BIOMASS BASED STEAM GENERATION PROJECT BY GUJARAT AMBUJA EXPORTS LTD

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Project Title	Biomass based steam generation project by Gujarat Ambuja Exports Ltd
Version	1.2
Report ID	VCS733-4
Date of Issue	05-Oct-2022
Project ID	733
Monitoring Period	01-January-2014 to 31-March-2018
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity consisted 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 was 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) was used to generate steam for use within the plant premises.

The steam boiler in the project started commercial operation on27-Mar-2008. The project has undergone emission reductions verification three times before. This is 4th verification in the project.

The total emission reductions achieved in the current monitoring period is **55,888 tCO_2e**.

1.2 Sectoral Scope and Project Type

Sectoral Scope: 01:

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	+91-99174 66414
Email	rkgupta@ambujagroup.com

1.4 Other Entities Involved in the Project

Organization name	
Role in the Project	
Contact person	

Title	
Address	
Telephone	
Email	

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

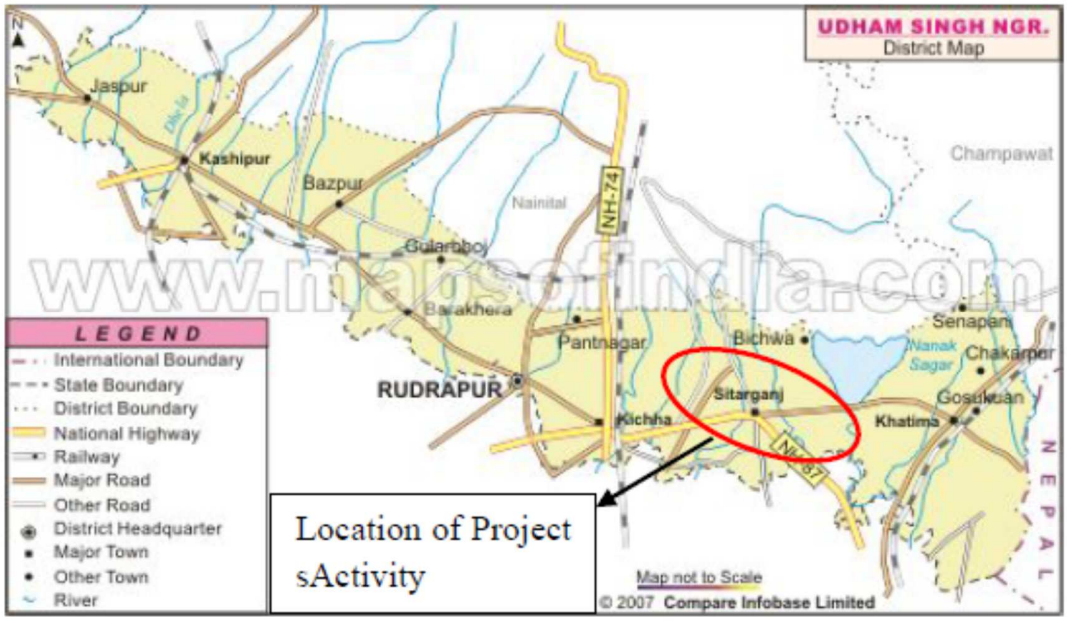
Crediting Period: 01-April- 2008- 31-March-2018

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). The geo coordinates of the location:

Latitude 28º 55´ 43" N, and Longitude 79º 42´25" E

Location is depicted in following maps:



1.8 Title and Reference of Methodology

AMS-I.C.: "Thermal energy production with or without electricity", Version 16[1] 5

1.9 Participation under otherGHGPrograms

Not applicable

1.10 Other Forms of Credit

Net GHG emission reductions or removals generated by the Project are not to be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits.

The Project did not participate to generate any other form of GHG-related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.11 Sustainable DevelopmentContributions

The project activity is biomass based thermal energy generation through the installation of a boiler to generate steam by combustion of biomass, thereby doing away with the use of coal for process heating. The project activity contributes to GHG emission reductions of the baseline scenario which is to generate steam using coal.

[1]https://cdm.unfccc.int/filestorage/J/P/D/JPDYLFAR5MKUVZ97G31H84TS0CEBQN/EB51_repan19_AMS-I.C_ver16.pdf?t=M3J8cmUwa3RtfDBSKziuSh6hlvlr5hHIJKuz

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
Sequential row number	*SDG Target number*	*Number and text of SDG indicator or, if no official SDG indicator is applicable, user-defined indicator*	*Indicate the project's contribution to the SDG Indicator (implemented activities to increase or decrease)*	*Brief description of the quantifiable impact of the project's activities related to the SDG indicator, during the monitoring period.*	*Brief description of the cumulative quantifiable impact of the project's activities related to the SDG indicator, over the project lifetime.*
1)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	**Previous:** Verification 1 (01-Apr-2018 to 31-Mar-2010): 19,556 tCO2e Verification 2(01-Apr-2010 to 31-Dec-2012): 69,418 tCO2e Verification 3(01-Jan-2013 to 31-Dec-2013): 30,964 tCO2e **Current Project Contributions:** Verification 4 (01-Jan-2014 to 31-Mar-2018): 55,888tCO$_2$e	**Cumulative:**175,826 tCO2e (including current monitoring period)

*The project reports to only one SDG is mentioned here, as the projects registered before 20 January 2023 have to demonstrate contributions to at least three SDGs by 20 January 2025. PP will provide information on its contribution to the relevant SDGs in the subsequent reports.

2 SAFEGUARDS

2.1 No Net Harm

An environmental impact assessment is not required by law for these types of project activities. As per the prevailing regulation of the Host Party i.e. India represented by (erstwhile) Ministry of Environment and Forests (MoEF) and now Ministry of Environment, Forests & Climate Change, Govt. of India and also the line ministry for environmental issues in India EIA need not to be carried out for projects which falls under the list whose investment is less than INR 1000 million. As per MoEF&CC notification the project activity does not fall under the purview of the Environmental impact Assessment thus the project activity is exempted from the environmental clearances.

The project has no negative socio-economic impacts. The project creates only positive socio-economic impacts in the form of employment generation and thereby providing income generation opportunities to people. There is direct and indirect employment generation in biomass collection and logistics and plant operation.

2.2 Local Stakeholder Consultation

The stakeholder consultations were held prior to project registration details of which are part of the registered PD. Project participant is open to continuous feedback from the stakeholder.

The project activity is located inside an industrial park which is developed by local industrial development authority (SIDCOL) and is responsible for compliance of all local laws and regulatory requirements. Nonetheless PP has appointed Head-HR as the focal point for all communication with regard community grievances. No such grievance has been received from anyone so far. Besides this, PP has taken up several initiatives for community welfare from time to time.

2.3 AFOLU-Specific Safeguards

Not Applicable, as this project is a non-AFOLU project.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project activity involved 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 was also co-fired along with biomass in the boiler. The steam produced from the boiler was consumed in process. The project reduced greenhouse

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	Value
Boiler type	Semi-outdoor, Bi-drum, Water tube, AFBC boiler
Capacity	30TPH
Steam Pressure	17.5 kg/cm2
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	27-Mar-2008
Start date of commercial operation at the site	28-Mar-2008
Biogas generation Plant commissioning	28-Jul-2008

Outage details for the Boiler as well as the Biogas generation plant are provided in Appendix II.

The project activity has been in use only as a backup after a new cogeneration plant was installed at the plant site. This is the reason that project activity has been operated for a shorter period than normal during the current monitoring period. There has been no generation in the year 2018.

3.2 Deviations

2.3.1 Methodology Deviations

There has not been any methodology deviation during the current monitoring period.

2.3.2 Project Description Deviations

There has not been any deviation during the current monitoring period.

3.3 Grouped Projects

The project is not a grouped project.

4 DATA AND PARAMETERS

4.1 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 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 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 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 $SEC_{Biomass, PJ, y} = (\Sigma FC_{Biomass, PJ, y} * NCV_{Biomass, y}) / EG_{PJ,y}$ $= (57117.8*1000*2930* 4.1868) / (70662000*7920)$ $= 1.25$
Purpose of 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 $SEC_{Coal, PJ, y} = (\Sigma FC_{Coal, PJ, y} * NCV_{Coal, y}) / EG_{PJ,y}$ $=(31350.8*1000*4271*4.1868)/(70662000*7920)$ $= 1.00$
Purpose of Data	Calculation of Project emission

Comments	This parameter is fixed ex-ante

4.2 Data and Parameters Monitored

Data / Parameter	Q_{steam}
Data unit	Metric Tonne
Description	Quantity of steam generated
Source of data	Onsite measurement
Description of measurement methods and procedures 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	267,722.70 (Cumulative value for the monitoring period)
Monitoring equipment	Mass flow integrating totalizer Meter number: 10070322 Make:Manas Model number: MICRO CS-3003-NOT-2 Meter accuracy: ±3% Least Count: 0.1 tonne/hr Calibration Frequency: Annual Refer **Appendix I** for calibration details
QA/QC procedures to be applied	Steam flow meter is calibrated/ tested annually independently by a third party.
Purpose of 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 class.

Data / 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 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 V** for the information
Monitoring equipment	Steam Temperature Gauge Meter number:GAEL/BL/89 Make: TEMPSENS Gauge Accuracy: ±1% Least count: 1 Degree C Calibration frequency: Annual Refer **Appendix I** for meter calibration details.
QA/QC procedures to be applied	Gauge is tested at least once annually as per manufacturer's prescribed standards. Refer Appendix I for calibration details.
Purpose of Data	Calculation of Baseline emission
Calculation method	Not applicable
Comments	Not applicable

Data / 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 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 to **Appendix III** for information
Monitoring equipment	Steam Pressure Gauge Meter number: 6390 Make: CBL Gauge Accuracy: ±4% Calibration frequency: Annual Refer to **Appendix I** for details on meter calibration.
QA/QC procedures to be applied	Gauge is tested at least once annually.
Purpose of Data	Calculation of Baseline emission
Calculation method	Not applicable
Comments	There is no impact on the emission reduction calculation due to steam pressure gauge accuracy class.

Data / 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 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 to **Appendix III** for information
Monitoring equipment	Feed Water Temp Gauge Meter Number: GAEL/BL/90 Make: MIEPL Accuracy class: ± 1% Calibration frequency: 1 year For detailed information on calibration, refer to Appendix I.
QA/QC procedures to be applied	Gauge is tested at least once annually by a third party. Gauge Accuracy: Class A,B There are two resistance tolerances specified 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 Least Count: 1 Degree C Refer **Appendix I** for calibration details.
Purpose of Data	Calculation of Baseline emission
Calculation method	Not applicable
Comments	Not applicable

Data / 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 applied	Quantity of biomass used in project activity would be measured using weighing scale and recorded in log books regularly.
Frequency of	Monitoring frequency : Continuous

monitoring/recording	Recording Frequency : Monthly
Value monitored	75,460.12 (Cumulative value for the monitoring period)
Monitoring equipment	Weighbridge Meter serial number: 6637 For calibration details: Refer to **Appendix I**
QA/QC procedures to be applied	The weighing scale is calibrated periodically by a third party
Purpose of Data	Calculation of Baseline emission
Calculation method	Not applicable
Comments	Not applicable

Data / 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 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	10,248.14 (Cumulative value for the monitoring period)
Monitoring equipment	Weighbridge Meter serial number: 6637 For calibration details: Refer to **Appendix I**
QA/QC procedures to be applied	The weighing scale is calibrated periodically by a third party.
Purpose of Data	Calculation of Project emission
Calculation method	Not applicable
Comments	Not applicable

Data / 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 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	3321.99 (weighted average value for the monitoring period)
Monitoring equipment	Bomb calorimeter
QA/QC procedures to be applied	Bomb calorimeter is tested internally at site for fuel sample testing.
Purpose of Data	Calculation of Baseline & Project emission
Calculation method	Not applicable
Comments	Not applicable

Data / 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 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. 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	4334.00 (maximum value for the monitoring period)

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

Data / 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 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 I for calibration details.
Frequency of monitoring/recording	Monitoring frequency : Continuously Recording Frequency : Daily
Value monitored	1,299,978.00 (Cumulative value for the monitoring period)
Monitoring equipment	Biogas flow meter Meter Serial No. : 98402 Make: Manas Model: MICRO CS-3003-NOT-2 Accuracy class ± 0.25% Calibration frequency (as per PDD) in years: 3 For details on Calibration, refer to **Appendix I**

QA/QC procedures to be applied	Gas flow meter is calibrated regularly.
Purpose of Data	Calculation of Baseline emission
Calculation method	Not applicable
Comments	The volume is normalized to take Normal temperature and pressure into account.

Data / 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 applied	External laboratory tests are conducted on half yearly basis.
Frequency of monitoring/recording	Half yearly basis
Value monitored	4963.89(refer **Appendix IV** for details)
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Not applicable
Purpose of Data	Calculation of Baseline & Project emission
Calculation method	Not applicable
Comments	Not applicable

4.3 Monitoring Plan

GAEL had the following structure for data monitoring, collection, data archiving and calibration of equipment for this project activity. The team comprised of the following members:

- Head
- Plant In-charge
- Shift In-charge

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

Responsibilities of Plant In-charge: Responsibility for maintaining the data records, ensuring completeness of data, and reliability of data (calibration of equipment).

Responsibilities of Shift In-charge: Responsibility for day to day data collection and maintaining 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 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 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 equipment is calibrated as per section 3.2 and documents pertaining to testing of equipment were maintained by Plant In-charge.

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

Maintenance of instruments and equipment used in data monitoring:

The Operations Department is responsible for the proper functioning of the equipment/ instruments and takes corrective action(Instruments/equipment shall be rested/recalibrated or replaced) if found not operating, as required.

Emission reduction calculation: Emission reduction calculations and monitoring report are 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 did not result in any unidentified activity that could result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline for the project activity was 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

<u>Calculation of baseline emissions for the current monitoring period</u>

As per Para 35, AMS IC Ver. 16

$BE_{Cofire,y} = (FC_{biomass,k,y} * NCV_{biomass,k,y} * EF_{BL}) / (SEC_{PJ,j,y,measured} * \eta_{BL})$
= (75,460.12*1000*3,322*4.1868 * 96.1)/ (1.25 * 100% *10^9)

= 80,688.40 tCO_2e

As per Para 15, AMS IC Ver. 16

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

= (581.59/100%) * 96.1

= 55,890.88 tC02 e

The detailed worksheet of baseline emission calculation is provided in ER sheet.

5.2 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:

$PEy = \Sigma FF_{i,y} \times NCV_i \times EF_i$

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

Calculation of project emission for the current monitoring period

As per Para 35, AMS-I.C. Ver. 16

$PE_y = 0$

As per Para 15, AMS-I.C. Ver. 16

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

$= (0*4042*14.1868*96.1)/10^6$

$=0\ tCO_2e$

5.3 Leakage

A. Leakage due to use of non-renewable 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

5.4 Net GHG Emission Reductions and Removals

Calculation of Emission Reductions for the current monitoring period

$ER_y = BE_y - PE_y - L_y$

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 = 80,688.40 – 0 - 0

= 80,688.40 tCO_2e

As per Para 15, AMS IC Ver. 16

ER y = 55,890.88 – 0 - 0

= 55,890.88 tCO_2e

So final emission reductions for the current monitoring period

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

= Min (80,688.40 tCO_2e, 55,890.88 tCO_2e)

= 55,890.88 tCO_2e

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)*
2014	33,762.58	0	0	33,762
2015	15,663.90	0	0	15,663
2016	4,932.62	0	0	4,932
2017	1,531.78	0	0	1,531
2018	-	0	0	-
Total	55,890.88	0	0	55,888

*Rounded down number

Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD:

Amount achieved during this monitoring period(tCO2e)	Amount estimated during this monitoring period as per registered PD(tCO2e)
55,888	193,441

The baseline emissions in the current monitoring period are 71% lower than the estimated ex-ante emission reductions.The project activity has been in use only as a backup after a new cogeneration plant was installed at the plant site. This is the reason that project activity has been operated for a shorter period than normal during the current monitoring period.There has been no generation in the year 2018.

APPENDIX I: METER AND CALIBRATION DETAILS

	Mass flow integrating Totalizer	Flow meter-Biogas	Steam Pressure Gauge	Steam Temp. Gauge	Feed Water Temp Gauge	Weigh bridge
Meter Serial No	10070322	98402	6390	GAEL/BL/89	GAEL/BL/90	6637
Make	Manas	Manas	CBL	TEMPSENS	MIEPL	
Model	MICRO CS-3003-NOT-2	MICRO CS-3003-NOT-2				
Accuracy class	± 3%	± 0.25%	± 4%	± 1%	± 1%	
Calibration frequency in years	1	3	1	1	1	3[2]
Date of calibration I	09-Mar-2013	25-Feb-2013	09-Mar-2013	19-Mar-2013	09-Mar-2013	8-Nov-2013
Validity	08-Mar-2014	24-Feb-2016	08-Mar-2014	18-Mar-2014	08-Mar-2014	7-Nov-2016
Date of calibration II	08-Mar-2014	24-Feb-2014	08-Mar-2014	18-Mar-2014	08-Mar-2014	11- Nov -2014
Validity	07-Mar-2015	23-Feb-2017	07-Mar-2015	17-Mar-2015	07-Mar-2015	10-Nov-2017
Date of calibration III	07-Mar-2015	23-Feb-2015	07-Mar-2015	17-Mar-2015	07-Mar-2015	16-Nov-2015
Validity	06-Mar-2016	22-Feb-2018	06-Mar-2016	16-Mar-2016	06-Mar-2016	15-Nov-2018
Date of calibration IV	05-Mar-2016	22-Feb-2016	05-Mar-2016	16-Mar-2016	05-Mar-2016	21-Nov-2016
Validity	04-Mar-2017	21-Feb-2019	04-Mar-2017	15-Mar-2017	04-Mar-2017	20-Nov 2019
Date of calibration V	04-Mar-2017	21-Feb-2017	04-Mar-2017	14-Mar-2017	04-Mar-2017	20-Nov-2017
Validity	03-Mar-2018	20-Feb-2020	03-Mar-2018	14-Mar-2018	03-Mar-2018	19-Nov-2020

[2] 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 three years**"

Hence, three years is considered to be the calibration frequency in this project case.

	Mass flow integrating Totalizer	Flow meter-Biogas	Steam Pressure Gauge	Steam Temp. Gauge	Feed Water Temp Gauge	Weigh bridge
Date of calibration VI	03-Mar-2018	20-Feb-2018	03-Mar-2018	14-Mar-2018	03-Mar-2018	
Validity	02-Mar-2019	19-Feb-2021	02-Mar-2019	13-Mar-2019	02-Mar-2019	

APPENDIX II: OUTAGE DETAILS

Boiler Outage Record			
(From 01-Jan-2014 to 31-Dec-2014)			
Date	**Breakdown/Shutdown**	**BD/SD Hours**	**Reason**
01 November 2014	Breakdown	19	Clinker formation
01 December 2014	Breakdown	19	ID fan impeller vibration problem
04 November 2014	Breakdown	5	Husk elevator jam
15 April 2014	Breakdown	5	Grid failure
05 February 2014	Breakdown	7	Boiler bank tube leakage
05 March 2014	Breakdown	3	Power cut
05 May 2014	Breakdown	9	Power cut
05 July 2014	Breakdown	17	ID fan tripped
05 August 2014	Breakdown	12	PA line jam
05 September 2014	Breakdown	11	Grid failure
05 October 2014	Breakdown	6	Power cut
05 November 2014	Breakdown	8	Power cut
05 December 2014	Breakdown	24	Bunker empty
13 May 2014	Breakdown	17	Electrical fault
15 May 2014	Breakdown	4	PA line jam
16 May 2014	Breakdown	6	Husk handling problem
19 May 2014	Breakdown	4	Furnace problem
21 May 2014	Breakdown	11	Power cut
23 May 2014	Breakdown	4	Furnace nozzle broken
24 May 2014	Breakdown	4	ID fan tripped
26 May 2014	Breakdown	3	Bunker empty
27 May 2014	Breakdown	4	Husk elevator jam
28 May 2014	Breakdown	10	Power cut
29 May 2014	Breakdown	8	Electrical fault
30 May 2014	Breakdown	4	ID fan problem
31 May 2014	Breakdown	3	Power cut
06 January 2014	Breakdown	2	Bunker empty
06 February 2014	Breakdown	10	Clinker formation
06 March 2014	Breakdown	10	Clinker formation
06 April 2014	Breakdown	8	Clinker formation
06 May 2014	Breakdown	14	ID fan problem
06 June 2014	Breakdown	11	Grid Failure
06 July 2014	Breakdown	12	PA line jam
06 August 2014	Breakdown	4	Power cut
06 September 2014	Breakdown	10	Power cut
06 October 2014	Breakdown	12	Electrical fault
06 November 2014	Breakdown	13	FD's VFD card damaged

Boiler Outage Record			
(From 01-Jan-2014 to 31-Dec-2014)			
Date	**Breakdown/Shutdown**	**BD/SD Hours**	**Reason**
06 December 2014	Breakdown	13	Power cut
13 June 2014	Breakdown	12	Power cut
14 June 2014	Breakdown	7	Electrical fault
15 June 2014	Breakdown	8	Electrical fault
16 June 2014	Breakdown	11	Husk screen bearing damaged
17 June 2014	Breakdown	8	PA line jam
18 June 2014	Breakdown	14	ID fan problem
19 June 2014	Breakdown	24	Furnace nozzle broken
20 June 2014	Breakdown	18	Clinker formation
21 June 2014	Breakdown	13	Electrical fault
22 June 2014	Breakdown	18	Grid failure
23 June 2014	Breakdown	14	Power cut
24 June 2014	Breakdown	15	Power cut
25 June 2014	Breakdown	10	PA fan bearing worn out
26 June 2014	Breakdown	12	Electrical fault
27 June 2014	Breakdown	12	Electrical fault
28 June 2014	Breakdown	11	Electrical fault
29 June 2014	Breakdown	5	Electrical fault
30 June 2014	Breakdown	9	Electrical fault
07 January 2014	Breakdown	9	ID fan problem
07 February 2014	Breakdown	14	PA fan tripped
07 March 2014	Breakdown	12	Power cut
07 April 2014	Breakdown	8	Electrical fault
07 May 2014	Breakdown	19	Power cut
07 June 2014	Breakdown	12	Husk elevator jam
07 July 2014	Breakdown	2	Grid failure
07 August 2014	Breakdown	11	Boiler bank tube leakage
07 September 2014	Breakdown	9	Boiler drum level problem
07 October 2014	Breakdown	10	Power cut
07 November 2014	Breakdown	14	Power cut
07 December 2014	Breakdown	20	Power cut
13 July 2014	Breakdown	4	Bunker empty
14 July 2014	Breakdown	7	Bunker empty
15 July 2014	Breakdown	5	Bunker empty
16 July 2014	Breakdown	5	Bunker empty
27 July 2014	Breakdown	4	Bunker empty
18 July 2014	Breakdown	2	Bunker empty
19 July 2014	Breakdown	15	Boiler bank tube leakage
20 July 2014	Breakdown	14	Boiler bank tube leakage
23 July 2014	Breakdown	3	Power cut

Boiler Outage Record			
(From 01-Jan-2014 to 31-Dec-2014)			
Date	**Breakdown/Shutdown**	**BD/SD Hours**	**Reason**
24 July 2014	Breakdown	2	Bunker empty
25 July 2014	Breakdown	3	Bunker empty
26 July 2014	Breakdown	3	Bunker empty
27 July 2014	Breakdown	4	Bunker empty
28 July 2014	Breakdown	3	Bunker empty
29 July 2014	Breakdown	2	Bunker empty
30 July 2014	Breakdown	6	Husk screen bearing damaged
31 July 2014	Breakdown	6	Power cut
08 January 2014	Breakdown	6	Grid failure
08 February 2014	Breakdown	6	Electrical fault
08 March 2014	Breakdown	4	Bunker empty
08 April 2014	Breakdown	18	Under bed chain broken
08 May 2014	Breakdown	6	Power cut
08 June 2014	Breakdown	20	Boiler feed pump line leakage
08 July 2014	Breakdown	6	Power cut
08 August 2014	Breakdown	2	Electrical fault
08 November 2014	Breakdown	4	Electrical fault
14 August 2014	Breakdown	2	Electrical fault
15 August 2014	Breakdown	2	Electrical fault
19 August 2014	Breakdown	3	Bunker empty
20 August 2014	Breakdown	4	Bunker empty
21 August 2014	Breakdown	4	Bunker empty
22 August 2014	Breakdown	5	Bunker empty
23 August 2014	Breakdown	8	ID fan problem
24 August 2014	Breakdown	8	Instrumentation fault
25 August 2014	Breakdown	8	Instrumentation fault
26 August 2014	Breakdown	9	ID fan problem
27 August 2014	Breakdown	7	Electrical fault
28 August 2014	Breakdown	9	Electrical fault
29 August 2014	Breakdown	7	Electrical fault
30 August 2014	Breakdown	12	Clinker formation
31 August 2014	Breakdown	7	Power cut
09 January 2014	Breakdown	4	PA fan tripped
09 February 2014	Breakdown	2	Grid failure
09 March 2014	Breakdown	6	ID fan problem
09 April 2014	Breakdown	2	Power cut
09 May 2014	Breakdown	2	Power cut
09 June 2014	Breakdown	2	Power cut
09 July 2014	Breakdown	3	Power cut
09 August 2014	Breakdown	4	Power cut

Boiler Outage Record			
(From 01-Jan-2014 to 31-Dec-2014)			
Date	**Breakdown/Shutdown**	**BD/SD Hours**	**Reason**
09 September 2014	Breakdown	4	Bunker empty
09 October 2014	Breakdown	3	Bunker empty
09 November 2014	Breakdown	3	Bunker empty
09 December 2014	Breakdown	4	Bunker empty
13 September 2014	Breakdown	3	Bunker empty
14 September 2014	Breakdown	4	Bunker empty
15 September 2014	Breakdown	3	Bunker empty
16 September 2014	Breakdown	3	Power cut
17 September 2014	Breakdown	2	Electrical fault
18 September 2014	Breakdown	5	Electrical fault
19 September 2014	Breakdown	8	Electrical fault
20 September 2014	Breakdown	5	Instrumentation fault
22 September 2014	Breakdown	2	Bunker empty
23 September 2014	Breakdown	1	Bunker empty
24 September 2014	Breakdown	7	Power cut
25 September 2014	Breakdown	2	Bunker empty
26 September 2014	Breakdown	2	Power cut
27 September 2014	Breakdown	3	Bunker empty
30 September 2014	Breakdown	2	Bunker empty
10 January 2014	Breakdown	3	Bunker empty
10 June 2014	Breakdown	2	Power cut
10 September 2014	Breakdown	5	Power cut
10 November 2014	Breakdown	2	Power cut
17 October 2014	Breakdown	1	Power cut
27 October 2014	Breakdown	3	Power cut
28 October 2014	Breakdown	5	Electrical fault
11 October 2014	Breakdown	2	Bunker empty
13 November 2014	Breakdown	11	Transfer pump not working
17 November 2014	Breakdown	3	Bunker empty
18 November 2014	Breakdown	4	Bunker empty
20 November 2014	Breakdown	4	Power cut
23 November 2014	Breakdown	6	Power cut
24 November 2014	Breakdown	24	Clinker formation
25 November 2014	Breakdown	21	Clinker formation
26 November 2014	Breakdown	6	Power cut
12 November 2014	Breakdown	6	Electrical fault
23 December 2014	Breakdown	6	Electrical fault
26 December 2015	Breakdown	1	Power cut

Boiler Outage Record			
(From 01.Jan.2015 to 31.Dec.2015)			
Date	Breakdown/Shutdown	BD/SD Hours	REASON
01 January 2015	Breakdown	2	Power cut
01 March 2015	Breakdown	7	Electrical fault
01 May 2015	Breakdown	8	Electrical fault
01 June 2015	Breakdown	15	Bed nozzle broken
14-Janl-2015	Breakdown	12	VFD problem
15-Jan-2015-31-Jan-2015	Shutdown	408	Power plant started
1-Feb-2015-27-Feb-2015	Shutdown	648	Power plant started
28-Febl-2015	Breakdown	9	Power cut
03 March 2015	Breakdown	24	VFD problem
03 June 2015	Breakdown	3	Bunker empty
25 March 2015	Breakdown	2	Bunker empty
26 March 2015	Breakdown	5	Power cut
04 March 2015	Breakdown	24	VFD problem
04 September 2015	Breakdown	8	Electrical fault
04 October 2015	Breakdown	16	Clinker formation
13 April 2015	Breakdown	14	Husk elevator problem
18 April 2015	Breakdown	22	Main steam gasket leakage
24 April 2015	Breakdown	16	Electrical fault
26 April 2015	Breakdown	4	Bunker empty
27 April 2015	Breakdown	24	Husk elevator buckets damaged
28 April 2015	Breakdown	17	ID fan tripped
29 April 2015	Breakdown	12	Coal crusher bearing broken
30 April 2015	Breakdown	16	Feed pump problem
05 January 2015	Breakdown	15	Steam arrest at tube
05 February 2015	Breakdown	13	Electrical fault
05 March 2015	Breakdown	14	Electrical fault
05 December 2015	Breakdown	20	Grid failure
13 May 2015	Breakdown	12	Electrical fault
14 May 2015	Breakdown	21	PA fan motor bearing changed
16 May 2015	Breakdown	20	Electrical fault
21 May 2015	Breakdown	8	PA line jam
30 May 2015	Breakdown	8	Power cut
31 May 2015	Breakdown	5	Power cut
06 December 2015	Breakdown	8	Electrical fault
13 June 2015	Breakdown	4	Bunker empty
17 June 2015	Breakdown	9	Husk elevator problem
25 June 2015	Breakdown	9	Husk elevator problem
26 June 2015	Breakdown	3	Bunker empty
28 June 2015	Breakdown	13	Electrical fault

Boiler Outage Record			
(From 01.Jan.2015 to 31.Dec.2015)			
Date	Breakdown/Shutdown	BD/SD Hours	REASON
07 November 2015	Breakdown	9	Coal crusher bearing broken
07 December 2015	Breakdown	6	Power cut
13 July 2015	Breakdown	7	Electrical fault
16 July 2015	Breakdown	9	Electrical fault
17-July-2015-31-July-2015	Shutdown	360	Power plant is in use
1-Aug-2015-31-Aug-2015	Shutdown	744	Power plant is in use
1-Sep-2015-14-Sep-2015	Shutdown	336	Power plant is in use
15 September 2015	Breakdown	16	Electrical fault
16 September 2015	Breakdown	4	Bunker empty
17 September 2015	Breakdown	20	Electrical fault
18 September 2015	Breakdown	10	Electrical fault
19 September 2015	Breakdown	13	Electrical fault
20 September 2015	Breakdown	14	Electrical fault
1-Oct-2015-31-10/2015	Shutdown	744	Power plant is in use
1-Nov-2015-30-Nov-2015	Shutdown	720	Power plant is in use
1-Dec-2015-31-Dec-2015	Shutdown	744	Power plant is in use

Boiler Outage Record			
(From 01-Jan-2016 to 31-Dec-2016)			
Date	Breakdown/Shutdown	BD/SD hours	REASON
1-Jan-2016-31-Jan-2016	Shutdown	744	Power plant is in use
1-Feb-2016-29-Feb-2016	Shutdown	696	Power plant is in use
01/03/2016-8-Mar-2016	Shutdown	192	Power plant is in use
03 September 2016	Breakdown	19	Electrical fault
03 October 2016	Breakdown	6	Power cut
16 March 2016	Breakdown	16	Husk elevator problem
21 March 2016	Breakdown	13	Power cut
24 March 2016	Breakdown	2	Bunker empty
25 March 2016	Breakdown	4	power cut
04 August 2016	Breakdown	9	Electrical fault
9-Apr-2016-14-Apr-2016	Shutdown	144	Power plant is in use
15 April 2016	Breakdown	8	Power cut
19 April 2016	Breakdown	16	Electrical fault
20-Apr-2016-30-Apr-2016	Shutdown	264	Power plant is in use
1-May-2016-31-May-2016	Breakdown	744	Power plant is in use
1-June-2016-3-June-2016	Shutdown	72	Power plant is in use

Boiler Outage Record			
(From 01-Jan-2016 to 31-Dec-2016)			
Date	Breakdown/Shutdown	BD/SD hours	REASON
06 April 2016	Breakdown	4	Power cut
06 May 2016	Breakdown	9	PA line jam
06/06/2016-30-June-2016	Shutdown	600	Power plant is in use
1-July-2016-31-July-2016	Shutdown	744	Power plant is in use
1-Aug-2016-31-Aug-2016	Shutdown	744	Power plant is in use
1-Sep-2016-30-Sep-2016	Shutdown	720	Power plant is in use
1-Oct-2016-19-Oct-2016	Shutdown	456	Power plant is in use
20 October 2016	Breakdown	5	Bunker empty
22 October 2016	Shutdown	16	Power cut
23-Oct-2016-31-Oct-2016	Shutdown	216	Power plant is in use
1-Nov-2016-15-Nov-2016	Shutdown	360	Power plant is in use
16 November 2016	Breakdown	6	Electrical fault
17 November 2016	Breakdown	7	Electrical fault
18 November 2016	Breakdown	4	Power cut
25-Nov-2016-27-Nov-2016	Shutdown	72	Power plant is in use
28 November 2016	Breakdown	17	Bed problem
29 November 2016	Shutdown	16	Economiser leakage arrest
3011/2016	Shutdown	24	Economiser leakage arrest
1-Dec-2016-31-Dec-2016	Shutdown	744	Power plant is in use

Boiler Outage Record			
(From 01-Jan-2017 to 31-Dec-2017)			
Date	Breakdown/Shutdown	BD/SD Hours	REASON
1-Jan-2017-31-Jan-2017	Shutdown	744	Power plant is in use
1-Feb-2017-2-Feb-2017	Shutdown	48	Power plant is in use
02 March 2017	Breakdown	2	Bunker empty
02 April 2017	Breakdown	6	Power cut
5-Feb-2017-28-Feb-2017	Shutdown	576	Power plant is in use
1-Mar-2017-31-Mar-2017	Shutdown	744	Power plant is in use
1-Apr-2017-3-Apr-2017	Shutdown	72	Bed coil leakage arrest
04 April 2017	Breakdown	3	Power cut
04 June 2017	Breakdown	17	FD fan vfd problem
7-Apr-2017-17-Apr-2017	Shutdown	264	Power plant is in use
18 April 2017	Breakdown	17	Power cut

Boiler Outage Record			
(From 01-Jan-2017 to 31-Dec-2017)			
Date	Breakdown/Shutdown	BD/SD Hours	REASON
19 April 2017	Breakdown	7	Power cut
20 April 2017	Breakdown	8	Power cut
21 April 2017	Breakdown	4	Electrical fault
22-Apr-2017-30-Apr-2017	Shutdown	216	Power plant is in use
1-May-2017-31-May-2017	Shutdown	744	Power plant is in use
1-Jun-2017-30-Jun-22017	Shutdown	720	Power plant is in use
1-July-2017-10-July-2017	Shutdown	240	Power plant is in use
07 November 2017	Shutdown	22	Bed nozzle broken
12-July-2017-31-July-2017	Shutdown	480	Power plant is in use
1-Aug-2017-31-Aug-2017	Shutdown	744	Power plant is in use
1-Sep-2017-20-July-2017	Shutdown	480	Power plant is in use
21 September 2017	Shutdown	7	Husk elevator bucket change
22 September 2017	Breakdown	9	Power cut
23-Sep-2017-30-Sep-2017	Shutdown	192	Power plant is in use
1-Oct-2017-13-Oct-2017	Shutdown	312	Power plant is in use
14 October 2017	Breakdown	7	Power cut
17 October 2017	Breakdown	10	Electrical fault
18-Oct-2017-29-Oct-2017	Shutdown	288	Power plant is in use
30 October 2017	Breakdown	18	Electrical fault
31 October 2017	Shutdown	17	Power plant started
1-Nov-2017-30-Nov-2017	Shutdown	720	Power plant is in use
1-Dec-2017-10-Dec-2017	Shutdown	240	Power plant is in use
12 November 2017	Shutdown	21	Power plant started
12 December 2017	Breakdown	4	Power cut
14 December 2017	Shutdown	10	Electrical fault
15-Dec-2017-31-Dec-2017	Shutdown	408	Power plant is in use

Boiler Outage Record
(From 01-Jan-2018 to 31-Mar-2018)

Date	**Breakdown/Shutdown**	**BD/SD Hours**	**REASON**
01-Jan-2018 to 31-Jan-2018	Shutdown	744	Power plant running
01-Feb-2018 TO 28-Feb-2018	Shutdown	672	Power plant running
01-Mar-2018 TO 31-Mar-2018	Shutdown	744	Power plant running

APPENDIX III: BOILER DATA (STEAM AND FEEDWATER)

Month	Steam Pressure (kg/ cm²)	Steam Temperature (T)	Feed Water Temperature in Degree C
	P_{steam}	T_{steam}	T_{FW}
Jan-14	14.00	195.16	120.00
Feb-14	14.00	191.75	120.00
Mar-14	13.00	187.56	119.00
Apr-14	13.00	195.16	121.00
May-14	14.00	191.75	122.00
Jun-14	13.00	195.16	122.00
Jul-14	15.00	193.41	120.00
Aug-14	14.00	193.59	119.00
Sep-14	13.00	193.81	120.00
Oct-14	14.00	193.74	111.00
Nov-14	13.00	193.74	120.00
Dec-14	13.00	193.96	116.00
Jan-15	14.00	193.78	118.00
Feb-15	-	-	-
Mar-15	13.00	193.65	120.00
Apr-15	12.00	194.49	121.00
May-15	13.00	194.35	122.00
Jun-15	14.00	194.40	123.00
Jul-15	15.00	194.79	121.00
Aug-15	-	-	-
Sep-15	13.00	194.86	121.00
Oct-15	-	-	-
Nov-15	-	-	-
Dec-15	-	-	-
Jan-16	-	-	-
Feb-16	-	-	-
Mar-16	15.00	194.74	122.00
Apr-16	15.00	194.37	123.00
May-16	13.00	0.00	121.00
Jun-16	12.00	195.10	124.00
Jul-16	-	-	-
Aug-16	-	-	-
Sep-16	-	-	-

Month	Steam Pressure (kg/ cm2)	Steam Temperature (T)	Feed Water Temperature in Degree C
	P_{steam}	T_{steam}	T_{FW}
Oct-16	12.00	195.10	120.00
Nov-16	14.00	194.45	121.00
Dec-16	-	-	-
Jan-17	-	-	-
Feb-17	13.00	195.10	121.00
Mar-17	-	-	-
Apr-17	14.00	194.26	122.00
May-17	-	-	-
Jun-17	-	-	-
Jul-17	-	-	-
Aug-17	-	-	-
Sep-17	-	-	-
Oct-17	13.00	194.62	118.00
Nov-17	-	-	-
Dec-17	13.00	194.89	120.00
Jan-18	-	-	-
Feb-18	-	-	-
Mar-18	-	-	-

APPENDIX IV: BIOGAS NCV REPORT

Testing date	NCV_{Biogas} (kcal/kg)
13-Jan-2014	5570.18
23-Apr-2014	5521.00
21-Jul-2014	5836.00
22-Oct-2014	5618.09
14-Jan-2015	4900.00
27-Apr-2015	4836.00
23-Jul-2015	4796.00
26-Oct-2015	4986.00
15-Jan-2016	4896.00
27-Apr-2016	4795.00
13-Oct-2016	4694.00
22-Nov-2016	4618.00
17-Jan-2017	4682.00
12-Apr-2017	4694.00
17-Jul-2017	4721.00
9-Oct-2017	4409.00
4-Jan-2018	4814.00
Average	**4963.89**

APPENDIX V: AVERAGE STEAM TEMPERATURE

Month	°C
Jan-14	195.16
Feb-14	191.75
Mar-14	187.56
Apr-14	195.16
May-14	191.75
Jun-14	195.16
Jul-14	193.41
Aug-14	193.59
Sep-14	193.81
Oct-14	193.74
Nov-14	193.74
Dec-14	193.96
-	-

Month	°C
Jan-15	193.78
Feb-15	191.92
Mar-15	193.65
Apr-15	194.49
May-15	194.35
Jun-15	194.40
Jul-15	194.79
Aug-15	-
Sep-15	194.86
Oct-15	-
Nov-15	-
Dec-15	-
Jan-16	-

Month	°C
Feb-16	-
Mar-16	194.74
Apr-16	194.37
May-16	-
Jun-16	195.10
Jul-16	-
Aug-16	-
Sep-16	-
Oct-16	195.10
Nov-16	194.45
Dec-16	-
Jan-17	-
Feb-17	195.10