



21<sup>st</sup> May 2007

**Kind Attn : CDM Executive Board  
UNFCCC**

**Sub : Clarifications on the request for review in connection with the request for issuance for "Generation of Electricity through combustion of waste gases from Blast Furnace and Corex units at JSW Steel Limited (in JPL, unit 1), at Torangallu in Karnataka, India (0325)"**

Dear Sir /Madam

This is with reference to the request for review in connection with the request for issuance for "Generation of Electricity through combustion of waste gases from Blast Furnace and Corex units at JSW Steel Limited (in JPL, unit 1), at Torangallu in Karnataka, India (0325) .

We are enclosing herewith our clarifications to the comments raised in the request for review for your consideration.

Please note that the contact person for the review process would be Dr. P.Rambabu and his contact number is 09867531202 .

Thanking you

Yours Truly

**Suresh Iyer  
Deputy Gen Manager**

**Clarifications on the Request for review in connection with the request for issuance for “Generation of Electricity through combustion of waste gases from Blast furnace and Corex units at JSW Steel Limited (in JPL unit 1), at Torangallu in Karnataka, India (0325)”**

**Query 1**

*Two monitoring reports are submitted by the PPs: the first and the updated. Parameters for monitoring are correctly **described** in both of them along with the formulas used. Verifiers confirm that they checked everything (all excel sheets) and everything is correctly calculated. Technical details of the power plant are also given in Monitoring Reports.*

*In **the first report** the annual generations (total and net) for the years 2005 and 2006 are presented in Appendix I along with the baseline EF for captive power generation and the efficiency of power generation fixed ex-ante? Final annual results of baseline emissions are also presented. Total (**annual**) quantity of fuel consumed along with the necessary coefficients and calculated annual project emissions for 2005 and 2006 are also there.*

*In **updated monitoring report** the project emission is recalculated and instead of 191 t CO<sub>2</sub> it became 181 t CO<sub>2</sub> for the crediting period. Annual generation and all other coefficients are removed from the updated report and only final **monthly** results of baseline and project emissions for the years 2005 and 2006 are presented.*

*It should be mentioned that according to the monitoring plan the PPs have to measure and record the electricity daily, calorific values monthly, etc. Neither daily nor monthly figures are presented for these parameters.*

**Answer:**

The Project Proponent (PP) measured and recorded all the parameters like daily electricity generation, and monthly calorific value as required by monitoring methodology ACM0004 version 1. This data was made available in the emission reduction calculation spreadsheet attached to first monitoring report and updated monitoring report. These are again resubmitted here for your ready reference as Annex I and Annex II. Annex I is the emission reduction calculation sheet for the first monitoring report. Annex II is the emission reduction calculation sheet for the updated monitoring report.

While calculating the project and baseline emissions in the first monitoring report, figures in the emission reduction calculation sheet (Annex I) were presented as it is and in line with the Registered PDD. As a conservative approach, as suggested by the DOE the figures of the baseline and project emissions have been round down (as per the terminology in Microsoft Excel software) to whole numbers on the lower side (to be on the conservative side) in the emission reduction calculation sheet (Annex II) of the updated monitoring report.





|         |                           | Baseline Emission | Project Emission | Emission Reduction |
|---------|---------------------------|-------------------|------------------|--------------------|
| Annex 1 | First Monitoring Report   | 1365045           | 191              | 1364854            |
| Annex 2 | Updated Monitoring Report | 1365033           | 181              | 1364852            |

This has resulted in a reduction of baseline emissions by 12tCO<sub>2</sub>e and project emissions by 10 tCO<sub>2</sub>e resulting in a reduction of the emission reductions by 2 tCO<sub>2</sub>e . This change was incorporated in the emission reduction calculation (Annex II) as a conservative approach in the updated monitoring report .

The presentation formats in the first and updated monitoring reports are slightly different. The annual generation figure and other coefficient were removed from the updated monitoring report. The revised monitoring report version 03 ( Submitted herewith as Annex III) is modified to include monthly generation figures and all other coefficients (appendix 1 in the monitoring report version 03) in the same format as that in the first monitoring report. This revised **monitoring report version 3** (Annex III) also incorporates all the relevant information like quantity of fuel consumed , all necessary coefficients and calculated annual project emissions & base line emissions for the year 2005 and 2006.

The request for issuance was accompanied by both the monitoring reports (the first and updated) and complete information and data was presented in the request for issuance. Materially both the reports are the same except that the project proponent adapted to a rounddown (As per the terminology in Microsoft Excel software ) to whole numbers on the lower side as suggested by the DOE as a conservative approach in the updated monitoring report resulting in a reduction of the emission reductions in the updated report.

## Query 2

*The efficiency of captive power plant is measured and fixed ex-ante as it is clearly said in verification report (page 7). This approach is not correct and not so clear from the PDD. The PDD says "As a conservative approach the highest value 33.375% among the **options A** and B is considered for the baseline calculation (page 13). In my reading these A and B options as they are formulated in PDD are not the same A and B from methodology. Option A in PDD is: "Design Efficiency" while in methodology (page 5) for option A we have sub-options 1,2,3 and the highest value should be chosen among them **during monitoring process** because the sub-option 2 requests measuring the efficiency during monitoring though two other sub-options are fixed once ex-ante. Methodology doesn't say "or" among these three sub-options. Taking into consideration that this parameter is correctly insert in the registered monitoring plan (though there is not mentioned record frequency) my opinion is that Efficiency captive should be measured yearly during the crediting period then compared with two others (fixed ex-ante) and the highest one should be used for calculation of baseline. This parameter could be fixed only in case if option B as in methodology (100% efficiency) is assumed.*

## Answer:

We agree that various options for deducing the efficiency have not been presented in the registered PDD in the same way as in the Option A (page 5, of the methodology ACM0004 version 1).



However we would like to clarify as follows:

- Option A in the registered PDD (Page 11) is same as sub options 3 of option A of the methodology ACM 0004 version 1.
- Option B in the registered PDD –Page 11- (measured efficiency during monitoring : **option: Performance Guarantee test**) is same as sub options 1 of option A of the methodology (measured efficiency prior to project implementation).
- The figures for the sub option 2 "measured efficiency during monitoring " in the version 01 of the methodology ACM0004 has been presented as Option B in the registered PDD – Page 11 (measured efficiency during monitoring : **Option: Normal Check**). However the figure related to this option was not presented in the tabular comparison of the PDD in page 12. The data was made available to the DOE (verifier) during the verification process . Based on a conservative approach the highest value among the above 3 options is considered for base line calculations.

We are here with presenting all the above three options as described in the methodology ACM0004, version 01:

|   | <b>Option A, sub option 2 of the methodology</b>                                      |                           | <b>Option A, sub option 3 of the methodology</b> |
|---|---|---------------------------|--|
| <b>Option A, sub option 1 of the methodology</b>  | Measured efficiency during monitoring   |                           | Design Efficiency                                |
| Option B of the registered PDD (Measured efficiency during monitoring (performance Guarantee Test ) | Option B of the registered PDD (Measured efficiency during monitoring (Normal Check ) |                           | Option A of the PDD (Design)                     |
|   | April 05-Dec 05   | Jan 06-Dec 06             |  |
| With low pressure economizer  | With low pressure economizer  |                           | With low pressure economizer                     |
| <b>31.88%</b>   | <b>32.41%<sup>1</sup></b>   | <b>32.22%<sup>2</sup></b> | <b>33.375%</b>                                   |

<sup>1</sup> Plant Operation Data (efficiency calculation sheet)

<sup>2</sup> Plant Operation Data (efficiency calculation sheet)





(The highest value 33.375% among the option is considered for the baseline calculation.  
Eff=33.375%=0.33)

From the above it can be seen that the conservative values (as required by ACM 0004, version 1) still remains to be design efficiency and conclusion remains unchanged.

The data and information was made available to the DOE (verifier) during the verification stage. However, as the presentation in the monitoring report does not adhere to the required format of the methodology ACM0004 version 01, the monitoring report is accordingly modified at page 5 and 11 and submitted as **Annex III** along with this reply.

Attachments :

Annex I –Emission reduction calculation sheet for the first monitoring report

Annex II – Emission reduction calculation sheet for the updated monitoring report

Annex III– Revised monitoring report version 3

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Annex I  
Emission reduction calculation sheet for the first monitoring report  
(see separate Excel spreadsheets)

Annex II  
Emission reduction calculation sheet for the updated monitoring report  
(see separate Excel spreadsheets)

Annexure III  
Revised monitoring report version 3



## Monitoring Report

### 1. Title of the project activity

Generation of Electricity through combustion of waste gases from Blast furnace and Corex units at JSW Steel Limited (in JPL unit 1), at Torangallu in Karnataka, India.

**PDD Version:** 04

**Date of registration:** 12/01/2007

**Project Registration Code:** 0325

**Date of Monitoring Report:** 19/05/2007

**Version of the monitoring Report:** 03

### 2. Executive Summary

The purpose of this monitoring report is to provide estimation of GHG emission reductions achieved by this CDM project activity for periodic verification by the DOE. The relevant details of the project activity are given below:

|    | Activity   | Dates                           |
|----|--|---------------------------------|
| 1. | Start of crediting period (start of commercial operation of captive power plant) | 1 April 2005                    |
| 2. | First monitoring period  | 1 April 2005 - 31 December 2006 |

The project activity consists of setting up and operation of a 1x100 MW power plant (JPL unit 1), for generation of electricity by combustion of waste gases from Blast Furnace and Corex units. The Blast Furnace in JSW Steel Limited (formerly Jindal Vijayanagar Steel Ltd.) has a capacity of 0.9 Million tons per annum, which will produce blast furnace gas of around 800 Kcal/NM<sup>3</sup> calorific value. After in house consumption at JSW Steel, certain amount of excess BF gas is available for Power generation which otherwise would have been flared. In addition, the project activity also uses the gases generated by COREX units of JSW Steel which are in excess of internal (JSW Steel) consumption. The power generated by the project activity is supplied to JSW Steel –which otherwise would have been met by power from a captive power plant using coal as the fuel as is the common practice or from any other Independent power producer. This project activity is undertaken by the JSW Power Limited (which is recently merged with the JSW Steel Limited<sup>1</sup>).

In this project activity the steam generator is capable of firing BF & Core Gases. This steam generator is a natural circulation Bi-drum type. The Steam Generator is a vertical two pass unit with a maximum continuous rating of about 390 t/hr of superheated steam at a pressure of 93 kg/sq.cm (a) and temperature of 540 deg C when supplied with feed water at a temperature of 237 deg C at the economizer inlet.

The power generated by this project activity will replace/ substitute the major quantity of electricity that could have been generated by the JSW Steel or an Independent power Producer using coal. Since the waste gas would have been flared anyway in absence of project activity, the additional emissions from generation of power by combusting waste gases, in the project activity, is zero. Hence, the project activity is effecting GHG emission reduction by displacing power generation with GHG intensive fossil fuel with that of “zero GHG emission fuel”.

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<sup>1</sup> JSW Power Ltd. was incorporated on 25/07/2003 and merged with JSW Steel on 16/11/2005

In order to estimate emission reductions, JPL unit 1 maintains the following monitored/estimated records for parameters relevant to the project activity and its operations.

|                   |  |
|-------------------|--|
| Q <sub>1</sub>    | = Daily quantity of Light Diesel Oil (LDO)   |
| NCV <sub>1</sub>  | = Net calorific value of LDO   |
| Q <sub>2</sub>    | = Daily quantity of High Speed Diesel (HSD)  |
| NCV <sub>2</sub>  | = Net calorific value of HSD   |
| EG <sub>GEN</sub> | =Total electricity generated and supplied through Generator transformer- GT-1 & GT-2 (MWh /yr)                       |
| EG <sub>AUX</sub> | =Total auxiliary Energy consumed by the project, supplied through Station aux. Transformer & 6.6 Incomer-I (MWh /yr) |

The primary data monitored is as per Annex 4 and section D in the registered project design document (PDD); the details are provided under section 5 in this monitoring report. Using the data maintained for the monitoring period mentioned above, the total emission reductions being claimed during this monitoring period is **1364852 tCO<sub>2e</sub>**.

### 3. References

The approved methodology called ACM0004 (version 01, Sectoral Scope: 01, 8 July 2005)-“Consolidated baseline methodology for waste gas and/or heat for power generation”, has been applied to this project activity.

### 4. General description of the project activity

#### 4.1. Project Participants

| <b>Name of Party involved<br/>((host) indicates a host Party)</b> | <b>Private and/or public<br/>entity(ies)<br/>project participants<br/>(as applicable)</b> | <b>Kindly indicate if the<br/>Party involved wishes to<br/>be considered as project<br/>participant (Yes/No)</b> |
|---|---|--|
| 1. Government of India  | 1. JSW Steel Limited  | No.  |
| 2. Government of United Kingdom                                   | 2. Noble Europe Limited<br>3. EDF Trading Limited   | No.  |

#### 4.2. Physical location of the project activity

The power plant (in the project activity) is located to the West of the Blast Furnace in JSW Steel premises. The geographical location is approximately 15° 9' latitude (N) and 76° 51' longitude (E). A state high way (No. 42) connecting Bellary and Sandur is adjacent to the plant. The site is situated almost at the centre point between the two famous towns Bellary and Hospet, which are 80 km apart. The nearest railway station is Toranagallu of South Central Railway. The existing steel plant has a railway line link.

#### 4.3. Technical description of the project

The technology employed in the project activity for using BF and COREX process generated waste gases to generate electricity is first of its kind in the world which addressed problems involved in combined firing of gases differing in relevant characteristics. The steam generator used is designed for firing either 100% COREX gas and combination of COREX

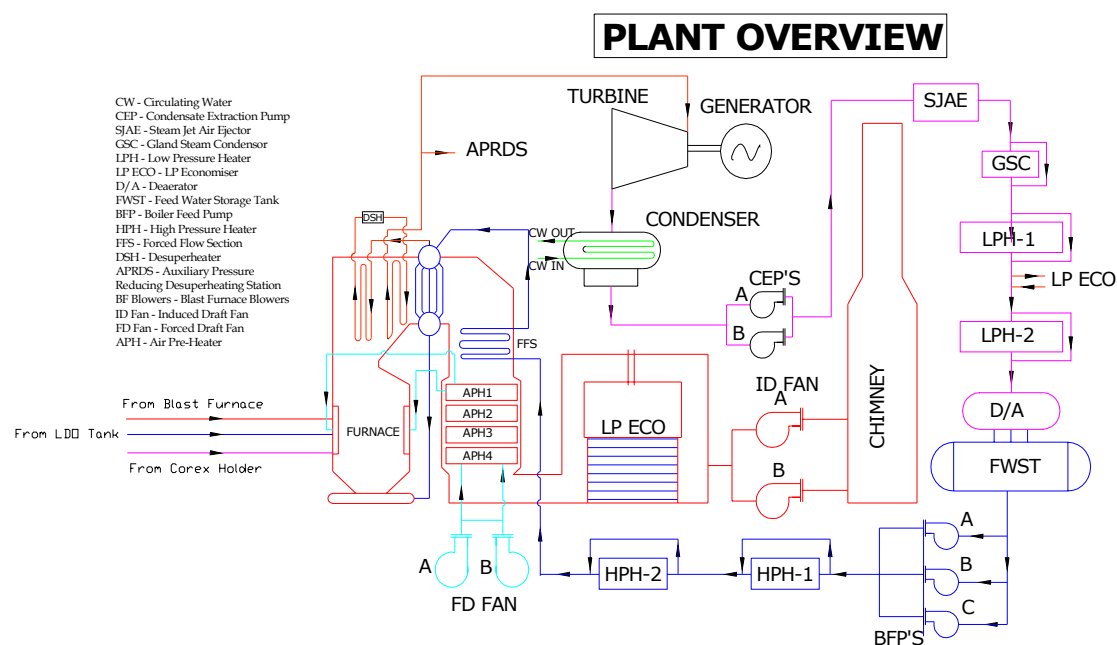
gas and BF gas and is rated to generate about 390 t/hr of superheated steam at a pressure of 93 kg/cm<sup>2</sup>(a) and temperature of 540°C. The steam generator is a natural circulation Bi-drum type, equipped with facilities for firing LDO for start-up. The steam turbine is a single cylinder machine with facility for turbine bypass, driving a turbo-generator at 3,000 rpm to produce 100 MW output [Maximum Continuous Rating (MCR)]. The steam generator is designed as semi-outdoor equipment while the turbine generator sets with all auxiliary and feed cycle equipment are located indoor.

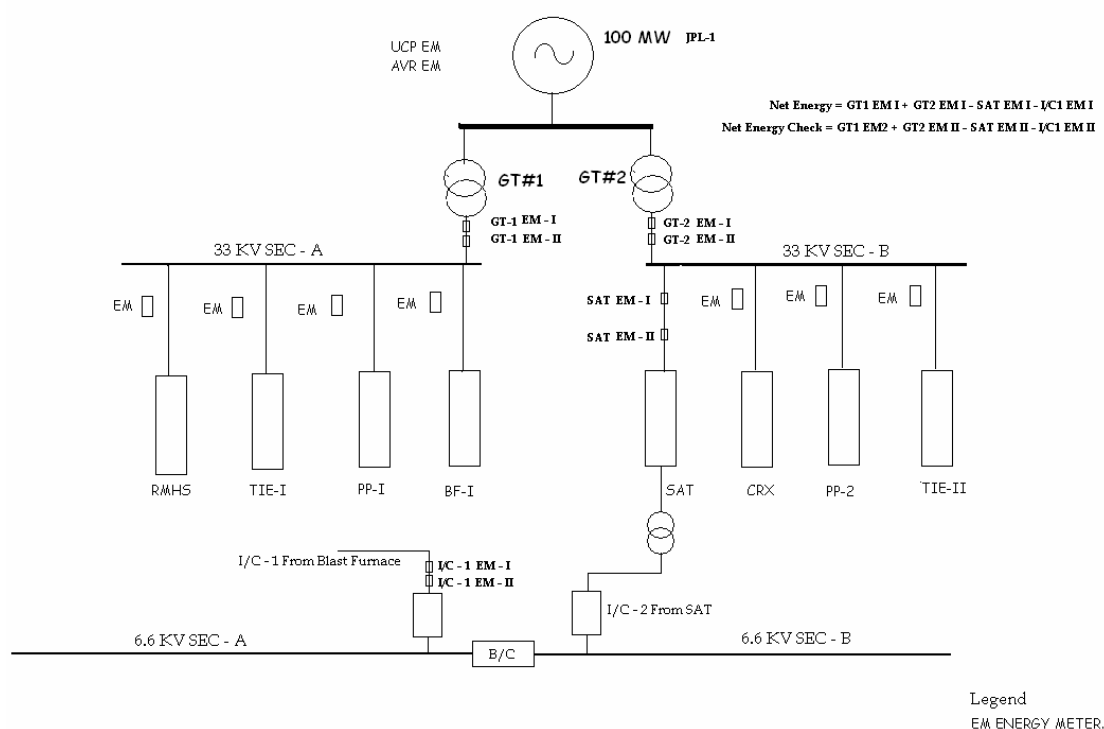
Boiler firing system consists of separate elevations for BF and COREX waste gases and start-up fuel (LDO). By combining COREX with higher calorific value and BF gases with lower calorific value, the flame stability is achieved without any conventional fuel support. The novel boiler design, come-up first time in the world, applied in this project achieves the required steam temperature with widely varying calorific value of gases. The explosive and toxic nature of these waste gases is also appropriately accounted for in the design. In this boiler, a Low Pressure (LP) Economiser is installed in waste gas path after boiler air pre heater. The condensate from the LP heater is routed through the Low Pressure Economiser water side. This helps in maintaining gas temperature at chimney inlet lesser than even for differing compositions of BF and COREX waste gases firing.

The steam from boiler is taken through main steam line and admitted to turbine. Turbine is coupled with generator capable of producing 100MW of electrical power. The steam coming out of turbine is condensed in a condenser and the condensate is fed back to boiler through regenerative feed system. In case of total power failure, 320 KVA emergency DG will come into service and provide supply for turbine lubrication oil pump.

The power generated from the generator is fed to 33 KV sections A and B through two separate generator transformers (10.5KV /33 KV). From 33 KV sections A and B, individual feeders connect to JSWSL plant loads, as well as to the station auxiliary transformer. During start-up power is drawn either from 33 KV Tie-II or 6.6 KV incomer –I. While the unit is under a shut-down, power is fed by Tie I and Tie II to JSWSL loads.

The plant overview and power evacuation diagram are provided below:





## 5. Monitoring Methodology and Plan

The approved monitoring methodology ACM0004 (version 01) has been applied to this project activity. The parameters monitored/ estimated and recorded in order to estimate the emission reductions from the project activity during the monitoring period is indicated in the table below (also refer section B.2 in the registered PDD). The detailed data and calculations of baseline emission, project emissions and emission reductions are provided in the attached MSEXcel file (Appendix 1).

| ID No.           | ID Label         | Data variable                    | Data unit         | Comments  |
|------------------|------------------|----------------------------------|-------------------|---|
| 1 <sub>1</sub> . | Q <sub>1</sub>   | Volume of LDO used in the boiler | m <sup>3</sup>    | Monitored daily at '0:00' hours and recorded in the control room log-book and computer database.  |
| 2 <sub>1</sub> . | NCV <sub>1</sub> | Net Calorific value of LDO       | TJ/m <sup>3</sup> | GCV is measured whenever procured/ once in a month from storage tank. The NCV is estimated from GCV value following equation no. 1 of ASTM procedure no. D 4809-00. |
| 3 <sub>2</sub> . | EF <sub>1</sub>  | Carbon emission factor of LDO    | tC/TJ             | As per 'Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Workbook: Table 1-2', a value of 20.2 tC/TJ have been used.                            |
| 1 <sub>2</sub> . | Q <sub>2</sub>   | Volume of HSD used in the DG     | m <sup>3</sup>    | Monitored daily at '0:00' hours and recorded in the control room log-book and computer database.  |

| ID No.           | ID Label                                   | Data variable   | Data unit         | Comments   |
|------------------|--|---|-------------------|--|
| 2 <sub>2</sub> . | NCV <sub>2</sub>                           | Net calorific value of HSD  | TJ/m <sup>3</sup> | GCV is measured whenever procured/ once in a month from storage tank. The NCV is estimated from GCV value following equation no. 1 of ASTM procedure no. D 4809-00 and Indian Oil Corporation Limited (IOC) test certificate for hydrogen content in HSD.  |
| 2 <sub>3</sub> . | EF <sub>2</sub>                            | Emission factor of HSD  | tC/TJ             | As per 'Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Workbook: Table 1-2', a value of 20.2 tC/TJ have been used.   |
| 4.               | EG <sub>GEN</sub>                          | Total electricity generated and supplied through Generator transformer- GT- 1 & GT-2                      | MWh/yr            | This is summation of electricity meter readings at '0:00' hours from generator transformers GT-1 and GT-2, and maintained in computer database. Joint meter readings are taken with JSW steel every month. 0.2 class energy meters are installed at panels Daily recording are maintained in a soft copy and monthly a printout is maintained for archiving the same .   |
| 5.               | EG <sub>AUX</sub>                          | Total auxiliary Energy consumed by the project, supplied through Station aux. Transformer & 6.6 Incomer-I | MWh/yr            | This is summation of electricity meter readings at '0:00' hours from station auxiliary transformer (SAT) and 6.6 kV incomer I panel, and maintained in computer database. Joint meter readings are taken with JSW steel every month. 0.5 class energy meters are installed at panels. Daily recording are maintained in a soft copy and monthly a printout is maintained for archiving the same. 6.6 KV incomer 1 Panel. |
| 6.               | EG <sub>Y</sub>                            | Net Electricity supplied to facility  | MWh/yr            | Calculated daily and monthly records. $EG_Y = EG_{GEN} - EG_{AUX}$   |
| 13.              | EF <sup>2</sup> <sub>CO<sub>2</sub>i</sub> | CO <sub>2</sub> emission factor for coal  | tC/TJ             | As per 'Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories Workbook: Table 1-2', a value of 25.8 tC/TJ have been used.   |
| 14.              | Eff <sub>captive</sub>                     | Efficiency of captive   | %                 | As per section B.2 in the registered   |

<sup>2</sup> The Value of  $EF_{CO_2si (coal)}$  is the Carbon Emission Factor of Coal whose value is taken as 25.8 tC/TJ from IPCC guidelines



| ID No. | ID Label | Data variable    | Data unit | Comments  |
|--------|----------|------------------|-----------|---|
|        |          | power generation |           | PDD, and As per Appendix 2 of this monitoring report. |

Using the data variables listed above and the formula provided below, the GHG emission reductions have been estimated.

**Baseline emissions are given as:**

$$BE_y = BE_{electricity,y} = EG_y \cdot EF_{electricity,y}$$

$EG_y$  Net quantity of electricity supplied, to the manufacturing facility by the project during the year y in MWh and

$EF_{electricity,y} = EF_y$  CO<sub>2</sub> baseline emission factor for the electricity displaced due to the project activity during the year y (tCO<sub>2</sub>/MWh)

$$EG_y = EG_{GEN} - EG_{AUX}$$

$EG_{NET}$  = Net Electricity supplied to the manufacturing facility by the project (MWh/yr)

$EG_{GEN}$  = Total electricity generated and supplied through Generator transformer- GT- 1 & GT-2 (MWh /yr)

$EG_{AUX}$  = Total auxiliary Energy consumed by the project, supplied through Station aux. Transformer & 6.6 Incomer-I (MWh /yr)

The baseline emission factor ( $EF_y$ ) has been determined using the option I (Option 1. If baseline scenario is captive power generation) as mentioned in the approved methodology ACM 0004.

If the baseline scenario is determined to be captive power generation (either existing or new), the Emissions Factor for displaced electricity is calculated as follows:

$$EF_{captive,y} = (EFCO_{2,i}(coal) / Eff_{captive}) \times (44/12) \times (3.6/1000)$$

where:

$EF_{captive,y}$  Emissions factor for captive power generation (tCO<sub>2</sub>/MWh)

$EFCO_{2,i}$  CO<sub>2</sub> emissions factor of fuel used (coal) in captive power generation (tC/TJ)  
(This is equal to carbon emission factor as defined in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories : Workbook Table 1-2)

$Eff_{captive}$  Efficiency of the captive power generation (%)

44/12 Carbon to Carbon Dioxide conversion factor

3.6/1000 TJ to MWh conversion factor

**Project Emissions are given as :**

$$PE_y = \sum Qi \cdot NCV_i \cdot EFi \cdot 44/12 \cdot OXID_i$$

where:

$PE_y$  =Project emissions in year y (tCO<sub>2</sub>)

$Q_i$  =Mass or volume unit of fuel i consumed (t or m<sup>3</sup>)

$NCV_i$  =Net calorific value per mass or volume unit of fuel i (TJ/t or m<sup>3</sup>)

$EF_i$  =Carbon emissions factor per unit of energy of the fuel i (tC/TJ)

$OXID_i$  =Oxidation factor of the fuel i (%)

As only HSD will be used in DG during emergency, hence the oxidation factor of 99% has been used as IPCC default values.

The carbon emission factor of 20.2 tC/TJ has been considered as default values from 1996 Revised IPCC Guideline

Also, LDO is used in the boiler as a start up fuel and hence will be included while calculating the project emissions.

Subscript 1: LDO

Subscript 2: HSD

## **Emission Reductions**

The emission reduction  $ER_y$  by the project activity during a given year  $y$  is the difference between the baseline emissions through substitution of electricity generation with fossil fuels ( $BE_y$ ) and the project emissions ( $PE_y$ ) as follows :

$$ER_y = BE_y - PE_y$$

$ER_y$  are the emissions reductions of the production activity during the year  $y$  in tonnes of  $CO_2$

$BE_y$  are baseline emissions due to displacement of electricity during the year  $y$  in tonnes of  $CO_2$

$PE_y$  are the project emissions during the year  $y$  in tonnes of  $CO_2$

## **6. Quality Control (QC) and Quality Assurance (QA)**

### **6.1. Management Processes for Emission Reduction**

JPL has leased the plant and equipment to JSW Steel and JVSL has in turn awarded the operation and maintenance responsibility to Jindal Thermal Power Generation Limited (JTPCL)<sup>3</sup>. JPL has also communicated to JSW Steel regarding the monitoring requirements and access to monitoring records for JPL and its nominees. Accordingly, JTPCL has constituted a management structure to monitor emission reductions and manage the CDM project.

JTPCL CEO has constituted the CDM project team, which is responsible for the project activity. The project documentation, registration and identifying project participants from Annex I countries is the responsibility of the coordinator of the project team. The monitoring and verification of the project activity is assigned to the four member team which is responsible for monitoring, verification and recording of the data, GHG emissions and emission reduction estimations. On a daily basis the monitoring reports are checked by the operation head. In case of any irregularity in the project activity it is reported to the operation head. On a monthly basis this report is forwarded to the CEO.

The site is included in ISO 14001 based Environmental Management System (EMS) in place, in which this CDM project activity is a part. Accordingly, the monitoring plan used herein is an integral part of the Environmental Management Programmes and is constituent of operational and management structure of this EMS.

### **6.2. Quality control (QC) and quality assurance (QA) procedures and Calibration/ Maintenance of Measuring and Analytical Instruments**

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<sup>3</sup> Subsequent to merger of JSW Power and JSW Steel and rechristening of JTPCL as JSW Energy, all aspects of operation and management structure as described above will be maintained.

The QA/QC procedures are as per applicable standards. All measuring and analytical instruments are being calibrated as per the standard procedures. The various meters used and back-up data and calibration records are available for verification at site. The specific details regarding parameters of concern are summarized below.

| <b>Data</b>  | <b>Uncertainty level of data<br/>(High/Medium/Low)</b> | <b>Are QA/QC<br/>procedures<br/>planned for these<br/>data?</b> | <b>explanation why<br/>QA/QC procedures are<br/>or are not being<br/>planned</b>  |
|--|--|---|---|
| 1 <sub>1</sub> ,2 <sub>1</sub> ,1 <sub>2</sub> ,2 <sub>2</sub> | Low  | yes   | This data is required for project emission calculation. This data is monitored using meters and standard testing equipment, which is regularly, calibrated following standard industry practices.   |
| 4,5,6  | Low  | yes   | This data is required for the baseline emission calculations. This data is used for the calculation of project electricity generation. This data is monitored using meters and standard testing equipment, which is regularly calibrated following standard industry practices. |
| 13,14  | Low  | no  | The data is directly used to calculate baseline emissions. This data is determined, so does not need QA procedure.  |
| 15   | Low  | Yes   | This data will be required for the calculation of baseline emissions (from captive power plant electricity).  |

### 6.3. Environmental Impacts including Trans-boundary 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. As part of the EIA study for the entire JSWSL complex, the operations of the project activity (electricity generation with waste gases) were also covered. No trans-boundary impacts are anticipated due to the electricity generation activities as project activity is located in the interior part of India. No significant environmental impacts have been

identified in the EIA report. The project activity operates under valid “Consent to Operate” from the Karnataka State Pollution Control Board (KSPCB) and has not been stopped during the monitoring period (1 April 2005 – 31 December 2006) due to any environmental violations.

## 7. Calculation of GHG Emission Reductions

The steps used for calculating the emission reductions are described below.

### 7.1. Calculation of Project Emissions

The project emissions have been calculated using equation (4) with data inputs mentioned under section 5 in this monitoring report; the detailed data and daily project emission estimates are separately provided under Appendix 1. The project emission from 1 April 2005 to 31 December 2006 is **181 tCO<sub>2e</sub>**.

### 7.2. Calculation of Baseline Emissions

The baseline emissions have been calculated using equations (1), (2) and (3) with data inputs mentioned under section 5 in this monitoring report; the detailed data and daily project emission estimates are separately provided under Appendix 1. The baseline emission from 1 April 2005 to 31 December 2006 is **1365033 tCO<sub>2</sub>**.

### 7.3. Calculation of ER<sub>y</sub>

Using equation (5), the emission reductions from 1 April 2005 to 31 December 2006 is **1364852 tCO<sub>2</sub>**.

## Appendix 1

| Emission Factor for Coal | C to CO <sub>2</sub> | TJ to MWh  | E <sup>fr</sup> of power generation | Emission Factor       |
|--------------------------|----------------------|------------|-------------------------------------|-----------------------|
| EF <sub>coal</sub>       | conversion           | Conversion |                                     | E <sub>fy</sub>       |
| tC/TJ                    |                      |            |                                     | tCO <sub>2</sub> /MWh |
| 25.8                     | 3.67                 | 0.0036     | 0.33                                | 1.03                  |

| Total Baseline emissions |                                  |                  |                       |                    |
|--------------------------|----------------------------------|------------------|-----------------------|--------------------|
| Year                     | Total net electricity Generation | Total Generation | Emission Factor       | Baseline Emissions |
|                          | MU                               | MWh              | tCO <sub>2</sub> /MWh | t CO <sub>2e</sub> |
| Apr-05                   | 58.5114                          | 58511.4          | 1.03                  | 60383              |
| May-05                   | 61.6792                          | 61679.2          | 1.03                  | 63652              |
| Jun-05                   | 65.3323                          | 65332.3          | 1.03                  | 67422              |
| Jul-05                   | 51.8842                          | 51884.2          | 1.03                  | 53544              |
| Aug-05                   | 54.3642                          | 54364.2          | 1.03                  | 56103              |
| Sep-05                   | 60.5922                          | 60592.2          | 1.03                  | 62531              |
| Oct-05                   | 62.7381                          | 62738.1          | 1.03                  | 64745              |

|                       |                  |                  |             |                |
|-----------------------|------------------|------------------|-------------|----------------|
| <b>Nov-05</b>         | <b>67.1005</b>   | <b>67100.5</b>   | <b>1.03</b> | <b>69247</b>   |
| <b>Dec-05</b>         | <b>67.1594</b>   | <b>67159.4</b>   | <b>1.03</b> | <b>69308</b>   |
| <b>Apr 05- Dec 05</b> | <b>549.3615</b>  | <b>549361.5</b>  | <b>1.03</b> | <b>566935</b>  |
|                       |                  |                  |             |                |
| <b>Jan-06</b>         | <b>58.826</b>    | <b>58826</b>     | <b>1.03</b> | <b>60708</b>   |
| <b>Feb-06</b>         | <b>62.8795</b>   | <b>62879.5</b>   | <b>1.03</b> | <b>64891</b>   |
| <b>Mar-06</b>         | <b>68.9012</b>   | <b>68901.2</b>   | <b>1.03</b> | <b>71106</b>   |
| <b>Apr-06</b>         | <b>68.1927</b>   | <b>68192.7</b>   | <b>1.03</b> | <b>70374</b>   |
| <b>May-06</b>         | <b>69.49485</b>  | <b>69494.85</b>  | <b>1.03</b> | <b>71718</b>   |
| <b>Jun-06</b>         | <b>61.5641</b>   | <b>61564.1</b>   | <b>1.03</b> | <b>63534</b>   |
| <b>Jul-06</b>         | <b>69.7774</b>   | <b>69777.4</b>   | <b>1.03</b> | <b>72010</b>   |
| <b>Aug-06</b>         | <b>52.134</b>    | <b>52134</b>     | <b>1.03</b> | <b>53802</b>   |
| <b>Sep-06</b>         | <b>63.7209</b>   | <b>63720.9</b>   | <b>1.03</b> | <b>65759</b>   |
| <b>Oct-06</b>         | <b>68.5767</b>   | <b>68576.7</b>   | <b>1.03</b> | <b>70771</b>   |
| <b>Nov-06</b>         | <b>63.084</b>    | <b>63084</b>     | <b>1.03</b> | <b>65102</b>   |
| <b>Dec-06</b>         | <b>66.2047</b>   | <b>66204.7</b>   | <b>1.03</b> | <b>68323</b>   |
| <b>Jan 06- Dec 06</b> | <b>773.35605</b> | <b>773356.05</b> | <b>1.03</b> | <b>798098</b>  |
| <b>Total</b>          |                  |                  |             | <b>2163131</b> |

| <b>Total project emissions</b> |  |                  |                     |                            |                          |
|--------------------------------|--|------------------|---------------------|----------------------------|--------------------------|
| <b>Year</b>                    | <b>Total Quantity of fuel Consumed</b> | <b>EF of LDO</b> | <b>OXID for LDO</b> | <b>C to CO<sub>2</sub></b> | <b>Project Emissions</b> |
|                                | <b>TJ</b>                              | <b>(tC/TJ)</b>   |                     |                            | <b>t CO<sub>2</sub>e</b> |
| <b>Apr-05</b>                  | <b>0.20</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>14</b>                |
| <b>May-05</b>                  | <b>0.22</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>16</b>                |
| <b>Jun-05</b>                  | <b>0.09</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>6</b>                 |
| <b>Jul-05</b>                  | <b>0.51</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>37</b>                |
| <b>Aug-05</b>                  | <b>0.04</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>2</b>                 |
| <b>Sep-05</b>                  | <b>0.00</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>0</b>                 |
| <b>Oct-05</b>                  | <b>0.04</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>3</b>                 |
| <b>Nov-05</b>                  | <b>0.15</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>10</b>                |
| <b>Dec-05</b>                  | <b>0.04</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>2</b>                 |
| <b>Apr 05- Dec 05</b>          | <b>1.29</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>90</b>                |
| <b>Jan-06</b>                  | <b>0.51</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>37</b>                |
| <b>Feb-06</b>                  | <b>0.00</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>0</b>                 |
| <b>Mar-06</b>                  | <b>0.22</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>15</b>                |
| <b>Apr-06</b>                  | <b>0.00</b>                            | <b>20.20</b>     | <b>0.99</b>         | <b>3.67</b>                | <b>0</b>                 |



|                       |             |              |             |             |            |
|-----------------------|-------------|--------------|-------------|-------------|------------|
| <b>May-06</b>         | <b>0.02</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>1</b>   |
| <b>Jun-06</b>         | <b>0.00</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>0</b>   |
| <b>Jul-06</b>         | <b>0.16</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>11</b>  |
| <b>Aug-06</b>         | <b>0.09</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>6</b>   |
| <b>Sep-06</b>         | <b>0.05</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>3</b>   |
| <b>Oct-06</b>         | <b>0.11</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>7</b>   |
| <b>Nov-06</b>         | <b>0.15</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>11</b>  |
| <b>Dec-06</b>         | <b>0.00</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>0</b>   |
| <b>Jan 06- Dec 06</b> | <b>1.31</b> | <b>20.20</b> | <b>0.99</b> | <b>3.67</b> | <b>91</b>  |
| <b>Total</b>          |             |              |             |             | <b>181</b> |

|                       | <b>Project Emissions</b> | <b>Baseline Emissions</b> | <b>Emission Reductions</b> |
|-----------------------|--------------------------|---------------------------|----------------------------|
|                       | <b>tCO2e</b>             | <b>tCO2e</b>              | <b>tCO2e</b>               |
| <b>Apr 05- Dec 05</b> | <b>90</b>                | <b>566935</b>             | <b>566845</b>              |
| <b>Jan 06- Dec 06</b> | <b>91</b>                | <b>798098</b>             | <b>798007</b>              |
| <b>Total</b>          | <b>181</b>               | <b>1365033</b>            | <b>1364852</b>             |

## Appendix 2

| Option A, sub option 1 of the methodology   |                                 | Option A, sub option 2 of the methodology   |                           | Option A, sub option 3 of the methodology |                                 |
|---|---------------------------------|---|---------------------------|---|---------------------------------|
| Measured efficiency prior to project implementation   |                                 | Measured efficiency during monitoring   |                           | Design Efficiency                         |                                 |
| Option B of the registered PDD (Measured efficiency during monitoring (performance Guarantee Test ) |                                 | Option B of the registered PDD (Measured efficiency during monitoring (Normal Check ) |                           | Option A of the PDD (Design)              |                                 |
|   |                                 | April 05-Dec 05   | Jan 06-Dec 06             |   |                                 |
| With low pressure economizer  | Without low pressure economizer | With low pressure economizer  |                           | With low pressure economizer              | Without low pressure economizer |
| <b>31.88%</b>   | <b>32.67%</b>                   | <b>32.41%<sup>4</sup></b>   | <b>32.22%<sup>5</sup></b> | <b>33.375%</b>                            | <b>32.84%</b>                   |

As a conservative approach the highest value 33.375% among the option is considered for the baseline calculation. Eff=33.375%=0.33

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<sup>4</sup> Plant Operation Data (efficiency calculation sheet)

<sup>5</sup> Plant Operation Data (efficiency calculation sheet)