

UNFCCC CDM Project Third Monitoring Report (Version 1)

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	-	20 April 2009

Contact Details of the Participant in the Project Activity

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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°59’N latitude and 88°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**. 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).

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Sl.No.	Project Code	Project Details	Start Date	CER Calculation for 3 rd 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. 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

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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.

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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									

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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
$\sum Equ_i$	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 equipment by fluke

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									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-	
<i>EGygrid</i>	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 the grid	Text	E	Once during PDD finalization	100%	Paper	-do-	

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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
$\sum_k GEN_{k,y}$	Electricity quantity	Total electricity generation by the grid	GWH	E	Once during PDD finalization	100%	Paper	-do-	
NHR_k	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-	
$COEF_i$	Emission co-efficient	CO ₂ emission co-efficient of each fuel (i) type	tCO ₂ /TJ	E	Once during PDD finalization	100%	Paper	-do-	
EF_{ygrid}	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.
$EG_{y, inhouse}$	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 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.

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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
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
$S_{i, prj}$	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	Total steam	Ton	M	Daily	100%	Electronic	-do-	Do

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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
	consumption	consumed at the project by the paper machine							
$P_{i,rep P}$	Total process output	Total process output at the project	Ton/ GWh	M	Daily	100%	Electronic	-do-	Do
S_{diff}	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
ϵ_{boiler}	Efficiency	Efficiency of the boilers in the project plant providing steam to the paper machine	%	C	Yearly	100%	Electronic	-do-	There are two boilers in the plant, IJT, IBL. The weighted average efficiency of the boilers would be considered based on their operating hours
Q_{air}	Flow rate	Flow rate of air induced in the boiler that is preheated by the	Kg/h	M	Daily	100%	Electronic	-do-	Flow rate will be measure by flow gauge installed at the inlet

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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
		flue gas exhaust							
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 measure by temperature gauge installed at the inlet
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 following sets of spreadsheets: -
 - 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**)

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:

$$EB = \sum_i ((P_{i,base} - P_{i,prj}) * Ohrs * Efy(mix)) \quad (I)$$

Where,

EB = Emission Reduction per (tCO₂/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 energymeter 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 kWxOhrs 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	Field Measurement Book. Document No. EP/E&U/4.5.1/ 01/01/01

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											direct energy meter monitoring.	
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 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 Power Analyser by kW & Ohrs.	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				
		TEM F7 (TG3 CT Fan2)	22.32	633.80	14146.42		N.A	N.A				

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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	<p>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.</p> <p>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.</p>	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				

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6	TEM P6	TEM P6 (PM3 VHP Pmp)	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 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	Field Measurement Book.

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		TEM P8 - MOD 15/14 (PM1)	22.46	643.50	14453.01		N.A	N.A				set having one Main & One Standby Pump as covered 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)	Document No. EP/E&U/4.5.1/01/01/01
		TEM P8 - MOD 17/20 (PM3)	29.36	524.15	15389.04		N.A	N.A					
		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					

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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
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10	TEM UT4	TEM UT4 (PM1 VHP Pmp)	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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Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

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

Project 0745: **Demand side energy conservation and reduction measures at ITC Tribeni Unit.**

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

		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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Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

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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Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

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 (IT BO/4/5 and BO/4/6)	8.95	635.21	5686.48		N.A	N.A				

Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

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 scenerio. 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 energymeters 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	1018016.09	45510.49	There were three pumps in place wherein any 2 used to run at a time in baseline scenerio. 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	Field Measurement Book. Document No. EP/E&U/4.5.1/01/01/01

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ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

											Meter readings (three energymeters 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 Emmision 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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ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

20	P26	P26 (PM4 Fan Pump)	N.A	N.A	N.A	488059.09	N.A	N.A	252675.00	235384.09	Only Baseline Energy Meter Readings are Provided - as the project is implemented in Feb 2008.	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											

Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

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 Dismantelled), 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	212564.50	74746.14	Base line period (October'03 to February'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	333601.00	361799.30	Base line period (October'03 to September'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							4863352.6					

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 (tCO₂ eqv.)

CDM-SSC-PDD (version 02)

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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 (°C)

Temp_{flue gas, outlet} = Temperature of the exhaust flue gas at the outlet of the preheater (°C)

Air_{LH,t} = Specific heat of Air (Publicly available literature**)

O_{hrs} = 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

Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

** http://www.engineeringtoolbox.com/dry-air-properties-d_973.html

Month	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		
	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 Emmison Co- efficient of Coal used in IJT	Emission Saved from this Project Annually
Month	kilo.joules	TJ/ton	tCO ₂ / ton of coal	tCO ₂
Jan-08	977770340.3	20000.52528	1694011.875	1114.018059
Feb-08	771537614.7			

Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

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*):

$$EB_y = [(Q_{\text{condensate}} * (\text{Enthalpy}_P - \text{Enthalpy}_B) / \epsilon_{\text{boiler}}) / NVC_{\text{FFI}}] * COEF_{\text{FFI}} \text{ (9)}$$

Where:

EB_y = Annual Baseline emission due fossil fuel usage (tCO₂ 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

Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

	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	74.57	4.477	81.777	366.078
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				
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):

$$EF_{\text{inhouse}} = E_{\text{net}} / EG_{\text{inhouse}} \quad (2)$$

Where:

EF_{inhouse} = In-house electricity emission factor (tCO₂/GWh)

E_{net} = Net emission (excluding extraction) for in-house power generation in tCO₂/yr.

EG_{inhouse} = Electricity generated in-house, gross in GWh.

$$E_{\text{net}} = E_{\text{Total}} - E_{\text{extraction}} \quad (3)$$

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

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

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ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

NCV=	GCV-10*MC%	Kcal/kg	4522.00
		TJ/000'ton	18.90
C%		%	30.21
TC		Tonne	13.5945
OXIDFF,i	IPCC	Fraction	1.00
Net Emission		tCO2/yr	49.85
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	Fraction	1.00
Net Emission		tCO2/yr	8993.5487
Coal ZIG-CLEAN Grd		000'ton	5.84

Project 0745: Demand side energy conservation and reduction measures at ITC Tribeni Unit.

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

(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%		%	47.53
TC		Tonne	57.04
OXIDFF,i		IPCC	1
Net Emission		tCO₂/yr	209.13
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	<i>E_{Total}</i>	tCO₂/yr.	123383.46
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	tCO₂/TJ	81.78
Emission due to extracted steam not used in power generation.	<i>E_{extraction}</i>	tCO₂/yr.	45135.14
Net emission (excluding extraction) for inhouse power generation	<i>E_{net}</i>	tCO₂/yr.	78248.32
Total Inhouse generation in 2008	<i>EGyinhouse</i>	GWh/yr.	49.82
In-house electricity emission factor	<i>EFyinhouse</i>	tCO₂/GWh	1570.78

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

$$EFy(mix) = (EGygrid * EFygrid + EGyinhouse * EFyinhouse) / (EGygrid + EGyinhouse) \text{-----}(5)$$

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. *yinhouse* = In-house electricity emission factor (tCO₂ /GWh; ex-post)

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

Project 0745: **Demand side energy conservation and reduction measures at ITC Tribeni Unit.**

ITC Limited – Paperboards and Specialty Papers Division (PSPD), Tribeni unit, Dist. Hooghly, W. Bengal, India

SUMMARY			
Project Category (Electrical Savings)			Total GWh saved
Energy Efficiency Measures - RETROFIT			0.544
Energy Efficiency Measures - REPLACEMENTS			2.161
Energy Efficiency Measures - Modification of COMPRESSED AIR SYSTEM			1.635
Energy Efficiency Measures - Process Redesigning in EFFLUENT PLANT			0.523
Total GWH savings			4.863
Electricity mix	Total Generation (GWh)	Emission Factor (tCO ₂ /GWh)	Gross Emission (tCO ₂)
In-house generation	49.815	1570.78	78248.32028
Electricity purchased	6.3026	1136	7159.666212
Total	56.1176		85407.99
Project Plant's Emission Factor for Electricity used (grid+ coal based captive) (tCO ₂ /GWh)			1521.95
Actual Emission Reduction from electrical savings (tCO ₂)			7401.76
Project Category (Thermal Savings)		Actual Emission Reduction (tCO ₂)	
TG3 Gland Vent Condenser (Project Code: WH1)		366.08	
Heat recovery from IJT Boiler flue gas exhaust: Project Code B11-B12		1114.02	
Total Emission Reduction from Thermal savings (tCO ₂)		1480.10	

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 (tCO₂e)	8881.86
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 (tCO₂e).	8881