PROJECT TITLE: "Biomass based steam generation project by Gujarat Ambuja Exports Ltd"

Document Prepared By **Gujarat Ambuja Exports Limited**

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MONITORING REPORT TITLE

Project Title	Biomass based steam generation project by Gujarat Ambuja Exports Ltd
Version	1.3
Report ID	GAEL/MR/03
Date of Issue	04- March-2014
Project ID	733
Monitoring Period	01-Jan-2013 to 31-Dec-2013 (Both days included)
Prepared By	Gujarat Ambuja Exports Limited
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

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. Biomass (rice husk) will be used to steam for use within the plant premises.

The total emission reductions achieved in this monitoring period is 30,964 tCO_2e.

Description of emission reduction due to implementation of project activity:

Sr. No.	Monitoring Period	Emission Reductions	Status
1.	01/04/2008 – 31/03/2010	19,556	Issued
2.	01/04/2010 – 31/12/2012	69,418	Issued
3.	01/01/2013 – 31/12/2013	30,964	Under Process
Total		**119,938**	

1.2 Sectoral Scope and Project Type

Sectoral Scope: 01**:** "Thermal energy for the user with or without electricity" AMS I-C; Version 16 (EB 51)

Type I : Energy (renewable/non-renewable)

1.3 Project Proponent

Organization name	Gujarat Ambuja Exports Limited
Contact person	**R.K. Gupta**
Title	Sr. General Manager
Address	C-50, ELDECO – SIDCUL Industrial Park Sitarganj – 262 405 Udham Singh Nagar District Uttarakhand (India)
Telephone	
Email	rkgupta@ambujagroup.com

1.4 Other Entities Involved in the Project

No other entities involved in the project activity.

1.5 Project Start Date

28-March-2008 (start date of commercial operation of the plant)

1.6 Project Crediting Period

- **Credit Period:** 10 years and 0 month; fixed
- **Crediting Period**: 01/04/2008 – 31/03/2018

1.7 Project Location

The project is located in Sitarganj, Udhamsingh 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 be given by the Latitude 28º 55´ 43" N and Longitude 79º 42´25" E. Location is depicted in following maps:

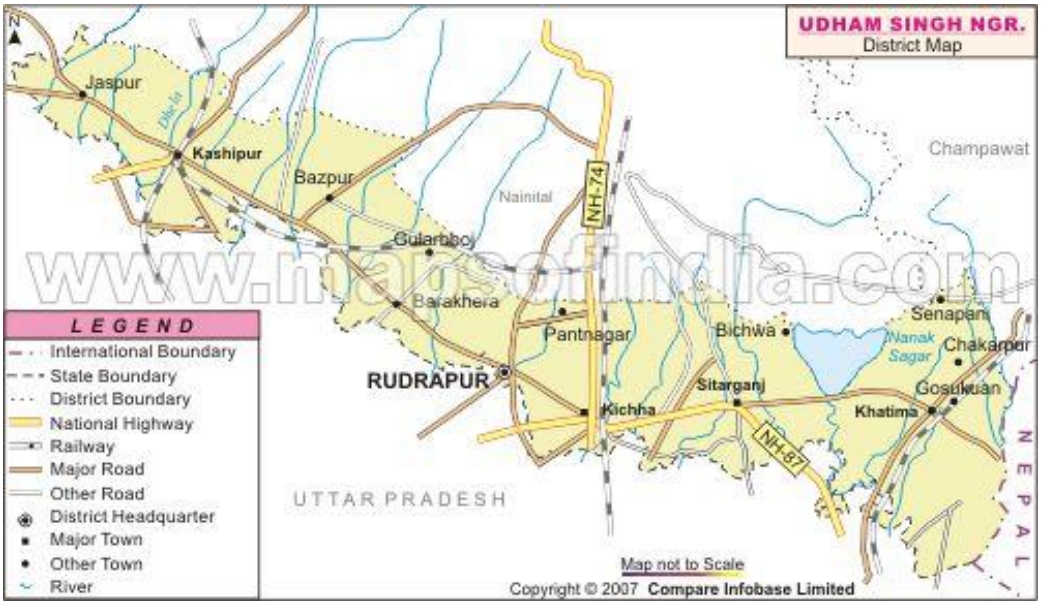


Figure 1: Location of project activity

1.8 Title and Reference of Methodology

Title: "Thermal energy production with or without electricity"
Reference: Category I C of Appendix B of the simplified modalities and procedures for small-scale CDM project activities as mentioned on UNFCCC CDM website.
Sectoral Scope: 1, AMS- I.C. version 16, EB 51[1]

1.9 Other Programs

The net GHG emission reductions or removals generated by the project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions.

[1] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN

The project has been purely taken up as VCS project and has not been applied for any form of environmental credit. The project is registered at VCS with a Project ID 733. The project activity is claiming credits under the VCS program for the crediting period (01/04/2008 to 31/03/2018).

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

Description

The project activity involves setting up a biomass-based boiler of capacity 30 TPH in the agro processing manufacturing facility of the project proponent. The biogas generated due to anaerobic digestion of wastewater in the plant is also co-fired along with biomass in the boiler. The steam produced from the boiler is consumed in process. The project reduces green house gas emission by combusting surplus biomass residue (rice husk) available in the region thereby substituting consumption of fossil fuel.

Technical specifications of the project activity

Parameter	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

The Starting date of project activity is 28 March 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	Breakdown/Shutdown	Boiler Downtime	Reasons
Jan-2013	Breakdown	11hr30min.	Power cut
	Breakdown	1hrs.25min.	Power cut
	Breakdown	50min.	ID fan tripped due to VFD problem
	Breakdown	1hrs.	Power cut
	Breakdown	03hrs.05min.	F.D. Fan's V.F.D. Problem
	Breakdown	2hrs.30min..	Power cut
	Breakdown	03hr.25min.	Power cut & checking of Flue gas path
Feb-2013	Breakdown	01hr.40 min.	Power cut
	Breakdown	21hr.20Min.	Boiler bank tube leakage
	Breakdown	24hr.	Boiler bank tube leakage
	Breakdown	16hr.30 min.	Boiler bank tube leakage
	Breakdown	02hr..	Power cut
	Shutdown	16hr45min.	Boiler bank tube leakage
	Breakdown	01hr 35min.	Power cut
March-2013	Breakdown	01hr.55min.	Power cut
April-2013	Shutdown	3hr 30min.	ID fan"s VFD changed
	Breakdown	01hr.05 min.	Power cut
	Breakdown	14hr.35min.	Furnace nozzle broken
May-2013	Breakdown	09hr.45min.	Boiler bank tube leakage
June-2013	Breakdown	03hr.	Furnace problem
	Breakdown	02hr.	Bunker empty
	Shutdown	01hr.30min.	Boiler inspection and checking
	Breakdown	17 hr.	Boiler bank tube leakage
	Breakdown	05hr.20min.	Electrical fault

	Breakdown	01hr.	PA line jam
	Breakdown	1 hr.	Power cut
	Breakdown	17hr.30 min.	Electrical fault
	Breakdown	24hr.	Electrical fault
	Breakdown	24hr.	Electrical fault
	Breakdown	24hr.	Electrical fault
	Breakdown	11hr.	Electrical fault
	Breakdown	01hr.05 min.	Power cut
	Breakdown	02hr.30min.	ID fan tripped
July-2013	Breakdown	01hr.20 min.	Banker empty
	Breakdown	03hr.10min	Power cut & ID Fan tripped
	Shutdown	01hr 07min.	Due to problem in plant
	Shutdown	01hr 35min.	Due to problem in plant
	Breakdown	01hr.10min.	Power cut
	Breakdown	05hr.50min.	Power cut
	Breakdown	01hr 20min.	I.D fan tripped
	Breakdown	02hr.45 min.	Power cut
	Breakdown	03hr.	Power cut
	Breakdown	02hr.35min.	Power cut
	Breakdown	21hr.30min.	Boiler bank tube leakage
	Breakdown	02hr.35 min.	Power cut
	Breakdown	08hr.55min.	Power cut and ID fan tripped
Aug-2013	Breakdown	02hr.	Elevator No.02&03 under maintenance
	Breakdown	02hr.30 min.	Bunker empty
	Breakdown	03hr.30min	Power cut
	Breakdown	01hr.20min.	ID fan tripped
	Breakdown	03hr.45min	Power cut

	Shutdown	20 hr.	Due to maintenance Work.
	Shutdown	192hr.	Due to maintenance Work.
Sep-2013	Shutdown	461 hr.	Due to Boiler maintenance Work.
	Breakdown	01hr45min	Due to power cut
Oct-2013	Breakdown	01hr.15min.	Chain broken of under bed no.3
	Breakdown	01hr.30min.	Boiler drum level problem
Nov-2013	Breakdown	05hr.40min	Due to problem in plant
	Shutdown	01hr.20min.	Due to leakage in steam line in starch plant
	Breakdown	01hr	Due to problem in plant
	Breakdown	01hr.45min	Due to power cut
Dec-2013	Breakdown	01hr.30min.	Due to problem in plant

Month	Breakdown/Shutdown	ETP Downtime hrs	Reason
Aug-2013	Shutdown	188hrs	Due to plant shutdown
Sep-2013	Shutdown	36 hrs	Due to plant shutdown

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

2.2 Deviations

2.2.1 Methodology Deviations

No deviation is taken during the current monitoring period

2.2.2 Project Description Deviations

No deviation is taken during the current monitoring period

2.3 Grouped Project

The specified project is not a part of a grouped project

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	$\eta_{BL, Thermal}$
Data unit	%
Description	Efficiency of baseline coal fired boiler
Source of data	Default value
Value applied:	100%
Justification of choice of data or description of measurement methods and procedures applied	A maximum of 100% is assumed in the baseline emission calculation as per the methodology which is a conservative value.
Purpose of the data	Calculation of Baseline emission
Comments	This parameter is fixed ex-ante

Data / Parameter	$\eta_{BL, Thermal}$
Data unit	%
Description	Efficiency of biomass fired boiler
Source of data	As per supplier information
Value applied:	80%
Justification of choice of data or description of measurement methods and procedures applied	As per supplier information
Purpose of the data	Calculation of Baseline emission
Comments	This parameter is fixed ex-ante

Data / Parameter	EF_i
Data unit	tCO_2e/ TJ
Description	Emission factor for fossil fuel i
Source of data	IPCC default value of coal
Value applied:	96.1

Justification of choice of data or description of measurement methods and procedures applied	IPCC default value. Ref: 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Purpose of the data	Calculation of Baseline & Project emission
Comments	This parameter is fixed ex-ante

Data / Parameter	$SEC_{Biomass, PJ, y}$
Data unit	kJ/ kJ steam
Description	Specific .Energy Consumption - Biomass
Source of data	Calculated Value
Value applied:	1.25
Justification of choice of data or description of measurement methods and procedures applied	As per registered PD calculation method of specific energy consumption of biomass is $SEC_{Biomass, PJ, y} = (\sum FC_{Biomass, PJ, y} * NCV_{Biomass, y}) / EG_{PJ,y}$ = (57117.8*1000*2930* 4.1868)/ (70662000*7920) = 1.25
Purpose of the data	Calculation of Project emission
Comments	This parameter is fixed ex-ante

Data / Parameter	$SEC_{Coal, PJ, y}$
Data unit	kJ/ kJ steam
Description	Specific .Energy Consumption - Coal
Source of data	Calculated Value
Value applied:	1.00
Justification of choice of data or description of measurement methods and procedures applied	As per registered PD calculation method of specific energy consumption of coal is

	$SEC_{Coal, PJ, y} = (\sum FC_{Coal, PJ, y} * NCV_{Coal, y}) / EG_{PJ,y}$ $=(31350.8*1000*4271*4.1868)/(70662000*7920)$ $= 1.00$[2]
Purpose of the data	Calculation of Project emission
Comments	This parameter is fixed ex-ante

3.2 Data and Parameters Monitored

Data / Parameter	Q_{steam}
Data unit	Tonne
Description	Quantity of steam generated
Source of data	Onsite measurement
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 the basis for estimations.
Frequency of monitoring/recording	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	169,860 (Cumulative value for the monitoring period)
Monitoring equipment	Mass flow integrating totalizer
QA/QC procedures to be applied	Steam flow meter is calibrated/ tested annually independently by a third party. Meter accuracy: ±3%[3] Least Count: 0.1 tonne Refer appendix 2 for calibration details.
Purpose of the data	Calculation of Baseline emission
Calculation method	Not applicable
Comments	There is no impact on the emission reduction calculation due to steam flow meter accuracy

[2] Efficiency of coal combustion is considered 100% for most conservative estimations

[3] As per manufacturer specification (http://www.manasmicro.in/pdf/orifice-flow-meter.pdf)

	class.

Data Unit / Parameter:	T_{steam}
Data unit:	Degree C
Description:	Temperature of the steam generated
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge. 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.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	Refer appendix 3.
Monitoring equipment:	Steam Temperature Gauge
QA/QC procedures to be applied:	Gauge is tested at least once annually as per manufacturer's prescribed standards. Gauge Accuracy: ±1%[4] Least count: 1 Degree C Refer appendix 2 for calibration details.
Purpose of the data	Calculation of Baseline emission
Calculation method:	Not applicable
Any comment:	Not applicable

Data Unit / Parameter:	P_{steam}
Data unit:	kg/cm^2
Description:	Pressure of the steam generated
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Measured using on-site pressure gauge. 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.

[4]As per manufacturer specification

Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	Refer appendix 3.
Monitoring equipment:	Steam Pressure Gauge
QA/QC procedures to be applied:	Gauge is tested at least once annually. Gauge Accuracy: ±4%[5] Least Count of gauge: 1 kg/ cm^2 Refer appendix 2 for calibration details.
Purpose of the data	Calculation of Baseline emission
Calculation method:	Not applicable
Any comment:	There is no impact on the emission reduction calculation due to steam pressure gauge accuracy class.

Data Unit / Parameter:	T_{FW}
Data unit:	Degree C
Description:	Temperature of the feed water into boiler
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Measured using on-site temperature gauge. 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.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	Refer appendix 3.
Monitoring equipment:	Feed Water Temp Gauge
QA/QC procedures to be applied:	Gauge is tested at least once annually by a third party. Gauge Accuracy: Class A,B[6] There are two resistance tolerances specified

[5]Maximum accuracy class observed in pressure gauge(http://www.wika.co.in/upload/DS_IN0002_GB_1372.pdf)

[6] As per manufacturer specification (http://www.miepl.com/Product.aspx?Subcategory_ID=3&Product_ID=67)

	in DIN/IEC751: Class A = ±(0.15 + 0.002*t)°C or 100.00 ±0.06 at 0°C Class B = ±(0.3 + 0.005*t)°C or 100.00 ±0.12 at 0°C[7] Least Count: 1 Degree C Refer appendix 2 for calibration details.
Purpose of the data	Calculation of Baseline emission
Calculation method:	Not applicable
Any comment:	Not applicable

Data Unit / Parameter:	$Q_{biomass, i,y}$
Data unit:	Tonne
Description:	Quantity of biomass of type i = rice husk transported and combusted in year y
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Quantity of biomass used in project activity would be measured using weighing scale and recorded in log books regularly.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	33,239.40 (Cumulative value for the monitoring period)
Monitoring equipment:	Weighbridge
QA/QC procedures to be applied:	The weighing scale is calibrated periodically by a third party[8].
Purpose of the data	Calculation of Baseline emission
Calculation method:	Not applicable
Any comment:	Not applicable

[7] http://www.omega.co.uk/temperature/pdf/pt100_tolerance.pdf

[8] 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”.

Data Unit / Parameter:	$Q_{fossil, i,y}$
Data unit:	Tonne
Description:	Quantity of fossil fuel of type i = coal combusted in year y
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Quantity of fossil fuel used in project activity would be measured using weighing scale and recorded in log books regularly.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	3,248.04 (Cumulative value for the monitoring period)
Monitoring equipment:	Weighbridge
QA/QC procedures to be applied:	The weighing scale is calibrated periodically by a third party[9]. Refer appendix 2 for calibration details.
Purpose of the data	Calculation of Project emission
Calculation method:	Not applicable
Any comment:	Not applicable

Data Unit / Parameter:	$NCV_{biomass, i}$
Data unit:	kcal/kg
Description:	Net calorific value of biomass of type i = rice husk used
Source of data:	On-site measurement
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 also done half yearly.

[9] 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”.

Frequency of monitoring/recording:	Monitoring frequency : On every procurement Recording Frequency : On every procurement
Value monitored:	Measured value[10]
Monitoring equipment:	Bomb calorimeter
QA/QC procedures to be applied:	Bomb calorimeter is tested internally at site for fuel sample testing.
Purpose of the data	Calculation of Baseline & Project emission
Calculation method:	Not applicable
Any comment:	Not applicable

Data Unit / Parameter:	$NCV_{ff,\,i}$
Data unit:	kcal/kg
Description:	Net calorific value of fossil fuel of type i = coal used
Source of data:	On-site measurement
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 was also done half yearly. Maximum value out of "maximum value obtained from external test report's and "weighted average NCV of coal" during the monitoring period is used for emission reduction calculation.
Frequency of monitoring/recording:	Monitoring frequency : On every procurement Recording Frequency : On every procurement
Value monitored:	Coal : 4063.25[11] Diesel: No diesel was used in current monitoring period.

[10] For determining NCV of biomass in-house testing is done for the monitoring period Jan 2013 to Dec 2013. From Jan 2013 to Dec 2013 monthly average NCV value is used for calculation.

[11] Maximum value out of "maximum value obtained from external test report's and "weighted average NCV of coal" during the monitoring period is used for emission reduction calculation.

Monitoring equipment:	Bomb calorimeter
QA/QC procedures to be applied:	Bomb calorimeter is tested internally at site for fuel sample testing.
Purpose of the data	Calculation of Project emission
Calculation method:	Not applicable
Any comment:	Not applicable

Data Unit / Parameter:	$Q_{biogas,y}$
Data unit:	Nm^3
Description:	Amount of biogas combusted in boiler in year y
Source of data:	Directly measured with gas flow meter installed at site
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 for a month for monthly calculations. Gas Flow Meter type : Orifice type Accuracy : ±0.25% Refer appendix 2 for calibration details.
Frequency of monitoring/recording:	Monitoring frequency : Continuously Recording Frequency : Daily
Value monitored:	663,993 (Cumulative value for the monitoring period)
Monitoring equipment:	Biogas flow meter
QA/QC procedures to be 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.
Purpose of the data	Calculation of Baseline emission
Calculation method:	Not applicable
Any comment:	The volume is normalized to take Normal temperature and pressure into account.

Data Unit / Parameter:	NCV_{Biogas}

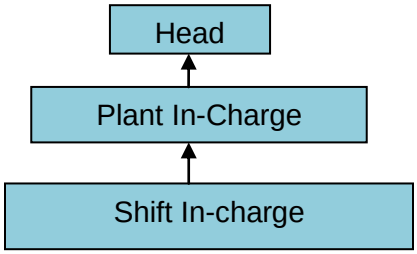
Data unit:	kcal/m^3
Description:	Net calorific value of biogas
Source of data:	External laboratory test report.
Description of measurement methods and procedures to be applied:	External laboratory tests are conducted on half yearly basis.
Frequency of monitoring/recording:	Half yearly basis
Value monitored:	**Date of testing** / **NCV (kcal/kg)** 15-01-2013 / 5589.5 13-07-2013 / 5574 **Average** / **5581.75**
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Purpose of the data	Calculation of Baseline & Project emission
Calculation method:	Not applicable
Any comment:	Not applicable

3.3 Monitoring Plan

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

Organizational Structure for Monitoring



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 source: 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 be 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 3.2 Documents pertaining to testing of equipments shall be maintained by Plant In-charge.

Archiving of data: Data collected as part of monitoring is archived and kept for at least 2 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 take 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 are 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.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The baseline for the project activity is steam generation using coal, therefore baseline emission is calculated as per Para 15 of the small scale methodology AMS I. C version 16.

Baseline emission (BE_y):

As per the methodology, baseline emissions for this case should be calculated as:

As per Para 35, AMS IC Ver. 16

$$BE_{Cofire,y} = (FC_{biomass,k,y} * NCV_{biomass,k,y} * EF_{BL}) / (SEC_{PJ,j,y} * \eta_{BL})$$

Where,

$BE_{Cofire,y}$ = Baseline emissions during the year *y* in tCO_2

$FC_{biomass,k,y}$ = Quantity of biomass type *k* combusted during the year *y* in volume or mass unit

$NCV_{biomass,k,y}$ = Average net calorific value of biomass type *k* combusted during the year *y* in TJ per unit volume or mass unit

EF_{BL} = CO_2 emission factor of the fossil fuel that would have been used in the baseline co-fired plant established using three years average historical data (tCO_2 / MWh)

$SEC_{PJ, j,y}$ = Specific energy consumption of fuel type *j* of the project activity in year *y* in TJ/MWh

η_{BL} = Energy efficiency of the equipment that would have been used in the baseline

As per Para 15, AMS IC Ver. 16

$$BE_{Thermal, CO2, y} = (EG_{Thermal, Biomass, y} / \eta_{BL, Thermal}) * EF_{FF, CO2}$$

Where,

$BE_{Thermal, CO2, y}$ = the baseline emissions from steam/heat displaced by the project activity during the year y; tCO_2e

$EG_{Thermal, Biomass, y}$ = the net quantity of steam/heat supplied by the project activity through biomass during the year y; TJ

$EF_{FF, CO2}$ = The CO_2 emission factor of the fossil fuel that would have been used in the baseline plant; tCO_2 / TJ, obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used

$\eta_{BL, Thermal}$ = the efficiency of the plant using fossil fuel that would have been used in the absence of the project activity

$$EG_{Thermal, Biomass, y} = EG_{Thermal, y} - EG_{Biogas, y}$$

$EG_{Thermal, y}$ = Total steam/ heat supplied by the project activity during the year y; TJ

$EG_{Biogas, y}$ = Total steam / heat supplied to project activity through biogas during the year y; TJ

Sample calculation of baseline emissions for the month of Jan 2013

As per Para 35, AMS IC Ver. 16

$BE_{Cofire,y} = (FC_{biomass, k, y} * NCV_{biomass, k, y} * EF_{BL}) / (SEC_{PJ, j,y, measured} * \eta_{BL})$

= (3532*1000*3496*4.1868 * 96.1)/ (1.25 * 100% *10^9)

= 3974.04 tCO2e

As per Para 15, AMS IC Ver. 16

$EG_{Thermal, Biomass, y} = (EG_{Thermal, y} - EG_{Biogas, y}) * EF_{Correction}$

= [{18931*(2794.38 – 401.43)}-{22132*6754*4.1868}] /10^9

= 44.68 TJ

$BE_{Thermal, CO2, y}$ = $(EG_{Thermal, Biomass, y} / \eta_{BL, Thermal})* EF_{FF, CO2}$

= (44.68/100%) * 96.1

= 4293.28 tCO_2e

The detailed worksheet of baseline emission calculation is given in appendix 4.

4.2 Project Emissions

There are no project activity emissions as this is a renewable project activity. However, small quantity of fossil fuel would be used for start up the boiler. Project emissions on account of use of fossil fuel would be considered and monitored.

Project Emissions due to Auxiliary Fuel (e.g. Coal) Consumption is estimated as per the following equation:

$$PE_y = \Sigma FF_{i, y} X NCV_i X EF_i$$

Where

PF_y =Project emissions from on-site fossil fuel combustion in year y, tCO_2e

$\Sigma FF_{i, y}$ =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, tCO_2/ TJ

Sample calculation of project emission for the month of Jan 2013

As per Para 35, AMS IC Ver. 16

PEy = 0

As per Para 15, AMS IC Ver. 16

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

= $(0*4063*4.1868*96.1)/10^6$

=0 tCO_2e

The detailed worksheet of project emission calculation is given in appendix 5.

4.3 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

4.4 Net GHG Emission Reductions and Removals

Sample calculation of Emission Reductions for the month of Jan 2013

$ER_y = BE_y – PE_y – L_y$

BE_y = Baseline Emissions as calculated in Section 4.1

PE_y = Project emissions as calculated in Section 4.2

L_y = Leakages = 0

As per Para 35, AMS IC Ver. 16

ER_y = 3974.04 – 0 - 0

= 3974.04 tCO_2e

As per Para 15, AMS IC Ver. 16

ER_y = 4293.28 – 0 - 0

= 4293.28 tCO_2e

So final emission reductions for month of Jan 2013

= Min (tCO_2e as per Para 35, tCO_2e as per Para 15)

= Min (3974.04 tCO_2e, 4293.28 tCO_2e)

= 3974.04 tCO_2e

The detailed worksheet of overall emission reduction calculation is given in appendix 6.

APPENDIX 1: ANNUAL EMISSION REDUCTION

Annual emission reductions estimated as per PD = 45,523 tCO_2e

Year	No. of Days	Values applied in ex-ante calculation of the registered PD (tCO_2e)	Actual values reached during the monitoring period (tCO_2e)
2013 (01/01/2013 - 31/12/2013)	365	45,523	30,964
Total		**45,523**	**30,964**[12]

Total emission reductions, for the monitoring period (01/01/2013 – 31/12/2013) are 30,964 tCO_2e against the estimated emission reductions 45,523 tCO_2e.

[12] Rounded down value

APPENDIX 2 : METER CALIBRATION

Meter Type	Date of testing	Due date of testing	Validity of calibration	Serial No	Accuracy Class	Calibration Agency
Mass flow integrating Totalizer	20-03-2012	19-03-2013	One year	10070322	± 3%	Winmet technologies Pvt. Ltd.
	09-03-2013	08-03-2014				
Steam Pressure Gauge	20-03-2012	19-03-2013	One year	6390	± 4%	Winmet technologies Pvt. Ltd.
	09-03-2013	08-03-2014				
Steam Temp. Gauge	20-03-2012	19-03-2013	One year	GAEL/BL/89	± 1%	Winmet technologies Pvt. Ltd.
	19-03-2013	18-03-2014				
Feed Water Temp Gauge	20-03-2012	19-03-2013	One year	GAEL/BL/90	± 1%	Winmet technologies Pvt. Ltd.
	09-03-2013	08-03-2014				
Flow meter – Biogas	06-09-2011	05-09-2014	Three years	10070323	± 0.25%	Winmet technologies Pvt. Ltd.
Weighbridge	08-11-2012	07-11-2013	Periodic[13]	6637	Class III	Vidhik Maap Vigyan Niyantarak
	08-11-2013	07-11-2014				

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.

[13] 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”.

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.

   Bomb calorimeter in house calibration details:

Sr. No.	Bomb Calorimeter Calibration Dates
1.	12-10-2012
2.	09-10-2013

APPENDIX 3: BOILER DATA

Month	Steam generation (MT)	Steam temperature Deg C[$]	Steam Pressure (Kg/cm^2)	Feed Water Temperature Deg C[$$]	Enthalpy of Saturated steam (kJ/kg)*	Enthalpy of feed water (kJ/kg)**
	Q_{steam}	T_{steam}	P_{steam}	$T_{feed\ water}$		
Jan-13	18931	203.2	15.90	95.81	2794.38	401.43
Feb-13	14856	200.4	15.15	93.47	2792.79	391.57
Mar-13	16584	198.2	14.90	94.10	2791.46	394.23
Apr-13	14905	197.9	14.91	93.08	2791.27	389.93
May-13	16725	197.9	14.98	91.89	2791.27	384.92
Jun-13	13046	197.6	14.77	88.56	2791.09	370.91
Jul-13	15115	196.1	13.32	87.67	2790.12	367.17
Aug-13	9764	195.4	12.45	90.23	2789.66	367.17
Sep-13	4112	197.9	14.99	94.29	2791.27	395.03
Oct-13	10863	198.0	14.97	93.30	2791.34	390.86
Nov-13	16365	198.0	15.00	95.00	2791.34	398.02
Dec-13	18594	198.0	14.98	92.52	2791.34	387.57
Total	**169860**					

* http://www.spiraxsarco.com/resources/steam-tables/saturated-steam.asp
** http://www.spiraxsarco.com/resources/steam-tables/saturated-water.asp
$ Actual error is higher than the prescribed error limit provided by the manufacturer.On conservative site PP considered actual error of 1.6% for the entire monitoring period as per latest calibration certificate (dated 19/03/2013).
$$ Actual error is lower than the prescribed error limit provided by the manufacturer.On conservative site PP considered maximum error of 1% for the entire monitoring period.

APPENDIX 4: BASELINE EMISSION CALCULATION

As per Para 15, AMS IC Ver. 16

Month	Steam generation (MT)	Energy Gen - Total (TJ)	Energy Gen - Biogas (TJ)	Energy Gen- Project Activity (TJ)	Baseline Emission (tCO_2 e)
Jan-13	18931	45.30	0.6	44.68	4293.28
Feb-13	14856	35.67	0.7	34.93	3356.82
Mar-13	16584	39.76	0.5	39.21	3768.07
Apr-13	14905	35.79	0.8	35.03	3366.71
May-13	16725	40.25	4.8	35.45	3406.32
Jun-13	13046	31.57	1.8	29.80	2863.39
Jul-13	15115	36.62	2.8	33.78	3246.44
Aug-13	9764	23.65	1.3	22.37	2150.13
Sep-13	4112	9.85	1.6	8.28	795.81
Oct-13	10863	26.08	2.1	24.00	2306.67
Nov-13	16365	39.17	0.8	38.42	3691.77
Dec-13	18594	44.70	1.0	43.69	4198.34
Total	**169860.00**	**408.41**	**18.78**	**389.63**	**37443.76**

As per Para 35, AMS IC Ver. 16

Month	Baseline Emission (tCO_2 e)
Jan-13	3974.04
Feb-13	3294.84
Mar-13	3692.66
Apr-13	3329.27
May-13	3221.29
Jun-13	2566.24
Jul-13	2656.00
Aug-13	1792.39
Sep-13	1632.23
Oct-13	3615.83
Nov-13	3594.73
Dec-13	3430.56
Total	**36800.07**

APPENDIX 5: PROJECT EMISSION CALCULATION

As per Para 35, AMS IC Ver. 16

Month	Project Emission (tCO_2 e)[#]
Jan-13	0
Feb-13	0
Mar-13	0
Apr-13	0
May-13	0
Jun-13	0
Jul-13	0
Aug-13	0
Sep-13	0
Oct-13	0
Nov-13	0
Dec-13	0
Total	**0**

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

Project Emission (PE_y) as per Para 15, AMS IC Ver. 16

Month	Quantity of coal consumed (MT)	Project Emission (tCO_2 e)
Jan-13	0.00	0.00
Feb-13	0.00	0.00
Mar-13	0.00	0.00
Apr-13	0.00	0.00
May-13	0.00	0.00
Jun-13	245.00	400.54
Jul-13	913.00	1492.62
Aug-13	855.00	1397.80
Sep-13	210.00	343.32
Oct-13	575.00	940.04
Nov-13	280.00	457.76
Dec-13	170.04	277.99
Total	**3248.04**	**5310.07**

APPENDIX 6: OVERALL EMISSION REDUCTION

As per Para 15, AMS IC Ver. 16

Month	Baseline Emission (tCO_2 e)	Project Emission (tCO_2 e)	Emission Reductions (tCO_2 e)
Jan-13	4293.28	0.00	4293.28
Feb-13	3356.82	0.00	3356.82
Mar-13	3768.07	0.00	3768.07
Apr-13	3366.71	0.00	3366.71
May-13	3406.32	0.00	3406.32
Jun-13	2863.39	400.54	2462.85
Jul-13	3246.44	1492.62	1753.82
Aug-13	2150.13	1397.80	752.33
Sep-13	795.81	343.32	452.49
Oct-13	2306.67	940.04	1366.63
Nov-13	3691.77	457.76	3234.01
Dec-13	4198.34	277.99	3920.35
Total	**37443.76**	**5310.07**	**32133.68**

As per Para 35, AMS IC Ver. 16

Month	Baseline Emission (tCO_2 e)	Project Emission (tCO_2 e)	Emission Reductions (tCO_2 e)
Jan-13	3974.04	0.00	3974.04
Feb-13	3294.84	0.00	3294.84
Mar-13	3692.66	0.00	3692.66
Apr-13	3329.27	0.00	3329.27
May-13	3221.29	0.00	3221.29
Jun-13	2566.24	0.00	2566.24
Jul-13	2656.00	0.00	2656.00
Aug-13	1792.39	0.00	1792.39
Sep-13	1632.23	0.00	1632.23
Oct-13	3615.83	0.00	3615.83
Nov-13	3594.73	0.00	3594.73
Dec-13	3430.56	0.00	3430.56
Total	**36800.07**	**0.00**	**36800.07**

Final emission reductions:

Month	Emission Reductions (Minimum of para 15 and para 35) (tCO_2 e)
Jan-13	3974.04
Feb-13	3294.84
Mar-13	3692.66
Apr-13	3329.27
May-13	3221.29
Jun-13	2462.85
Jul-13	1753.82
Aug-13	752.33
Sep-13	452.49
Oct-13	1366.63
Nov-13	3234.01
Dec-13	3430.56
Total	**30964**[14]

[14] Rounded down value