MONITORING REPORT

Second Verification

Monitoring Period

01.04.2007 to 31.03.2008

(Both days included)

Version: 01

Date: 28/04/2008

Project 0578: Deoband bagasse based Co-generation Power 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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1. Description of the project activity

1.1 Project Status

The project activity by Triveni Engineering and Industries Limited utilizes the bagasse to generate steam and electricity which caters to the captive steam and power requirements. The surplus amount of the power is exported to the electricity starved Uttar Pradesh Power Corporation Limited (UPPCL) grid (part of Northern regional grid).

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. This is the second verification for the project activity.

The major equipments deployed for 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

The project activity of Deoband comprises of an extraction cum condensing turbo generator of nominal capacity 22 MW and a high pressure boiler of 87 Kg/Cm^2 and 120 TPH steam generation capacity.

The turbine has been designed for a condition called valve wide open condition, wherein the flow in turbine can vary 3-5 % more than MCR turbine flow, which may result in power generation

slightly higher than the nominal capacity[1]. The project boiler can also generate steam slightly higher than MCR of 120 TPH[2].

During season operation, low pressure 3 Kg/Cm^2 steam is extracted from the turbine to meet the sugar process requirement which has wide fluctuations as per the cane crushing rate in the sugar factory, which is an inherent characteristic of the sugar industry. Apart from the steam for the sugar process, steam is also extracted for deaerator (at 3 Kg/Cm^2) and for high pressure feed water heater (at 9 Kg/Cm^2).

During off-season operation, there is no supply of 3 Kg/Cm^2 steam for the sugar process from the turbine and thus more steam goes to the condenser. Therefore, under off-season operating conditions, the inlet steam requirement of the turbine to generate same nominal power output of 22 MW decreases significantly. In fact, during off-season operation of the cogeneration plant, approximately 87 tph steam is required for generating 22 MW power[3].

[1] Note from project design consultant can be referred for verifying the turbine design.
[2] Boiler supplier certificate can be referred for verifying boiler design.
[3]The higher electricity generation during the verification period for some days when steam generation was low is attributable to the fact that there was less extraction of 3 kg/cm^2 process steam for sugar manufacture and which has lead to the larger availability of enthalpy (heat energy) of steam for power generation.

1.2 Pre project scenario

In the pre project scenario the proponent of the activity was meeting its in house steam and power requirements by a set of low pressure boilers and turbo generators respectively, the specifications for which are as given below:

Boiler details

Description	**1 no.**	**3 no.**	**3 nos.**	**1 no.**
Steam generating capacity (tonnes per hour)	25	20	40	65
Steam pressure (kg/cm^2)	11.27	11.27	32	32
Steam temperature (^0C)	270	270	400	400

Turbine details

Description	**2 nos. back pressure**	**2 nos. back pressure**	**1 nos. back pressure**
Power (MW)	3	1.5	1.25
Stem inlet pressure (kg/cm^2)	30	11	11

2. Parameters monitored

The project proponent has been monitoring the parameters as outlined in the registered PDD. The details of the monitoring parameters are as given below:

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 book.		NA
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	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 project plant and any other plant at site existing at 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	Bomb calorimeter			Calibrated periodically as per standard procedures by	98%

)	measured in accredited. labs.				accredited third party agencies.	
Thermal energy efficiency	Thermal energy efficiency is calculated from the heat input (from biomass combustion) and the enthalpy of the steam					NA
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)	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 %

	on an hourly basis. The hourly values for the day are averaged out to compute 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	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 %

	hourly values for the day are averaged out to compute the daily average values .The average monthly values are arrived at by averaging out the daily reported values for the month.					

3. Monitored data for Power generation

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			
Apr' 07	271,440	-	-	890,968	1,050,556	2,212,964	363,780	1,849,184	15,493,471	1,636,665	-	13,856,806
May' 07	-	-	-	-	-	-		-	13,271,000	1,223,824	55,167	11,992,009
June' 07	-	-	-	-	-	-		-	9,232,505	886,920	118,320	8,227,265
July' 07	-	-	-	-	-	-		-	14,514,000	1,374,850	47,024	13,092,126
Aug' 07	-	-	-	-	-	-		-	1,929,000	190,992	239,415	1,498,593
Sep' 07	-	-	-	-	-	-		-	-	-	255,542	(255,542)
Oct' 07	-	-	-	-	-	-		-	-	-	221,055	(221,055)
Nov' 07	61,080	-	-	124,618	245,128	430,826	77,400	353,426	4,089,000	440,050	234,482	3,414,468
Dec'07	726,000	-	-	1,115,972	1,452,724	3,294,696	455,886	2,838,810	16,198,000	1,637,200	97	14,560,703
Jan' 08	758,400	-	-	1,173,432	1,347,684	3,279,516	451,087	2,828,429	16,418,000	1,637,300	5,857	14,774,843
Feb' 08	683,880	-	-	1,244,698	1,432,756	3,361,334	448,920	2,912,414	15,225,000	1,510,000	5,737	13,709,263
Mar' 08	674,040			1,576,354	1,594,996	3,845,390	479,880	3,365,510	15,394,000	1,589,000	54,492	13,750,508
TOTAL	**3,174,840**	**-**	**-**	**6,126,042**	**7,123,844**	**16,424,726**	**2,276,953**	**14,147,773**	**121,763,976**	**12,126,801**	**1,237,188**	**108,399,987**

where

T1 - 1.5 MW turbine

T2 - 1.5 MW turbine

T3 - 1.25MW turbine

T4 - 3.0 MW turbine

T5 - 3.0 MW turbine

T6 - 22MW Project turbine

4. Parameters related to bagasse transportation

Biomass Quantity transported				
	Tons	KM	No.	KM
	Quantity	Distance	Truck Nos.	Total distance
Apr' 07	6578	76	515	39372
May' 07	7292	147	581	85322
June' 07	4152	185	349	64414
July' 07	1117	101	90	9108
Aug' 07	949	68	65	4420
Sep' 07	0	-	-	0
Oct' 07	0	-	-	0
Nov' 07	847	84	57	4772
Dec'07	1302	96	103	9888
Jan' 08	0	-	-	0
Feb' 08	692	96	63	6048
Mar' 08	11295	85	996	84894
TOTAL	**34223**			**308238**

5. Parameters related to bagasse and thermal energy

	(Tons)	NCV	Heat input	Steam Enthalpy	Steam flow	Heat Output	Efficiency of heat generation
	Quantity	Kcal/tonne	Kcal	Kcal/tonne	tonnes	Kcal	%
Apr' 07	33389	2092000	69849788000	816750	82050	67014337500	96.0
May' 07	22633	2075000	46963475000	814880	55431	45169613280	96.0
June' 07	15530	2110000	32768300000	815920	38016	31018014720	95.0
July' 07	24242	2145000	51999090000	815890	59409	48471209010	93.0
Aug' 07	3231	2085000	6736635000	817160	7906	6460466960	96.0
Sep' 07	0	-	0	-	0	0	0.0
Oct' 07	0	-	0	-	0	0	0.0
Nov' 07	8746	2010000	17579460000	815930	20141	16433646130	93.0
Dec'07	36218	2065000	74790170000	816490	87880	71753141200	96.0
Jan' 08	36259	2170000	78682030000	815610	88820	72442480200	92.0
Feb' 08	33546	2100000	70446600000	816380	82171	67082760980	95.0
Mar' 08	34479	2125000	73267875000	817740	84327	68957560980	94.0
TOTAL	**248273**						

6. Calculations for 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)[4] = 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

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

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)
NCV_i	Net calorific value of diesel (kJ /t)

Density of diesel (t/klitre) [5] **= 0.83**

Net calorific value of diesel (KJ/t) [6] **= 41.76**

CO_2 emission factor for diesel (tCO_2/GJ) [7] **= 0.0741**

Emission reductions

Baseline emissions (t CO_2) for April '07 – March '08 = **84875**

Project emissions (t CO_2) April '07 – March '08 = **198**

Emission reductions = **84875 - 198**

= **84677**

[5] Baseline Carbon Dioxide Emission Database Version 3.0 (www.cea.nic.in)

[6] Baseline Carbon Dioxide Emission Database Version 3.0 (www.cea.nic.in)

[7] Baseline Carbon Dioxide Emission Database Version 3.0 (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)
April 07- March 08	0.924	91901.67	198	84875	84677

Total Emission Reduction (t CO_2) = 84677

7. 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 Head (Power Plant) for the review.

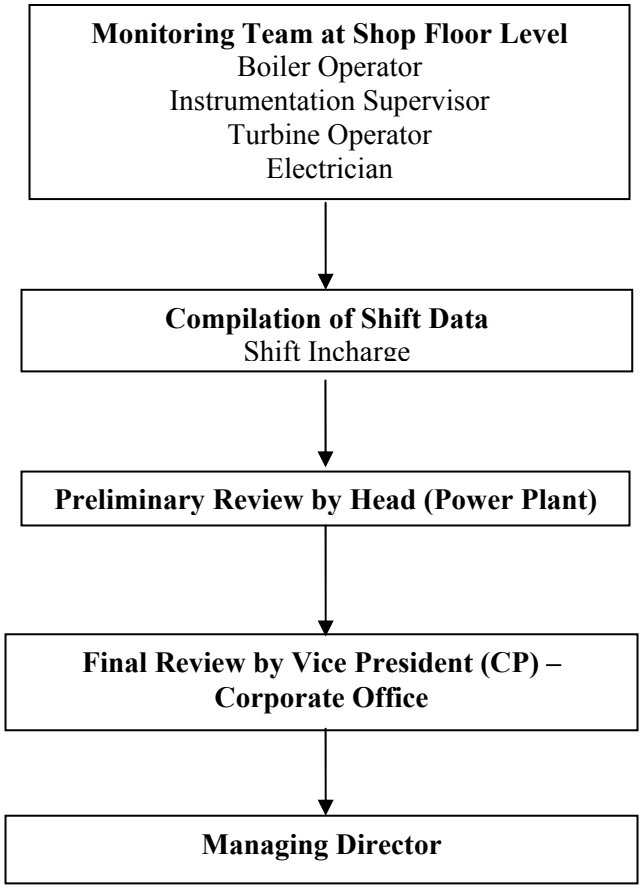
Shift Electrician (Electrical) is Responsible for taking meter readings for electricity generation daily.

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

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

Head (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 Head (Power Plant)
Final Review by Vice President (CP) – Corporate Office
Managing Director