# UNFCCC CDM Project
# Third Monitoring Report (Version 2)

## Demand side energy conservation and reduction measures at ITC Tribeni Unit

**Methodology Applied:**
AMS II D; Version 07
AMS I D; Version 09

**CDM registration number –** 0745

**Monitoring period** - 01/01/2008 up to 31/12/2008

**Document ID** - Document No: EP/E&U/4.5.1/03/05

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**Date** - 23 July 2009

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## Project background

The CDM project with Title – "**Demand side energy conservation and reduction measures at ITC Tribeni Unit**" has been registered as CDM project by the UNFCCC on 16 Dec 06 under reference number 0745. Further background on this project can be found in the PDD and associated documents, which are available on the UNFCCC website: http://cdm.unfccc.int/Projects/request_reg.html

Parties involved are India (Host Country) and the United Kingdom of Great Britain and Northern Ireland [other Parties]. Private entities involved are ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni, West Bengal, India and ABN AMRO BANK N.V., UK.

## Project Location

The project site is within the manufacturing complex of Paperboards & Specialty Papers Division, Tribeni unit of ITC Limited, located at Tribeni, district Hooghly, West Bengal, India ($22^{o}$59"N latitude and $88^{o}$24"E longitude).

## Project Monitoring

**Project Status**

All measures undertaken as the part of the CDM project has been successfully implemented and is operational. As per the registered PDD the ***crediting period*** of the project starts from ***01/01/2006 and extends till 31/12/2015***. The 1st verification as well as issuance is over and this was for the period ending 31.12.2006. This monitoring period is for 3rd verification and issuance and is for the period from 1.1.2008 to 31.12.2008 (both the dates inclusive).

| Sl.No. | Project Code | Project Details | Start Date | CER Calculation for 3rd issuance from | Comments |
|---|---|---|---|---|---|
| | | **Electrical Projects** | | | |
| 1 | TEM F5 | Retrofitting of Induced draught Fan of IJT boiler with efficient design Casing & Rotor. | 20.02.05 | 01.01.08 | Job Completed |
| 2 | TEM UT2 | Retrofitting the PM3 Broke chest pump with a correctly sized Impeller to suit duty. | 24.12.03 | 01.01.08 | Job Completed |
| 3 | TEM V5 | Retrofitting drive transmission of flat box vacuum pump to suit actual process requirement in Paper Machine no 3. | 29.03.04 | 01.01.08 | Job Completed |
| 4 | TEM F7 & F4A | TEM F7/: Replacement of cooling tower fans with fans having higher aerodynamic efficiency.<br>TEM F4A: Load-based operation of Cooling Tower Fan in Power Plant with Variable speed drive. | 19.03.04 | 01.01.08 | Job completed. TEM F4A done only on TG2 CT Fan No.1. |
| 5 | TEM P5 | Replacement of Edge-cutter pumps of Paper Machine 1 and 3 with higher efficiency pumps suited to prevailing load. | 22.03.04 | 01.01.08 | Job Completed |
| 6 | TEM P6 | Replacement of high pressure shower pump of Paper Machine 3 with energy-efficient pump. | 20.03.04 | 01.01.08 | Job Completed |
| 7 | TEM P7 | Replacement of Raw water pump of Water recycling plant ( Dynasand) of paper Machine 1 with correct sized efficient pump suited to system - thus eliminating running of additional pump. | 19.03.04 | 01.01.08 | Job Completed |
| 8 | TEM P8 | Replacement of pumps in water recycling plant ( Dynasand) of Paper Machine 1 and 3 with efficient pumps to suit prevailing load conditions. | 15.03.04 | 01.01.08 | Job Completed |
| 9 | TEM P11 | Replacement of low efficient feeding pump of PM3 Drum Thickener Shower with high efficient pump. | 22.02.04 | 01.01.08 | Job Completed |
| 10 | TEM UT4 | Replacement of high pressure shower pump of Paper Machine 1 with energy-efficient pump. | 18.01.04 | 01.01.08 | Job Completed |
| 11 | TEM UT6 | Replacement of high pressure shower pump of Paper Machine 4 with energy-efficient pump. | 12.03.04 | 01.01.08 | Job Completed |

| | | | | | |
|---|---|---|---|---|---|
| 12 | F 1,2,3 | Replacement of Paper Machine 1 and 3 Dryer's Pocket Ventilation system fans with energy efficient fans . | 20.02.06 | 01.01.08 | Job Completed on Paper machine 3. Paper Machine 1 Pocket Ventilation Fan not replaced. Emmision Reduction considered for Paper machine 3 only. |
| 13 | P15A | Replacement - Paper machine 1 Pump from Sump to water recycling plant(Dynasand). | 27.09.06 | N.A | Job Completed. The Process Requirement Changed from March 2007, resulting in installation of another pump to cater the process requirement of 175m3/hr flow instead of maximum 150m3/hr flow of the pump under this scheme. Hence no CER has been claimed for this project during this year, and the same also will not be considered for future. |
| 14 | P15B | Replacement - Paper machine 3 Pump from Sump to water recycling plant(Dynasand). | 20.06.06 | 01.01.08 | Job Completed. |
| 15 | P16 | Replacement of De-aerator feed pumps in two boilers ( IJT and IBIL) with energy efficient pumps. | 19.10.05 | 01.01.08 | Job Completed. |
| 16 | P4A | Modification of Cooling water system in Turbo-Generator no 2 leading to pump replacements. | 17.06.06 | 01.01.08 | Job Completed |
| 17 | P4B | Modification of Cooling water system in Turbo-Generator no 3 leading to pump replacements | 29.09.06 | 01.01.08 | Job Completed |
| 18 | WRC-1 | Recycling of used cooling water from compressor system . | N.A | N.A | Project not considered. |
| 19 | F8B | Installation of Natural Ventilation devices in Paper Machine buildings and finishing house leading to fan replacement | 12.05.05 | 01.01.08 | Job Completed |

| | | | | | |
|---|---|---|---|---|---|
| 20 | P26 | Process re-designing at Paper Machine no 4 approach flow system with replacement/retrofit of Fan Pump and Centricleaners. | 07.02.2008 | 01.03.08 | Job Completed in 2008. Hence Project CER Benefits not accumulated in 2007. CER Calculation started from March 2008. |
| 21 | TEM C1 | Modification of Compressed air piping system to eliminate leakage | 12.04.04 | 01.01.08 | Job Completed |
| 22 | TEM C2 | Installation of multi-step capacity controller logic for compressor in place of conventional unload/full-load control | 21.12.04 | 01.01.08 | Job Completed |
| 23 | TEM C3 | Use energy efficient air nozzles for cleaning and other blowing applications. | 17.04.04 | 01.01.08 | Job Completed |
| 24 | TEM C5 | Segregation of HP & LP compressed air lines in place of single-pressure operation. | 21.07.04 | 01.01.08 | Job Completed |
| 25 | TEM C4 | Replacement of inefficient screw compressors with two stage reciprocating compressor. | 28.12.05 | 01.01.08 | Job Completed |
| 26 | TEM ETP3 | Process re-designing at Flocculator of Effluent treatment plant. | 15.05.04 | 01.01.08 | Job Completed |
| 27 | TEM P9 | Process redesign at Effluent treatment plant's Sludge recycling system | 02.03.04 | 01.01.08 | Job Completed. |
| 28 | TEM ETP1 | Replacement of Mechanical Aeration System in Effluent Plant with Diffused Aeration. | 18.04.06 | 01.01.08 | Job Completed. |
| | | **Thermal Projects** | | | |
| 29 | F10A & B | Heat recovery from Paper Machine Dryer exhaust in Paper Machine 3 and reutilization in dryer. | N.A | N.A | Not Implemented Yet. Not Considered. |
| 30 | B11 -B 12 | Heat recovery from IJT Boiler flue gas exhaust & Deaerator system to preheat the induced air to the boiler . | 01.04.2007 | 01.01.08 | Job Completed. |
| 31 | WH1 | Heat recovery from Turbine Gland Vent condenser in Turbo Generator no 3 and reutilization in heating the return condensate of the boiler which in turn will pre heat the boiler feed water . | 16.03.2007 | 01.01.08 | Job Completed. |

**Monitoring Period Covered**

This is the ***third monitoring report*** of the project. It provides details on the performance of the CDM project towards greenhouse gas emission reduction ***for the period of 01/01/2008 to 31/12/2008***. ***Monitoring data*** were collected over the period ***01/01/2008*** up to ***31/12/2008***.

**Methodology Applied:**

The project was registered with following applicable CDM small scale approved methodology: -

**Project Category - II, D – Energy efficiency and fuel switching measures for industrial facilities, version 07, 28th November 2005, Scope 04**

**Project Category – I, D – Grid connected renewable electricity generation, version 9, 19th May 2006, Scope 1**

**Reference:**

http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

# Monitoring Plan: (as per registered PDD)

| ID number | Data type | Data variable | 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) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| **For measures that has led to electricity savings** | | | | | | | | | |
| $\sum Equ_i$ | Text/ numerical | Numbers of equipment/ devices replaced/ retrofitted under the project activity | Text/ numerical | E | Once during equipment replacement or retrofitted | 100% | Electronic / paper | +2 of the selected crediting period | |
| $\sum P_{i,base}$ | Electricity | Actual electricity consumed by the equipment at baseline | kW | M | Once before equipment replacement or retrofitted | 100% | Electronic / paper | -do- | Actual meter data before the project measure has been implemented (one month period) for individual equipment included in the energy saving programme under this project. About 60 numbers of energy meters has been installed against the measures taken to record the actual savings. Few measures which have been executed before installing energy meters, the actual energy consumption at the baseline have been determined by taking instantaneous energy reading of the |

| ID number | Data type | Data variable | 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) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | equipment by fluke meter times the operating hour of the equipment. |
| Ohrs | Operating hours | Operating hours of the equipment in the baseline | Hrs | M | Once before equipment replacement or retrofitted for a period of one month | 100% | Electronic / paper | -do- | |
| $\sum P_{i,prj}$ | Electricity | Actual electricity consumed by the equipment after the project measure implemented | kW | M | Yearly (cumulative) | 100% | Electronic / paper | -do- | |
| Ohrs | Operating hours | Operating hours of the equipment in the project | Hrs | M | Monthly | 100% | Electronic / paper | -do- | |
| *EGygrid* | Electricity quantity | Electricity imported from the grid | GWh | M | Monthly | 100% | Electronic | -do- | Project will monitor and record the actual import of electricity from the grid and cross check with the bills. |
| PN | Plant Name/ Installed Capacity and commissioning dates | Plant identification with installed capacity and commissioning dates of the power plants at | Text | E | Once during PDD finalization | 100% | Paper | -do- | |

| ID number | Data type | Data variable | 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) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | the grid | | | | | | | |
| $\sum_k GENk,y$ | Electricity quantity | Total electricity generation by the grid | GWH | E | Once during PDD finalization | 100% | Paper | -do- | |
| *NHRk* | Heat rate of the power plant | Net heat rate of the plants identified at the grid | Kcal/kWh | E | Once during PDD finalization | 100% | Paper | -do- | |
| *COEFi* | Emission co-efficient | $CO_2$ emission co-efficient of each fuel (i) type | $tCO_2/TJ$ | E | Once during PDD finalization | 100% | Paper | -do- | |
| *EFygrid* | Emission factor | $CO_2$ emission factor of the grid | $tCO_2/GWh$ | C | Once during PDD finalization | 100% | Paper | -do- | Grid emission factor only – ex- ante |
| $FF_i$ | Fuel used | Quantity of coal utilized by the unit for generation of electricity | MT | M | Daily | 100% | Paper/ Electronic | +2 years of the first crediting period | The coal procured will be measured after procurement at time of storage, plus during feed charge for boiler input. |
| *EGy, inhouse* | Electricity quantity | Electricity generated in-house gross | GWh | M | Daily | 100% | Electronic | -do- | |
| $NCV_{FF,I}$ | Energy | Average net calorific value of coal on dry basis | Kcal/kg | E | On every procurement | Sample | Paper/ electronic | +2 years of the first crediting period | The estimated calorific value will be recorded for each lot at every |

| ID number | Data type | Data variable | 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) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | procurement |
| C% | Carbon percentage | Average carbon percentage of coal on dry basis | % | M | Quarterly | Sample | Paper/ electronic | +2 years of the first crediting period | Third party analysis report will be maintained in-house. |
| EFy in-house | Emission factor | $CO_2$ emission factor of the in-house | $tCO_2/GWh$ | C | Annually | 100% | Electronic | +2 years of the first crediting period | In-house electricity emission factor only – ex-post. This has been calculated based on IPCC oxidation factor and regular fuel analysis report and in-house power generation. |
| **For measures leading to steam/coal savings** | | | | | | | | | |
| $S_{i,\ base}$ | Specific energy consumption | Specific steam consumption by the paper machine 3 at the baseline per unit of process output | Ton/ton | E | Daily | 100% | Electronic | -do- | Not applicable for the thermal projects implemented. |
| $S_{i,rep\ B}$ | Total energy consumption | Total steam consumed by the paper machine at the baseline for total process output | Ton | M | Daily | 100% | Electronic | -do- | Do |
| $P_{i,rep\ B}$ | Total process output | Total process output at the baseline | Ton | M | Daily | 100% | Electronic | -do- | Do |

| ID number | Data type | Data variable | 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) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| $S_{i,prj}$ | Specific energy consumption | Specific steam consumption by the paper machine 3 at the project per unit of process output | Ton/ton | E | Daily | 100% | Electronic | -do- | Do |
| $S_{i,rep\ P}$ | Total energy consumption | Total steam consumed at the project by the paper machine | Ton | M | Daily | 100% | Electronic | -do- | Do |
| $P_{i,rep\ P}$ | Total process output | Total process output at the project | Ton/ GWh | M | Daily | 100% | Electronic | -do- | Do |
| $S_{idiff}$ | Specific consumption of energy | Difference in specific consumption at the baseline and project scenario | Ton | C | Monthly | 100% | Electronic | -do- | Do |
| $S_{net}$ | Net reduction of energy | Net reduction in steam consumption per year | Ton | C | Yearly | 100% | Electronic | -do- | Do |
| $P_{act}$ | Process output | Actual process output (total output from the process in the year y) | Ton | C | Yearly | 100% | Electronic | -do- | Do |
| ɛboiler | Efficiency | Efficiency of the boilers in the project plant providing steam to the paper | % | C | Yearly | 100% | Electronic | -do- | There are two boilers in the plant, IJT, IBL. The weighted average efficiency of the |

| ID number | Data type | Data variable | 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) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| | | machine | | | | | | | boilers would be considered based on their operating hours |
| Qair | Flow rate | Flow rate of air induced in the boiler that is preheated by the flue gas exhaust | Kg/h | M | Daily | 100% | Electronic | -do- | Flow rate will be measure by flow gauge installed at the inlet |
| Temp flue gas | Temperature | Temperature of the flue gas at inlet | 0C | M | Daily | 100% | Electronic | -do- | Temperature will be measure by temperature gauge installed at the inlet of the pre-heater |
| Temp ambient | Temperature | Temperature of the flue gas at outlet | 0C | M | Daily | 100% | Electronic | -do- | Temperature will be measure by temperature gauge installed at the outlet of the pre-heater |
| Ohrs | Hours | Operating hours of the boiler | H | M | Daily | 100% | Electronic | -do- | |
| Condensate | Quantity | Quantity of the condensate return to the boiler | Kl | M | Daily | 100% | Electronic | -do- | Flow meter has been installed in the line |
| Temp P | Temperature | Temperature of the condensate at the project | $^0$C | M | Daily | 100% | Electronic | -do- | Temperature will be measured by temperature gauge installed at the inlet |

| ID number | Data type | Data variable | 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) | For how long is archived data to be kept? | Comment |
|---|---|---|---|---|---|---|---|---|---|
| Temp B | Temperature | Temperature of the condensate at the baseline | $^0$C | M | Daily (period of one month before implementation) | 100% | Electronic | -do- | Temperature will be measure by temperature gauge installed at the inlet before project implementation fore one month |

## Presentation of Monitoring Results

The monitoring results has been presented in the following documents

1. Workbook – Title – ***"Monitoring and Verification Results, Version 02".*** The workbook comprises on sets of spreadsheets delineating the following information: -

- Project Status
- Baseline energy (of each initiative) consumed as per the registered PDD
- Monthly compilation data sheet (for each initiative) of the raw data (either logged in identified logbooks/ formats) collated from the daily reports generated against monitoring and measurement of the performance of the measures included under the registered project.
- Monthly overview of energy consumed and annual energy savings achieved by the registered project.

2. Original monitoring and verification plan **(Doc. No : EP/E&U/4.5.1/03/01)**
3. Project wise Measurement & Verification Methodology **(Doc. No.: EP/E&U/4.5.1/03/02)** including calibration information

## Quality Assurance and Quality Control Adopted for the Project

The Project has adopted Operational Control Procedure (Ref - Doc. No. EP/E&U/OCP/01) under the practiced ISO14001: 2004 certified Environment management system of the unit. The primary object of the procedure is to "establish system for monitoring, measuring, recording, reporting, reviewing and communicating on the performance of Clean Development Project registered at UNFCCC under Reference No. # 0745".

The procedure clearly delineates roles and responsibility for all activities required to undertake under the CDM project and report on it performance on the periodic basis to the management of the Plant (Project Participant).

## Calculation of Emission Reduction

### For electricity savings measure:

$$EB = \Sigma i \left( \left( P_{i,base} - P_{i,prj} \right) * Ohrs * Efy(mix) \right) \qquad (1)$$

Where,

***EB*** = Emission Reduction per ($tCO_2/yr$)

***Σi*** = the sum over the group of "i" devices replaced, for which the replacement is operating during the year, implemented as part of the project.

$P_{i,base}$ = actual power consumed by the equipment/ device at the baseline (GW) per unit of operating hours monitored in the baseline.

$P_{i,prj}$ = actual power consumed by the equipment/ device at the project (GW) per unit of operating hours monitored in the project.

**Ohrs** = Operating hours in the project (hrs)

$EF_{y\ (mix)}$ = Emission factor of the electricity mix utilized in the unit (tCO2/GWh)

**Where, $EF_{y(mix)}$ is, weighted average emissions of the generation sources, i.e., in-house and grid imports as actual apportioned in the given year.**

| Sl.No. | Project Code | Project Code (Sub Items) | Baseline Power (kW), Monthly Average | Baseline Ohrs. (Monthly Average) | Baseline Consumption (KWh) (Monthly Average) | Annualised Baseline Consumption KWh) | Project Power (kW), Monthly Average | Project Ohrs. (Monthly Average) | Project Consumption (KWh) for the year | Energy Savings for the year in KWh | Comment | Data Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TEM F5 | TEM F5 (IJT ID Fan) | N.A | N.A | 43502.50 | 522030.00 | N.A | N.A | 181459.00 | 340571.00 | Base line period (Sept'04 to Jan'05) for 4 months. Monitoring of energy meter hence kW & Ohrs are not applicable. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 2 | TEM UT2 | TEM UT2 (PM3 Broke Chest Pump) | 15.65 | 597.75 | 9354.79 | 112257.45 | N.A | N.A | 34586.00 | 77671.45 | Baseline Measurement with kW x Ohrs from Oct'03 to Nov'03. Project Measurement with Power Analyser using kW & Ohrs from Jan'06 to Mar'06 and from Apr'06 onwards with direct energy meter monitoring. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 3 | TEM V5 | TEM V5 (PM3 Wire Box Vacuum Pump) | 42.93 | 530.83 | 22790.44 | 273485.33 | N.A | N.A | 147522.00 | 125963.33 | Base line period (October'03 to March'04) for 6 months with kW x Ohrs. Project Monitoring with Direct Energy Meter hence kW & Ohrs are not applicable. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 4 | TEM F7 & F4A | TEM F7 & F4A (TG2 CT Fan1) | 22.16 | 721.70 | 15992.87 | 728942.21 | N.A | N.A | 463332.29 | 265609.91 | There are 2 Fans in Cooling Towers of TG2 & TG3 Respectively covered in the Project Boundary, hence | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| | | TEM F7 (TG2 CT Fan2) | 24.44 | 721.70 | 17638.35 | | N.A | N.A | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TEM F7 (TG3 CT Fan1) | 20.46 | 633.80 | 12967.55 | | N.A | N.A | | | segregation of kW, Ohrs done for each Fan. Base line period (October'03 to February'04) for 5 months with kW x Ohrs. Project Monitoring with direct energy meters. | |
| | | TEM F7 (TG3 CT Fan2) | 22.32 | 633.80 | 14146.42 | | N.A | N.A | | | | |
| 5 | TEM P5 | TEM P5 (PM1 Edge Cutter Pump) | 3.53 | 643.50 | 2270.27 | 49534.27 | 0.79 | 538.46 | 9923.91 | 0.00 | There are Edge Cutter Pumps One each in PM1 & PM3 respectively covered in the Project Boundary, hence segregation of kW, Ohrs done for each Pump. Energy Savings for this project has not been considered due to non-availability of continuous metering during 2008, as per EB guidelines. Continuous Metering has been taken in line since December 2008 and savings will be included in the next monitoring period starting Jan 2009. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| | | TEM P5 (PM3 Edge Cutter Pump) | 3.54 | 524.15 | 1857.59 | | 0.80 | 499.21 | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | TEM P6 | TEM P6 (PM3 VHP Pump) | 50.36 | 524.15 | 26396.19 | 316754.33 | 36.53 | 499.21 | 218852.93 | 0.00 | Base line period (October'03 to February'04) for 5 months with kW x Ohrs. Project Energy Savings for this project has not been considered due to non-availability of continuous metering during 2008, as per EB guidelines. Continuous Metering has been taken in line since December 2008 and savings will be included in the next monitoring period starting Jan 2009. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 7 | TEM P7 | TEM P7 (MOD 15/13) | 7.96 | 643.50 | 5120.97 | 113328.07 | N.A | N.A | 76029.00 | 37299.07 | Base line period (October'03 to February'04) for 5 months with kW x Ohrs. Project Monitoring with Direct Energy Meter hence kW & Ohrs are not applicable. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| | | TEM P7 (MOD 15/17) | 6.72 | 643.50 | 4323.03 | | | | | | | |
| 8 | TEM P8 | TEM P8 - MOD 15/18 (PM1) | 0.00 | 643.50 | 0.00 | 445784.46 | N.A | N.A | 302650.00 | 143134.46 | There are Three Sets of Pumps each set having one Main & One Standby Pump as covered | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| | | TEM P8 - MOD 15/14 (PM1) | 22.46 | 643.50 | 14453.01 | | N.A | N.A | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | TEM P8 - MOD 17/20 (PM3) | 29.36 | 524.15 | 15389.04 | | N.A | N.A | | | under the project boundary. All the Six Pumps Energy Are Recorded for both baseline and project Period herein. Hence segregation of kW, Ohrs done for each Pump. Base line period (October'03 to February'04) for 5 months with kW x Ohrs. Project Monitoring with Power Analyser by kW & Ohrs from January'06 to October'06 and Direct Energy Meter Readings since November'06) | |
| | | TEM P8 - MOD 17/16 (PM3) | 0.00 | 524.15 | 0.00 | | N.A | N.A | | | | |
| | | TEM P8 - MOD 17/19 (PM3) | 0.00 | 524.15 | 0.00 | | N.A | N.A | | | | |
| | | TEM P8 - MOD 17/15 (PM3) | 13.94 | 524.15 | 7306.65 | | N.A | N.A | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | TEM P11 | TEM P11 (PM3 Drum Thickener Water Pump) | 12.53 | 514.06 | 6438.63 | 77263.59 | 7.65 | 499.21 | 45827.33 | 0.00 | Base line period (October'03 to January'04) for 4 months with kW x Ohrs. Energy Savings for this project has not been considered due to non-availability of continuous metering during 2008, as per EB guidelines. Continuous Metering has been taken in line since December 2008 and savings will be included in the next monitoring period starting Jan 2009. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | TEM UT4 | TEM UT4 (PM1 VHP Pump) | 36.83 | 661.67 | 24371.39 | 292456.67 | 22.88 | 538.46 | 147806.81 | 0.00 | Base line period (October'03 to December'03) for 3 months with kW x Ohrs. Energy Savings for this project has not been considered due to non-availability of continuous metering during 2008, as per EB guidelines. Continuous Metering has been taken in line since December 2008 and savings will be included in the next monitoring period starting Jan 2009. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | TEM UT6 | TEM UT6 (PM4 VHP Pump) | 46.20 | 600.00 | 27720.00 | 332640.00 | 23.72 | 595.65 | 169520.80 | 0.00 | Base line period (October'03 to February'03) for 5 months with kW x Ohrs. Energy Savings for this project has not been considered due to non-availability of continuous metering during 2008, as per EB guidelines. Continuous Metering has been taken in line since December 2008 and savings will be included in the next monitoring period starting Jan 2009. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 12 | F 1,2,3 | F 1,2,3 (PM3 PV Duct Blower Ground Floor - 5/25) | 21.57 | 584.99 | 12615.42 | 279757.06 | N.A | N.A | 174126.00 | 105631.06 | Base line period (October'03 to August'05) for 23 months with kW x Ohrs. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | F 1,2,3 (PM3 PV Duct Blower First Floor - 12/74) | 18.29 | 584.99 | 10697.67 | | N.A | N.A | | | Project Monitoring with Direct Energy Meter readings for March'06 to December'06 (project operative for 10 months in 2006), hence kW & Ohrs are not applicable to project monitoring results. PM1 PV Duct Fan is not replaced hence not considered for emission reduction. | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | P15A | P15A - PM1 Dynasand MOD 15/7 | 9.88 | 617.44 | 6100.97 | 73211.62 | N.A | N.A | N.A | 0.00 | Base line period (October'03 to August'05) for 36 months with kW x Ohrs. Project Monitoring with Direct Energy Meter readings for October'06 to December'06 (project operative for 3 months in 2006). Since January 2007 the Project Monitoring is not considered. The Process Requirement Changed from March 2007, resulting in installation of another pump to cater the increased process requirement of 175m3/hr flow instead of maximum 150m3/hr flow of the pump under this scheme. Hence no CER has been claimed for this project during this year, and the same also will not be considered for future. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | P15B | P15B - PM3 Dynasand MOD 17/11 and MOD 16/7 | 14.81 | 583.34 | 8640.52 | 103686.20 | N.A | N.A | 76854.00 | 26832.20 | Base line period (October'03 to June'06) for 33 months with kW x Ohrs. Project Monitoring with Direct Energy Meters. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 15 | P16 | P16 (IBIL 20/4 and 20/1)) | 6.66 | 695.67 | 4630.77 | 123806.97 | N.A | N.A | 39394.50 | 84412.47 | Each Boiler Dearator Pump System has a Main & a Standby Pump, for which average kw of both pumps multiplied by total pumping period of the plant is used for calculation in each boiler separately. Base line period (October'03 to October'05 with kW x Ohrs. Project Monitoring with Direct Energy Meter readings. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| | | P16 (IJT BO/4/5 and BO/4/6) | 8.95 | 635.21 | 5686.48 | | N.A | N.A | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | P4A | P4A (TG2 Cooling Water System) | 137.45 | 690.65 | 94931.10 | 1139173.17 | N.A | N.A | 581793.20 | 557379.97 | There were three pumps in place wherein any 2 used to run at a time in baseline scenario. Power in kW is the average running power of all the three taken in consideration for the baseline. Base line period (October'03 to June'06) for 33 months with kW x Ohrs. Project Monitoring with Direct Energy Meter readings (three energy meters sum) | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 17 | P4B | P4B (TG3 Cooling Water System) | 137.78 | 643.24 | 88627.22 | 1063526.59 | N.A | N.A | 1038712.39 | 24814.19 | There were three pumps in place wherein any 2 used to run at a time in baseline scenario. Power in kW is the average running power of all the three taken in consideration for the baseline. Base line period (October'03 to September'06) for 36 months with kW x Ohrs. Project Monitoring with Direct Energy Meter readings | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | (three energy meters sum) | |
| 18 | WRC-1 | WRC-1 | N.A | N.A | N.A | N.A | N.A | N.A | N.A | 0.00 | Project Not Implemented and not Considered for Emission Reduction. | N.A |
| 19 | F8B | F8B (Paper Machine 3&4 Exhaust Fans) | 75.35 | 730.00 | 55005.50 | 660066.00 | 0.00 | 0.00 | 0.00 | 660066.00 | Baseline kW and Run Hours Values are recorded for all the exhaust fans taken together. Project resulted in no exhaust fans running (due to natural ventilators installed on the machine roofs), hence the kW, run Hours and energy are zero during project monitoring stage. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | P26 | P26 (PM4 Fan Pump) | N.A | N.A | N.A | 488059.09 | N.A | N.A | 252675.00 | 235384.09 | Project is implemented in Feb 2008. Baseline and Project data is with direct energy meters. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 21 | TEM C1 | Mill Compressors | N.A | N.A | N.A | 3646199.93 | N.A | N.A | 2010944.1 | 1635255.8 | Baseline Energy Consumption has been captured for multiple compressors running therein and has been compiled to get the total figure stated as baseline annual consumption for the period April'03 to March'04. Hence kW & OHrs are not applicable. Project Energy Consumption Figures are Direct Energy Meter Readings for the Compressors kept in Line for the period January'06 to December '07, hence kW & OHrs are not applicable. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 and Excell Sheet Documents File Name - "MDS TEM C.xls" and "TEM C Hour Log1.xls" |
| 22 | TEM C2 | | | | | | | | | | | |
| 23 | TEM C3 | | | | | | | | | | | |
| 24 | TEM C5 | | | | | | | | | | | |
| 25 | TEM C4 | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | TEM ETP3 | TEM ETP3 (Floculator Basin in ETP) | 9.84 | 729.00 | 7173.82 | 86085.79 | 0.00 | 0.00 | 0.00 | 86085.79 | Base line period (January'03 to April'04) for 16 months with kW x Ohrs. Project Monitoring ensures that the equipment are not operational (Has been Dismantled), hence no power is consumed by the project. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 27 | TEM P9 | TEM P9 (ETP Sludge Handling Pumps) | 32.82 | 729.60 | 23942.55 | 287310.64 | N.A | N.A | 213057.50 | 74253.14 | Base line period (October'03 to Februaryl'04) for 5 months with kW x Ohrs. Project Monitoring with kW x Ohrs from January'06 to October'06 (10 months) and then from January'2007 to December 2007 direct energy meters. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |
| 28 | TEM ETP1 | TEM ETP1 (ETP Aeration System) | 79.28 | 731.00 | 57950.03 | 695400.30 | N.A | N.A | 334002.00 | 361398.30 | Base line period (October'03 to Septemberl'05) for 24 months with kW x Ohrs. Project Monitoring with Direct Energy Meter Readings hence kW & Ohrs are not applicable. | Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01 |

| | | |
|---|---|---|
| | **Total kWh Reduction During 2008** | **4841762.3** |

Fluke meters were used to monitor the instant kW of the following pumps during this crediting period:

- TEM P5: (PM1 Edge Cutter Pump) and (PM3 Edge Cutter Pump)
- TEM P6: (PM3 VHP Pump)
- TEM P11: (PM3 Drum Thickener Water Pump)
- TEM UT4: (PM1 VHP Pump)
- TEM UT6: (PM4 VHP Pump)

Since, use of portable instant kW meter (Fluke meter) once a month for measuring the average kW of the respective pumps as a basis for calculation of energy consumption may not be directly comparable in terms of robustness of practice. Hence the project proponent has conservatively decided not to claim any CER arising due to energy consumption reduction by the above mentioned pumps and in CER calculation energy savings arising out of above mentioned pumps have been considered "0" for this whole crediting period. Please refer the above table. Consequently the project has already fixed dedicated cumulative energy meters to each of these pumps for claiming emission reductions in future crediting periods.

## For thermal energy saving measures:

**Measure: - Heat recovery from Paper Machine Dryer exhaust in Paper Machine 3 and reutilization in dryer** ***(This project is under implementation and not considered in CER calculation for the present crediting period)***

**Measure: Heat recovery from IJT Boiler flue gas exhaust & De-aerator system to preheat the induced air to the boiler**
***(This initiative has started its operation from 1.4.2007 and from then onwards GHG emission reduction for this initiative has been considered. During 1st crediting period emission reduction due to this initiative was not considered):***

$$EB_y = [(Q_{IA} * (Temp_{flue\ gas,\ inlet} - Temp_{flue\ gas,\ outlet}) * Air_{LH,t} * O_{hrs}) / NVC_{FFi}] * COEF_{FFi}$$

**Where :**

$EB_y$ = Annual Baseline emission due fossil fuel usage ($tCO_2$ eqv.)

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$Q_{IA}$ = Quantum of air drawn as induced air to the boiler (kg/hr)
$Temp_{flue\ gas,\ inlet}$ = Temperature of the exhaust flue gas at the inlet preheater ($_0C$)
$Temp_{flue\ gas,\ outlet}$ = Temperature of the exhaust flue gas at the outlet of the preheater ($_0C$)
$Air_{LH,t}$ = Specific heat of Air (Publicly available literature**)
Ohrs = Operating hours of the boiler (hrs)
$NVC_{FFi}$ = Average NCV of fuel used in IJT boiler (i.e. coal ) in TJ/ tonne

$COEF_{FFi}$ = Average emission Co-efficient of coal used in IJT boiler in t CO2 / tonne of coal
**** http://www.engineeringtoolbox.com/dry-air-properties-d_973.html**

| | Source- IJT Log Book E&U/7.5/09 | | | | | Source- Finance Monthly Figures (Run_Hrs Record) | | $C_{pair}$ at STP=1004.9 kJ/Ton.$^0$K | Energy Saved |
|---|---|---|---|---|---|---|---|---|---|
| | Air Temp in Deg C | | Air Temp in Deg K | | T Air Flow | IJT Operating Hours | T Air Mass | | |
| Month | PH INLET | PH OUTLET | PH INLET | PH OUTLET | TPH | Hrs | Tonnes | kJ/Ton.$^0$K | kilo.joules |
| Jan-08 | 27.210 | 66.870 | 300.210 | 339.870 | 40.170 | 610.8 | 24533.6 | 1004.9 | 977770340.3 |
| Feb-08 | 26.540 | 68.660 | 299.540 | 341.660 | 39.691 | 459.3 | 18228.3 | 1004.9 | 771537614.7 |
| Mar-08 | 35.900 | 66.540 | 308.900 | 339.540 | 37.442 | 744.0 | 27857.0 | 1004.9 | 857722050.2 |
| Apr-08 | 37.500 | 79.120 | 310.500 | 352.120 | 41.437 | 689.3 | 28560.4 | 1004.9 | 1194507602.0 |
| May-08 | 39.000 | 72.200 | 312.000 | 345.200 | 36.924 | 715.8 | 26428.3 | 1004.9 | 881717602.9 |
| Jun-08 | 37.000 | 70.250 | 310.000 | 343.250 | 39.120 | 716.8 | 28039.5 | 1004.9 | 936881674.3 |
| Jul-08 | 34.800 | 78.240 | 307.800 | 351.240 | 42.303 | 709.5 | 30014.1 | 1004.9 | 1310202875.1 |
| Aug-08 | 35.500 | 80.600 | 308.500 | 353.600 | 42.137 | 680.3 | 28663.5 | 1004.9 | 1299056723.9 |
| Sep-08 | 37.700 | 74.200 | 310.700 | 347.200 | 40.080 | 682.0 | 27334.8 | 1004.9 | 1002608564.4 |
| Oct-08 | 31.900 | 76.000 | 304.900 | 349.000 | 42.426 | 744 | 31565.3 | 1004.9 | 1398849789.4 |
| Nov-08 | 36.210 | 78.400 | 309.210 | 351.400 | 40.617 | 720 | 29244.0 | 1004.9 | 1239850001.4 |
| Dec-08 | 26.600 | 71.310 | 299.600 | 344.310 | 38.354 | 744 | 28535.3 | 1004.9 | 1282063849.4 |
| | | | | | | | | ANNUALLY | 13152768687.8 |

| | Energy Saved | Average NCV of IJT Coal | Average Emission Co-efficient of Coal used in IJT | Emission Saved from this Project Annually |
|---|---|---|---|---|
| Month | kilo.joules | TJ/ton | $tCO_2$ / ton of coal | tCO2 |
| Jan-08 | 977770340.3 | **0.02000052528** | **1.694746444** | **1114.501127** |

| | | | | |
|---|---|---|---|---|
| Feb-08 | 771537614.7 | | | |
| Mar-08 | 857722050.2 | | | |
| Apr-08 | 1194507602.0 | | | |
| May-08 | 881717602.9 | | | |
| Jun-08 | 936881674.3 | | | |
| Jul-08 | 1310202875.1 | | | |
| Aug-08 | 1299056723.9 | | | |
| Sep-08 | 1002608564.4 | | | |
| Oct-08 | 1398849789.4 | | | |
| Nov-08 | 1239850001.4 | | | |
| Dec-08 | 1282063849.4 | | | |
| | 13152768687.8 | | | |
| (TJ) | **(13.15276869)** | | | |

**Measure: Heat recovery from Turbine Gland Vent condenser in Turbo Generator no 3 and reutilization in heating the return condensate of the boiler which in turn will pre heat the boiler feed water** ***(This initiative has started its operation from 17.03.2007 and from then onwards GHG emission reduction for this initiative has been considered. During 1st crediting period emission reduction due to this initiative was not considered):***

$$EB_y = [(Q_{condensate} * (Enthalpy_P - Enthalpy_B) / \varepsilon_{boiler}) / NVC_{FFi}] * COEF_{FFi} \quad (9)$$

**Where:**

$EB_y$ = Annual Baseline emission due fossil fuel usage ($tCO_2$ eqv.)
$Q_{condensate}$ = Quantum of condensate returned to the boiler (kl)
$Enthalpy_P$ = Enthalpy of the condensate at the project (kcal/kl)
$Enthalpy_B$ = Enthalpy of the condensate at the baseline (kcal/kl)
$NVC_{FFi}$ = Average NCV of fuel used in IJT boiler (i.e. coal ) in kcal / tonne
$COEF_{FFi}$ = Average emission Co-efficient of coal used in IJT boiler in t CO2 / tonne of coal

| | TG3 Condensate Temp. Monthly Average in Deg.C | TG3 GVC Outlet Temp. Monthly Average in Deg.C | Enthalpy of TG3 Condensate (KJ/Kg) | Enthalpy of GVC Outlet Condensate (KJ/Kg) | Diff in Enthalpy (KJ/Kg) | TG3 Total Condensate (KG) | Energy Saved in KJ | Weighted Average Boiler Efficiency | Primary Energy Saved in TJ | Average Emission Factor of in-house steam produced. $tCO_2/TJ$ | Emission Reduction Achieved $tCO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Jan-08 | 57.792 | 65.633 | 241.939 | 274.767 | 32.828 | 10730000 | 352244440 | | | | |
| Feb-08 | 55.643 | 62.647 | 232.947 | 262.262 | 29.315 | 9785000 | 286847275 | | | | |
| Mar-08 | 44.844 | 51.741 | 187.783 | 216.623 | 28.84 | 10886000 | 313952240 | | | | |
| Apr-08 | 51.531 | 58.828 | 215.745 | 246.275 | 30.53 | 12452000 | 380159560 | | | | |
| May-08 | 44.419 | 51.269 | 186.006 | 214.649 | 28.643 | 4477000 | 128234711 | | | | |
| Jun-08 | 49.514 | 54.818 | 207.309 | 229.495 | 22.186 | 11748000 | 260641128 | **74.57** | 4.477 | 81.754 | **365.977** |
| Jul-08 | 58.034 | 63.580 | 242.952 | 266.169 | 23.217 | 13431000 | 311827527 | | | | |
| Aug-08 | 59.170 | 64.267 | 247.706 | 269.046 | 21.34 | 12744000 | 271956960 | | | | |
| Sep-08 | 59.445 | 65.039 | 248.857 | 272.279 | 23.422 | 12700000 | 297459400 | | | | |
| Oct-08 | 53.826 | 57.849 | 225.345 | 242.178 | 16.833 | 10595000 | 178345635 | | | | |
| Nov-08 | 57.900 | 62.956 | 242.391 | 263.556 | 21.165 | 12332000 | 261006780 | | | | |
| Dec-08 | 54.643 | 60.070 | 228.763 | 251.473 | 22.71 | 13015000 | 295570650 | | | | |

## For grid electricity emission factor (tCO2/Gwh):

**EFygrid =** Emission factor of the grid (ex-ante: 1136 tCO2/GWh)

| **Build Margin of Eastern Region ($tCO_2$/GWh)** | **Simple Operating Margin of Eastern Region ($tCO_2$/GWh)** | **Combine Margin of Eastern Region ($tCO_2$/GWh)** |
|---|---|---|
| **1076** | **1195** | **1136** |

## For in-house electricity generation emission factor (tCO2/Gwh):

***EFyinhouse = E_net / EGyinhouse*** ***(2)***

Where:

***EFyinhouse*** = In-house electricity emission factor ($tCO_2$ /GWh)

E_net =Net emission (excluding extraction) for in-house power generation in tCO2/yr.

EGyinhouse = Electricity generated in-house, gross in GWh.

E_net = E_Total – E_extraction (3)

E_Total = $[FF_{,i,y} * C\% * OXID_{FF,i} * (44/12)]$ ***(4)***

E_Total =emission due to total steam production in year y (tCO2/yr.)

$FF_{i,y}$ = Amount of fossil fuel by type 'i' used to generate electricity in year y (MT, in dry basis.)

C% = carbon % (in fraction) of the Fuel by type 'i' used in year y

$OXID_{FF,i}$ = default IPCC oxidation factor for fossil fuel type "i", (1.0 for coal)

E_extraction = emission due to extracted steam not used in power generation in year y (tCO2/yr.)

| Emission Factor of in-house power generation | | | 2008 |
|---|---|---|---|
| **Total Fuel used by type** | | **Unit** | |
| **Coal A Grd (IJT)** | | 000'ton | 1.05 |
| NCV= | GCV-10*MC% | Kcal/kg | 3665.48 |
| | | TJ/000'ton | 15.32 |
| C% | | % | 45.73 |
| TC | | Tonne | 480.62 |
| OXIDFF,i | IPCC | Fraction | 1 |
| **Net Emission** | | **tCO2/yr** | 1762.28 |
| **Coal C Grd (IJT)** | | 000'ton | 0.05 |

| | | | |
|---|---|---|---|
| NCV= | GCV-10*MC% | Kcal/kg | 4522.00 |
| | | TJ/000'ton | 18.90 |
| C% | | % | 45.4 |
| TC | | Tonne | 20.43 |
| OXIDFF,i | IPCC | Fraction | 1.00 |
| **Net Emission** | | **tCO2/yr** | **74.91** |
| **Coal B Grd (IJT)** | | 000'ton | 32.54 |
| NCV= | GCV-10*MC% | Kcal/kg | **4827.87** |
| | | TJ/000'ton | 20.18 |
| C% | | % | 46.105 |
| TC | | Tonne | 15001.6449 |
| OXIDFF,i | IPCC | Fraction | **1.00** |
| **Net Emission** | | **tCO2/yr** | **55006.03** |
| **Coal IMPORTED Grd (IJT)** | | 000'ton | 0.49 |
| NCV= | GCV-10*MC% | Kcal/kg | **4347.40** |
| | | TJ/000'ton | 18.17 |
| C% | | % | 55.08 |
| TC | | Tonne | 267.6888 |
| OXIDFF,i | IPCC | Fraction | **1.00** |
| **Net Emission** | | **tCO2/yr** | **981.53** |
| **Coal B Grd (IBIL)** | | 000'ton | 5.32 |
| NCV= | GCV-10*MC% | Kcal/kg | 4845.83 |
| | | TJ/000'ton | 20.26 |
| C% | | % | 46.11 |
| TC | | Tonne | 2452.79 |
| OXIDFF,i | | IPCC | 1.00 |
| **Net Emission** | | **tCO2/yr** | **8993.5487** |
| **Coal ZIG-CLEAN Grd** | | 000'ton | 5.84 |

| | | | |
|---|---|---|---|
| **(IBIL)** | | | |
| NCV= | GCV-10*MC% | Kcal/kg | 3408.40 |
| | | TJ/000'ton | 14.25 |
| C% | | % | 36.33 |
| TC | | Tonne | 2120.22 |
| OXIDFF,i | | IPCC | 1 |
| **Net Emission** | | **tCO2/yr** | **7774.14** |
| **Coal E Grd (IBIL)** | | 000'ton | 0.12 |
| NCV= | GCV-10*MC% | Kcal/kg | 2791.90 |
| | | TJ/000'ton | 11.67 |
| C% | | % | 34.12 |
| TC | | Tonne | 40.94 |
| OXIDFF,i | | IPCC | 1 |
| **Net Emission** | | **tCO2/yr** | **150.13** |
| **Coal F Grd (IBIL)** | | 000'ton | 51.45 |
| NCV= | GCV-10*MC% | Kcal/kg | 2900.33 |
| | | TJ/000'ton | 12.12 |
| C% | | % | 25.12 |
| TC | | Tonne | 12922.05 |
| OXIDFF,i | | IPCC | 1 |
| **Net Emission** | | **tCO2/yr** | **47380.86** |
| **Coal IMPORTED Grd (IBIL)** | | 000'ton | 0.32 |
| NCV= | GCV-10*MC% | Kcal/kg | 4233.67 |
| | | TJ/000'ton | 17.70 |
| C% | | % | 55.45 |
| TC | | Tonne | 177.99 |
| OXIDFF,i | | IPCC | 1 |
| **Net Emission** | | **tCO2/yr** | **652.65** |
| **Coal A Grd (IBIL)** | | 000'ton | 0.34 |
| NCV= | GCV-10*MC% | Kcal/kg | 3228.08 |
| | | TJ/000'ton | 13.49 |
| C% | | % | 45.73 |
| TC | | Tonne | 156.40 |
| OXIDFF,i | | IPCC | 1 |

| | | | |
|---|---|---|---|
| **Net Emission** | | **tCO2/yr** | **573.45** |
| | | | |
| **Total emission** | ***E_Total*** | **tCO2/yr.** | **123349.52** |
| **Steam (energy eqv.) extracted and not used for power generation** | Calculated from steam table based on extracted steam temp. & pressure | **TJ** | **411.59** |
| **Total Fuel energy used for Total steam generation** | Calculated based on quantity of fuel burned and NCV of fuel | **TJ** | **1508.79** |
| **Average Emission Factor of in-house steam produced** | Calculated based on total emission and total fuel energy used leading to total emission | **$tCO_2$/TJ** | **81.75** |
| **Emission due to extracted steam not used in power generation.** | ***E_extraction*** | **tCO2/yr.** | **45122.72** |
| **Net emission (excluding extraction) for inhouse power generation** | ***E_net*** | **tCO2/yr.** | **78226.80** |
| **Total Inhouse generation in 2008** | ***EGyinhouse*** | **GWh/yr.** | **49.82** |
| **In-house electricity emission factor** | ***EFyinhous*** | **tCO2/GWh** | **1570.35** |

## For Mixed (Grid and in-house) electricity emission factor (tCO2/GWh):

EFy(mix) = (EGygrid * EFygrid + EGyinhouse * EFyinhouse) / (EGygrid + EGyinhouse)----------(5)

Where:
EFy(mix) = Weighted average emission factor (in tCO2/GWh) based on in-house generation and purchased grid electricity.
EGyinhouse = Electricity generated in-house, gross in GWh.
EGygrid = Electricity purchased from grid in GWh.
EF*yinhouse* = In-house electricity emission factor ($tCO_2$ /GWh; ex-post)
EFygrid = Emission factor of the grid ( ex-ante : 1136 tCO2/GWh)

| **SUMMARY** | | | |
|---|---|---|---|
| **Project Category (Electrical Savings)** | | | **Total GWh saved** |
| Energy Efficiency Measures - RETROFIT | | | 0.544 |
| Energy Efficiency Measures - REPLACEMENTS | | | 2.141 |
| Energy Efficiency Measures - Modification of COMPRESSED AIR SYSTEM | | | 1.635 |
| Energy Efficiency Measures - Process Redesigning in EFFLUENT PLANT | | | 0.522 |
| **Total GWH savings** | | | **4.842** |
| **Electricity mix** | **Total Generation (GWh)** | **Emission Factor ($tCO_2$/GWh)** | **Gross Emission ($tCO_2$)** |
| | | | |
| **In-house generation** | 49.815 | 1570.35 | 78226.79562 |
| **Electricity purchased** | 6.2776 | 1136 | 7131.266558 |
| **Total** | **56.0926** | | **85358.06** |
| **Project Plant's Emisson Factor for Electricity used (grid+ coal based captive) ($tCO_2$/GWh)** | | | **1521.73** |
| **Actual Emission Reduction from electrical savings ($tCO_2$)** | | | **7367.88** |
| **Project Category (Thermal Savings)** | | **Actual Emission Reduction (tCO2)** | |
| **TG3 Gland Vent Condenser (Project Code: WH1)** | | 365.98 | |
| **Heat recovery from IJT Boiler flue gas exhaust: Project Code B11-B12** | | 1114.50 | |
| **Total Emission Reduction from Thermal savings ($tCO_2$)** | | **1480.48** | |

| | |
|---|---|
| **Total Emission Reduction from Thermal and Electrical Energy savings projects for this reporting period, that is, 1st January 2008 to 31st December, 2008 - both the dates inclusive ($tCO_2e$)** | **8848.36** |
| **Total Emission Reduction from Thermal and Electrical energy savings projects for this reporting period, that is, 1st January 2008 to 31st December, 2008 - both the dates inclusive and rounded Down ($tCO_2e$).** | **8848** |

**CER Comparison**

| | |
|---|---|
| Annual CERs as per registered PDD | 8195t $CO_2$ |
| CERs claimed for the monitoring period | 8848 t $CO_2$ |
| Actual CERs generated in the project activity is only 7.968% higher than what was projected in the registered PDD which cannot be considered as a significant increase over the projection. The emission factor for electrical savings used in the PDD was calculated very conservatively. The increase is also partially attributable to marginally higher energy savings from electrical measures (4.842 GWh compared to 4.67 GWh in the PDD). | |