

MONITORING REPORT

“Biomass based steam generation project by Gujarat Ambuja Exports Ltd”

Verified Emission Reductions (VERs):

1st April 2008 to 31st March 2010

(Both days included)

Monitoring Report Version: Version 3

Date: 16/08/2011

Gujarat Ambuja Exports Limited

C-50, ELDECO – SIDCUL Industrial Park

Sitarganj – 262 405

Udham Singh Nagar District

Uttarakhand (India)

91-129-4090400

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1. Project details:

- **PD version & date:** Version 1; 25th September 2009
- **Methodology version:** “Thermal energy for the user with or without electricity”
AMS I-C; Version 16, Scope 1 (EB 51)
- **Project Commissioning:** 27th March 2008
- **Monitoring Period:** From 1st April 2008 till 31st March 2010

2. Project Description

The project activity consists of biomass based thermal energy generation in the starch processing division of Gujarat Ambuja Exports Ltd (GAEL) at ELDECO – SIDCUL Industrial Park, Sitarganj, Udham Singh Nagar District, Uttarakhand. The project activity is installation of a boiler to generate steam by combustion of biomass, thereby doing away with the use of coal for process heating. Also the project activity utilises biogas as a fuel in the same boiler. This biogas is produced from the anaerobic digestion of wastewater within the plant premises. The purpose of the project activity is to generate steam for process heating. This generates 30TPH of steam which is utilized for process heating in the starch manufacturing process. .

Project proponent:

R.K. Gupta

Sr. General Manager

C-50, ELDECO – SIDCUL Industrial Park

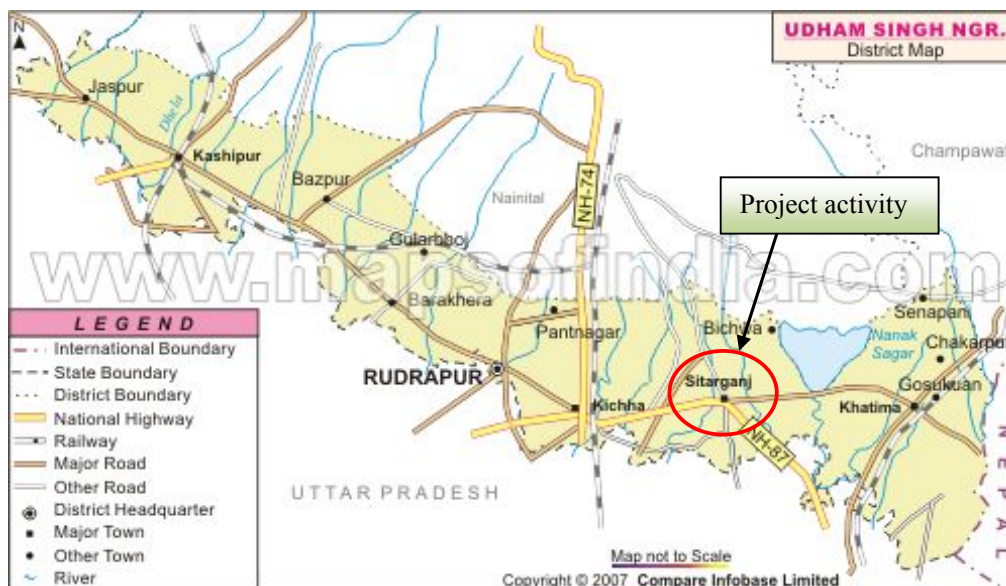
Sitarganj – 262 405

Udham Singh Nagar District

Uttarakhand (India)

Location of the project activity:

The project is located in Sitarganj, Udham Singh Nagar district, Uttarakhand state. The nearest Rail head is at Kathgodam (37km from site) and the airport is at Pantnagar (50km from site). Its exact location of Sitarganj is given by the Latitude 28° 55' 43" N and Longitude 79° 42' 25" E.



Technical description of the project:

The project activity is installation of biomass based boiler for steam production. The installed capacity of the project activity is 30TPH or 19.63 MW_{thermal}.

Technical specifications of the project activity:

Parameters	Values
Boiler Type	Semi-outdoor, Bi-drum, Water tube, AFBC boiler
Capacity	30TPH
Steam Pressure	17.5 kg/cm ²
Steam temperature	Saturated
Fuel	Rice husk/Coal/Bio-gas
Make	Cheema Boilers

Implementation status of the project activity:

The Starting date of project activity is 1st April 2008. The various commissioning dates related to the project are tabulate below:

Activity	Date
Boiler Commissioning and handover to m/s. Gujarat Ambuja Export Ltd.	27/03/2008
Start date of commercial operation at the site	28/03/2008
Biogas generation Plant commissioning	28/07/2008

Table 1: Downtime details for the Boiler as well as the Biogas generation plant are as follows:

Month	Boiler Downtime (hour)	Reasons
Apr-08	36.8	Boiler maintenance
	2	Power cut by UPCL
May-08	2.5	Electrical problem in ID and FD
	2.25	Mechanical problem
	4	Boiler bed problem
	24	Plant maintenance
	5.6	Power cut by UPCL
	11	Power supply fail
	1	Feed pump strainer chock
	3	Feed pumps maintenance
	36	Boiler maintenance
	2	Bunker empty
Jun-08	5.16	Power cut by UPCL
	7	Bunker empty
	50	Boiler maintenance
	1.9	Feeder problem
Jul-08	7	Bunker empty
	71	Boiler bed problem
	6	Electrical problem
	1	Conveyor problem
	1	Back air lock check
	12	Mechanical problem
	1	Crasher Jam

	3	Power cut by UPCL
	12	Boiler maintenance
Aug-08	5.5	Power cut by UPCL
	12	Boiler bed problem
	1	Power fail
Sep-08	4	Electrical problem in ID and FD fan
	2.25	Power fail
	3	Boiler bed problem
	24	Boiler maintenance
	24	Plant maintenance
	5	Power cut by UPCL
Oct-08	1	Power fail
	4	Boiler maintenance
	32	Plant maintenance
	6	Boiler bed problem
Nov-08	6	Boiler bed problem
	2	Power cut by UPCL
Dec-08	2	Electrical problem in ID fan
	1	Plant maintenance
	1	Power cut by UPCL
	48	Boiler maintenance
Jan-09	100	Boiler maintenance
	2	Power fail
	1	Electrical problem in ID and FD fan
Feb-09	2	Power cut by UPCL
	7	Boiler maintenance
	1	Electrical problem
Mar-09	3	Power cut by UPCL
	24	Shutdown
	104	Plant maintenance
	2	Electrical problem
Apr-09	6	Power cut by UPCL
	4	Plant maintenance
May-09	5	Power cut by UPCL
	48	Shutdown
	14	Boiler bed problem
Jun-09	2	Power cut by UPCL
Jul-09	5	Power cut by UPCL
	2	Boiler bed problem
Aug-09	24	Plant maintenance
	4	Power cut by UPCL
Sep-09	4	Power cut by UPCL
	6	Boiler bed problem
	1	Electrical problem in ID fan
Oct-09	2	Boiler bed problem
Nov-09	-	-

Dec-09	-	-
Jan-10	-	-
Feb-10	77	Plant maintenance
	4	Power cut by UPCL
Mar-10	3	Power cut by UPCL

Month	ETP Downtime (hour)	Reasons
Apr-08	-	-
May-08	-	-
Jun-08	-	-
Jul-08	-	-
Aug-08	-	-
Sep-08	-	-
Oct-08	-	-
Nov-08	-	-
Dec-08	48	No effluent, boiler under shutdown
Jan-09	96	No effluent, boiler under shutdown
Feb-09	-	-
Mar-09	144	Plant shutdown
Apr-09	-	-
May-09	48	Plant shutdown
	24	No effluent, boiler under breakdown
Jun-09	-	-
Jul-09	-	-
Aug-09	22	Plant maintenance
	32	No effluent water
Sep-09	-	-
Oct-09	-	-
Nov-09	-	-
Dec-09	-	-
Jan-10	-	-
Feb-10	24	Plant shutdown
Mar-10	-	-

There are no changes that have happened in project activity which may impact the applicability of the methodology.

3. Formula Used

Baseline Emissions (sample calculation for the month of Nov 2008)

As per Para 35, AMS IC Ver 16

$$\begin{aligned}
 BE_{\text{Cofire, y}} &= [(FC_{\text{biomass}} * NCV_{\text{biomass}}) / (SEC_{\text{biomass}} * \eta_{\text{BL, thermal}})] / * EF_{\text{BL}} \\
 &= [(574 * 1000 * 3127.92 * 4.1868) / (1.25 * 100\%)] / 10^6 * 96.1 \\
 &= 578 \text{ tCO}_2\text{e}
 \end{aligned}$$

As per Para 15, AMS IC Ver 16

$$\begin{aligned}
 BE_{\text{Thermal, CO}_2, y} &= (EG_{\text{Thermal, Biomass, y}} / \eta_{\text{BL, thermal}}) * EF_{\text{BL, FF, CO}_2} \\
 &= (8.29 / 100 \%) * 96.1 \\
 &= 797 \text{ tCO}_2\text{e}
 \end{aligned}$$

Project Emission (sample calculation for the month of Nov 2008)

As per Para 35, AMS IC Ver. 16

As per the approach defined in paragraph 35, the project emission is not required to be considered. Hence, it has been considered as Zero.

$$PE_y = 0$$

As per Para 15, AMS IC Ver. 16

$$PE_y = \sum FF_{i,y} * NCV_i * EF_i$$

Where

PF_y = Project emissions from on-site fossil fuel combustion in year y, tCO₂e

$\sum FF_{i,y}$ = Quantity of fossil fuel combusted in the project plant in year y, tonne

NCV_i = Net calorific value of fossil fuel type i, TJ/tonne

EF_i = Emission factor for fuel i; IPCC default value, tCO₂/ TJ

$$\begin{aligned} PE_y &= [(354 * 4489 * 4.1868) / 10^6 * 96.1] \\ &= 639 \text{ tCO}_2\text{e} \end{aligned}$$

Leakage

A. Leakage due to use of nonrenewable biomass:

Since no non-renewable biomass used this component is zero.

B. Leakage due to transportation of biomass residues to the project site:

No leakage as per the PD.

$$Ly = 0$$

Emission Reductions (sample calculation for the month of Nov 2008)

$$ER_y = BE_y - PE_y - L_y$$

As per Para 35, AMS IC Ver. 16

$$\begin{aligned} ER_y &= 578-0-0 \\ &= 578 \text{ tCO}_2\text{e} \end{aligned}$$

As per Para 15, AMS IC Ver. 16

$$\begin{aligned} ER_y &= 797-639-0 \\ &= 158 \text{ tCO}_2\text{e} \end{aligned}$$

So final emission reductions for month of Nov 2008

$$= \text{Min (tCO}_2\text{e as per Para 35, tCO}_2\text{e as per Para 15)}$$

$$= \text{Min (578 tCO}_2\text{e, 158 tCO}_2\text{e)}$$

$$= 158 \text{ tCO}_2\text{e}$$

Parameters considered for estimation of ER due to Steam generation

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	η_{BL} , Thermal
Data unit:	%
Description:	Efficiency of baseline coal fired boiler
Source of data used:	Default value
Value(s) :	100 %
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	This parameter is fixed ex-ante

Data / Parameter:	η_{BL} , Thermal
Data unit:	%
Description:	Efficiency of biomass fired boiler
Source of data used:	Default value
Value(s) :	80 %
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	This parameter is fixed ex-ante

Data / Parameter:	EF_i
Data unit:	tCO ₂ e/ TJ
Description:	Emission factor for fossil fuel i
Source of data used:	IPCC default value of coal
Value(s) :	96.1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	This parameter is fixed ex-ante

Data / Parameter:	Density of biogas
Data unit:	lb/ft ³
Description:	Density of biogas
Source of data used:	http://www.dairyfarmenergy.com/DLtech_Publications/Heating_Valu_e_of_Biogas.pdf
Value(s) :	0.074 ¹
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	This parameter is fixed ex-ante

Data / Parameter:	Conversion factor for Lb/ft ³ to Kg/m ³
Data unit:	Kg/m ³ / Lb/ft ³

¹ The Methane proportion in a sample of biogas primarily decides the density of the biogas. It is also very obvious that as the methane proportion decreases, the density of biogas increase. Out of the three test conducted by the PP, the minimum proportion of methane is 62 %, so the density corresponding to 62 % methane proportion is considered for calculation. This is conservative.

Description:	Conversion factor for Lb/ft ³ to Kg/m ³
Source of data used:	http://www.engineeringtoolbox.com/density-converter-d_1038.html
Value(s) :	16.02
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	This parameter is fixed ex-ante

Data / Parameter:	Conversion factor
Data unit:	kJ/ kcal
Description:	Conversion factor for KJ to Kcal
Source of data used:	
Value(s) :	4.1868
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	This parameter is fixed ex-ante

Data / Parameter:	Sp. Energy Consumption
Data unit:	kJ/ kJ steam
Description:	Sp. Energy Consumption
Source of data used:	As per validated VCS PD
Value(s) :	1.25
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	This parameter is fixed ex-ante

D.2. Data and parameters monitored	
Data / Parameter:	Q _{steam}
Data unit:	Tonne
Description:	Quantity of steam generated
Measured /Calculated /Default:	measured
Source of data:	Onsite measurement
Value(s) of monitored parameter:	196803.72 (Cumulative quantity for the monitoring period)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Directly measured using steam flow meter/ totalizer installed at the site. Data is monitored on hourly basis and logged in the sheet at site. Consolidated data for a month is on the basis for estimations.
Measuring/ Reading/ Recording frequency:	The data is monitored on hourly basis and logged in the sheet at site.
Calculation method (if applicable):	-

QA/QC procedures applied:	Steam flow meter will be calibrated/ tested annually independently by a third party. Meter accuracy: $\pm 0.25\%$ Least Count: 0.1 tonne Refer table 5 for calibration details
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Data / Parameter:	T_{steam}
Data unit:	Degree C
Description:	Temperature of the steam generated
Measured /Calculated /Default:	Measured
Source of data:	On-site measurement
Value(s) of monitored parameter:	Measured value (Refer table “Boiler Data” under section D2) ²
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge.
Measuring/ Reading/ Recording frequency:	The data is monitored on hourly basis and logged in the sheet at site. Average of such data captured in a month is used for the estimation purpose.
Calculation method (if applicable):	-
QA/QC procedures applied:	Gauge is tested at least once annually as per manufacturer’s Prescribed standards. Gauge Accuracy: $\pm 0.25\%$ Least count: 1 Dec C Refer table 5 for calibration details

Data / Parameter:	P_{steam}
Data unit:	kg/cm ²
Description:	Pressure of the steam generated
Measured /Calculated /Default:	measured
Source of data:	On-site measurement
Value(s) of monitored parameter:	Measured value (Refer table “Boiler Data” under section D2)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Measured using on-site pressure gauge.
Measuring/ Reading/	The data is monitored on hourly basis and logged in the sheet at site.

² During the monitoring period the PP could not log the steam temperature values from the gauge itself as the display unit of the gauge was faulty. So PP has logged down the steam temperature values corresponding to the saturated pressure values for the monitoring period. This is to be noted that these readings are not used for emission reduction calculation.

Recording frequency:	Average of such data captured in a month is used for the estimation purpose.
Calculation method (if applicable):	
QA/QC procedures applied:	Gauge is tested at least once annually. Gauge Accuracy: $\pm 0.5\%$ Least Count of gauge: 1 kg/ cm ² Refer table 5 for calibration details

Data / Parameter:	T _{FW}
Data unit:	Degree C
Description:	Temperature of the feed water into boiler
Measured /Calculated /Default:	Measured
Source of data:	On-site measurement
Value(s) of monitored parameter:	Measured value (Refer table “Boiler Data” under section D2)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge.
Measuring/ Reading/ Recording frequency:	The data is monitored on hourly basis and logged in the sheet at site. Average of such data captured in a month is used for estimation purpose.
Calculation method (if applicable):	
QA/QC procedures applied:	Gauge is tested at least once annually by a third party. Gauge Accuracy: $\pm 0.25\%$ Least Count: 1 Deg C Refer table 5 for calibration details

Data / Parameter:	Q _{biomass, i, y}
Data unit:	Tonne
Description:	Quantity of biomass of type i transported and combusted in year y
Measured /Calculated /Default:	measured
Source of data:	On-site measurement
Value(s) of monitored parameter:	29506 (Cumulative value for the monitoring period)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Quantity of biomass used in project activity is measured using weighing scale and recorded in log books regularly.
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures applied:	The weighing scale is calibrated periodically by a third party

	Refer table 5 for calibration details
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Data / Parameter:	$Q_{\text{fossil}, i, y}$
Data unit:	Tonne
Description:	Quantity of fossil fuel of type i combusted in year y
Measured /Calculated /Default:	4850 (Cumulative value for the monitoring period)
Source of data:	On-site measurement
Value(s) of monitored parameter:	Measured value
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Quantity of fossil fuel used in project activity is measured using weighing scale and recorded in log books regularly.
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures applied:	The weighing scale is calibrated periodically by a third party Refer table 5 for calibration details

Data / Parameter:	NCV _{biomass, i}
Data unit:	kcal/kg
Description:	Net calorific value of biomass of type i used
Measured /Calculated /Default:	measured
Source of data:	On-site measurement / IPCC default value
Value(s) of monitored parameter:	Measured value ³
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Measurement is done by project proponent through sample testing at the site using bomb calorimeter. The testing is done each time the fuel is procured. An external testing is being done half yearly. Where the test report shows result in GCV, a conversion factor of 95 % is considered to convert GCV into NCV. http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1wb1.pdf
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	

³ NCV of biomass was not monitored from April 2008 to September 2008 because no Bomb calorimeter was available for measurement of NCV of biomass. Monitoring started from October 2008 onwards. Minimum of the NCV value data obtained from in-house test reports and external lab test reports has been considered for the non monitored period of April 2008 to Sep 2008. From October 2008 onwards the average of the monitored values is considered.

QA/QC procedures applied:	Bomb calorimeter is tested internally at site for fuel sample testing.
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Data / Parameter:	NCV _{ff, i}
Data unit:	kcal/kg
Description:	Net calorific value of fossil fuel of type i used
Measured /Calculated /Default:	measured
Source of data:	On-site measurement / IPCC default value
Value(s) of monitored parameter:	4489 ⁴
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Measurement was done by project proponent through sample testing at the site using bomb calorimeter. The testing is done each time the fuel is procured. An external testing was also done half yearly. Where the test report shows result in GCV, a conversion factor of 95 % is considered to convert GCV into NCV. http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1wb1.pdf
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures applied:	Bomb calorimeter is tested internally at site for fuel sample testing.

Data / Parameter:	Q _{biogas, y}
Data unit:	Nm ³
Description:	Amount of biogas combusted in boiler in year y
Measured /Calculated /Default:	measured
Source of data:	Directly measured with gas flow meter installed at site
Value(s) of monitored parameter:	6514325 (Cumulative value for the monitoring period)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	Continuous flow of biogas is recorded in the meter at boiler inlet. The data is recorded on daily basis from the Totalizer and logged in the sheet at site. This is aggregated monthly for calculations. Gas Flow Meter type : Orifice type Accuracy : ±0.25% Refer table 5 for calibration details
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	

⁴ The NCV value for coal is the maximum available value out of, in house and external test report. This is conservative.

QA/QC procedures applied:	Gas flow meter is supplied with the manufacturer calibration certificate. The subsequent calibration is done at least once in 3 years. Gas flow meters undergo maintenance/calibration yearly.
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Data / Parameter:	NCV _{Biogas}
Data unit:	kcal/m ³
Description:	Net calorific value of biogas
Measured /Calculated /Default:	Measured
Source of data:	External laboratory test report.
Value(s) of monitored parameter:	6234 ⁵ Refer worksheet 'Ex-ante and Ex-post values" in ER calculation sheet.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Description of measurement methods and procedures to be applied:	External laboratory tests are conducted on half yearly basis.
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	
QA/QC procedures applied:	

Table 2: Boiler Data

Month	Steam generation in (MT)	Steam temp (deg C)	Steam Pressure (Kg/cm ²)	Feed Water Temperature in Deg C ⁶	Enthalpy of saturated steam (kJ/kg)	Enthalpy of feed water (kJ/kg) ⁷	Quantity of Biogas Consumed ⁸ (Nm ³)
Apr-08	4044.70	203.5	15.28	103.00	2793.38	431.76	157704 ⁹
May-08 ¹⁰							
Jun-08	8777.20	203.2	15.73	102.00	2794.12	427.54	327478
Jul-08 ¹¹							
Aug-08 ¹²	20446.00	203.5	15.71	103.00	2794.09	431.76	396956
Sep-08	6862.00	203.5	15.92	107.00	2794.42	448.67	306707
Oct-08	6500.00	203.5	16.26	105.00	2794.94	440.22	386299
Nov-08	7052.00	203.5	16.19	103.00	2794.83	431.76	320680
Dec-08	7932.00	203.5	16.36	103.00	2795.09	431.76	308005
Jan-09	7568.00	203.5	16.42	102.00	2795.17	427.54	199177
Feb-09	9915.00	203.5	16.18	102.00	2794.82	427.54	280859

⁵ The biogas NCV value is the average value (in kcal/m3) of all available external biogas NCV test reports. NCV values available from the test reports are in unit kcal/kg however as per the PDD the unit is kcal/m3, hence the ex-ante fixed conversion factor is used for the conversion.

⁶ Maximum value of feed water temperature is considered for each month. This is conservative.

⁷ <http://www.spiraxsarco.com/resources/steam-tables/saturated-steam.asp>

⁸ Error of 0.25 % has been considered for the period when calibration is delayed i.e. between April 2008 to September 2008.

⁹ 0.25% error considered in consumed biogas for non calibrated duration of April 2008 to Sep 2008.

¹⁰ Steam generation not considered for this month as data was found to be inconsistent.

¹¹ Steam generation not considered for this month as data was found to be inconsistent.

¹² The steam flow meter was reset in August so on conservative side the initial reading taken as zero.

Mar-09	7150.08 ¹³	202.7	16.23 ¹⁴	102.26 ¹⁵	2795.01 ¹⁶	427.54	178054
Apr-09	8062.00	202.8	16.38	101.00	2795.12	423.32	195542
May-09	8193.00	202.8	16.37	105.00	2795.10	440.22	196407
Jun-09	10672.00	202.8	16.45	106.00	2795.22	444.44	286947
Jul-09	10129.00	202.8	16.46	107.00	2795.23	448.67	304563
Aug-09	9967.00	202.8	16.42	112.00	2795.17	469.85	295660
Sep-09	8319.00	202.9	16.70	99.00	2795.58	414.88	249480
Oct-09							
Nov-09	8582.00	202.9	16.53	101.00	2795.33	423.32	664605
Dec-09	13368.00	202.8	16.62	102.00	2795.46	427.54	374657
Jan-10	13412.00	202.9	16.76	103.00	2795.66	431.76	393989
Feb-10	8977.00	202.8	16.78	103.00	2795.69	431.76	320680
Mar-10	10875.74 ¹⁷	202.8	16.72 ¹⁸	102.26 ¹⁹	2795.72 ²⁰	427.54	369876

Table 3: Baseline emission calculation

As per Para 15, AMS IC Ver. 16

Month	Steam generation (MT)	Energy Gen - Total	Energy Gen - Biogas (TJ)	Energy Gen-Project Activity (TJ)	Baseline Emission (tCO ₂ e)
Apr-08	4044.70	9.55	4.12	5.44	522
May-08 ²¹					
Jun-08	8777.20	20.77	8.55	12.22	1175
Jul-08 ²²					
Aug-08	20446.00	48.30	10.36	37.94	3646
Sep-08	6862.00	16.10	8.01	8.09	778
Oct-08	6500.00	15.31	10.08	5.22	502
Nov-08	7052.00	16.66	8.37	8.29	797
Dec-08	7932.00	18.75	8.04	10.71	1029
Jan-09	7568.00	17.92	5.20	12.72	1222
Feb-09	9915.00	23.47	7.33	16.14	1551
Mar-09	7150.08	16.93	4.65	12.28	1180
Apr-09	8062.00	19.12	5.10	14.02	1347
May-09	8193.00	19.29	5.13	14.17	1361
Jun-09	10672.00	25.09	7.49	17.60	1691
Jul-09	10129.00	23.77	7.95	15.82	1520

¹³ Error of 0.25 % has been considered for the non calibrated period i.e. month of March 2009.

¹⁴ 0.5 % error considered for non calibrating period i.e. month of March 2009.

¹⁵ 0.25 % error considered for this period as feed water temperature gauge not calibrated.

¹⁶ Error of 0.10 % has been considered for the non calibrated period i.e. month of March 2009.

¹⁷ Error of 0.25 % has been considered for the non calibrated period i.e. month of March 2010.

¹⁸ Error of 0.50 % has been considered for the non calibrated period i.e. month of March 2010.

¹⁹ 0.25 % error considered for this period as feed water temperature gauge not calibrated.

²⁰ Error of 0.10 % has been considered for the non calibrated period i.e. month of March 2009.

²¹ Not considered for emission reduction calculation because the steam generation could not be logged correctly and consistently because of steam totalizer display problem.

²² Not considered for emission reduction calculation because the steam generation could not be logged correctly and consistently because of steam totalizer display problem.

Aug-09	9967.00	23.18	7.72	15.46	1486
Sep-09	8319.00	19.81	6.51	13.29	1277
Oct-09					
Nov-09	8582.00	20.36	17.35	3.01	289
Dec-09	13368.00	31.65	9.78	21.87	2102
Jan-10	13412.00	31.70	10.28	21.42	2059
Feb-10	8977.00	21.22	8.37	12.85	1235
Mar-10	10875.74	25.76	9.65	16.10	1547

As per Para 35, AMS IC Ver. 16

Month	Baseline Emission (tCO ₂ e)
Apr-08	662
May-08	-
Jun-08	881
Jul-08	-
Aug-08	1163
Sep-08	204
Oct-08	293
Nov-08	578
Dec-08	679
Jan-09	1021
Feb-09	1229
Mar-09	989
Apr-09	1473
May-09	1565
Jun-09	1950
Jul-09	1980
Aug-09	1855
Sep-09	1594
Oct-09	
Nov-09	2179
Dec-09	2174
Jan-10	2303
Feb-10	1926
Mar-10	2139

Project Emissions calculation:

As per Para 35, AMS IC Ver. 16

Month	Project Emission ²³ (tCO₂ e)
Apr-08	0
May-08	0
Jun-08	0
Jul-08	0
Aug-08	0
Sep-08	0
Oct-08	0
Nov-08	0
Dec-08	0
Jan-09	0
Feb-09	0
Mar-09	0
Apr-09	0
May-09	0
Jun-09	0
Jul-09	0
Aug-09	0
Sep-09	0
Oct-09	0
Nov-09	0
Dec-09	0
Jan-10	0
Feb-10	0
Mar-10	0

As per Para 15, AMS IC Ver. 16

Month	Quantity of coal consumed (MT)	Project Emission (tCO₂ e)
Apr-08	0	0
May-08	119	214
Jun-08	240	433
Jul-08	114	206
Aug-08	1653	2985
Sep-08	427	771
Oct-08	229	414
Nov-08	354	639
Dec-08	498	899
Jan-09	393	710

²³ As per the approach defined in paragraph 35, the project emission is not required to be considered. Hence, it has been considered as Zero.

Feb-09	443	800
Mar-09	316	571
Apr-09	0	0
May-09	0	0
Jun-09	64	116
Jul-09	0	0
Aug-09	0	0
Sep-09	0	0
Oct-09	0	0
Nov-09	0	0
Dec-09	0	0
Jan-10	0	0
Feb-10	0	0
Mar-10	0	0

Leakage:

$$L_y = 0$$

Emission Reductions = Baseline Emissions – Project Emissions - Leakage

Table 4: Overall Emission Reduction

As per Para 35, AMS IC Ver. 16

Month	Baseline Emission (tCO ₂ e)	Project Emission (tCO ₂ e)	Emission Reductions (tCO ₂ e)
Apr-08	662	0	662
May-08	0	0	0
Jun-08	881	0	881
Jul-08	0	0	0
Aug-08	1163	0	1163
Sep-08	204	0	204
Oct-08	293	0	293
Nov-08	578	0	578
Dec-08	679	0	679
Jan-09	1021	0	1021
Feb-09	1229	0	1229
Mar-09	989	0	989
Apr-09	1473	0	1473
May-09	1565	0	1565
Jun-09	1950	0	1950
Jul-09	1980	0	1980
Aug-09	1855	0	1855

Sep-09	1594	0	1594
Oct-09	0	0	0
Nov-09	2179	0	2179
Dec-09	2174	0	2174
Jan-10	2303	0	2303
Feb-10	1926	0	1926
Mar-10	2139	0	2139
Total	28838	0	28838

As per Para 15, AMS IC Ver. 16

Month	Baseline Emission (tCO ₂ e)	Project Emission (tCO ₂ e)	Emission Reductions (tCO ₂ e)
Apr-08	522	0	522
May-08	0	214	-214
Jun-08	1175	433	741
Jul-08	0	206	-206
Aug-08	3646	2985	660
Sep-08	778	771	6
Oct-08	502	414	88
Nov-08	797	639	158
Dec-08	1029	899	129
Jan-09	1222	710	513
Feb-09	1551	800	751
Mar-09	1180	571	609
Apr-09	1347	0	1347
May-09	1361	0	1361
Jun-09	1691	116	1575
Jul-09	1520	0	1520
Aug-09	1486	0	1486
Sep-09	1277	0	1277
Oct-09	0	0	0
Nov-09	289	0	289
Dec-09	2102	0	2102
Jan-10	2059	0	2059
Feb-10	1235	0	1235
Mar-10	1547	0	1547
Total	28317	8760	19556

Final emission reductions:

Month	Emission Reductions (Minimum of Para 15 and Para 35) (tCO₂ e)
Apr-08	522
May-08	-214
Jun-08	741
Jul-08	-206
Aug-08	660
Sep-08	6
Oct-08	88
Nov-08	158
Dec-08	129
Jan-09	513
Feb-09	751
Mar-09	609
Apr-09	1347
May-09	1361
Jun-09	1575
Jul-09	1520
Aug-09	1486
Sep-09	1277
Oct-09	0
Nov-09	289
Dec-09	2102
Jan-10	2059
Feb-10	1235
Mar-10	1547
Total	19,556 (Rounded down)

Comparison of actual emission reductions with estimates in the VCS-PD:

Year	Values applied in ex-ante calculation of the registered PD²⁴ (Emission reductions) (tCO₂e)	Actual values reached during the monitoring period (Emission reductions) (tCO₂e)
2008	34,298	1,886
2009	45,523	12,831
2010	11,225	4,841
Total	91,045	19,556 (Rounded down)

The total emission reductions, for the monitoring period, are 19, 556 tCO₂e against the estimated emission reductions 91,045 tCO₂e.

5. Quality Control (QC) and Quality Assurance (QA)

Data collection procedures:

Data generation: Steam produced is measured by a flow meter cum totalizer.

²⁴ This has been calculated for the period equivalent to proposed monitoring period.

Data recording

Project developer records the various gauge readings as mentioned in section D on hourly basis each month.

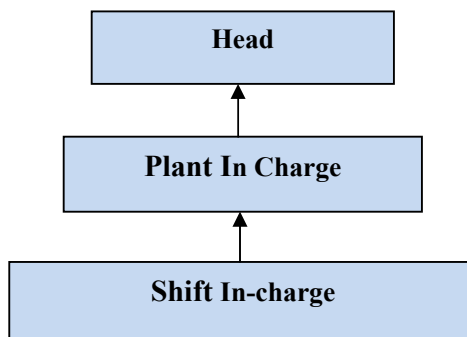
Archiving of data: Data collected as part of monitoring will be archived and kept for at least 2 years after the crediting period or from the last issuance whichever is later.

Calculation:

Reporting: The measured and calculated values are included in an Excel sheet and reported in the CDM MR.

GAEL proposed the following structure for data monitoring, collection, data archiving and calibration of equipments for this project activity. The team comprises of the following members.

1. Head
2. Plant In-charge
3. Shift In-charge



Responsibilities of Head: Overall functioning and maintenance of the project activity.

Responsibilities of Plant In-charge: Responsibility for Maintains the data records, ensures completeness of data, and reliability of data (calibration of equipments).

Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintains day to day log book for monitored data.

Data collection and record keeping: Data is collected at the plant operation site under the supervision of the shift-in-charge and records are maintained in daily logs. The reports are checked periodically by the Plant In-charge and discussed thoroughly with the data monitoring personnel. A separate log is also being maintained for the biomass supply on the site, its storage and usage in the project activity.

Reliability of data collected: The reliability of the measuring equipments is calibrated as per section 3.3 Documents pertaining to testing of equipments is maintained by Plant In-charge.

Archiving of data: Data collected as part of monitoring is archived and kept for at least two years after the crediting period or from the last issuance whichever is later.

Maintenance of instruments and equipments used in data monitoring:

The Operations Department is responsible for the proper functioning of the equipments/instruments and takes a corrective action if found not operating, as required.

Emission reduction calculation: Emission reduction calculations and monitoring report is done annually based on the data collected. This is done by the team. The monitoring report and the emission reduction calculation is maintained by the head for verification.

Emergency preparedness: The project activity does not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Maintenance of instruments and equipments used in data monitoring:

The Operations Department is responsible for the proper functioning of the equipments/instruments and take a corrective action if found not operating, as required. Pressure and Temperature gauges and flow meters of Boiler form a part of the monitoring system of the project activity. The details of the meters are given below:

Table 5: Meters calibration details

Meter Type	Date of testing	Validity of calibration	Serial No	Accuracy Class	Calibration Agency
Mass flow integrating Totalizer ²⁵	10-03-2008 26-03-2009 28-03-2010	One year	10070322	± 0.25%	Authentic Systems & Technologies
Steam Pressure Gauge ²⁶	10-03-2008 26-03-2009 28-03-2010	One year	6390	± 0.5%	Authentic Systems & Technologies
Steam Temp. Gauge	10-03-2008 26-03-2009 28-03-2010	One year	GAEL/BL/89 ²⁷	± 0.25%	Authentic Systems & Technologies
Feed Water Temp Gauge ²⁸	10/03/2008 26/03/2009 28/03/2010	One year	GAEL/BL/90 ²⁹	± 0.25%	Authentic Systems & Technologies
Flow meter – Biogas ³⁰	12-09-08	Three years	MICRO CS-3003-NOT-2	± 0.25%	Alpha Control Instruments Pvt. Ltd

²⁵ Mass flow Totalizer was not calibrated for the period 09/03/09 to 25/03/09 and again from 25/03/10 to 27/03/10 so maximum permissible error of 0.25 % has been considered for the whole month of March 2009 & March 2010 on conservative side.

²⁶ Steam pressure gauge was not calibrated for the period 09/03/09 to 25/03/09 and again from 25/03/10 to 27/03/10 so maximum permissible error of 0.5 % has been considered for the whole month of March 2009 & March 2010 on conservative side.

²⁷ The serial number is not available for steam temperature gauge so internal TAG No. is given as GAEL/BL/89.

²⁸ Feed water temperature gauge was not calibrated for the period 09/03/09 to 25/03/09 and again from 25/03/10 to 27/03/10 so maximum permissible error of 0.25 % has been considered for the whole month of March 2009 & March 2010 on conservative side.

²⁹ The serial number is not available for steam temperature gauge so internal TAG No. is given as GAEL/BL/90.

³⁰ The biogas flow meter was not calibrated for the period from April 2008 to Sep 2008 so maximum permissible error of 0.25 % has been considered for the non calibrating period.

Weighbridge	08-12-06 19-11-08 04-11-09	Periodic ³¹	6637	Class III	Niyantarak Vidhik Maap Vigyan
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The reliability of the meters and gauges is checked by testing on a yearly basis. Documents pertaining to testing of meters are maintained at the site.

1. NCV testing procedure: The testing of coal is carried out by the project proponent through sample testing at the site using bomb calorimeter. The testing is done each time the fuel is procured. An external testing is also being done half yearly. The biogas testing takes place through external laboratory on half yearly basis. The biomass testing also takes place at the site for some fuels using a bomb calorimeter in the laboratory at the project site. An instruction manual is available which serves as the reference document while carrying out all the tests pertaining to the biomass such as moisture content, calorific value of fuel, etc.

³¹ In the project case calibration frequency of Weigh Bridge is not specified in monitoring plan of VCS-PD. However, taking the conservative approach, PP has considered the guidance on calibration of meters for small scale projects which prescribes calibration of meters at least once in 3 years, As per para 12 (c) of EB 35 Annex 35 "Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in 3 years".