CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

BOF Gas recovery at Jindal Vijayanagar Steel Limited (JVSL) and combustion for power generation and supply to Karnataka Grid, India.

A.2. Description of the project activity:

JVSL operates a BOF shop in its existing steel manufacturing operations. These operations are equipped with 2 nos. * 120 t BOF converters. Presently, both the converters are operating in 2/2 mode and have already reached the total capacity of 1.57 MTPA (million ton per annum) of crude steel. During the operation of the BOF converters, waste gases[1] (called BOF gases) are generated. These waste gases contain a combustible component in the form of carbon monoxide (CO), which makes it a health hazard if emitted to the atmosphere. Hence, the BOF waste gases are currently being flared, in a business as usual scenario.

The BOF waste gases also have a latent heat potential[2] due to the presence of CO, which may be extracted and utilized to generate electricity in a generate thermal power. In order to generate electricity, these waste gases need collection, stabilization (to ensure continuous and steady flow at required pressure) and delivery to a thermal power plant.

The BOF waste gases are proposed to be delivered through a gas grid established for this purpose, to an existing power plant of a sister concern called the Jindal Thermal Power Company Limited (JTPCL)[3], and few other new thermal power plants are proposed to be developed in the recent future.

Based on the above characteristics of the BOF waste gases, a part of the same is taken back into the steel manufacturing operations of JVSL for meeting the internal heat requirement purposes, and the excess part would be flared in the atmosphere in the absence of the project activity.

The project activity envisages to, develop, design, engineer, procure, finance, construct, own, operate and maintain a gas grid for collection and distribution of the excess BOF gases to the JTPCL and other proposed power plants in future.

A.3. Project participants:

The project activity is proposed by the JVSL (project sponsor) at its steel plant in Toranagallu, Bellary District of Karnataka. JVSL is part of the US$ 1.5 Billion Jindal Group. The group has synergistically diversified into 11 business units with plants at 13 locations in India and at 3 locations in the USA. The principal promoters are the Jindal Group and the KSIIDC. The remaining sharing-holding is in the form of public equity, and through participation by some banks (Indian and Overseas), Financial Institutions (Domestic and Foreign).

PricewaterhouseCoopers (PwC) are assisting the project sponsor in developing the Project Design Document (PDD) and defence of the PDD in Host Government Approval (HGA) and validation

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[1] Specific gas yield is 80 NM^3 per ton of crude steel (tcs).

[2] Gross Calorific value is in the range of about 2,000 kCals/SCM.

[3] Located adjacent to the JVSL facilities ~~within a common Jindal Group complex~~.

procedure. PwC, formed by the global merger of Pricewaterhouse and Coopers & Lybrand in 1998, is the world's largest financial and professional services organisation with 125,000 people in 142 countries and 867 offices worldwide. The contact information on project participant and PwC are provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The project is proposed in JVSL steel plant at Toranagallu, District Bellary, State of Karnataka, India.

A.4.1.1. Host Party(ies):

Government of India.

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

District Bellary, State of Karnataka.

A.4.1.3. City/Town/Community etc:

Toranagallu

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

The JVSL plant is located at 15° 11'N Latitude and 76° 41'E Longitude. The site is at a distance of 29 Km from Bellary, 33 Km from Hospet and 340 Km from Bangalore by road. The nearest railway station is at Toranagallu.

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

The project activity is applicable to 'Category 9, metal production', as per sectoral scope. In the absence of an appropriate project category definition, a new project category may be considered titled *"Process waste gas recovery and combustion for electricity generation ~~in grid connected power plants~~"*.

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

The technology applied to the project activity is designed to capture/ collect, store and stabilize (i.e., ensure steady and uninterrupted supply to power generator) and deliver BOF gas to the power plant(s). All gas pipelines forming the gas grid for BOF waste gas collection and transportation, booster pumps, a floating top gas holder for storage and stabilization of the BOF waste gas, and nitrogen purging/sealing facility etc., constitute the technology for the project activity. The technology involves fully PLC controlled state of the art equipment and control systems.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

- In the absence of facilities to collect, stabilize and transport the excess BOF waste gases, and use them as fuel in the power plant, the same would be ~~is currently being~~ flared.

- On recovery of the excess BOF waste gas, the calorific value of 2,000 kCals/SCM shall be recovered through power generation and evacuation to the state grid.

- There shall be no net change in the GHG emission due to burning of excess BOF waste gas, but the power generated on account of the recovery of latent heat from excess BOF waste gas shall result in avoidance of need to use GHG intensive fuels for generating and supplying the same amount of electricity to the grid as produced using the excess BOF waste gas.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Using the methodology and emission calculation procedures discussed later in this document, the total emission reduction over the 10 year fixed crediting period works out to approximately 341,324 tCO_2.

A.4.5. Public funding of the project activity:

The proponent proposes to identify potential participants (Parties under Annex 1) in due course and it is as yet not known if any public funding shall be sought. In case public funding is sought, the proponent shall duly ensure that it is additional to any ODA.

SECTION B. Application of a baseline methodology

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

In the absence of an approved baseline methodology for the project activity, a new methodology has been developed. This is called *"Avoiding flaring of waste gases from steel manufacturing operations and its utilization for substituting GHG intensive fuel in power generating units and/ or generating power to supply to grid".*

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

- ✓ JVSL uses the basic oxygen furnace (BOF) route in an existing industry for steel production, wherein waste gases are produced; part of the BOF waste gases are used for meeting the normal[4] internal heating requirements at JVSL and the rest are flared (in the absence of the project activity).

- ✓ The project activity does not result in diversion of waste gases required for internal heating requirements for power generation.

- ✓ There will be no integrated process change in the BOF plant due to the project activity, except for providing for additional facilities to collect and supply the waste gases to power generator(s).

- ✓ There is no regulation in India at central or Karnataka state levels encouraging or prohibiting the use of BOF waste gases for power generation.

- ✓ There are no existing regulations mandating the use of any GHG intensive fuel for power generation, and the choice of fuel selection is a prerogative of a project proponent.

- ✓ The waste gases supplied to the power plant partially replaces existing use of coal in existing power plant of JTPCL. It could also be supplied to new power plants to be developed within JVSL complex in future, using the gas grid established in this project activity.

[4] In Mixer, Laddle Pre-heater and Tundish Pre-heater.

- ✓ JVSL has the option of either allowing the waste gases to be flared in the absence of the project activity, or use the same for power generation.

- ✓ The project activity will result in power generation that will be supplied to the Karnataka grid (local) and southern grid (regional); there is no surplus of power in the grid.

~~There are several larger issues that favour justification of choice of the selected new methodology:~~

- ✓

- ✓ ~~The economy of India as a whole is in transition to a market economy. There are still several structural imperfections that distort the market e.g. potentially attractive fuels like oil and natural gas have only been recently taken out of the ambit of administered price mechanism and the pricing continues to be distorted.~~

- ✓ ~~Due to several risk factors prevalent in the power sector in Karnataka, there is considerable uncertainty in the number and nature of power projects that may or may not come up.~~

- ✓ ~~Amongst several other risk factors, despite the runaway demand supply deficit, there is a nearly 45% shortfall in planned new capacity addition in the power sector, primarily because of the poor financial health of state owned state electricity boards and the consequent payment security to the generators serving the system. Various entities in the power sector have failed to evolve appropriate payment security mechanisms. The pitfall is amply demonstrated by the closure of the Dabhol Power Corporation in Maharashtra state on account of a power purchase and payment imbroglio. In Karnataka also, the sole purchaser of power is the KPTCL, which is also a state-owned entity and its financial health is a suspect.~~

- ✓ ~~The resource endowment pattern of Karnataka has not undergone any significant alteration. There is though a general decline in interest in Hydro-Power projects on account of several socio-economic and environmental issues associated with them, inter-state water sharing disputes and the uncertainties on account of climatological factors. This is expected to result in increased reliance on fossil fuel based capacity additions, which shall result in increased GHG emission intensity of the grid. There have been significantly large natural gas finds in Krishna – Godavari (K-G) basin in the neighbouring state of Andhra Pradesh. This may in time result in Andhra Pradesh becoming a power surplus state with new capacity addition in the state. But the development of the K-G gas fields and the consequent impact on power sector of the region is not expected in the time horizon of relevance to the project.~~

- ✓ ~~No significant change in the access or availability of technology is expected for the power sector in the state.~~

B.2. Description of how the methodology is applied in the context of the project activity:

As mentioned earlier in this document, the project activity will have two significant components, viz., replacement of coal with excess BOF waste gas in existing JTPCL power plant (including use of these gases in proposed greenfield power plant), and supply of generated electricity at these power plants to the state/ regional grids. The project activity is thus in line with the proposed new methodology which applies to the following types of project activities:

- ✓ steel manufacturing operations using the BOF route, where excess waste gases with latent heat content are produced and used for internal heating purposes; any excess gases are flared;

- ✓ potential for utilizing waste gases for generation of electricity thereby substituting commonly available GHG intensive fuel (coal in this case) and supply the generated electricity to the grid; and

- ✓ waste gas collection, stabilisation *(due to fluctuations in waste gas heat content and flow over time)* and supply to power generators connected to the gas grid.

With the above background, the additionality for the project activity can be demonstrated through the following steps, as per steps on additionality demonstration proposed in the baseline methodology:

Step 0 Preliminary screening based on the starting date of the project activity.

The project proponent wishes to consider the start date of the crediting period for the project activity prior to its registration, and between 1 January 2000 and 31 December 2005. Relevant documents to show that project activity has started from year 2004 are available with JVSL for verification by a DOE during project activity validation. The CDM benefits for the project activity were seriously considered while conceptualising the project to cross several barriers so that the project activity could be attractive for implementation. There is official evidence in the form of confidential internal documentation that may be verified to confirm to this~~. For example, in a board resolution, JVSL referred to availing the benefits of CDM to overcome the disadvantages of generation cost of electricity using excess BOF waste gases, which is marginally higher than cost at which power is available from the grid. The resolution is supported by an internal assessment of power availability and associated uncertainties likely to come up in future~~.

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

In case the project activity was not mandated under existing legal requirements, the plausible alternatives to project activity could have been one or more of the following:

- ✓ flaring excess BOF waste gases (after meeting normal internal heating requirements);

- ✓ existing power generator (JPTCL) would continue using coal for generating electricity; and

- ✓ any greenfield power plant may choose and obtain regulatory permission to use any GHG intensive fuel to generate electricity.

In India, laws and regulations do not mandate the utilization of waste gases from steel manufacturing processes. However, there are instances in national power policies favouring such utilization in preference to using GHG intensive fuels such as coal for power generation due to low cost and other logistical considerations. The Electricity Act 2003 does not restrict or empower any other authority to restrict the fuel choice for power generation. The draft National Electricity Policy (revised in August 2004) asserts 'coal would necessarily continue to remain the major fuel' and 'use of gas as a fuel for generation would depend upon its availability at reasonable prices'. The applicable environmental regulations do not restrict the choice of fuel for generation units located anywhere any other part of India. The decision to use excess BOF waste gases as fuel for power generation is an internal decision by the board members of JVSL.

Step 2 Investment Analysis.

- ✓ The chosen alternative to the project is flaring the excess BOF waste gases which do not involve any investment, while the project activity requires investment of Rs. 21 crores for installation of gas-holder, fabric seal in the gas-holder and other related equipment like gas direction damper, gas change-over device, pressure control damper, by-pass valve, water-sealed check valves, booster fans, gas carrying ducts and water u-seals, etc.

- ✓ The power generator using the excess BOF waste gases would generate power and supply it to grid. The fuel costs being 'pass through', the power generator too, would not have any significant incentive to use the waste gases for power generation, except from any incentive due to CDM revenueand purchasing power from the grid (after paying the wheeling charges as allocated). The cost of power in the alternative scenario in comparison to the project activity has been worked out to be Rs. 1.94/kWh which is cheaper than that in the project activity.

Step 3 Barrier Analysis

- ✓ ***(3a) Financial or economic barriers Investment***: The project activity involves investment has adopted some elements of new technology for collection, storage and stabilization of excess BOF waste gases and supply to thermal power generator(s) such as JTPCL. Due to this, additional investments were to be made that makes the project activity is financially less attractive compared to purchase of power from the grid. The investors to this project activity (JVSL management) had also perceived risks to their investment due to unfamiliarity with the new technology.

- ✓ ***(3b) Technological barriers***: The technology for waste gas utilization to generate power is not widely used, and there is unfamiliarity and uncertainties on the processes and procedures involved. The new technology takes into account the cyclic nature of LD Converter operation requiring periodic maintenance shutdowns, while power generation is a continuous operation, causing an input – output mismatch. Though this mismatch is dampened to some extent through installation of a gas holder, the risk of disruption in supply of waste gases remains. The technologically inferior alternative is to shift to 100% use of coal, which would result in higher net emissions. JVSL has carried out certain level of R&D or and pilot plant studies (transporting excess waste gases to a power generator from existing COREX I plant that follows the BOF route) to establish certain degree of reliability in the of the new technology.

- ✓ ***(3c) Barriers due to prevailing practice***: The project activity would be amongst the first few integrated steel plants in the country. It may be highlighted here that JVSL is the first Indian steel industry following the BOF route whose waste gases are used for generating power and supplying to the grid.

The barriers discussed above could prevent the implementation of the project activity if there is no sufficient incentive for overcoming these barriers and making the project happen.

Step 4 Common Practice Analysis

- ✓ As mentioned under step 4 earlier, JVSL is the first steel industry in India that will supply waste gases for generation of power. The project activity is unique in the sense that it is the only such plant in India and is the only project where BOF waste gas will be directly fed to a power plant serving the state grid.

- ✓ JVSL has established through R&D work and/ or pilot-scale studies utilizing COREX I plant waste gases that this technology is a viable alternative to use of coal.

Step 5 Impact of CDM Registration

- ✓ The success of the project activity through assistance of CDM benefits may encourage other steel industries following the BOF route to go for such CO_2 avoiding projects.
- ✓ The success may also encourage development of policies at national level encouraging the use of waste gases as potential alternatives to use of GHG intensive fuels.
- ✓ The success may also encourage equity participation by private parties on such projects, and bring in investors.
- ✓ This could bring credibility to the project activity and the new technology.

Based on the above analysis, it is satisfactorily concluded that the project activity is additional to a baseline scenario.

B.3. 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:

In the absence of the project activity, the BOF waste gases will not be dispatched to power plant(s) for generation of electricity and supply to the grid, resulting in the following incidences/ occurences:

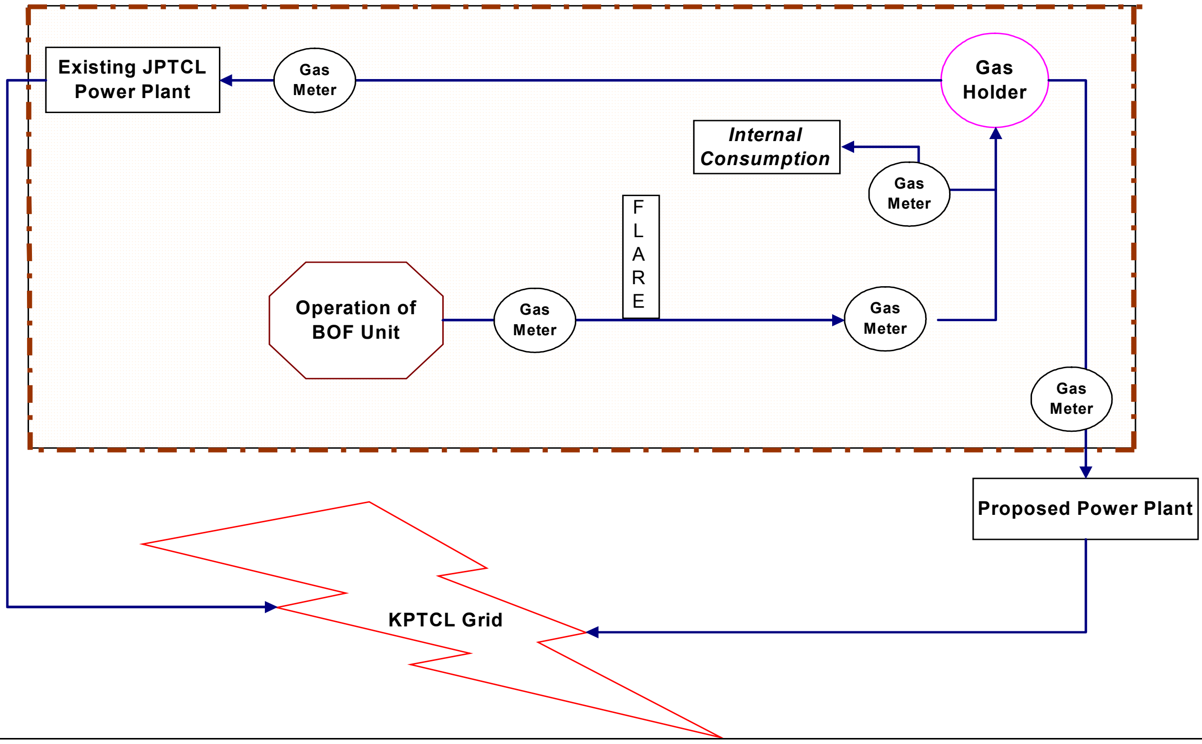
1. excess BOF waste gases would have continued to be flared leading to CO_2 emissions;
2. the existing power plant (JTPCL) which has taken regulatory permission to use 100% coal if no waste gases are available, would have continued with use of coal leading to CO_2 emissions; and
3. new greenfield power projects utilizing more GHG intensive fuels would have come up faster to meet the demand-supply gap in the Karnataka state grid, leading to further GHG emission.

All or some of the above would be avoided, reduced or delayed because of the project activity. There is no net change in CO_2 emission due to combustion of BOF waste gases (i.e. pre and post project activity), even though there is generation of electrical energy in the project activity that is evacuated to Karnataka grid. The emission reduction is on account of the avoided emission to the extent of the electrical energy generated and evacuated to the grid.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The proposed CDM project activity comprises effecting any modifications in the existing BOF waste gas collection and handling system, and including all equipment and accessories necessary for collection, stabilization (for ensuring desired flow and pressure of excess BOF waste gas at power plants) and transportation of these waste gases to the existing (JTPCL) and proposed power plant(s). This is in line with the project boundary suggested in the baseline methodology.

Project Boundary for the Excess BOF Gas Utilization Project



B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

The current draft will be completed by 25 May 2005, subject to approval of the proposed new baseline methodology. The baseline may require updating prior to validation.

Dr. P Ram Babu of PricewaterhouseCoopers (P) Limited has assisted the project sponsor in determining the baseline methodology.

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:

The commercial operation has commenced from May 2005, which is taken to be the starting date of the Project Activity. As it is not prior to the adoption of Decision 17/CP.7 (10 November 2001), no documentation is required.

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

The Project is expected to be operational for a period of 30 years from the date of commencement of operations.

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

C.2.1. Renewable crediting period

Not opted for.

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

May 2005.

C.2.2.2. Length:

10 years.

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

In the absence of an approved monitoring methodology, a new monitoring methodology called *"Monitoring the generation, storage, stabilization and supply of waste gases from steel manufacturing operations to thermal power plant(s)"* has been used.

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

The chosen monitoring methodology is applicable to the project activity due to the following:

- the monitoring methodology is applied to the JVSL steel production plant that uses basic oxygen furnace (BOF) route, and a part of the waste gases is used for normal internal heating requirements, while the remaining waste gases is flared in the absence of the project activity;

- project activity will not induce diversion of waste gases required for internal usage;

- proposed project activity will not result in integrated process change, except for possible associated changes due to use of waste gases for electricity generators;

- there are neither Indian regulations to constrain use of coal at the JTPCL nor any regulation making use of excess BOF waste gases mandatory for power generation;

- the excess waste gas supplied to the JTPCL, partially replaces coal usage at JTPCL;

- there are only two possible alternatives to the project activity, viz., continued flaring of excess BOF waste gases over and above the internal consumption, or its use for power generation; and

- project activity results in supply of electricity to the KPTCL grid which also gets supply from the Southern grid due to deficit of power.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
$W_{p,y}$	Annual quantity of waste gas available/ provided for use in power generation at JTPCL during any year 'y'	Records from JTPCL and BOF plant	SCM	m	Annual	Daily	Electronic	No comments.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>> The project activity of power generation with excess BOF gas does not generate any additional GHG emissions. Hence, the annual emission form project activity **PE_Y=0**.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
$F_{x,p}$	Amount of existing GHG intensive fuel 'x' consumed by JTPCL during any year 'y'	Existing Project records at JTPCL	tonnes	m	Annual	Daily	Electronic or paper	No comments.
GCV	'Gross Calorific Value' for BOF waste gas	Existing Project records at JTPCL	kCal/ SCM	e	Annual	Monthly	Electronic or paper	No comments.
$HR_{p,y}$	'Heat Rate' for BOF waste gas based on average daily values	Existing Project records at JTPCL	kCal/ MWh	e	Annual	Monthly	Electronic or paper	No comments.
AUX	Auxiliary consumption at JTPCL	Existing Project records at JTPCL	Percent	m	Annual	Annual	Electronic or paper	No comments.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
AG	Actual generation of plants in the operating margin	Published data from Central Electricity Authority	GWh	e	Annual	Annual	Electronic or paper	No comments.
IC	Installed capacity of plants in the operating margin	Published data from Central Electricity Authority	MW	e	Annual	Annual	Electronic or paper	No comments.
PLF	Representative plant load factors for plants in the operating margin	Published data from Central Electricity Authority	%	e	Annual	Annual	Electronic or paper	Previous 3 years data to be used.
$F_{i,j}$	Amount of existing GHG intensive fuel 'i' consumed by power plant 'j' in the grid	Existing Project records at JTPCL	tonnes	m	Annual	Annual	Electronic or paper	No comments.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
GEN_j	Electricity delivered to the grid by power plant 'j'	Published data from Central Electricity Authority	GWh	e/ c	Annual	Annual	electronic	No comments.
GEN_m	Installed capacity addition to the grid by each project/ fuel type[5] 'm' added to the grid	Published data from Central Electricity Authority	MW	e	Annual	Annual	electronic	5 years data
PLF_m	Typical plant load factors or electricity generation efficiency for each project/ fuel type 'm'	As per typical values from Central Electricity Authority	%	e	Annual	Annual	electronic	5 years data

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
$NPO_{p,y}$	'Net electricity generated by waste gases' at power plant 'p' during year 'y'.	Existing Project records at power generator using waste gases or Receiver of power delivered by power plant	GWh	m/ e	Monthly	Annual	Electronic or paper	No comments.
$W_{p1,y}$	Quantity of waste gas available from/ provided by waste gas generator '1' during year 'y', to power generator 'p'	Existing Project records of power generator using waste gases or waste gas generator	SCM	m	Annual	Daily	Electronic or paper	No comments.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
GCV_{p1}	Average 'Gross Calorific Value' for waste gas provided by waste gas generator '1'.	Existing Project records of power generator using waste gases or waste gas generator	kCal/ SCM	m	Annual	Daily	Electronic or paper	No comments.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The baseline emissions are calculated using combined margin methodology as per procedures provided in the baseline methodology. The rational for the same is that substitution of coal with excess BOF waste gases have not yet started in the project activity, and hence there is no data available to estimate/ monitor the extent of coal substitution with available excess BOF waste gases to generate equivalent quantity of heat. In the absence of the same, a conservative baseline emission rate is calculated with the combined margin component of the baseline only.

Least 'Merit Order' Operating Margin calculations (based on performance ratio)

The OM emission factor ($EF_{OM,y}$) is calculated as per the following procedure. The OM emission factor will be dynamic, i.e., can change annually for every crediting year. All the generating units contributing to the selected grid will be identified and data on their installed capacities, actual annual generation/ delivery to the grid and representative plant load factors (PLF) (average for previous 3 years prior to the project activity) will be obtained from published available data sources. Utilizing these data, the performance ratio of each plant will be calculated by applying following formula:

*Performance Ratio (PR) = (Actual Generation - AG) / (Installed Capacity – IC * PLF)……(1)*

The PRs for all plants in the operating margin are analyzed to select the worst performers[6] (low performance ratio) who contributed about 10% of the total power generated in the grid in the operating year. The total power contributed by these plants will be $\Sigma\, GEN_j$ (in GWh).

To calculate CO_2 emission factor from each of these power plants, their annual power dispatch (GEN_j) is multiplied by the individual emission factor(s). The summation of CO_2 contributed by all plants provides the total CO_2 contributed by all the plants in the operating margin given as following, from which the operating margin is calculated.

$$EF_{OM,y} = \Sigma\,(F_{i,j} * COEF_i) / \Sigma\, GEN_j \quad \text{………………………………………………(2)}$$

and

$$COEF_i = NCV_i * CEF_i * OXID_i * (44/12) \quad \text{…………………………………………….………(3)}$$

Build Margin calculations

This has been calculated as the capacity addition-weighted average emission factor (tCO_2/GWh) of a sample of power plants recently added to the grid, as per the following algorithm:

$$EF_{BM,,y} = \Sigma\,(3.6 * GEN_{m\%} * EF_m / PLF_m) \quad \text{……………………………………………………………(4)}$$

$$EK_m = CEF_m * OXID_m * (44/12) \quad \text{……………………………………………………………………(5)}$$

$$GEM_{m\%} = GEN_m * 100 / \Sigma\, GEN_m \quad \text{……………………………………………………………………(6)}$$

The sample group of recent additions to the grid has been taken as 20% of the grid capacity as this is larger than the total capacity addition from 5 most recent plants added to the grid.

A straight average[7] of the OM and BM has been taken to calculate the CM.

$$EF\_BL_{CM,y} = (EF_{OM,y} + EF_{BM,,y}) / 2 \quad \text{…………………………………………………(7)}$$

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[6] Ranked in order (0 – 1, including fractional values).

Baseline Emissions - BEy (in tCO_{2equ}) = $EF\_BL_{CM,y}$ * *Annual net electricity* (NPO_y) *generated by project activity* ……..(8)

Calculation of Annual Net Electricity generated by Project Activity

The annual measure of net electricity generated at any power plant using excess waste gases will be calculated as per the following algorithm.

$MPO_{p,y} = W_{p,y} * GCV / HR_{p,y}$……………………………………………………………………(9)

$W = \Sigma W_{p,y}$ …………………………………………………………………….……………(10)

$NPO_{p,y} = MPO_{p,y} * (1 – AUX/100)$ …………………………………………………..…………(11)

$NPO_y = \Sigma NPO_{p,y}$ ……………………………………………………………………….…………(12)

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Not opted for.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not applicable.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
PROD	Annual quantity of metal (liquid steel) produced	Project data of BOF plant	tonnes	m	Annual	Daily	Electronic/ paper	Not applicable.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Potential leakages (**LE_y** in tCO_2) due to use of substituting GHG intensive material in place of waste gases for internal requirements in the steel operations are calculated using the following formula:

$$LE_y = Q_{ALT,y} * NCV_{ALT} * CEF_{ALT} * OXID_{ALT} * (44/12) \quad (13)$$

where:

$Q_{ALT,y}$: Amount (in tonnes) of any alternate GHG intensive fuel(s) if used for internal requirements replacing normal use of waste gases

CEF_{ALT} : Carbon Emission Factor (in tonnes of C / TJ) for alternate GHG intensive fuel(s)

NCV_{ALT} : Net Calorific Value (in TJ/10^3 tonnes) for alternate GHG intensive fuel(s)

$OXID_{ALT}$: Oxidation Factor for alternate GHG intensive fuel(s), i.e., fraction of carbon oxidised during combustion for power generation.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The emission reduction is calculated using the following formula, as per **component 3** mentioned in the baseline and monitoring methodologies, for calculating approximate emission reductions at the JTPCL power where fuel substitution has not yet started *(also refer section D.2.1.4 in this PDD), i.e.*,

$ER_y = Baseline\ II * BEC_1 - PE_y - LE_y$ ………………………………………………………………….(14)

or,

$ER_y = (EF\_BL_{CM,y} * NPO_y) - PE_y - LE_y$ ……………………………………………………………..(15)

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
$W_{p,y}$ *(Table D.2.1.1)*	*Low*	*The monitoring will regularly be checked as part of ISO 9001:2000. Measurements and checks will be done by third party annually.*
$F_{x,p}$ *(Table D.2.1.3)*	*Low*	*Same as above*
GCV *(Table D.2.1.3)*	*Low*	*Same as above*
$HR_{p,y}$ *(Table D.2.1.3)*	*Low*	*Same as above*
PROD *(Table D.2.3.1)*	*Low*	*Same as above*
$F_{i,j}$ *(Table D.2.1.3)*	*Low*	*This has been taken from official published data from the Central Electricity Authority. Hence, QA/QC procedures will not be required.*
GEN_j *(Table D.2.1.3)*	*Low*	*Same as above*
GEN_m *(Table D.2.1.3)*	*Low*	*Same as above*

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

The project will be operated and managed by JVSL who is also the project proponent. JVSL will ensure safety in operation of the plant; a project manager will be allocated with the responsibility for ensuring that the safety issues are addressed. JVSL will supply BOF waste gases to the power plant(s) as per the design and the quantum of fuel will be logged in and archived electronically.

Although it is being anticipated that there won't be any leakage emissions due to the CDM power project, however, if any such condition arises, and leakage effect is found due to any of the CDM project activity, such leakage will be accounted accordingly as mentioned in the chosen applied baseline methodology.

The GHG emission reductions estimated herein will be a target in the ISO 14000 standards based Environmental Management System (EMS) that will be put in place at JVSL. Accordingly, the monitoring plan proposed herein will become an integral part of the Environmental Management Programmes and would be constituent of operational and management structure of EMS.

D.5 Name of person/entity determining the monitoring methodology:

Dr. P Ram Babu of PricewaterhouseCoopers (P) Limited, whose contact information is set out at Annex 1 has assisted the Sponsor in determining the baseline methodology.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

There will be no project activity related emissions since in the absence of the project the BOF waste gases would have been flared emitting CO_2.

E.2. Estimated leakage:

Zero, since no alternate GHG intensive material[8] replacing waste gases for meeting internal requirements will be used, i.e. $\mathbf{LE_y}$ = 0.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Zero, since both $\mathbf{PE_y}$ and $\mathbf{LE_y}$ as in equation (14) are zeros.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

The estimated anthropogenic emissions of CO_2 *(GHG considered in this PDD as per the methodology adopted)* is 341,324 tCO_2 for 10 year crediting period.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The emission reductions work out to 341,324 tCO_2 for the 10 year crediting period.

E.6. Table providing values obtained when applying formulae above:

Emission reduction calculations due to use of BOF

		Years =>									
Particulars	**Units**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Project Emission	**tCO2/GWh**	0	0	0	0	0	0	0	0	0	0
Baseline Emission	**tCO2/GWh**	362	362	362	362	362	362	362	362	362	362
Projected Generation	**GWh**	65	98	98	98	98	98	98	98	98	98
Annual Emission Reduction	**tCO2**	23,540	35,309	35,309	35,309	35,309	35,309	35,309	35,309	35,309	35,309
Total Emission Reduction	**tCO2**										**341,324**

The detailed calculations are provided under Annex 3 ~~Appendix 1~~.

SECTION F. Environmental impacts

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

Thirty-two categories of activities with a certain investment criteria are required to undertake an Environmental Impact Assessment (EIA) under the Environmental Impact Notification of Government of India. This project activity is not covered under any of the categories as per the said notification. Nevertheless, the project sponsors have undertaken an EIA for the proposed project activity. The detailed EIA report shall be made available for validation.

[8] Refer equation (12) under section D.2.3.2 ($Q_{ALT,y}$ = 0).

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

The environmental impacts (negative/positive) due to the proposed activity are summarized below:

1. There would not be any impact on the water environment, nor any significant amount of liquid waste generation, or its impact on land environment.

2. Emission of CO_2 due to combustion of fuel such as coal will be avoided.

3. The avoidance of noise pollution which otherwise would have been generated due to handling/ transportation of solid fuel such as coal is a positive impact on maintaining the quality of acoustic environment. The booster pumps, which are a major source of noise in this particular activity will be provided with acoustic enclosures, hoods and claddings so as to bring the noise level below 85-dB (A).

4. The utility would deal only with gases and does not utilise any other raw material which other wise can be evaluated as a hazardous/ non-hazardous waste.

5. In a power generation activity with coal as a base fuel, emissions of primary pollutants are not ruled out. Even in such a case impact on the health of flora and fauna is envisaged to a certain extent. The ecological impacts are potentially due to the release of such emissions to the atmosphere and their impacts on vegetation, terrestrial flora and fauna. However, in a case like this where BOF waste gas will be used, the impact on the ecological systems is avoided, as no air emissions would be generated in this activity.

6. The operation of the JVSL plant has seen several changes in the socio-economic and cultural environment. The contribution of JVSL towards provisions of employment and livelihood opportunities has improved the quality of life of the people in the surrounding habitations. The proposed power generation activity would add to this, through its contribution of providing social and economic benefits in terms of employment opportunities during operations and maintenance of the plant, and secondly, by providing cleaner environment and better environment health conditions to the people in the neighbouring villages.

7. The generation of electricity from such a clean process would contribute towards meeting the states deficit in electricity requirements.

The proposed Clean Development Mechanism (CDM) initiative would contribute towards:

- Maintenance of regional air quality, and subsequently ecosystem and human health.
- Conservation of natural resources such as coal and water.
- Contribute towards regional developmental goals.
- Contribute to Karnataka State's power deficit facilitating industrial growth.
- Socio-economic development through provision of employment opportunities for local population.

In view of above positive impacts and contribution towards the nation's goal of sustainable development and improvement in quality of life of local population, the proposed development and implementation of systems for waste heat recovery of BOF Gas and utilisation in power generation is recommended. The clearance of this CDM initiative by JVSL would facilitate the process of sustainable energy production.

SECTION G. Stakeholders' comments

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

To create awareness on the environmental issues, JVSL organizes mass awareness programme each year wherein all local stakeholders, mainly neighbouring community participates. During 2003, the programme was on the theme of ''Sustainable development of Northern Sandur Taluka '' on 10th June, where members of village Panchayats (local body), local NGO's and senior citizens were invited to share any concerns, knowledge and information. In this programme, the CDM initiatives of JVSL were explained and it was also announced that the individual villages will be approached by a local stakeholder consultation team consisting of Dr. P. Ram Babu of PricewaterhouseCoopers, Mr. P.K. Sarkar (Head, Environment Management), and Mr. R. T. Srinivasa Rao (AGM, Environment management) and their concerns related to the CDM initiative of JVSL will be sought. The participants in the meeting were also encouraged to articulate the concerns, but the general response was that the concerns will be communicated to and discussed with the team during their consultation visits. Subsequently the consultation schedule was decided and the participants requested that the consultations be held near the Village Panchayat office on the 23rd of June. It was announced that the project brief and the summary of EIA are available at Mr. Sarkar's office and can be made available to any stakeholder in the nearest Village Panchayat office on request by telephone. Similarly, it was announced that any concern regarding the project can also be communicated to Mr. Sarkar by telephone or in writing. Accordingly the team visited the villages on 23rd June 2003 from 10:00 to 19:00 hrs and conducted meetings next to the village panchayat office in full public gaze and without any access/ participation restrictions.

FOLLOWING ARE THE PEOPLE CONSULTED AT VARIOUS VILLAGES

Sl. No	Name of Village	People contacted
1	Sandur	Sri V.R.Ghorpade, Ex-President, Zilla Panchayat , Bellary.
	Vaddu Panchayat	
2	Vaddu	Smt. Santamma, Vice President
3	Vaddu	Sri Marudra Gouda
4	Basapur	Sri Hanumantappa, Member
5	Basapur	Sri P.H. Ranganath, Member
6	Basapur	Sri G. Thippe swamy, Member
7	Jog	Sri C.M.Durganna,
8	**VADDU**	Sri D.H.Anjanappa
9	**TALUR**	Sri M. Thippeswami
	Kurekuppa Panchayat	
10	Kurekuppa	Sri Malla Reddy, Member
11	Kurekuppa	Sri Devanna, Member
12	Kurekuppa	Sri Hema Reddy
13	Toranagallu Stn.	Sri G. Revanna
14	Toranagallu Stn.	Sri K. RajaShekar

Toranagallu Panchayat		
15	Toranagallu	Smt Chennamma, President
16	Sultanpura	Smt Huligamma, Vice President
17	Sultanpura	Sri Hurkundappa
18	Toranagallu	Sri N.Shankar, Member
19	Toranagallu	Smt V.T.Sridevi , Member
20	Toranagallu	Sri Hemappa

Contents of the Project brief that was communicated to the local Stakeholders in local language

Presently, Jindal Vijayanagar Steel Limited is flaring the excess COREX gas and total BOF Gas. This excess gas, if utilized for power generation, will provide additional power to the grid. Coal based power plants emit many gases that harm the human health and ecology, and also Green House Gasses (GHG) namely CO_2 *which has become a global concern. The excess Corex gas and BOF gas if utilized for power generation, instead of flaring as is practiced now, will produce power without the additional gaseous pollutants. To utilize the COREX and BOF gases in the power plant the additional facilities for storage that need to undertaken, were explained.*

G.2. Summary of the comments received:

The local stakeholders appreciated the two initiatives without additional resource use and emissions of harmful gases. Local stakeholders articulated the following concerns:

a) The project results in more power availability in Karnataka Grid but at the same time the benefit of extra power would not accrue to them directly and solve the problems of irregular supply. Some participants enquired “Can JVSL or JTPCL supply the power to local villagers?”

b) Additional power could boost the economic activity in the region and that finally will improve the quality of life in the region. Some participants enquired, “Could JVSL ensure that the local economy benefits through such an initiative?”

c) Many expressed concern if the project would draw any additional water and also desired water should be made available to them.

d) Some stakeholders expressed that the vegetative cover in and around be improved.

e) Some stakeholders enquired if storage of COREX and BOF gas would be safe.

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

a) In response to the first query [(a) above] Mr. Rao explained to the participants in Kannada Language (the local language) that as per the law, the power can only be fed into the grid and JVSL or JTPCL cannot supply any power to the local communities directly.

b) Mr. Rao in response to the second query [(b) above] assured to the participants in Kannada Language that the local suppliers, contractors and workmen will have preference in undertaking these initiatives. However, ensuring that the power generated through these two initiatives would catalyze local economic development is beyond the scope and mandate of JVSL .

c) Mr. Rao in response to the third concern [(c) above] explained to the participants in Kannada Language that the initiatives would require less water than the present situation or alternate situation, where coal is being utilized for power generation.

It was brought to their notice that Supply of drinking water to 9 villages namely, Old Daroji, New Daroji, Madapur, Basapur, Kurekuppa, Toranagallu station, Toranagallu village Talur and Vaddu under Rajiv Gandhi Drinking water mission with proposed contribution of 41.5 lakhs from JVSL are already under implementation. Also the other rural development programmes taken up by JVSL were explained including water supply to the areas that fall en-route to JVSL incoming water line.

d) Mr. Rao explained to the participants, in response to their articulated desire [(d) above], in Kannada Language that JVSL would continue the vegetation cover improvement through its ongoing plantation programme.

e) Mr. Rao in response to the expressed concern [(e) above] explained to the participants in Kannada Language the safety features of the devices, equipment that will be used and also outlined the safety precautions that will be taken during the operation. He said that this would also become a part of onsite and off site emergency preparedness plan.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Jindal Vijayanagar Steel Limited
Street/P.O.Box:	PO Vidya Nagar
Building:	Toranagallu
City:	Bellary
State/Region:	Karnataka
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Country:	India
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E-Mail:	brahmanand.singh@jvsl.com, suresh.iyer@jvsl.com
URL:	www.jvsl.com
Represented by:	
Title:	Jt. Managing Director & CEO or (Alternately) Exe. Asst. to Managing Director
Salutation:	Dr. (Alternately) Mr.
Last Name:	Singh (Alternately) Iyer
Middle Name:	-
First Name:	Brahmanand (alternately) Suresh
Department:	CEO (alternately) Managing Director's Office
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Direct FAX:	+91- 8395 – 250138
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E-Mail:	ram.babu@in.pwc.com
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Represented by:	
Title:	Associate Director
Salutation:	Mr.
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Mobile:	+91-9820135929
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Direct tel:	+91-22-5669 1302
Personal E-Mail:	ram.babu@in.pwc.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The proponent proposes to identify potential participants (Parties under Annex 1) in due course and it is as yet not known if any public funding shall be sought. In case public funding is sought, the proponent shall duly ensure that it is additional to any ODA.

Annex 3

BASELINE INFORMATION

Combined Margin

Particulars	Specific emission ($tCO2/GWh$)
Operating Margin	569.28
Build Margin	154.13
Combined Margin	**361.71**

Type of FUEL	Net Calorific Value* (TJ/ 10^3 tonnes)	Carbon Emission Factor* (t C/ TJ)	Fraction of Carbon Oxidised - Oxidation Factor**	Emission Coefficient (tCO_2/ 10^3 tonnes)
Diesel***	43.33	20.2	0.990	3177.2
Natural Gas***	48.15	15.3	0.995	2687.7
Coal****	19.98	26.8	0.980	1924.1
Lignite****	9.8	27.6	0.980	971.9

Notes:

* Default values obtained from Table 1-2 of Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook
** Default values obtained from Table 1-4 of Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook
*** Default values obtained from Table 1-3 of Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook
**** Default values obtained from Table 2.4 of IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

Particulars	Value	Unit
GCV of BOF gas	2000.00	kCal/Nm^3
GCV of BOF Gas in Tjoules	0.0000084	Tjoules/NM^3
Annual BOF gas generation expected	80.00	NM^3/tcs
Annual expected crude steel production	1.60	Million Tonnes
Total Annual BOF gas generation	128000000.00	NM^3
Total heat content of BOF Gas generated	256000000000.00	kCal
Heat rate	2570.00	kCal/KWh
Total power generated from BOF Gas per annum	99.61	GWh
Auxiliary consumption @2%	1.99	GWh
Net BOF gas based power exported by power plant per annum	97.62	GWh

Power Plants	Type of FUEL	STATE	PLF (%) by technology (average all India from CEA on performance basis of recent years)	Generation April'03 - Mar'04 (GWh)	Installed Capacity (MW)	Performance Ratio (PR)	Emission Coefficient (tCO_2/ 10^3 tonnes)	GHG Intensive Fuel Used (10^3 tonnes)	Emission Rate (tCO_2)
PEPPARA	Hydro	KER	0.4	1.0	10.1	0.2	0.0	0.0	0.0
SRISAILAM	Hydro	AP	0.4	309.0	3024.0	0.3	0.0	0.0	0.0
METTUR TUNNEL	Hydro	TN	0.4	70.0	672.0	0.3	0.0	0.0	0.0
METTUR DAM	Hydro	TN	0.4	15.0	134.4	0.3	0.0	0.0	0.0
SINGUR	Hydro	AP	0.4	6.0	50.4	0.3	0.0	0.0	0.0
NAGARJUNA SAGAR	Hydro	AP	0.4	369.0	2721.6	0.3	0.0	0.0	0.0
LOWER BHAVANI	Hydro	TN	0.4	9.0	53.8	0.4	0.0	0.0	0.0
NIZAM SAGAR	Hydro	AP	0.4	6.0	33.6	0.4	0.0	0.0	0.0
PARSENS VALLEY	Hydro	TN	0.4	18.0	100.8	0.4	0.0	0.0	0.0
KUTTALAM GT	Natural Gas	TN	0.52	108.0	436.8	0.5	2687.7	16.8	45144.0
ENNORE	Coal	TN	0.82	1258.0	3099.6	0.5	1924.1	1186.0	2281983.4
YELHANKA (DG)	Diesel	KAR	0.86	384.0	866.9	0.5	3177.2	79.9	253824.0
TORANGALLU IMP	Coal	KAR	0.82	766.0	1790.9	0.5	1924.1	148.0	284766.9
KUNDAH	Hydro	TN	0.4	429.0	1864.8	0.6	0.0	0.0	0.0
LOWER METTUR	Hydro	TN	0.4	97.0	403.2	0.6	0.0	0.0	0.0
VAIGAI	Hydro	TN	0.4	5.0	20.2	0.6	0.0	0.0	0.0
KUTHUNGAL	Hydro	KER	0.4	19.0	70.6	0.7	0.0	0.0	0.0
P. NALLUR CCGT	Natural Gas	TN	0.82	1314.0	2276.5	0.7	2687.7	204.4	549252.0
SERVALAR	Hydro	TN	0.4	19.0	67.2	0.7	0.0	0.0	0.0
SRISAILAM LB	Hydro	AP	0.4	328.0	1102.1	0.7	0.0	0.0	0.0
KADAMPARI	Hydro	TN	0.4	408.0	1344.0	0.8	0.0	0.0	0.0
NEYVELI FST EXT	Lignite	TN	0.82	1993.0	2893.0	0.8	971.9	2224.9	2162405.0
SURULIYAR	Hydro	TN	0.4	41.0	117.6	0.9	0.0	0.0	0.0
MANI DPH	Hydro	KAR	0.4	11.0	30.2	0.9	0.0	0.0	0.0
PEDDAPURAM CCGT	Natural Gas	AP	0.86	1249.0	1589.3	0.9	2687.7	194.2	522082.0
B. BRIDGE D.G	Diesel	TN	0.78	992.0	1310.4	1.0	3177.2	206.4	655712.0
JOG	Hydro	KAR	0.4	160.0	403.2	1.0	0.0	0.0	0.0
JEGURUPADU GT	Natural Gas	AP	0.86	1505.0	1700.5	1.0	2687.7	234.1	629090.0
GODAVARI GT	Natural Gas	AP	0.78	1100.0	1362.8	1.0	2687.7	171.1	459800.0
KODAYAR	Hydro	TN	0.4	141.0	336.0	1.0	0.0	0.0	0.0
ALIYAR	Hydro	TN	0.4	86.0	201.6	1.1	0.0	0.0	0.0
KAYAMKULAM GT	Natural Gas	KER	0.82	2118.0	2410.8	1.1	2687.7	329.4	885324.0
		SUM GEN$_j$ =		**15334.0**			*SUM(Fi,j * COEFi,j) =*		**8729383.3**
							Operation Margin =		**569.283**

OPERATING MARGIN CALCULATIONS

BUILD MARGIN CALCULATIONS

Power Plant	State in Southern Grid	Installed Capacity MW	Fuel	Status (Commissioned/ Under construction)	Dates	PLF_m	Expected Generation (GWh)	EF_m
Priyadarshini Jurala Hydro Electric Project	AP	234	Hydro	Underconstruction	03/10/07	0.60	1,179	0
Bhoopalapally Thermal Power Station	AP	500	Coal	Underconstruction	03/10/07	0.82	3,444	
Kaiga Unit 3	Karnataka	220	Atomic	Underconstruction	03/01/07	0.80	1,478	0
Kaiga Unit 4	Karnataka	220	Atomic	Underconstruction	03/01/07	0.80	1,478	0
Kudankulam Unit 1	TN	1,000	Atomic	Underconstruction	03/01/07	0.80	6,720	0
Rayala seema Thermal Power Project Stage - II	AP	420	Coal	Underconstruction	01/01/07	0.82	2,893	96
Vijayawada Thermal Power Station stage - IV	AP	660	Coal	Underconstruction	01/01/07	0.82	4,546	96
TAPS 4	Tamil Nadu	540	Atomic	Underconstruction	01/01/07	0.80	3,629	0
TAPS 3	Tamil Nadu	540	Atomic	Underconstruction	04/01/06	0.80	3,629	0
	SUM =	**4,334**				**SUM =**	**28,997**	
				Grid Generation =			**135,027**	
				20% of Grid Generation =			**27,005**	

GEN_{coal} =	1,580 MW	EF_{coal} =	96.30133	tCO_2/ TJ
GEN_{sum} =	4,334 MW	PLF_{coal} =	0.82	
$GEN_{coal\%}$ =	36 %	**$EF_{BM,y}$ =**	**154.13**	**tCO_2/ GWh**

Reference:
(1) Ministry of Power Report 2002 - 03.
(2) PLF_m considered is based on Capacity Group as given under published document by CEA - Performance Review of
(3) Data of 75 plants commisioned in last 5 years in India for the period 1999 - 2004.
(4) Plants under Capacity Addition Scheme by CEA and other agencies, only those plants which are under construction has
(5) Date selected for underconstruction plant are the tentative date of Synchronization of those plants with the electricity grid.
(6) Calculated using IPCC data provided under worksheet "IPCC_Emission_Co-eff.".

Annex 4

MONITORING PLAN

The details of the monitoring plan are provided under section D.2.1, and the scheme of monitoring is mentioned below.

Data to be monitored ***(as per ID used in the PDD)***	**Reference location in the PDD**	**Monitoring requirements/ Plan**
$W_{p,y}$	Table D.2.1.1	Daily
$F_{x,p}$	Table D.2.1.3	Annual
GCV	Table D.2.1.3	Monthly
$HR_{p,y}$	Table D.2.1.3	Monthly
AUX	Table D.2.1.3	Annual
$F_{i,j}$	Table D.2.1.3	Annual
GEN_j	Table D.2.1.3	Annual
GEN_m	Table D.2.1.3	Annual
PLF_m	Table D.2.1.3	Annual
PROD	Table D.2.3.1	Daily

- - - - -

APPENDIX 1

BASELINE AND PROJECT EMISSION CALCULATIONS

(THIS SECTION HAS BEEN SHIFTED TO ANNEX 3)