to obtain the required clearance from the Ministry of Environment & Forest (MoEF), Government of India (GoI), an EIA Report is a statutory prerequisite. Thus, the Environmental Impact Assessment (EIA) study is been conducted to predict the possible environmental impacts due to construction and operation of the project activity, suggesting environmental remedies/safeguards and formulating an effective Environmental Mitigation Plan to ensure an environmentally sustainable development.

Keeping in view the nature of activities related to the proposed supercritical power plant as well as guidelines of Ministry of Environment and Forest (MoEF), New Delhi, a study area comprising core (10 km) as well as general study area (15 km radius), had been selected for monitoring baseline status of environmental quality and prediction of impacts.

The comprehensive EIA study included:

- Assessment of prevailing baseline environmental quality within the impact zone based on one season field studies (summer season)
- Identification, quantification and evaluation of significant impacts due to proposed power plant
- Evaluation of proposed pollution control measures and preparation of environmental management plan (EMP) outlining additional control measures to be adopted for mitigation of possible adverse impacts

The major environmental disciplines studied include geology, soils, surface and ground water hydrology, meteorology, land use, surface and ground water quality, air quality, terrestrial ecology, demography and socioeconomics, and noise. The study consists of field data generated over winter season along with relevant data collected from various agencies on the above disciplines. The details of the analysis carried out, as available in the EIA report, are given below:

Sl. No.	Component of Environment	No. of Monitoring Stations	Period of Monitoring/ Sampling	Frequency of Monitoring	Parameters Analyzed
1	Soils	10	Winter	Once	Physio-chemical parameters, heavy elements and microbial characteristics.
2	Meteorology	1	Winter	Monthly	General climate, Wind speed and direction, Maximum and Minimum Temperature, Relative Humidity, Atmospheric pressure, cloud

					cover and Rainfall.
3	Water quality	Surface: 3 Ground: 5	Winter	Monthly	Physical, Chemical, Bacteriological parameters, trace inorganic and heavy metals.
4	Air quality	10	Winter	Thrice a day	SO_2, NO_x, SPM, RPM, O_3
5	Terrestrial ecology	1	Winter	Once	Flora, fauna and socio-economic condition
6	Noise	10	Winter	Twice a day	Peak, background & equivalent noise levels

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

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The findings of the environment management plan (EMP) are summarised below:

Construction Phase

- Separate entry point and route will be provided to the vehicles carrying construction materials so as not to affect the existing route causing congestion and air pollution
- To protect the area from vehicular pollution (including noise), suitable measures will be taken in consultation with the local administration for providing enough space for the vehicular movement
- Waste soils generated will be used to the extent possible purpose for miscellaneous activities and will not be allowed to cause fugitive emission
- Dust-prone areas affected by excavation, levelling and transportation will be controlled by water sprinkling
- Infrastructural services including water supply, toilets, electricity and fuel will be provided to the construction workers so as to avoid overburdening the existing environment
- Workers working in high noise level zones will be provided with ear plugs/muffs
- Proper storage and disposal facilities for oily wastes (hazardous material) will be provided

Operational Phase

Air

- The stacks will be suitable designed with a minimum height of 275 m which will disperse and dilute the pollutants concentration to desirable level as predicted by mathematical modelling
- High efficiency (not less than 99.9%) ESPs will be provided to ensure maximum particulate concentration in the flue gas within 50 $mg/Nm^{3(173)}$ under worst operating condition
- Dust extraction and suppression system will be provided at different transfer points specially at coal handling plant to control the fugitive dust emission

Water

[173] 1 Nm^3 = 1 m^3

- Adequate treatment facilities will be provided to all the wastewater streams emanating from the proposed facility to control water pollution
- A well designed water harvesting system will be provided

Noise:

- Noise emitted from Turbines, air compressors, crushers, blowers, pumps etc. will be less than 95 dβ (A) at a distance of one meter from the equipment
- Proper encasement of noise generating sources will be done to reduce the noise levels below prescribed limits
- The turbine will be provided with an acoustic enclosure to the maker's standards
- Silencers will be used to reduce the noise in air intake and exhausted system
- Double glass panelled construction will be installed to decrease the noise level at control and electrical buildings
- Workers working in high noise zones will be provided with ear plugs/muffs
- Proper maintenance will also reduce noise levels considerably

Solid Waste:

- Sanitary wastes generated from household activities and plant operations will be disposed of in a sanitary landfill

SECTION E. Stakeholders' comments

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

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NPL identified the following local stakeholders to be associated with the project activities, directly or indirectly:

1. NPL Employees
2. Employees of EPC Contractor
3. Local Gram Panchayat Sarpanchs
4. Local Villagers
5. Punjab State Electricity Board officials
6. Punjab Pollution Control Board officials
7. Government officials (S.D.M., M.L.A., Tehsildar)

In order to address and incorporate the concerns of the local stake-holders, NPL sent out invitation letters to the identified stake-holders 4-5 days in advance. The letter contained information of the date & site of the meeting along with the agenda of the meeting along with a broad description of the project activity.

The stakeholder meeting was conducted on 30/03/2010.

E.2. Summary of the comments received:

>>

The proposed project activity is an environmentally friendly project which enables improvement of the local area by setting up a power plant. It does not require any displacement of local population and hence no problems of resettlement or rehabilitation have been envisaged. The proposed project activity has therefore not caused any adverse social impacts on local population but has rather helped in improving their quality of life. NPL has communicated to the relevant stakeholders about the project. Several stakeholders were identified and approached by the project proponent for the purpose of obtaining feedback. A summary of the comments obtained from the relevant stakeholders of the project activity have been summarised as follows:

Question/Issue	Requested By	Response by Project Proponent
What is the benefit of using supercritical technology?	Mr. Gurtej Singh, SDM, Rajpura	The main benefit of this technology is reduction in coal consumption compared to conventional subcritical technologies and the subsequent reduction in emissions.
Will the Railway Siding for the Power Plant affect the drainage in the area?	Mr. Gurtej Singh, SDM, Rajpura	The complete Railway Siding would be designed as per Indian Railway norms. Adequate care would be taken such that the drainage of the area is not affected.
How will waste be collected and disposed?	Mr. S. K. Goel, PPCB	High efficiency dust collectors and separators will be installed to ensure that negligible dust formation is caused. Latest technology will be used for ash collection to ensure low fugitive emissions from handling process and less area utilization for waste disposal.
How will social resources	Mr. Kuldeep Singh, Tehsildar, Rajpura	The proposed project activity will reduce the demand-supply gap of electricity in India and local industrial

improve in the locality?		growth will be accelerated due to increased availability of power in the region. The proposed project activity will also generate employment for the local populace for the purposes of construction, commissioning, operation and maintenance.
What are the prospects of employment opportunity because of project?	Mr. Harjinder Singh, Villager (Sural Kalan)	The construction & operation of the Power Plant would provide employment opportunities to local population. People will get opportunity to get associated with NPL through direct or indirect employment.
How the technology selected is more efficient than sub-critical technology?	Mr. S. K. Goel, PPCB	As explained during the presentation supercritical is high in terms of cost and efficiency whereas sub-critical technology is less in terms of cost as well as efficiency in power generation. Thus less efficient means to generate same one unit (1 kWh) of power as compared to supercritical, the plant will consume more fossil fuel (coal). Thus the super critical project activity will conserve precious fossil fuels by consuming less quantity of coal for power generation. However, the cost of the supercritical technology is higher than conventional ones and hence, acts as a hindrance to its prevalent use. NPL hopes that their proactive step will also encourage the thermal power sector to further invest in supercritical technology.
Further description on general concept on CDM	Mr. S. K. Gupta, L&T-MHI Boiler Ltd.	Explained that the Greenhouse effect mentioned in the presentation is a natural phenomenon and is essential for life on earth. However, the amount of CO_2 in the atmosphere has been ever-increasing which leads to the increased greenhouse effect and thus global warming. The development of UNFCCC and emergence of the Kyoto Protocol is a global solution to combat this global warming. The Kyoto Protocol of UNFCCC held at Kyoto, Japan led to the initiation of three programmes: Joint Implementation (JI), European Emission Trading Scheme (EU ETS) and Clean Development Mechanism (CDM). The CDM is applicable in India (non Annex I country) as per the protocol. A project may be taken up for CDM if it causes emission reduction compared with a baseline scenario and is additional. The supercritical technology causes lesser emissions compared to conventional subcritical technology. However, this technology is comparatively costlier on account of which they may be taken up as CDM projects to get carbon credits.
Concluding Speech	Mr. Raj Khurana	Mr. Khurana appreciated the efforts undertaken by NPL to use the most latest & efficient technology for setting up the power plant compared to conventional ones. He expressed the hope that the performance of the power

		plant would match the best operating power plant in the world. He emphasized that such proactive steps for environment protection are the need of the hour considering the impacts of global warming on the present and future generations. He also stated that CSR activities are very inspiring and more such activities are expected in the project area.

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

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NPL has taken care of all the conditions stipulated in the relevant clearances and all comments have been addressed.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Nabha Power Limited
Street/P.O.Box:	SCO-32, Sector 26-D, Madhya Marg
Building:	-
City:	Chandigarh
State/Region:	-
Postcode/ZIP:	160019
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Telephone:	+91 172 464 6846
FAX:	+91 172 464 6802
E-Mail:	-
URL:	-
Represented by:	
Title:	Project Director – Nabha Power Limited
Salutation:	Mr.
Last name:	Narang
Middle name:	Kumar
First name:	Suresh
Department:	-
Mobile:	-
Direct FAX:	-
Direct tel:	+91 1762 243 007
Personal e-mail:	SURESHKUMAR_NARANG@LNTENC.COM

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is available to the project activity from countries included in Annex- I.

Annex 3

BASELINE INFORMATION

The baseline information has been provided in Section B.4 of this document.

Annex 4

MONITORING INFORMATION

Monitoring plan has been discussed in section B.7 of this document.

Community Development:
NPL would also use at a minimum, 2% of the revenues accrued from the sale of Certified Emission Reductions (CERs) on realization, on an annual basis on some of the following social welfare activities:

1) Conducting health awareness programs.
2) Conducting Medical camps.
3) Distribution of Free Medicines.
4) Opening Primary Health care centre.
5) Providing Ambulance/Mobile Dispensary services.
6) Up gradation of hospital wards and village first aid centres.
7) Conducting free surgeries and sponsoring medical expenses.
8) Conducting Adult Education programmes.
9) Conducting Vocational training programs.
10) On job Training of ITI students.
11) Skill training programmes for College/School Dropouts.
12) Conducting Computer Literacy programs.
13) Refurbishment of School building / Furniture / Drinking water / Library.
14) Providing scholarships to meritorious students.
15) Assisting in improvement of local infrastructure like lighting, roads, water supply, sewerage system etc.
16) Encourage self help groups amongst women and assist them to set up tailoring, embroidery, utility articles with bamboo and other creative skills.
17) Tree Plantations.
18) Promote sports infrastructure.
19) Conducting sports programs.
20) Conducting cultural & religious programs.
21) Participating in other social welfare scheme of own or conducted by others.
22) Funding to the Non Governmental Organization for the social welfare activities.

The details of such expenditure made would be included in the monitoring report for the period following the transaction and the format proposed by NPL is as follows:

Action Plan for expenditure incurred through 2% of CER revenues									
Financial Year (A)	**Activity (B)**	**Issued CERs (C)**	**CER Price (D)**	**Total CDM Amount (E=CxD)**	**Expenditure in Current year (F)**	**Expenditure Carried forward (G)**	**Net Expenditure for Current Year (H = F+G)**	**Expenditure as % of CDM amount for current year (I = H/E)**	**Reference Documentation (J)**
Indicates the year for which the assessment is being provided	*Provides details of the social/ community activities on which the expenditure has been incurred*	*Quantity of CERs issued for the assessment year*	*CER price at which the transaction has happened*	*Total amount CDM amount received*	*Expenditure made on the social/ community development activity in the current assessment year*	*Additional expenditure incurred on capital goods in the previous assessment years being carried forward to the current assessment year*	*Net Expenditure on social/ community development activity for the current year*	*Indicates the % of the total CDM amount spent on social/community development activity*	*Indicates the documentation to be provided to the DOE during the verification to evidence the amount spent on social/community development activity*

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