MONITORING REPORT

Monitoring Period

01.11.2004 to 31.03.2007

(Both days included)

Version: 05

Date: 03/09/2007

Project 0578: Deoband bagasse based Co-generation Power Project

Project Site:

Deoband Village, Saharanpur District, Uttar Pradesh

Triveni Engineering & Industries Limited (TEIL)

15-16, Sector 16-A

8th Floor, Express Trade Towers

Noida ,

Uttar Pradesh - 201301

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Table of contents

S.No.	Content	Page
1.	Current Status of the Project	3
2.	Statement to what extent the Project has been implemented as planned	4
3.	Statement to the sustainability development with the project activity	6
4.	Parameters being monitored as per the monitoring plan	7
5.	Electricity generation data	13
6.	Biomass Transportation Data	15
7.	Fuel Consumption Data	16
8.	Emission reduction	18
8.	Measures to ensure the Results / uncertainty analysis	20
9.	Roles and responsibilities	21

Current Status of the Project

The bagasse based Co-generation Power Project has been successfully commissioned by Triveni Engineering & Industries Limited (TEIL) at Deoband Village, Saharanpur District, Uttar Pradesh, .and is operational since November 2004.

The major equipments commissioned in the project activity are as follows:

Boiler details

Description	**1nos. water tube**
Steam generating capacity (tons per hour)	120
Steam pressure (kg/cm^2)	87
Steam temperature (^{0} C)	515

Turbine details

Description	**1no. extraction cum condensing turbine**
Power (kW)	22000
Steam inlet pressure(kg/cm^2)	84

Statement to what extent the Project has been implemented as planned

The Project has been completed as planned and described in the Project Design Document (PDD).

Reference : http://cdm.unfccc.int

The plant is in operation continuously (with outages – forced & planned) since November 2004. The plant is using the available sugar mill generated bagasse and bought bagasse which was available surplus in the market as a fuel for the co-generation. The project activity uses a portion of the steam and electricity to run its own cane crushing facility and cogeneration plant and exports surplus power to the UPPCL.

Monitoring Period

The Monitoring Period is chosen from 01.11.2004 to 31.03.2007 (both days included).

Statement to the sustainable development with the project activity

- The project activity has resulted in providing employment opportunities to for the local people.

- The project activity contributes in conserving the fossil fuel like coal which can now be utilized for other useful purposes.

- By generating clean power, project activity has helped to eliminate an equivalent amount of carbon dioxide emissions which would have been otherwise generated due to power generation at grid.

Parameters being monitored as per the monitoring plan

The following parameters are monitored on regular basis:

Parameter	Monitoring method	Instrument used	Recording frequency	QA/QC	Calibration	% accuracy level
Quantity of Biomass transported (tones)	Quantity of biomass transported on trucks has been measured on a weigh bridge, provided with suitable scale to measure the weight	Weigh bridge	Continuous	The details of the number of trucks carrying the bagasse, quantity of bagasse in each truck are recorded in a log book on a regular basis.	Calibrated periodically as per standard procedures by accredited third party agencies.	98%
Average return trip distance between biomass fuel supply site and project site. (km)	Mean value of km travelled by trucks is recorded	Distance meters	Continuous	Regular recording of the distance of transportation of each truck is done in the log book.		NA
Number of truck trips for biomass transportation	Number of truck trips are measured and recorded in log books	-	Continuous	Regular recording of the distance of transportation of each truck is done in the log		NA

				book.		
Average CO_2 emission factor for transportation of biomass with trucks (tCO_2/Km)	National data is Chosen.		Annually			NA
Net quantity of electricity generated in the project plant during the year (MWh)	Net quantity of electricity produced is been monitored by energy meters of class 0.2	Energy meters	Continuous		Calibrated periodically as per standard procedures by accredited third party Agencies.	99. 5%
Total quantity of electricity generated at the project site (Including the project plant and any other plant at site existing at	Total quantity of electricity produced has been monitored by energy meters of class- 0.2	Energy meters	Continuous		Calibrated periodically as per standard procedures by accredited third party Agencies.	99. 5%

the start of the project activity) (MWh)						
Net quantity of heat generated from firing biomass in the project plant (MWh)	Net quantiy of heat can Be calculated from monitored parameters.	Flow meter	Continuous		All Meters are calibrated by accredited external third party, periodically	99%
Quantity of biomass type combusted in the project plant (tonne)	Quantity of biomass type combusted in the project plant is measured on weigh bridge.	Weigh bridge	Continuous			99.5%
Net calorific value of biomass (Kcal/tonne)	Net Calorific value of biomass has been measured in accredited. labs.	Bomb calorimeter			Calibrated periodically as per standard procedures by accredited third party agencies.	98%
Thermal	Thermal					NA

energy efficiency	energy efficiency is calculated from the heat input (from biomass combustion) and the enthalpy of the steam					
Steam temperature (^{0}C)	The thermocouple based temperature measuring device is being used for the continuous monitoring of the parameter. The data is continuously recorded in the Distributed Control System (DCS) on an hourly basis. The hourly values for the day are averaged out to compute	Thermocouple based temperature measuring device.	Hourly	The values are recorded continuously on hourly basis in the DCS. In order to maintain the highest levels of accuracy the measuring instruments are calibrated regularly as per the manufacturers' specification.	The temperature measuring device is calibrated regularly as per the manufacturers' specification.	99.9 %

	the daily average values .The average monthly values are arrived at by averaging out the daily reported values for the month.					
Steam pressure (Kg/cm^2)	The continuous monitoring of the parameter is being done through the pressure transmitter. The data is recorded in the Distributed Control System (DCS) on an hourly basis. The hourly values for the day are averaged out to compute the daily average	Pressure transmitter.	Hourly	The values are recorded continuously on hourly basis in the DCS. In order to maintain the highest levels of accuracy the measuring instruments are calibrated regularly as per the manufacturers' specification.	The measuring instrument (pressure transmitter) is calibrated regularly as per the manufacturers' specification.	99.9 %

	values .The average monthly values are arrived at by averaging out the daily reported values for the month.					

Electricity Generation Data

Month	Existing Units								Project Plant			
	Generation (KWh)						Auxiliary consumption	Net Generation	Generation (KWh)	Auxiliary consumption	Import form banked electricity	Net Generation
	T1	T2	T3	T4	T5	Total			T6			
Nov '04	890,520	863,160	-	2,166,138	1,929,200	5,849,018	612,464	5,236,554	-	-		-
Dec '04	699,480	753,720	-	2,179,190	2,037,672	5,670,062	616,272	5,053,790	10,460,000	1,107,550	61,920	9,290,530
Jan '05	90,000	193,980	-	923,078	1,507,584	2,714,642	615,289	2,099,353	10,672,000	1,072,313	52,320	9,547,367
Feb '05	159,840	37,200	-	841,932	1,560,468	2,599,440	616,742	1,982,698	13,970,000	1,406,670	23,760	12,539,570
Mar '05	618,780	8,160	-	2,106,572	2,049,372	4,782,884	614,939	4,167,945	15,609,000	1,569,000	8,880	14,031,120
Apr '05	186,720	-	-	828,464	810,472	1,825,656	329,100	1,496,556	15,048,000	1,429,100	18,960	13,599,940
May '05	-	-	-	-	-	-	-	-	5,918,000	501,000	6,960	5,410,040
Jun '05	-	-	-	-	-	-	-	-	-	-		-
Jul '05	-	-	-	-	-	-	-	-	-	-		-
Aug '05	-	-	-	-	-	-	-	-	-	-		-
Sept '05	-	-	-	-	-	-	-	-	-	-		-
Oct '05	-	-	-	17,602	92,976	110,578	20,520	90,058	3,766,000	511,100	88,320	3,166,580
TOTAL	**2,645,340**	**1,856,220**	**-**	**9,062,976**	**9,987,744**	**23,552,280**	**3,425,325**	**20,126,955**	**75,443,000**	**7,596,733**		**67,585,147**
Nov '05	-	162,780	-	1,096,940	1,636,544	2,896,264	614,227	2,282,037	13,928,000	1,415,500	44,880	12,467,620
Dec '05	-	526,560	-	949,676	1,872,728	3,348,964	617,015	2,731,949	15,711,000	1,663,600	6,720	14,040,680
Jan '06	-	19,800	-	833,092	1,711,580	2,564,472	615,243	1,949,229	14,868,000	1,532,000	74,400	13,261,600
Feb '06	78,720	349,740	-	799,942	1,555,008	2,783,410	616,118	2,167,292	14,665,000	1,481,000	7,440	13,176,560
Mar '06	-	640,920	-	917,306	1,768,052	3,326,278	617,244	2,709,034	16,410,000	1,637,000	2,640	14,770,360
Apr '06	24,240	285,420	-	502,554	1,049,412	1,861,626	409,610	1,452,016	15,629,000	1,521,000	16,800	14,091,200
May '06	-	-	-	-	-	-	-	-	15,721,700	1,416,000		14,295,380

											10,320	
Jun '06	-	-	-	-	-	-	-	-	3,109,000	284,000	261,600	2,563,400
Jul '06	-	-	-	-	-	-	-	-	-	-	291,360	291,360
Aug '06	-	-	-	-	-	-	-	-	-	-	282,240	282,240
Sept '06	-	-	-	-	-	-	-	-	-	-	280,800	280,800
Oct '06	-	-	-	60,658	207,376	268,034	42,633	225,401	1,304,000	215,020	292,280	796,700
TOTAL	**102,960**	**1,985,220**	**-**	**5,160,168**	**9,800,700**	**17,049,048**	**3,532,091**	**13,516,957**	**111,345,700**	**11,165,120**		**98,609,100**
Nov '06	379,620	-	-	1,301,162	1,482,902	3,163,684	629,006	2,534,678	14,220,000	1,547,600	19,560	12,652,840
Dec '06	675,800	-	-	1,490,212	1,798,796	3,964,808	630,629	3,334,179	15,638,000	1,617,600	209,160	13,811,240
Jan '07	107,580	-	-	1,151,410	1,739,452	2,998,442	596,153	2,402,289	16,534,000	1,565,800	-	14,968,200
Feb '07	337,140	-	-	1,276,340	1,407,644	3,021,124	921,015	2,100,109	14,415,000	1,475,000	49,080	12,890,920
Mar '07	495,120	-	-	1,414,947	1,644,136	3,554,203	612,429	2,941,774	15,925,000	1,660,676	3,380	14,260,944
TOTAL	**1,995,260**	**-**	**-**	**6,634,071**	**8,072,930**	**16,702,261**	**3,389,232**	**13,313,029**	**76,732,000**	**7,866,676**		**68,584,144**

where

T1 - 3MW turbine

T2 - 3MW turbine

T3 - 1.25MW turbine

T4 - 1.50MW turbine

T5 - 1.50MW turbine

T6 - 22MW Project turbine

Biomass Transportation Data

Biomass Quantity transported				
	Tons	KM	No.	KM
	Quantity	Distance	Truck Nos.	Total distance
Nov -04	0	0	0	0
Dec-04	0	0	0	0
Jan- 05	2686	122	188	22989
Feb- 05	6826	117	463	54024
Mar-05	9843	107	660	70369
Apr-05	15089	88	1077	94925
May-05	4848	85	378	32032
Jun-05	19	200	2	400
Jul-05	0	0	0	0
Aug-05	0	0	0	0
Sep-05	0	0	0	0
Oct-05	7659	100	462	46397
TOTAL	**46970**			**321136**
Nov -05	9961	95	599	57164
Dec-05	10719	88	701	61916
Jan- 06	12983	82	879	72160
Feb- 06	6528	79	431	33918
Mar-06	12906	76	854	64972
Apr-06	7497	158	537	84650
May-06	2940	112	215	24048
Jun-06	150	103	10	1028
Jul-06	0	0	0	0
Aug-06	0	0	0	0
Sep-06	0	0	0	0
Oct-06	173	73	11	803
TOTAL	**63856**			**400659**
Nov-06	3581	74	232	17142
Dec-06	6695	75	422	31490
Jan 07	22702	94	1480	139440
Feb-07	8924	73	650	47742
Mar-07	9197	74	660	48532
TOTAL	**51098**			**284346**

Fuel consumption data

	Quantity	NCV	Heat input	Steam Enthalpy	Steam flow	Heat Output	Efficiency of heat generation	Steam Temperature	Steam pressure
	tonnes	Kcal/tonne	Kcal	Kcal/tonne	tonnes	Kcal	%	^{0}C	Kg/cm^2
Nov 04	0	0	0	0	0	0	-	-	0
Dec-04	24371	1987000	48425177000	814230	54842	44654001660	92	508.5	83.0
Jan 05	22729	2095000	47617255000	819550	50842	41667561100	88	507.5	81.5
Feb 05	29654	2278000	67551812000	817650	67640	55305846000	82	517.4	80.7
Mar-05	34756	2100000	72987810000	819300	81105	66449326500	91	507.1	80.3
April-05	27815	2190000	60914850000	817700	70578	57711630600	95	511.0	82.8
May-05	9080	2295000	20838600000	817860	23577	19282685220	93	508.4	81.4
June-05	0	0	0	0	0	0	0	0	0
Jul-05	0	0	0	0	0	0	0	0	0
Aug-05	0	0	0	0	0	0	0	0	0
Sept-05	0	0	0	0	0	0	0	0	0
Oct-05	8596	2080000	17879680000	815930	21383	17447031190	98	505.0	82.2
TOTAL	**157001**								
Nov-05	29830	2110000	62941300000	814770	74825	60965165250	97	506.5	83.8
Dec-05	34344	2261000	77651784000	814320	86345	70312460400	91	506.7	85.4
Jan 06	31227	2330000	72758910000	805520	78487	63222848240	87	494.1*	80.2
Feb-06	31815	2194000	69802110000	814940	78488	63963010720	92	507.7	84.8
Mar-06	35571	2185000	77722635000	814960	87252	71106889920	91	507.8	85.4
April-06	32042	2015000	64564630000	814740	78224	63732221760	99	506.7	84.7
May-06	25119	2072000	52046568000	815010	62503	50940570030	98	503.9	82.4
Jun -06	4954	2171000	10755134000	815850	12219	9968871150	93	505.2	81.6

Jul-06	0	0	0	0	0	0	0	0	0
Aug-06	0	0	0	0	0	0	0	0	0
Sept-06	0	0	0	0	0	0	0	0	0
Oct-06	3368	1999000	6732632000	810180	8175	6623221500	98	502.3	77.3
TOTAL	**228270**								
Nov-06	32117	2085000	66963945000	815350	79584	64888814400	97	507	82.2
Dec-06	35399	2280000	80709720000	815520	87666	71493376320	89	508.7	85.2
Jan 07	36188	2065000	74728220000	815100	89398	72868309800	98	508.1	85.7
Feb-07	32265	2024000	65304360000	814090	79360	64606182400	99	506.2	85.0
Mar-07	35845	2201000	78894845000	813380	88150	71699447000	91	504.1	80.8
TOTAL	**171814**								

* Due to the furnace problem

Emission reduction

Baseline and project emissions are calculated as per the formulas mentioned in Section E of the PDD. The same is given below:

Formulae used

The emission reduction is given by

Emission reduction = Baseline emissions – Project emissions

Baseline emissions

$ER_{electricity,y} = EG_y \times EF_{electricity,y}$

where $ER_{electricity,y}$ - are the baseline emissions due to displacement of electricity during the year y in tons of CO_2

EG_y - Min {($EG_{project\ plant,\ y}$), ($EG_{total,\ y} - (EG_{historic,\ 3\ yr})/3$)}

Carbon Emission Factor as per the baseline adopted (t CO2/million KWh)[1] = 923.54

The following table gives the details about the historic generation in Kilo Watt Hours (KwH).

Turbo Generator	T4	T5	T3	T1	T2	Total
2001- 2002	4170480	4277190	0	10783292	10958904	30189866
2002- 2003	4279200	4570080	0	10621988	10544352	30015620
2003- 2004	4542060	4880640	0	11175840	11134240	31732780

The historic generation details had been verified by DOE during validation

Project emissions

$$PET_y = \sum_i FC_{TR,i,y} \cdot NCV_i \cdot EF_{CO2,FC,i}$$

where

PET_Y CO_2 emissions during the year due to transport of the biomass residues to the project plant (tCO_2/MWh)

$FC_{TR,I}$ (ton) Fuel consumption of diesel in trucks for transportation of biomass residues during the year *y* (mass unit per year)

$EF_{CO2,FF,I}$ CO_2 emission factor for diesel (tCO_2/GJ)

[1] http://cdm.unfccc.int

NCV_i Net calorific value of diesel (kJ /t)

Density of diesel (t/klitre) [2] **= 0.83**

Net calorific value of diesel (KJ/t) [3] **= 41.76**

CO_2 emission factor for diesel (tCO_2/GJ) [4] **= .0741**

Emission reductions

Baseline emissions (t CO_2) for Nov '04 – Oct '05 = **52,703**

Project emissions (t CO_2) Nov '04 – Oct '05 = **206**

Emission reductions = 52,703 - 206

= **52,497**

Baseline emissions (t CO2) for Nov '05 – Oct'06 = 75250

Project emissions (t CO_2) Nov '05 – Oct '06 = **257**

Emission reductions = 75250 **- 257**

= **74,993**

Baseline emissions (t CO2) for Nov '06 – Mar '07 = **63,097**

Project emissions (t CO_2) Nov '06 – Oct '07 = **183**

Emission reductions = **63,097 - 183**

= 62,915

[2] Baseline Carbon Dioxide Emission Database Version 1.1 (www.cea.nic.in)

[3] Baseline Carbon Dioxide Emission Database Version 1.1 (www.cea.nic.in)

[4] Baseline Carbon Dioxide Emission Database Version 1.1 (www.cea.nic.in)

Period	Baseline Emission factor (tCO_2/MWh)	Net Power produced (MWh)	Project emissions (ton of CO_2)	Baseline emissions (ton of CO2)	Emission reductions (ton of CO2)
Nov 04-Oct 05	0.92	57,586.11	206	52703	52497
Nov 05-Oct 06	0.92	82,348.35	257	75250	74993
Nov 06-Mar 07	0.92	68,584.14	183	63097	62915

Total Emission Reduction (t CO_2) = 190,404

Measures to ensure the Results / uncertainty analysis

As per the Power Purchase Agreement (PPA), the energy exported to the UPPCL Grid is recorded from two independent meters viz., Main Meter and Check Meter and reading of main meter is used for billing. In the event of main meter not in operation / fails, the reading of the check meter shall be used for billing. The Calibration of monitoring equipment has been carried out according to the specifications of the equipment (I^{st} calibration in 2 years of installation and thereafter subsequent calibrations at an interval of 1 year). Power Generation, Export & Auxiliary Consumption, fuel consumption are being recorded daily and the same is being verified and approved by Manager (O&M).

Roles and responsibilities

Shift Engineer (Co-Gen) is responsible for monitoring of daily data of the steam generated from bagasse based boiler, steam fed to turbine, parameters of steam and flow meter readings of the captive power plant. The report is then sent to the GM (Power Plant) for the review.

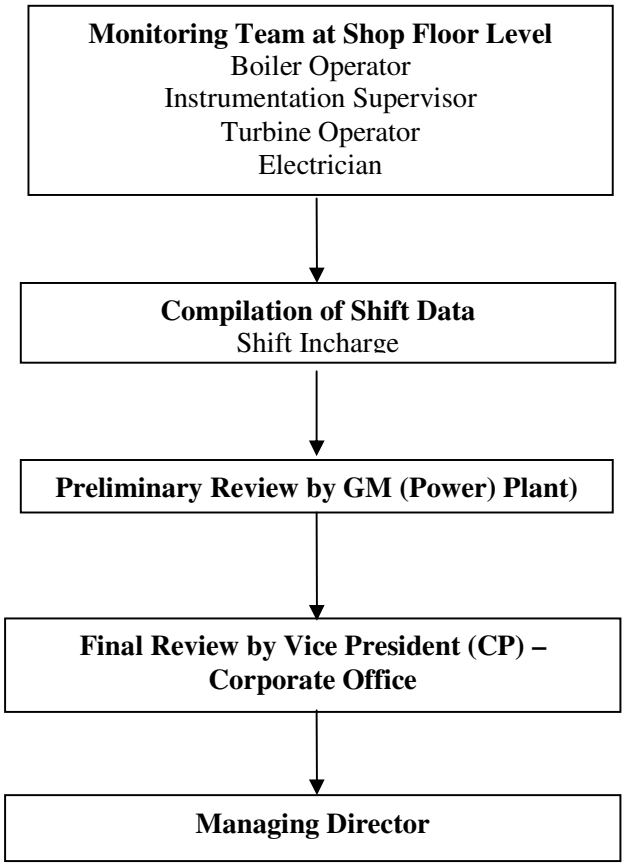
Shift Electrician (Electrical) is Responsible for taking meter readings for electricity generation daily.

Shift Incharge is Responsible for compilation of data which is then sent to GM (Power) for preliminary review.

The electricity generation details report is sent to the GM (Power Plant) through Shift incharge with due verification for his review on a daily basis. In the absence of GM (Power Plant) this role is performed by the Dy. Chief Engineer.

GM (Power Plant) is responsible for reviewing the monitored parameters report on a daily basis and presenting a daily executive summary report, duly signed by himself, to the Vice President (CP) Corporate office which is finally reported to Managing Director (MD), TEIL.

Organization structure responsible for monitoring and reporting of parameters involved in CDM project activity has been presented in the following flow chart.


Monitoring Team at Shop Floor Level
Boiler Operator
Instrumentation Supervisor
Turbine Operator
Electrician
Compilation of Shift Data
Shift Incharge
Preliminary Review by GM (Power) Plant)
Final Review by Vice President (CP) – Corporate Office
Managing Director