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

Document Prepared By **Gujarat Ambuja Exports Limited**

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Project Title	Biomass based steam generation project by Gujarat Ambuja Exports Ltd
Version	1.1
Report ID	GAEL/MR/02
Date of Issue	28-March-2013
Project ID	733
Monitoring Period	01-Apr-2010 to 31-Dec-2012 (Both days included)
Prepared By	Gujarat Ambuja Exports Limited
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1 PROJECT DETAILS

1.1 Summary Description of 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 69,418 tCO_2 e.

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

Roles and Responsibilities:

The project proponent is responsible for maintenance of all the monitoring equipment. The proponent is also responsible for recording the data and makes the data available to the DOE during validation and verification.

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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:

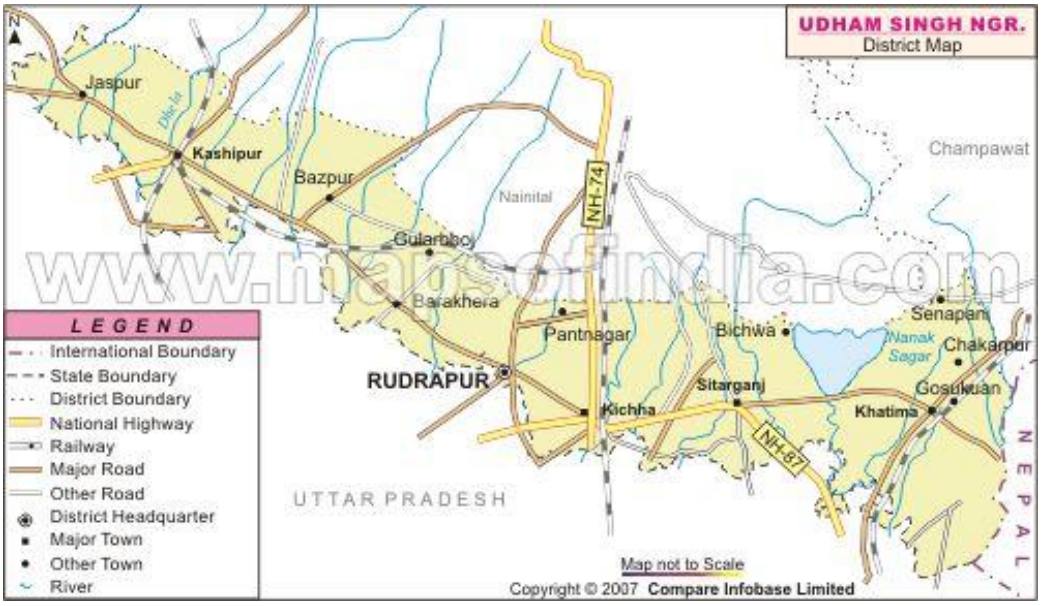


Figure 1: Location of project activity

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]

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The Starting date of project activity is 28 March 2008. The various commissioning dates related to the project are tabulate below:

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

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	Reasons
April-2010	6hr 45min.	P.A fan's bearing damage
	10 hr	Boiler shut down
May-2010	5hrs.	ID Fan's both bearing problem
	1hr15min.	Boiler main valve gland leakage
	1hrs.	P.A. fan's bearing problem
	1hrs.	F.D. Fan's V.F.D. Chock problem
June-2010	1hr. 15Min.	Drum level controller problem
July-2010	5hr.30min.	Feed water control valve problem
	5 hrs	Air box problem
Aug-2010	1hr. 20Min.	ID fan trip
	68 hrs	Fluidized bed problem
	10 hrs.	Boiler shut down
Sep-2010	4hr.	Control valve problem
	2 hr. 45 min.	labour problem
	11 hrs.	Fluidized bed problem
	38 hrs.	Fuel feeding problem
	1hr. 20Min.	banker empty
Oct-2010	7 hr 20 min.	bed problem clinker formed
	5 hrs	Boiler down due to empty bunker
	8 hrs.	Bed problem because of clinker formation
	7 hr	Plant shutdown
Nov-2010	6hr 45min.	Furnace bed temp. down.
	49 hr. 50 min.	furnace clinker formation
	3 hr. 20 min.	banker empty & feeder no.02 B/D
	2 hr.	bed temp. came down
	23hr.40 min.	bunker fired/ elevator conveyer belt burnt
	5hr.35min.	bed fluidization problem
Dec-2010	10 hr.	motor terminal box broken of PA fan
Feb-2011	2 hr.	wind box bed material jam and nonstop valve gland leakage
March-2011	1 hr.	wind box jam by sand
	34 hrs.	Plant shut down (preventive maintenance)
	1 hr.30 min.	Main stop valve gland leakage.
April-2011	1 hr.15 min.	banker empty
	31 hrs.	Plant shut down (preventive maintenance)

	3hr.45min.	FD fan tripped
May-2011	4hr. 45 min.	V.F.D. Of feeder problem
	5hr.15 min.	bearing and plumber block broken
	10 hr.35 min.	banker empty
	3hr 30 min.	ID fan chock problem.
June-2011	1 hr.	banker empty
	3hr05min.	banker empty and bed disturb
	1 hr.	due to very low load
	7hr 05min.	banker empty
	2 hr.40 min.	power cut
	30 hr.30 min.	due to bed disturb
July-2011	1 hr.30 min.	P.A fan's motor problem
	4hr.40 min.	banker empty
	23 hr 30min.	bed clinker problem
	8 hr.30 min.	bed problem
Aug-2011	2 hr.55 min	banker empty
	425 hrs	boiler shut down for maintenance work
Sep-2011	4 hr.	power cut & feeder's m.s plate cut
	1 hr.	power cut
	9 hr.35 min.	power supply problem
	3 hr.	Power cut and FD fan trip.
	17 hr.30 min.	Economizer Coil. Leakage
Oct-2011	1 hr. 50 min.	new steam flow meter sensor changed
	72 hrs.	Plant shut down (preventive maintenance)
Dec-2011	6hr 20 min.	power cut
	1 hr.	ID fan tripped
Jan-2012	10 hrs.40 min	power cut & ID Fan tripped
Feb-2012	30 hr 35 min	Economizer Coil. Leakage
	03 hr 25min	P.A fan's bearing broken
March-2012	4hr 25 min	I.D fan tripped & power cut
	59 hrs.	Plant shut down (preventive maintenance)
	1 hr.	power cut
April-2012	8 hr.30 min.	boiler furnace come down due to over bed feeding
	5 hr 20 min.	feed water pump no 01& 02 motor problem
	6 hr30min.	P.A fan motor problem & banker empty
	3hr30 min.	boiler main breaker problem
May-2012	8 hr.50 min.	PA fan's motor problem
	1 hr20min.	F.D fan's V.F.D problem
June-2012	1 hr.10 min.	F.D fan V.F.D problem
	15hr	boiler bank tube both side leakage
July-2012	1 hr.15min.	FD fan's V.F.D problem
	2 hr15min.	no power due to electrical panel problem
	8 hr.15 min.	electrical problem in breaker
	22 hrs.	Plant shut down (preventive maintenance)
	7 hr 05min	power problem
Aug-2012	14 hr 50min.	power problem
	2hr.60min.	boiler bed problem

	10 hr.	boiler bed problem due to clinker
	1 hr.15min.	P.A fan and gas engine tripped
	10 hr.	boiler APH cleaning
Sep-2012	7 hr 45min	power problem
	2 hr.35 min.	banker empty
	16 hr 45min	boiler bank tube leakage
	3hr.55min.	banker empty
Oct-2012	1 hr.	I.D fan tripped
	138 hrs.	Boiler annual shut down
	2 hr.50min	I.D fan's bearing problem
	3 hr. 25min.	Power problem in ID fan & power cut
	18 hr.30min	boiler bank tube leakage
	3 hr. 20min.	power cut
Nov-2012	2 hr.55min	I.D fan tripped
	13 hr. 45min.	boiler bank tube leakage
	30 hr 10min	power cut
	1 hr.30min	F.D fan's V.F.D problem
Dec-2012	2 hr. 20min.	rice husk elevator cable burnt
	11 hr.25min	power cut

Month	ETP Downtime (hour)	Reasons
May-2010	24	No effluent due to plant shut down
Aug-2010	60	No effluent due to plant shut down
Sept-2010	10	No effluent Boiler under shut down
April-2011	8	No effluent Boiler under shut down
Aug-2011	444	No effluent Boiler under shut down
Oct-2011	76	No effluent due to plant shut down
July-2012	8	No effluent due to plant shut down
Aug-2012	4	No effluent due to plant shut down
Sept-2012	6	No effluent due to plant shut down
Oct-2012	132	No effluent due to plant shut down
Dec-2012	8	Gas holder maintenance work

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

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 Unit / Parameter:	$\eta_{BL, Thermal}$
Data unit:	%
Description:	Efficiency of baseline coal fired boiler
Source of data:	Default value
Value applied:	100%
Purpose of the data:	A maximum of 100% is assumed in the baseline emission calculation as per the methodology which is a conservative value.
Any comment:	This parameter is fixed ex-ante

Data Unit / Parameter:	$\eta_{BL, Thermal}$
Data unit:	%
Description:	Efficiency of biomass fired boiler
Source of data:	As per supplier information
Value applied:	80%
Purpose of the data:	As per supplier information
Any comment:	This parameter is fixed ex-ante

Data Unit / 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
Purpose of the data:	IPCC default value. Ref: 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Any comment:	This parameter is fixed ex-ante

3.2 Data and Parameters Monitored

Data Unit / 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:	476445 (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: ±0.25% Least Count: 0.1 tonne Refer table 2 for calibration details.
Calculation method:	Not applicable
Any comment:	Not applicable

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 annex 1.
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: ±0.25% Least count: 1 Degree C Refer table 2 for calibration details.
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.
Frequency of monitoring/recording:	Monitoring frequency : Continuous Recording Frequency : Monthly
Value monitored:	Refer annex 1.
Monitoring equipment:	Steam Pressure Gauge
QA/QC procedures to be applied:	Gauge is tested at least once annually. Gauge Accuracy: ±0.5% Least Count of gauge: 1 kg/cm^2

	Refer table 2 for calibration details.
Calculation method:	Not applicable
Any comment:	Not applicable

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 annex 1.
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: ±0.25% Least Count: 1 Degree C Refer table 2 for calibration details.
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:	75975.66 (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.
Calculation method:	Not applicable
Any comment:	Not applicable

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:	12824.10 (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. Refer table 2 for calibration details.
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.
Frequency of monitoring/recording:	Monitoring frequency : On every procurement Recording Frequency : On every procurement
Value monitored:	Measured value[2]
Monitoring equipment:	Bomb calorimeter
QA/QC procedures to be applied:	Bomb calorimeter is tested internally at site for fuel sample testing.
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

[2] For determining NCV of biomass in-hous testing is done for the monitoring period April 2010 to Dec 2012. From April 2010 to Dec 2012.monthly average NCV value is used for calculation.

	Recording Frequency : On every procurement
Value monitored:	4408.57[3]
Monitoring equipment:	Bomb calorimeter
QA/QC procedures to be applied:	Bomb calorimeter is tested internally at site for fuel sample testing.
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 table 2 for calibration details.
Frequency of monitoring/recording:	Monitoring frequency : Continuously Recording Frequency : Monthly
Value monitored:	2321684 (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.

[3] 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.

Calculation method:	Not applicable
Any comment:	The volume is normalized to take Normal temperature and pressure into account.

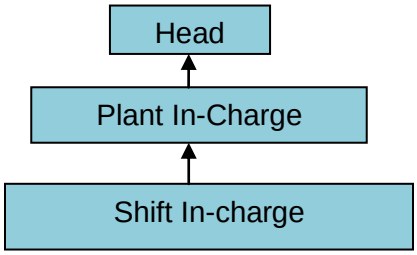
Data Unit / Parameter:	NCV_{Biogas}
Data unit:	$kcal/m^3$
Description:	Net calorific value of biogas
Source of data:	External laboratory test report.
Description of measurement methods and procedures to be applied:	External laboratory tests are conducted on half yearly basis.
Frequency of monitoring/recording:	Half yearly basis
Value monitored:	**Date of testing** / **NCV (kcal/kg)** 05-01-2010 / 5135 25-06-2010 / 4641 31-07-2010 / 5739 13-12-2010 / 4664 11-05-2011 / 5590.77 05-10-2011 / 5433.82 17-02-2012 / 5590.77 18-04-2012 / 5438.4 31-07-2012 / 4934.83 **Average** / **5240.84**
Monitoring equipment:	Not applicable
QA/QC procedures to be applied:	Not applicable
Calculation method:	Not applicable
Any comment:	Not applicable

3.3 Description of the 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 (BEy):

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

As per Para 35, AMS IC Ver. 16

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

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)

$SEC_{PJ,j,y,measured}$ = 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 April 2010

As per Para 35, AMS IC Ver. 16

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

= (1937*1000*3283*4.1868 * 96.1)/ (1.25 * 100% *10^9)

= 2046.95 tCO2e

As per Para 15, AMS IC Ver. 16

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

= [{9728*(2794.6 – 399.24)}-{237262*6341*4.1868}] /10^9

= 17 TJ

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

= (17/100%) * 96.1

= 1633.96 tCO_2e

The detailed worksheet of baseline emission calculation is given in annex-2.

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 April 2010

As per Para 35, AMS IC Ver. 16

PEy = 0

As per Para 15, AMS IC Ver. 16

PEy **= ΣFF $_{i,y}$* NCV$_i$ * EF$_i$ * OXID$_i$**

= (0*4408.57*4.1868*96.1)/10^6

=0 tCO_2e

The detailed worksheet of project emission calculation is given in annex-3.

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 Summary of GHG Emission Reductions and Removals

Sample calculation of Emission Reductions for the month of April 2010

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 $_y$ = 2046.95 – 0 - 0

= 2046.95 tCO_2e

As per Para 15, AMS IC Ver. 16

ER $_y$ = 1633.96 – 0 - 0

= 1633.96 tCO_2e

So final emission reductions for month of April 2010

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

= Min (2046.95 tCO_2e, 1633.96 tCO_2e)

= 1633.96 tCO_2e

The detailed worksheet of overall emission reduction calculation is given in annex-4.

5 ADDITIONAL INFORMATION

5.1 Revision in Monitoring Plan

No request for Revision in monitoring plan applied to this monitoring period

5.2 Comparison between Actual VERs Generated v/s VERs Estimated in the Registered PD

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	Actual values reached during the monitoring period
		(Emission reductions) (tCO_2e)	**(Emission reductions) (tCO_2e)[4]**
2010 (01/04/2010 – 31/12/2010)	275	34,298	7,897
2011 (01/01/2011 - 31/12/2011)	365	45,523	27,639
2012 (01/01/2012 - 31/12/2012)	366	45,648	33,882
Total		**1,25,469**	**69,418**

Total emission reductions, for the monitoring period (01/04/2010 – 31/12/2012) are 69,418 tCO_2e against the estimated emission reductions 1, 25,469 tCO_2e.

5.3 Meter Calibration

Table 2: Meters calibration details

Meter Type	Date of testing	Validity of calibration	Serial No	Accuracy Class	Calibration Agency
Mass flow integrating Totalizer	28-03-2010	One year	10070322	± 0.25%	Authentic Systems & Technologies
	27-03-2011				Authentic Systems & Technologies
	20-03-2012				Winmet technologies Pvt. Ltd.
Steam Pressure Gauge	28-03-2010	One year	6390	± 0.5%	Authentic Systems & Technologies
	27-03-2011				Authentic Systems & Technologies
	20-03-2012				Winmet technologies Pvt. Ltd.

[4] Rounded down values

Steam Temp. Gauge	28-03-2010	One year	GAEL/BL/89	± 0.25%	Authentic Systems & Technologies
	27-03-2011				Authentic Systems & Technologies
	20-03-2012				Winmet technologies Pvt. Ltd.
Feed Water Temp Gauge	28-03-2010	One year	GAEL/BL/90	± 0.25%	Authentic Systems & Technologies
	27-03-2011				Authentic Systems & Technologies
	20-03-2012				Winmet technologies Pvt. Ltd.
Flow meter – Biogas	06-09-2011	Three years	10070323	± 0.25%	Winmet technologies Pvt. Ltd.
	12-09-2008				Alpha Control Instruments Pvt. Ltd
Weighbridge	04-11-2009	Periodic[5]	6637	Class III	Vidhik Maap Vigyan Niyantarak
	08-11-2010				
	08-11-2011				
	08-11-2012				

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.

   Bomb calorimeter in house calibration details:

[5] 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”.

Sr. No.	Bomb calorimeter calibration dates
1.	02-08-2009
2.	05-06-2010
3.	26-05-2011
4.	09-04-2012

Annex-1

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}	$T_{feed\ water}$		
Apr-10	9728	203.6	16.84	95.29	2794.60	399.24
May-10	10476	202.9	16.53	96.79	2794.22	405.56
Jun-10	10829	202.8	16.55	94.29	2794.16	395.03
Jul-10	11982	203.5	16.33	96.23	2794.55	403.20
Aug-10	9780	203.1	16.27	89.79	2794.33	376.09
Sep-10	11289	203.2	15.95	81.56	2794.38	341.51
Oct-10	12848	203.2	16.37	90.53	2794.38	379.20
Nov-10	12173	202.5	16.20	93.55	2794.00	391.91
Dec-10	15653	203.3	16.43	91.79	2794.44	384.50
Jan-11	15264	203.3	16.36	90.95	2794.44	380.97
Feb-11	14085	203.1	16.43	94.31	2794.33	395.11
Mar-11	14172	203.0	16.43	94.57	2794.27	396.21
Apr-11	13639	203.1	16.41	95.60	2794.33	400.55
May-11	13661	205.7	16.36	93.82	2795.70	393.05
Jun-11	12421	203.1	16.25	92.75	2794.33	388.54
Jul-11	13571	203.1	16.51	93.55	2794.33	391.91
Aug-11	3749	202.9	16.20	84.81	2794.22	355.15
Sep-11	11844	203.3	16.30	92.45	2794.44	387.28
Oct-11	12500	208.0	16.39	91.77	2796.83	384.42
Nov-11	15939	203.6	16.35	93.45	2794.60	391.49
Dec-11	16513	203.7	16.41	93.41	2794.66	391.32
Jan-12	16032	203.8	16.41	94.48	2794.71	395.83

Feb-12	15238	203.8	16.39	94.98	2794.71	397.93
Mar-12	13844	203.9	16.28	94.30	2794.76	395.07
Apr-12	14089	203.4	16.27	95.51	2794.49	400.17
May-12	15685	203.3	16.32	93.32	2794.44	390.94
Jun-12	15563	203.3	16.23	92.96	2794.44	389.43
Jul-12	64098	202.7	16.25	92.77	2794.11	388.63
Aug-12	6907	203.4	16.33	93.87	2794.49	393.26
Sep-12	6566	203.3	16.31	95.70	2794.44	400.97
Oct-12	11053	202.5	16.02	92.22	2794.00	386.31
Nov-12	16270	199.9	14.96	94.74	2792.50	396.92
Dec-12	18984	200.2	15.95	93.70	2792.68	392.54
Total	**476445**					

* http://www.spiraxsarco.com/resources/steam-tables/saturated-steam.asp
** http://www.spiraxsarco.com/resources/steam-tables/saturated-water.asp

Annex-2

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)
Apr-10	9728	23.3	6.3	17.0	1633.96
May-10	10476	25.0	6.6	18.4	1768.46
Jun-10	10829	26.0	2.9	23.0	2214.07
Jul-10	11982	28.7	4.2	24.5	2353.60
Aug-10	9780	23.7	0.1	23.6	2265.02
Sep-10	11289	27.7	2.8	24.9	2393.05
Oct-10	12848	31.0	0.8	30.2	2900.56
Nov-10	12173	29.2	1.1	28.2	2705.41
Dec-10	15653	37.7	2.2	35.6	3418.27
Jan-11	15264	36.8	3.8	33.1	3178.16
Feb-11	14085	33.8	2.8	31.0	2977.45
Mar-11	14172	34.0	2.7	31.3	3003.51
Apr-11	13639	32.6	2.7	29.9	2875.15
May-11	13661	32.8	2.1	30.7	2954.81
Jun-11	12421	29.9	1.3	28.5	2743.64
Jul-11	13571	32.6	2.5	30.1	2897.01
Aug-11	3749	9.1	0.4	8.8	842.74
Sep-11	11844	28.5	0.8	27.7	2665.20
Oct-11	12500	30.2	2.1	28.0	2695.10
Nov-11	15939	38.3	2.4	35.9	3447.04
Dec-11	16513	39.7	1.1	38.6	3711.75
Jan-12	16032	38.5	1.4	37.1	3561.61
Feb-12	15238	36.5	0.1	36.5	3503.55
Mar-12	13844	33.2	0.1	33.1	3178.60
Apr-12	14089	33.7	1.2	32.6	3128.14
May-12	15685	37.7	1.4	36.3	3487.73
Jun-12	15563	37.4	0.7	36.8	3532.01
Jul-12	64098	154.2	0.2	154.0	14799.66
Aug-12	6907	16.6	0.1	16.5	1587.46
Sep-12	6566	15.7	0.6	15.1	1454.60
Oct-12	11053	26.6	1.5	25.1	2409.99
Nov-12	16270	39.0	1.2	37.7	3625.99
Dec-12	18984	45.6	1.5	44.0	4233.11

As per Para 35, AMS IC Ver. 16

Month	Baseline Emission (tCO_2 e)
Apr-10	2046.95
May-10	2180.01
Jun-10	1953.92
Jul-10	1093.95
Aug-10	1266.20
Sep-10	764.66
Oct-10	203.17
Nov-10	1516.78
Dec-10	2813.11
Jan-11	3334.65
Feb-11	3113.50
Mar-11	3171.02
Apr-11	2941.12
May-11	2758.88
Jun-11	1669.02
Jul-11	2265.49
Aug-11	1382.20
Sep-11	2157.70
Oct-11	2311.62
Nov-11	3204.53
Dec-11	3732.35
Jan-12	3911.70
Feb-12	4279.33
Mar-12	3143.32
Apr-12	3182.39
May-12	3333.94
Jun-12	3584.24
Jul-12	3595.79
Aug-12	2891.90
Sep-12	3311.41
Oct-12	2763.30
Nov-12	3411.25
Dec-12	3878.56

Annex-3

Project Emissions calculation

As per Para 35, AMS IC Ver. 16

Month	Project Emission (tCO_2 e)[6]
Apr-10	0
May-10	0
Jun-10	0
Jul-10	0
Aug-10	0
Sep-10	0
Oct-10	0
Nov-10	0
Dec-10	0
Jan-11	0
Feb-11	0
Mar-11	0
Apr-11	0
May-11	0
Jun-11	0
Jul-11	0
Aug-11	0
Sep-11	0
Oct-11	0
Nov-11	0
Dec-11	0
Jan-12	0
Feb-12	0
Mar-12	0
Apr-12	0
May-12	0
Jun-12	0
Jul-12	0
Aug-12	0
Sep-12	0
Oct-12	0
Nov-12	0
Dec-12	0

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

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

Month	Quantity of coal consumed (MT)	Project Emission (tCO_2 e)
Apr-10	0.00	0.00
May-10	0.00	0.00
Jun-10	364.80	647.08
Jul-10	1347.00	2389.30
Aug-10	971.00	1722.35
Sep-10	1416.80	2513.11
Oct-10	2181.00	3868.64
Nov-10	1089.00	1931.66
Dec-10	385.00	682.91
Jan-11	40.00	70.95
Feb-11	15.00	26.61
Mar-11	0.00	0.00
Apr-11	0.00	0.00
May-11	119.00	211.08
Jun-11	1095.00	1942.30
Jul-11	596.00	1057.18
Aug-11	80.00	141.90
Sep-11	885.00	1569.81
Oct-11	613.00	1087.34
Nov-11	0.00	0.00
Dec-11	1.40	2.48
Jan-12	0.00	0.00
Feb-12	0.00	0.00
Mar-12	0.00	0.00
Apr-12	0.00	0.00
May-12	0.00	0.00
Jun-12	0.00	0.00
Jul-12	117.00	207.53
Aug-12	830.00	1472.25
Sep-12	590.00	1046.54
Oct-12	78.31	138.91
Nov-12	9.79	17.37
Dec-12	0.00	0

Annex 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-10	2046.95	0.00	2046.95
May-10	2180.01	0.00	2180.01
Jun-10	1953.92	0.00	1953.92
Jul-10	1093.95	0.00	1093.95
Aug-10	1266.20	0.00	1266.20
Sep-10	764.66	0.00	764.66
Oct-10	203.17	0.00	203.17
Nov-10	1516.78	0.00	1516.78
Dec-10	2813.11	0.00	2813.11
Jan-11	3334.65	0.00	3334.65
Feb-11	3113.50	0.00	3113.50
Mar-11	3171.02	0.00	3171.02
Apr-11	2941.12	0.00	2941.12
May-11	2758.88	0.00	2758.88
Jun-11	1669.02	0.00	1669.02
Jul-11	2265.49	0.00	2265.49
Aug-11	1382.20	0.00	1382.20
Sep-11	2157.70	0.00	2157.70
Oct-11	2311.62	0.00	2311.62
Nov-11	3204.53	0.00	3204.53
Dec-11	3732.35	0.00	3732.35
Jan-12	3911.70	0.00	3911.70
Feb-12	4279.33	0.00	4279.33
Mar-12	3143.32	0.00	3143.32
Apr-12	3182.39	0.00	3182.39
May-12	3333.94	0.00	3333.94
Jun-12	3584.24	0.00	3584.24
Jul-12	3595.79	0.00	3595.79
Aug-12	2891.90	0.00	2891.90
Sep-12	3311.41	0.00	3311.41
Oct-12	2763.30	0.00	2763.30
Nov-12	3411.25	0.00	3411.25
Dec-12	3878.56	0.00	3878.56

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-10	1633.96	0.00	1633.96
May-10	1768.46	0.00	1768.46
Jun-10	2214.07	647.08	1566.99
Jul-10	2353.60	2389.30	-35.70
Aug-10	2265.02	1722.35	542.67
Sep-10	2393.05	2513.11	-120.06
Oct-10	2900.56	3868.64	-968.09
Nov-10	2705.41	1931.66	773.75
Dec-10	3418.27	682.91	2735.36
Jan-11	3178.16	70.95	3107.21
Feb-11	2977.45	26.61	2950.84
Mar-11	3003.51	0.00	3003.51
Apr-11	2875.15	0.00	2875.15
May-11	2954.81	211.08	2743.73
Jun-11	2743.64	1942.30	801.34
Jul-11	2897.01	1057.18	1839.83
Aug-11	842.74	141.90	700.84
Sep-11	2665.20	1569.81	1095.40
Oct-11	2695.10	1087.34	1607.76
Nov-11	3447.04	0.00	3447.04
Dec-11	3711.75	2.48	3709.26
Jan-12	3561.61	0.00	3561.61
Feb-12	3503.55	0.00	3503.55
Mar-12	3178.60	0.00	3178.60
Apr-12	3128.14	0.00	3128.14
May-12	3487.73	0.00	3487.73
Jun-12	3532.01	0.00	3532.01
Jul-12	14799.66	207.53	14592.13
Aug-12	1587.46	1472.25	115.21
Sep-12	1454.60	1046.54	408.06
Oct-12	2409.99	138.91	2271.08
Nov-12	3625.99	17.37	3608.63
Dec-12	4233.11	0.00	4233.11

Final emission reductions:

Month	Emission Reductions (Minimum of Para 15 and Para 35) (tCO_2e)[7]
Apr-10	1633.96
May-10	1768.46
Jun-10	1566.99
Jul-10	-35.70
Aug-10	542.67
Sep-10	-120.06
Oct-10	-968.09
Nov-10	773.75
Dec-10	2735.36
Jan-11	3107.21
Feb-11	2950.84
Mar-11	3003.51
Apr-11	2875.15
May-11	2743.73
Jun-11	801.34
Jul-11	1839.83
Aug-11	700.84
Sep-11	1095.40
Oct-11	1607.76
Nov-11	3204.53
Dec-11	3709.26
Jan-12	3561.61
Feb-12	3503.55
Mar-12	3143.32
Apr-12	3128.14
May-12	3333.94
Jun-12	3532.01
Jul-12	3595.79
Aug-12	115.21
Sep-12	408.06
Oct-12	2271.08
Nov-12	3411.25
Dec-12	3878.56

[7] Emission reduction comes negative in the respective months July 2010, Sept 2010 & Oct 2010 because coal and biogas consumption is higher in respective of biomass.