BIOMASS BASED STEAM GENERATION PROJECT BY STERLING AGRO INDUSTRIES LTD.

Document Prepared by Enen Green Services Pvt. Ltd.

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CONTENTS

1 PROJECT DETAILS 3

1.1 Summary Description of the Implementation Status of the Project 3
1.2 Sectoral Scope and Project Type 4
1.3 Project Proponent 4
1.4 Other Entities Involved in the Project 4
1.5 Project Start Date 5
1.6 Project Crediting Period 5
1.7 Project Location 5
1.8 Title and Reference of Methodology 6
1.9 Participation under other GHG Programs 6
1.10 Other Forms of Credit 7
1.11 Sustainable Development 7

2 SAFEGUARDS 8

2.3 AFOLU-Specific Safeguards 8

3 IMPLEMENTATION STATUS 9

3.1 Implementation Status of the Project Activity 9
3.2 Deviations 10
3.3 Grouped Projects 10

4 DATA AND PARAMETERS 10

4.1 Data and Parameters Available at Validation 11
4.2 Data and Parameters Monitored 11
4.3 Monitoring Plan 26

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS 31

5.1 Baseline Emissions 31
5.2 Project Emissions 32
5.3 Leakage 32
5.4 Net GHG Emission Reductions and Removals 33

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Purpose of the project activity and the measures taken to reduce greenhouse gas emissions:

Sterling Agro Industries Ltd. (Hereafter Project proponent) has undertaken a project activity, which entails thermal energy generation using renewable biomass. The purpose of the project activity is to utilise the available surplus renewable biomass in the region for the generation of thermal energy. The project activity was implemented in the Dairy products manufacturing unit of Sterling Agro Industries Ltd. (SAIL) at Bhitouna plant, Kanshiram Nagar, Uttar Pradesh. The generated thermal energy is being used for captive consumption in the Dairy products manufacturing unit.
Project proponent has installed a 15TPH biomass based boiler, which avoided the use of coal in steam generation. In the absence of this project activity, an equivalent amount of energy would have been generated from the coal based boiler with higher GHG emissions. In this current monitoring period from 1-January- 2013 to 31-December-2018; 100% rice husk was used and it resulted in the reduction of 154,983 tons of GHG emissions.

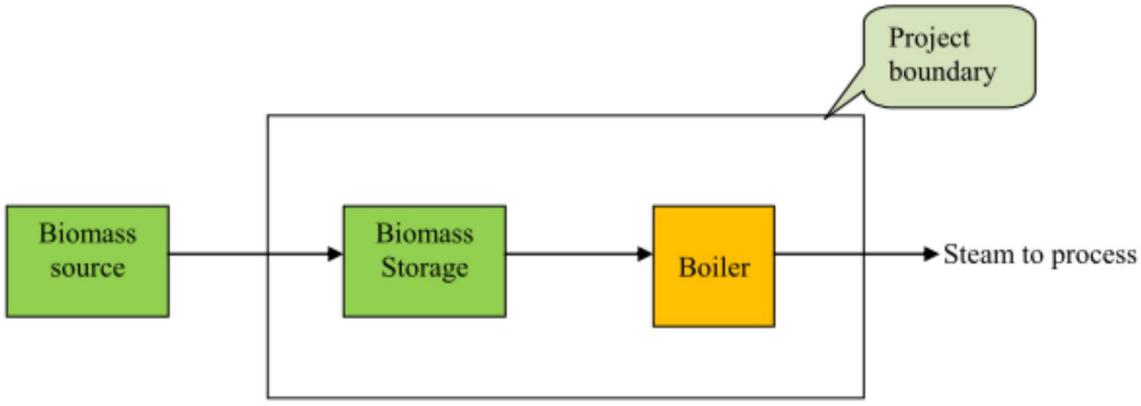
Brief description of the installed technology and equipment:

The plant was successfully commissioned and handed over to PP on 25/04/2009. The plant was in operation continuously since commissioning. No major equipment has been replaced or exchanged since commissioning.
The project boundary includes 15 TPH Cheema make biomass fired boiler for thermal energy generation. The details of project boundary and Technical specification of the biomass boiler used in the project activity are illustrated below:

Technical Specification of the Boiler

Type	Semi outdoor, Bi drum, water tube, AFBC boiler
Capacity	15TPH
Steam Pressure	21kg/cm2
Steam Temperature	Saturated
Make	Cheema Boiler

The project activity is installation of a new biomass fired boiler with rated capacity of 15 tonnes per hour of saturated steam at 21 kg/cm2 pressure. The boiler is of semi outdoor atmospheric fluidized bed combustion (AFBC), bi-drum water tube boiler. The steam generated in the project is supplied to the dairy plant of the project proponent. Both high and low pressure steam is required in the dairy plant. High pressure steam at approximately 21kg/cm2 pressure is required for the Spray Dryer and the low pressure steam at 3.5kg/cm2 is required in the milk and cream pasteurizer, butter and ghee unit, chilling process and cleaning purpose. Continuous and uninterrupted supply of steam is required for the dairy plant to ensure safe and clean products. Any interruption in steam supply leads to milk coagulation and affect the quality of the final product.



Relevant dates for the project activity:
Project activity was commissioned on 24/04/2009.

The project activity has been operational since then at full capacity.

Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period (01/01/2013 – 31/12/2018): 154,983 tCO_2e

1.2 Sectoral Scope and Project Type

The project belongs to Sectoral Scope 1, Energy industries (renewable / non-renewable sources)

This type of project with less than 1,000,000 tCO_2e per year. Further, the project is not a part of any groupedproject.

1.3 Project Proponent

Organization name	**Sterling Agro Industries Ltd.**
Contact person	Sharad Saluja
Title	Mr.
Address	Netaji Subhash Place, Pitampura 11th Floor, Aggarwal Cyber Plaza 2,New Delhi
Telephone	+91 9811345050
Email	sharad.saluja@gmail.com

1.4 Other Entities Involved in the Project

Organization name	**Enen Green Services Private Limited**
Role in the Project	Project participant
Contact person	Ruchika Sharma
Title	Ms.
Address	506,T4, RPS Savana, sector 88,Faridabad
Telephone	+91-9953935506
Email	enengreen@gmail.com

1.5 Project Start Date

The project start date is 25- April- 2009

1.6 Project Crediting Period

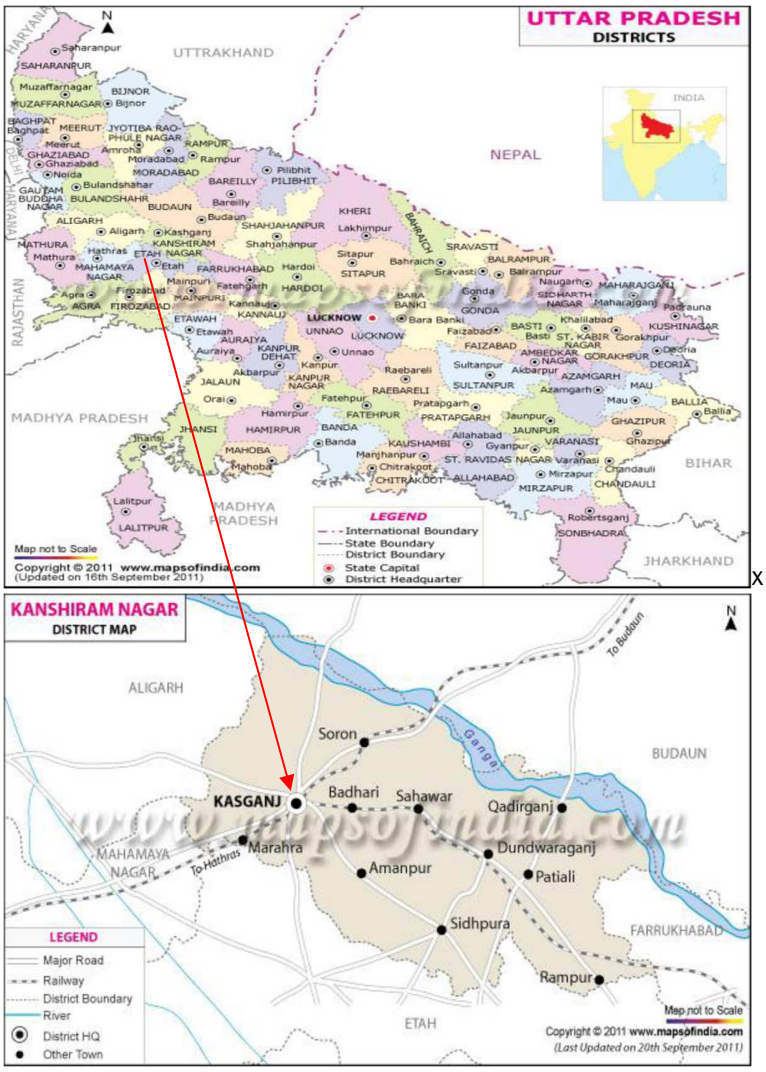
The validated choice of crediting period is 10 years

The crediting period is 25- April- 2009 to 24- April- 2019.

1.7 Project Location

Kasganj is connected to the project site by state highway. Kasganj Bus Station is the nearest bus terminal. Agra Civil Enclaves is the nearest airport. The geographical location of the plant is between Longitude 78°39'59.04" East and Latitude 27°49'52.13" North. Location is depicted in following maps-

Host Country: India.
State: Uttar Pradesh
District: Kanshiram Nagar
Village: Bhitouna
Geo-coordinates: Latitude: 27°49'52.13" N Longitude: 78°39'59.04" E



1.8 Title and Reference of Methodology

Title of the methodology applied: **Thermal energy production with or without electricity**

Type I – Renewable energy project

Category I.C: Thermal Energy production with or without electricity;Version13

Sectoral Scope: 1

The reference has been taken from the list of the small-scale CDM project activity categories contained in Appendix B of the simplified M&P for small-scale CDM project activities.

1.9 Participation under other GHG Programs

The project is also registered under CDM mechanism of UNFCCC. Reference no of project is 2952. Credits from Monitoring period 06- February -2010– 31- December -2012is

claimed as CDM project. However for the current monitoring period there is no application for verification under CDM mechanism in order to avoid double counting.

Mechanism in where Verification were verified	Monitoring period
VCS	25/04/2009 TO 05/02/2010
CDM	06/02/2010 TO 05/02/2011
CDM	06/02/2011 TO 31/12/2011
CDM	01/01/2012 TO 31/12/2012
VCS	01/01/2013 to 31/12/2018

1.10 Other Forms of Credit

The project is also registered under CDM mechanism of UNFCCC. Reference no of project is2952. Credits from Monitoring period 06-February-2010 – 31-December -2012are claimed as CDM project. The project is not registered in any other emission trading scheme. However for the current monitoring period there is no application for verification under CDM mechanism in order to avoid double counting. Project activity is not registered under REC mechanism.

https://www.recregistryindia.nic.in/index.php/publics/registered_regens

1.11 Sustainable Development

Project's contribution to Sustainable Development

The contributions of proposed project activity towards sustainable development are explained with indicators like social, economical, environmental and technological well-being, asfollows:

Environmental well-being

- Renewable biomass is used as a fuel in the project activity. Uses of renewable fuels will reduce the GHG emission to the environment as compared to non-renewable fuels which have positive emissions to the atmosphere.

- The project activity will also reduce the pollution associated with the extraction and transport of the fossil fuel.

Social well being

- The project activity will result in lower GHG emissions to the surrounding environment and improve the working conditions inside the plant premises as well as improving the local environment for people living in close proximity.
- The project activity will provide business opportunity for biomass suppliers, contractors, local people etc.

Economic well being

The project has created a business opportunity during construction phase for local stakeholders such as suppliers, contractors, bankers etc. contributing to economic well-being aspects. Further, the project also influences creation of employment opportunities for local people, which would enhance their social status. Also it Saves the coal and HSD and thus allows it to be diverted to other needy sections of the economy

Technological well being

The project activity utilizes biomass as fuel to generate steam and electricity. It is an advanced and sustainable technology for long term benefits. The project activity is expected to increase awareness and interest among the industry players to make investments in similar areas.

2 SAFEGUARDS

2.1 No Net Harm

This project activity does not involve any negative environmental or socio-economic impacts, as the biomass based boiler are installed for generation of steam and power using biomass as fuel in boiler which is a clean source of energy. Therefore, there are no potential negative environmental and socio-economicimpacts.

2.2 Local Stakeholder Consultation

At the time of project registration PP has organized stakeholder consultation meetings by*the District Magistrate,(Kasganj), Kashiram Nagar dated on 28/08/08* and Gram Panchayats of Soron road, Kasganj, Kanshiram Nagar dated on 28/08/08. A meeting was also held with villagers at the plant site on 28/08/08. Meeting presided with the brief introduction of the Villagers and representatives and investors. Mr. Vimal Agrawal, Director, Sterling Agro Industries Ltd. briefed about the agenda of the meetings and introduced the Global Warming, The plant has register and contact details at reception for local stakeholders to communicate. Local stakeholders may even meet after prior appointment with appointed person by management for any issues or concern. Appointed person will resolve their issues if any and also notify higher management about their concern and steps taken to resolve their issues. The same will be recorded and reviewed on quarterlybasis. During the current monitoring no comments received from local stakeholders.

2.3 AFOLU-Specific Safeguards

Not Applicable.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The plant was successfully commissioned and handed over to PP on 24/04/2009. The plant was in operation continuously since commissioning. No major equipment has been replaced or exchanged since commissioning. The details of project implementation are provided below.

S. No	Events	Date
1	Placement of Purchase order for biomass fired boiler	22/01/2008
2	Date of commissioning	24/04/2009
3	Date of Project registration	06/02/2010

The project boundary includes 15 TPH Cheema make biomass fired boiler for thermal energy generation. The details of project boundary and Technical specification of the biomass boiler used in the project activity are illustrated below:

Technical Specification of the Boiler

Type	**Semi outdoor, Bi drum, water tube, AFBC boiler**	
Make	Cheema Boiler	
Boiler Identification number	UP-6510	
Capacity	15	TPH
Steam Pressure	21	kg/cm^2
Steam Temperature	Saturated^2	^0c
Possible Fuel combination	-100% rice husk -100% coal -70% Rice husk/coal with 30% bagasse.	

The project activity is installation of a new biomass fired boiler with rated capacity of 15 tonnes per hour of saturated steam at 21 kg/cm2 pressure. The boiler is of semi outdoor atmospheric fluidized bed combustion (AFBC), bi-drum water tube boiler. The steam generated in the project is supplied to the dairy plant of the project proponent. Both high and low pressure steam is required in the dairy plant. High pressure steam at approximately 21kg/cm2 pressure is required for the Spray Dryer and the low pressure steam at 3.5kg/cm2 is required in the milk and cream pasteurizer, butter and ghee unit, chilling process and cleaning purpose. Continuous and uninterrupted supply of steam is required for the dairy plant to ensure safe and clean products. Any interruption in steam supply leads to milk coagulation and affect the quality of the final product.

There is no exchange of equipment during the monitoring period. There is no event occurred during this monitoring period, which may have impact on the applicability of the methodology as well as emission reduction

3.2 Deviations

2.3.1 Methodology Deviations

No deviation from methodology is sought during this monitoring period.

2.3.2 Project Description Deviations

During CDM first and second monitoring period, an increase in ER is observed due to following reasons:

1. Higher steam demand in the dairy products manufacturing unit results in higher PLF
2. Lower feed water inlet temperature

The changes described above from the registered PDD, version-1.3, dated 31/08/2009 are "permanent change". Changes are **permanent** under the situations mentioned under section B of Annex 66, EB 48. Therefore, the above changes trigger a notification in accordance with Section D of EB 48 Annex66.
Hence, PDD notification has been submitted to EB as per the guidelines outlined in Annex 66 and 67 of EB 48. Notification request was approved by UNFCCC on 01/02/2012. The details of the same can be found in following link of UNFCCC website-
https://cdm.unfccc.int/Projects/DB/SGS-UKL1251986974.66/view

As per the registered CDM PDD the biomass surplus availability of the project needs to be done on annual basis. However as per the clarification from UNFCCC- SSC -255, *,(Clarification on vintage of data and survey period for assessment of biomass availability in AMS-I.D (submitted 17 Dec 08): SSC_255)* the biomass assessment needs to be conducted once in entire crediting period. PP would like to seek deviation for the same in the current monitoring period. The registered PDD mentions that surplus biomass is available in the region which is more than 25%. Thus leakage emission is considered as zero. .PP would like to seek deviation based on UN clarification for this parameter.

Above deviations do not have any impact onthe applicability of the methodology, additionality or the appropriateness of the baseline scenario.

3.3 Grouped Projects

This is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	EF_{CO2}
Data unit	tCO_2/ TJ
Description	The CO2 emission factor per unit of energy of coal that would have been used in the baseline plant in absence of the project activity
Source of data	As per IPCC 2006 Volume 2 Energy Table 1.4
Value applied	96.1
Justification of choice of data or description of measurement methods and procedures applied	Default values, as per table 1.4 of IPCC 2006 Volume 2 Energy. Para 34 of AMS I C version 13, also suggested to adopt IPCC default emission factor.
Purpose of Data	Baseline emission calculation
Comments	-

Data / Parameter	η_{th}
Data unit	%
Description	The efficiency of the baseline coal fired boiler.
Source of data	As per methodology AMS I.C, Para 13. This value is being used to calculate the baseline emission.
Value applied	100
Justification of choice of data or description of measurement methods and procedures applied	The data is transparent and verifiable.
Purpose of Data	Baseline emission calculations
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	$Q_{steam,i}$
Data unit	Tonnes
Description	Quantity of steam generated
Source of data	On site measurement taken from steam flow meters.

<table>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Directly measured using steam flow meter. Data will be monitored on daily basis.

Monitoring: steam flow meter.

Data type: Measured.

Range: 0 to 100%

Archiving policy: Paper.

Recording Frequency: Daily

Responsibility: Manager (power plant) is responsible for regular calibration of the meter

Calibration Frequency: Annually</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Daily</td></tr>
<tr><td>Value monitored</td><td>2013: 111669 Tonne.

2014:111649 Tonne

2015: 109162 Tonne

2016: 109529 Tonne

2017: 102064 Tonne

2018: 109197 Tonne</td></tr>
<tr><td>Monitoring equipment</td><td>Monitoring Equipment: Steam Flow meter

Accuracy class: ±0.2 FS Serial number: 2k8060277

Calibration frequency: Annually

<table>
<tr><th>Date of Calibration</th><th>Due date of Calibration</th><th>Delay in Calibration</th><th>Non-Calibration Period</th></tr>
<tr><td>22-02-2012</td><td>21-02-2013</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>21-02-2013</td><td>20-02-2014</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>20-02-2014</td><td>19-02-2015</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>13-04 -2015</td><td>12/4/2016</td><td>Delay</td><td>19-02-2015 to 13-04-2015</td></tr>
<tr><td>17-07-2016</td><td>16-07-2017</td><td>Delay</td><td>12-04-2016 to 17-07-2016</td></tr>
<tr><td>15 -07-2017</td><td>14-07-2018</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>14-07-</td><td>13-07-2019</td><td>No delay</td><td>N.A.</td></tr>
</table>
</td></tr>
</table>

	2018
QA/QC procedures to be applied	The meter is calibrated and checked annually. .
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$T_{steam,i}$
Data unit	Degree Celsius
Description	Temperature of the steam generated.
Source of data	On site measurement
Description of measurement methods and procedures to be applied	Monitoring: temperature gauge Data type: Measured Range: 0 to 600 DEG. C Archiving policy: Paper. Recording Frequency: Daily Responsibility: Manager (power plant) is responsible for regular calibration of the meter Calibration Frequency: Annually
Frequency of monitoring/recording	Daily
Value monitored	2013: 218.5 2014: 217.8 2015: 217.6 2016: 217.8 2017: 217.8 2018: 217.8
Monitoring equipment	Monitoring Equipment: Temp Calibrator with RTD2 sensor Accuracy class: 0-600^0 C

	Serial number: 07046215 Calibration frequency: Annually

Date of Calibration	Due date of Calibration	Delay in Calibration	Non-Calibration Period
22-02-2012	21-02-2013	No delay	N.A.
21-02-2013	20-02-2014	No delay	N.A.
20-02-2014	19-02-2015	No delay	N.A.
13-04 - 2015	12/4/2016	Delay	19-02-2015 to 13-04-2015
16-07-2016	15-07-2017	Delay	12-04-2016 to 16-07-2016
11/7/2017	10/7/2018	No delay	N.A.
14-07-2018	13-07-2019	Delay	10-07-2018 to 14-07-2018

QA/QC procedures to be applied	The meter is calibrated and checked annually
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$P_{steam,i}$
Data unit	Kg/cm^2
Description	Pressure of the steam generated
Source of data	On-site measurement from pressure gauge.
Description of measurement methods and procedures to be applied	Monitoring: pressure gauge. Data type: Measured Range : 0 to 70 Kg/cm^3 Archiving policy: Paper. Recording Frequency: hourly Responsibility: Manager (power plant) is responsible for

<table>
<tr><td></td><td>regular calibration of the meter

Calibration Frequency: Annually</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Daily</td></tr>
<tr><td>Value monitored</td><td>2013: 20.6

2014: 20.5

2015: 20.6

2016: 20.6

2017: 20.6

2018: 20.6</td></tr>
<tr><td>Monitoring equipment</td><td>Monitoring Equipment: DigitalPressure Gauge

Accuracy class: 0-70 Kg/cm^3

Serial number: 0408P601

Calibration frequency: Annually

<table>
<tr><th>Date of Calibration</th><th>Due date of Calibration</th><th>Delay in Calibration</th><th>Non-Calibration Period</th></tr>
<tr><td>22-02-2012</td><td>21-02-2013</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>21-02-2013</td><td>20-02-2014</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>20-02-2014</td><td>19-02-2015</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>13-04 - 2015</td><td>12/4/2016</td><td>Delay</td><td>19-02-2015 to 13-04-2015</td></tr>
<tr><td>14-07-2016</td><td>13-07-2017</td><td>Delay</td><td>12-04-2016 to 14-07-2016</td></tr>
<tr><td>13 -07-2017</td><td>12/7/2018</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>12/7/2018</td><td>11/7/2019</td><td>No delay</td><td>N.A.</td></tr>
</table>
</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>Gauge will be tested annually as per manufacturer’s prescribed standards.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>-</td></tr>
</table>

Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$E_{steam, i}$
Data unit	*Kcal/kg*
Description	Enthalpy of the steam generated
Source of data	Estimated based on steam temperature and pressure using steam table.
Description of measurement methods and procedures to be applied	Estimated value based on steam temperature and pressure
Frequency of monitoring/recording	Daily
Value monitored	2013: 668.89 2014: 667.28 2015: 667.28 2016: 668.89 2017: 668.89 2018: 668.89
Monitoring equipment	The data is sourced from Steam table and hence this is not applicable.
QA/QC procedures to be applied	QA / QC is not applicable as the enthalpy of steam was directly calculated using the steam table.
Purpose of the data	Calculation of baseline emissions
Calculation method	Enthalpy of steam was directly calculated using the steam table.
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$T_{FW,i}$
Data unit	Degree Celsius

<table>
<tr><td>Description</td><td>Temperature of the feed water in the boiler.</td></tr>
<tr><td>Source of data</td><td>On-site measurement from temperature gauge installed at feed water inlet.</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Monitoring: temperature gauge

Data type: Measured

Range: 0 to 600 DEG.C

Archiving policy: Paper.

Recording Frequency: hourly

Responsibility: Manager (power plant) is responsible for regular calibration of the meter.

Calibration Frequency: Annually</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Daily</td></tr>
<tr><td>Value monitored</td><td>2013: 78.4

2014: 78.5

2015: 78.4

2016: 78.5

2017: 78.3

2018: 78.5</td></tr>
<tr><td>Monitoring equipment</td><td>Monitoring Equipment: Temperature Gauge

Accuracy class: 0-600^{0} C

Serial number5: 07046215

Calibration frequency: annually

<table>
<tr><th>Date of Calibration</th><th>Due date of Calibration</th><th>Delay in Calibration</th><th>Non-Calibration Period</th></tr>
<tr><td>22-02-2012</td><td>21-02-2013</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>21-02-2013</td><td>20-02-2014</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>20-02-2014</td><td>19-02-2015</td><td>No delay</td><td>N.A.</td></tr>
</table>
</td></tr>
</table>

	13-04 - 2015	12/4/2016	Delay	19-02-2015 to 13-04-2015
	16-07-2016	15-07-2017	Delay	12-04-2016 to 16-07-2016
	11/7/2017	10/7/2018	No delay	N.A.
	14-07-2018	13-07-2019	Delay	10-07-2018 to 14-07-2018
QA/QC procedures to be applied	The gauge was calibrated and checked annually.			
Purpose of the data	Calculation of baseline emissions			
Calculation method	-			
Comments	Data will be kept for crediting period + 2 years.			

Data / Parameter	$E_{FW, i}$
Data unit	*Kcal/kg*
Description	Enthalpy of feed water into boiler
Source of data	The data is sourced from steam table.
Description of measurement methods and procedures to be applied	Calculated.
Frequency of monitoring/recording	Daily
Value monitored	2013: 78.38 2014: 78.48 2015: 78.39 2016: 78.45 2017: 78.32 2018: 78.46
Monitoring equipment	The data is sourced from Steam table and hence this is not applicable.

QA/QC procedures to be applied	QA / QC is not applicable as the enthalpy of steam was directly calculated using the steam table.
Purpose of the data	Calculation of baseline emissions
Calculation method	Enthalpy of Feed Water was directly calculated using the steam table.
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	NCVff,i
Data unit	KJ/kg
Description	Net calorific value of fossil fuel of type i used.
Source of data	Plant laboratory
Description of measurement methods and procedures to be applied	Monitoring: Digital bomb calorimeter Data type: Estimated Archiving policy: Paper. Recording Frequency: Once in a year Responsibility: Manager (power plant) is responsible for regular calibration of the meter.
Frequency of monitoring/recording	Annually
Value monitored	0
Monitoring equipment	Monitoring Equipment: Digital bomb calorimeter Range : -10 to 10^0C Serial number: 2171-02-03 Calibration frequency: annually

Date of Calibration	Due date of Calibration	Delay in Calibration	Non-Calibration Period

	31-07-2012	30-07-2013	No delay	N.A.
	21-02-2013	20-02-2014	No delay	N.A.
	22-07-2014	21-07-2015	Delay	20-02-2014 to 22-07-2014
	15-07 -2015	14-07-2016	No delay	N.A.
	14-07-2016	13-07-2017	No delay	N.A.
	13 -07-2017	12/7/2018	No delay	N.A.
	12/7/2018	11/7/2019	No delay	N.A.

QA/QC procedures to be applied	Bomb calorimeter was calibrated annually.
Purpose of the data	Calculation of Project emissions
Calculation method	Measurement would be done on a Daily basis in plant laboratory using Bomb calorimeter. The data would be monitored annually. A bomb calorimeter is a type of constant-volume calorimeter used in measuring the heat of combustion of a particular reaction. Bomb calorimeters have to withstand the large pressure within the calorimeter as the reaction is being measured. Electrical energy is used to ignite the fuel, as the fuel is burning, it will heat up the surrounding air, which expands and escapes through a tube that leads the air out of the calorimeter. When the air is escaping through the copper tube it will also heat up the water outside the tube. The temperature of the water allows for calculating calorie content of the fuel. The CV measured by the Bomb calorimeter is Gross Calorific value. The conversion of GCV to NCV would be carried out by analyzing fuel characteristics and using algorithm as per IPCC-2006 guidelines, Volume-2 (Energy), Chapter-1(Introduction), page no-1.17. Since no fossil fuel was combusted in this monitoring period, no measurement for NCV was carried out.
Comments	Data will be kept for crediting period + 2 years.

<table>
<tr><td>Data / Parameter</td><td>NCVbiomass,i</td></tr>
<tr><td>Data unit</td><td>KJ/kg</td></tr>
<tr><td>Description</td><td>Net calorific value of Biomass of type i used.</td></tr>
<tr><td>Source of data</td><td>GCV of the rice husk was measured once in a year in the Plant laboratory using a bomb calorimeter and NCV was calculated using algorithm as per IPCC-2006 guidelines, Volume-2 (Energy), Chapter-1(Introduction), page no-1.17.(please refer calculation method).</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Monitoring: Digital bomb calorimeter

Data type: Estimated

Archiving policy: Paper.

Recording Frequency: Once in a year

Responsibility: Manager (power plant) is responsible for regular calibration of the meter.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Annually</td></tr>
<tr><td>Value monitored</td><td>9708.78</td></tr>
<tr><td>Monitoring equipment</td><td>Monitoring Equipment: Digital bomb calorimeter

Range :-10 to 10^{0}C

Serial number: 2171-02-03

Calibration frequency: annually

<table>
<tr><th>Date of Calibration</th><th>Due date of Calibration</th><th>Delay in Calibration</th><th>Non-Calibration Period</th></tr>
<tr><td>31-07-2012</td><td>30-07-2013</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>21-02-2013</td><td>20-02-2014</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>22-07-2014</td><td>21-07-2015</td><td>Delay</td><td>20-02-2014 to 22-07-2014</td></tr>
</table>
</td></tr>
</table>

	15-07 - 2015	14-07-2016	No delay	N.A.
	14-07-2016	13-07-2017	No delay	N.A.
	13 -07-2017	12/7/2018	No delay	N.A.
	12/7/2018	11/7/2019	No delay	N.A.

QA/QC procedures to be applied	Bomb calorimeter was calibrated annually.
Purpose of the data	Calculation of Baseline emissions
Calculation method	Measurement would be done on a Daily basis in plant laboratory using Bomb calorimeter. The data would be monitored annually. A bomb calorimeter is a type of constant-volume calorimeter used in measuring the heat of combustion of a particular reaction. Bomb calorimeters have to withstand the large pressure within the calorimeter as the reaction is being measured. Electrical energy is used to ignite the fuel, as the fuel is burning, it will heat up the surrounding air, which expands and escapes through a tube that leads the air out of the calorimeter. When the air is escaping through the copper tube it will also heat up the water outside the tube. The temperature of the water allows for calculating calorie content of the fuel. The CV measured by the Bomb calorimeter is Gross Calorific value. The conversion of GCV to NCV would be carried out by analyzing fuel characteristics and using algorithm as per IPCC-2006 guidelines, Volume-2 (Energy), Chapter-1(Introduction), page no-1.17. Since fossil fuel was not combusted in this monitoring period, no measurement for NCV was carried out.
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$Q_{fossil, i,y}$
Data unit	Kg

<table>
<tr><td>Description</td><td>Quantity of fossil fuel of type i combusted in year y</td></tr>
<tr><td>Source of data</td><td>On-site measurement using weighing scales and the same was recorded in the log book.</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Monitoring: weigh bridge

Data type: Measured

Range: 0 to 12 TON

Archiving policy: Paper.

Recording Frequency: Daily

Responsibility: Manager (power plant) is responsible for regular calibration of the meter.

Calibration Frequency: Annually</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Daily</td></tr>
<tr><td>Value monitored</td><td>0</td></tr>
<tr><td>Monitoring equipment</td><td>Monitoring Equipment: weighing Scales.

Accuracy class: 0 to 12 Ton

Serial number: EB08MR051

Calibration frequency: annually

<table>
<tr><th>Date of Calibration</th><th>Due date of Calibration</th><th>Delay in Calibration</th><th>Non-Calibration Period</th></tr>
<tr><td>31-07-2012</td><td>30-07-2013</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>21-02-2013</td><td>20-02-2014</td><td>No delay</td><td>N.A.</td></tr>
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<tr><td>14-07-2016</td><td>13-07-2017</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>13 -07-2017</td><td>12/7/2018</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>12/7/2018</td><td>11/7/2019</td><td>No delay</td><td>N.A.</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures to be</td><td>The weigh scale used for measuring fuels is calibrated annually. The data can be cross checked with the fossil fuel procurement</td></tr>
</table>

applied	data.
Purpose of the data	Calculation of Project emissions
Calculation method	-
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$Q_{biomas, i,y}$
Data unit	Kg
Description	Quantity of Biomass of type i combusted in year y
Source of data	On-site measurementusing weighing scales and the same was recorded in the log book.
Description of measurement methods and procedures to be applied	Monitoring: weigh bridge Data type: Measured Range: 0 to 12 TON Archiving policy: Paper. RecordingFrequency: Daily Responsibility:Manager (power plant) is responsible for regular calibration of the meter. Calibration Frequency:Annually
Frequency of monitoring/recording	Daily
Value monitored	2013:32,734.3 2014:32,671.21 2015: 31,825 2016:32,116.7 2017:32,159.1

<table>
<tr><td></td><td>2018: 32,007.8</td></tr>
<tr><td>Monitoring equipment</td><td>Monitoring Equipment: weighing Scales.

<u>Range: 0 to 12 TON</u>

Serial number: EB08MR051

Calibration frequency: annually

<table>
<tr><th>Date of Calibration</th><th>Due date of Calibration</th><th>Delay in Calibration</th><th>Non-Calibration Period</th></tr>
<tr><td>31-07-2012</td><td>30-07-2013</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>21-02-2013</td><td>20-02-2014</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>22-07-2014</td><td>21-07-2015</td><td>Delay</td><td>20-02-2014 to 22-07-2014</td></tr>
<tr><td>15-07 -2015</td><td>14-07-2016</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>14-07-2016</td><td>13-07-2017</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>13 -07-2017</td><td>12/7/2018</td><td>No delay</td><td>N.A.</td></tr>
<tr><td>12/7/2018</td><td>11/7/2019</td><td>No delay</td><td>N.A.</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The weigh scale used for measuring fuels is calibrated annually. The data can be cross checked with the fossil fuel procurement data.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of Baseline emissions</td></tr>
<tr><td>Calculation method</td><td>-</td></tr>
<tr><td>Comments</td><td>Data will be kept for crediting period + 2 years.</td></tr>
</table>

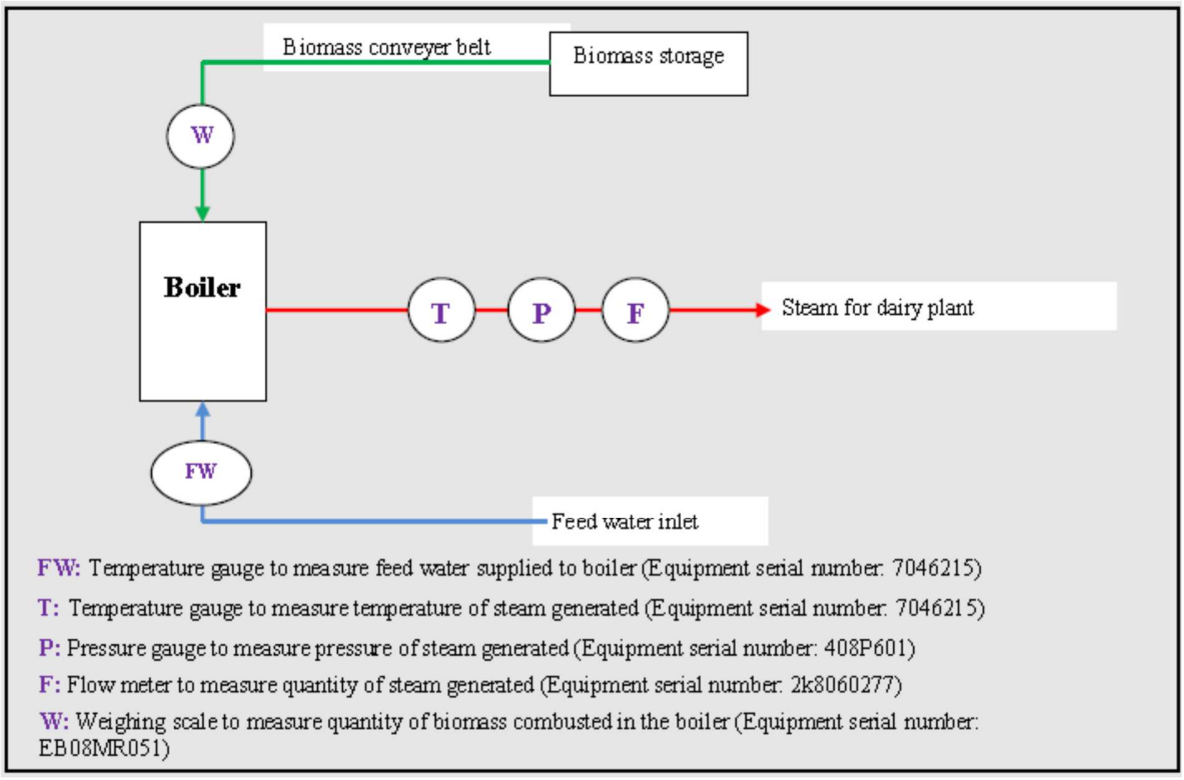
Data / Parameter	Biomass Availability
Data unit	Tonnes
Description	Surplus biomass availability in the region
Source of data	Sterling Agro Industries Ltd. had carried out biomass assessment through an external expert at the beginning of the crediting period (i.e during validation of the project) and it was demonstrated that

	the quantity of available biomass in the region is 316%.
Description of measurement methods and procedures to be applied	Measured
Frequency of monitoring/recording	PP has conducted the biomass assessment study at the beginning of the crediting period (i.e. during validation) of the project activity and it was demonstrated that the quantity of available biomass in the region is more than 25% than the quantity of biomass that is utilized including the project activity. Hence as per "General guidance on leakage in biomass project activities, version-03" EB 47, Annex 28, the monitoring of this parameter is not required for leakage emission calculation.
Value monitored	*N/A*
Monitoring equipment	N/A
QA/QC procedures to be applied	N/A
Purpose of the data	Calculation of Leakage emissions
Calculation method	-
Comments	Data will be kept for crediting period + 2 years.

4.3 Monitoring Plan

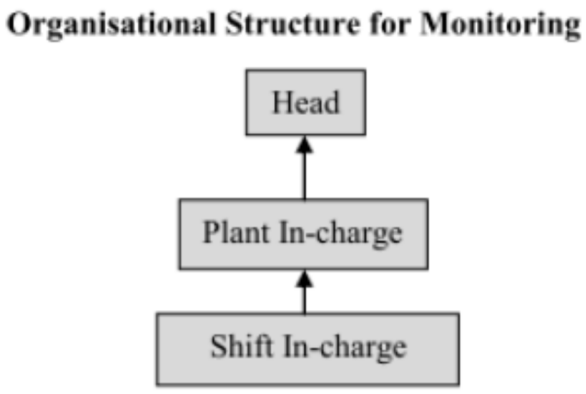
For above stated parameters for which monitoring and measurements apply, Supervisors take measurements and records are made. Management of Sterling Agro Industries Ltd. ensures that appropriate equipments required for the measurement are provided.

The Metering arrangement showing the meter locations of the parameters are provided below:



Operational & Management Structure-

Sterling Agro Industries Ltd. has the following structure for data monitoring, collection, data archiving, and calibration of metering equipments. The team comprises of the following members:



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.

Personnel training: In order to ensure a proper functioning of the project activity and a proper monitoring of emission reductions, the staffs are trained with CDM interaction sessions, technical presentations and training on CDM etc which helped workers to undertake the necessary tasks in a transparent and credible approach.

The operators and other grass root level workers are also trained for equipment operation, data recording, reports writing, O&M and emergency preparedness etc which is in compliance with the monitoring plan.

Data collection and record keeping: Data are collected at the plant operation site under the supervision of the shift-in-charge and data are recorded and maintained in daily logs. The reports are checked periodically by the Plant In-charge and discussed thoroughly with the data monitoring personnel. Internal CDM audit is carried out by the head of the CDM team to check the correctness of monitoring procedures and data monitored by the CDM team. A similar procedure is carried out for accurate data collection and record keeping of biomass supply on the site, its storage and usage in the project activity.

Reliability of data collected: The reliability of data collected is ensured through the periodic calibration of the equipments used for the monitoring report. The record of the same is maintained by Plant In-charge.

Maintenance of instruments and equipments: Instruments are subject to a regular maintenance and cross-checking of once in a year. The Operations Department monitors the proper functioning of the equipments/ instruments throughout the monitoring period and also done the corrective action whenever required.

Emergency preparedness: The project activity does not result in any unidentified activity that can result in substantial emissions from the project activity. In case of failure of the monitoring equipments, monitoring equipment will be replaced. Data pertains to that period will not be considered for emission reduction calculation. During the current monitoring period equipment failure is nil.

Calibration of Monitoring Equipments:

Meter Type	Date of calibration	Calibration due on	Delay in calibration	Non-Calibration Period	Serial No	Make	Accuracy Class and Range	Calibration Agency
Temperature Gauge – Steam	22-02-2012	21-02-2013	No delay	N.A.	7046215	Masibus	±0.2%FS 0-600 Deg C	Classic instrumentation Pvt Ltd.
	21-02-2013	20-02-2014	No delay	N.A.				
	20-02-2014	19-02-2015	No delay	N.A.				
	13-04 -2015	12/4/2016	Delay	19-02-2015 to 13-04-2015				
	16-07-2016	15-07-2015	Delay	12-04-2016 to				

				16-07-2016				
	11/7/2017	10/7/2018	No delay	N.A.				
	14-07-2018	13-07-2019	Delay	10-07-2018 to 14-07-2018				
Temperature Gauge – Feed water	22-02-2012	21-02-2013	No delay	N.A.	7046215	Masibus	±0.2%FS 0-600 Deg C	Classic instrumentation Pvt Ltd.
	21-02-2013	20-02-2014	No delay	N.A.				
	20-02-2014	19-02-2015	No delay	N.A.				
	13-04 -2015	12/4/2016	Delay	19-02-2015 to 13-04-2015				
	16-07-2016	15-07-2015	Delay	12-04-2016 to 16-07-2016				
	11/7/2017	10/7/2018	No delay	N.A.				
	14-07-2018	13-07-2019	Delay	10-07-2018 to 14-07-2018				
Pressure gauge-Steam	22-02-2012	21-02-2013	No delay	N.A.	408P601	Forbes	±1%FS 0-70 Kg/cm^3	Classic instrumentation Pvt Ltd.
	21-02-2013	20-02-2014	No delay	N.A.				
	20-02-2014	19-02-2015	No delay	N.A.				
	13-04 -2015	12/4/2016	Delay	19-02-2015 to 13-				

				04-2015				
	14-07-2016	13-07-2017	Delay	12-04-2016 to 14-07-2016				
	13 -07-2017	12/7/2018	No delay	N.A.				
	12/7/2018	11/7/2019	No delay	N.A.				
Steam flow meter	22-02-2012	21-02-2013	No delay	N.A.	2k8060277	Forbes	±0.2% FS 0 to 100%	Classic instrumentation Pvt Ltd.
	21-02-2013	20-02-2014	No delay	N.A.				
	20-02-2014	19-02-2015	No delay	N.A.				
	13-04 -2015	12/4/2016	Delay	19-02-2015 to 13-04-2015				
	17-07-2016	16-07-2017	Delay	12-04-2016 to 17-07-2016				
	15 -07-2017	14-07-2018	No delay	N.A.				
	14-07-2018	13-07-2019	No delay	N.A.				
Digital Bomb Calorimeter	31-07-2012	30-07-2013	No delay	N.A.	21710203	Rajdhani	±0.01% FS - 10 to + 10 Deg	Classic instrumentation Pvt Ltd.
	21-02-2013	20-02-2014	No delay	N.A.				
	22-07-2014	21-07-2015	Delay	20-02-2014 to 22-07-2014				
	15-07 -2015	14-07-2016	No delay	N.A.				
	14-07-2016	13-07-2017	No delay	N.A.				
	13 -07-2017	12/7/2018	No delay	N.A.				
	12/7/2018	11/7/2019	No delay	N.A.				

Weighing balance/ indicator	31-07-2012	30-07-2013	No delay	N.A.	EB08MR051	Avery	±0.003 Ton 0 to 12 Ton	Galaxy test & calibration Lab
	21-02-2013	20-02-2014	No delay	N.A.				
	22-07-2014	21-07-2015	Delay	20-02-2014 to 22-07-2014				
	15-07 -2015	14-07-2016	No delay	N.A.				
	14-07-2016	13-07-2017	No delay	N.A.				
	13 -07-2017	12/7/2018	No delay	N.A.				
	12/7/2018	11/7/2019	No delay	N.A.				

For calibration delay period correction factor applied: Project participant would like to emphasize that the meters were calibrated as per the monitoring plan. For the period where the meters did not follow calibration frequency an erro factor is being applied accordingly. There calibration certificates were checked and it is found that the meters are working properly and within the permissible limit. As per Para 366 of VVS , for the delayed period manufacturer accuracy class was applied accordingly as the error are within the permissible limit. For non-calibration period, the Project proponent has applied the maximum error factor of equipment on monitored values as per GUIDELINES FOR ASSESSING COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS" version 01. The calculation is presented in ER sheet.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

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

$BE_y = HG_y * EF_{CO2} / \eta th$

Where;

BE_y = the baseline emissions from steam displaced by the project activity during the year y in tCO_2e.

HG_y = the net quantity of steam supplied by the project activity during the year y in TJ.

EF_{CO2} = the CO_2 emission factor per unit of energy of the coal that would have been used in the baseline plant in (tCO_2 / TJ), IPCC default emission factor is used (96.1 tCO_2/TJ).

ηth = the efficiency of the boiler using coal that would have been used in the absence of the project activity.

Sample Calculation for Baseline Emissions:

A sample calculation for baseline emission is presented below for the month January 2013:

BEy = HGy * EFCO2 /ηth

= 9730×1000 × (668.89 – 78.38) × 4.1868 × 96.1/10^9 / 100%

BEy = 2311 tCO_2.

For entire monitoring period from 01-January-2013 to 31-December-2018

BEy = 154,983 tCO_2

5.2 Project Emissions

Project emissions on account of use of fossil fuel would be considered and monitored as per the "**Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", version-02, EB41.**

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

PEFC,j,y= ΣFCi,j,y* COEFi,y

Where;
*PEFC,j,y*Are the CO2 emissions from fossil fuel combustion in process j during the year *y* (tCO2/yr)
*FCi,j,y*the quantity of fuel type *i*combusted in process *j* during the year *y* (mass or volume unit/yr)
*COEFi,y*the CO2 emission coefficient of fuel type *i*in year *y* (tCO2/mass or volume unit)

*i*the fuel types combusted in process *j* during the year *y*. yr(round up Value)

The CO2 emission coefficient *COEFi,y*is calculated based on net calorific value and CO2 emission factor of the fuel type *i*, as follows:
COEFi,y= NCVi,y* EFCO2,i,y
Where,
*COEFi,y*the CO2 emission coefficient of fuel type i in year *y* (tCO2/mass or volume unit)
*NCVi,y*the weighted average net calorific value of the fuel type *i*in year *y* (GJ/mass or volume unit)
EFCO2,i,y the weighted average CO2 emission factor of fuel type *i*in year *y* (tCO2/GJ)
i the fuel types combusted in process *j* during the year *y*
Sample Calculation of Project Emission:
A sample calculation for project emission is presented below for the month January 2012:
Since Fossil fuel consumption in the boiler is zero in this monitoring period, the value of
ΣFCi,j,y= 0
*PEFC,j,y= 0 * COEFi,y*
PEFC,j,y= 0

5.3 Leakage

A. Leakage as per the "General guidance on leakage in biomass project activities".

PP has conducted the biomass assessment study at the beginning of the crediting period and it was found that the quantity of available biomass in the region is more than 25% than the quantity of biomass that is utilized including the project activity. Since there is enough biomass residue

available in the region that goes unutilized and hence leakage emissions on account of competing use of this biomass residue has not been considered.

B. Leakage due to transfer of equipments to/ from the project activity

As per the methodology, if the equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. The equipments installed in the project activity are not transferred from any other activity. Besides, no existing equipment has been transferred from the project site. Hence leakage for this part is zero.

C. Leakage due to transportation of biomass to the plant site

The project activity is not expected to cause any leakage emissions due to transportation of biomass; rather it is expected to result in reduced leakage emissions due to reduced transportation of fuel. In the pre-project scenario coal was procured from the mines located at a distance of around 300-350 kms from the project site, where as in the post project scenario the project activity the biomass is procured from in a region of max 100 kms from the project site. However being conservative the project proponent is not claiming any emission reductions due to reduced fuel transportation.

Calculation for Leakage:

As described above the Leakage (Ly) emission for this current monitoring period is zero. Ly = 0

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year-2013	26,520	0	0	26,520
Year-2014	26,433	0	0	26,433
Year-2015	25,849	0	0	25,849
Year-2016	26,010	0	0	26,010
Year-2017	24,242	0	0	24,242
Year-2018	25,929	0	0	25,929
Total	154,983	0	0	154,983

Comparison of Emission Reductions with ex-ante estimated values:

Monitored ERs	Estimated ERs for period	Difference in the ERs	Percentage difference in ERs
154,983	157,548	-2,565	-1.63%

Therefore, there is an increase in emission reductions as compared to the ex-ante estimated value (6x26,258=157,548) for the equivalent period of 6 years.The actual emission reduction is less than the estimated value. The reason for the same is less steam flow for the monitoring period.