**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

# CONSOLIDATED MONITORING REPORT

| | |
|---|---|
| **Title of the Programme of Activities** | "Promotion of Biomass Based Heat Generation Systems in India" |
| **Reference number of the Programme of Activities** | PoA 4041[1] |
| **Version number of the consolidated monitoring report** | 1.0 |
| **Completion date of the consolidated monitoring report** | 24/11/2012 |
| **Registration date of the Programme of Activities** | 12/01/2011 |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period Number 1<br>Duration: 12/01/2011 to 31/08/2012 (First and Last days included) |
| **Coordinating/managing entity** | Thermax Sustainable Energy Solutions Ltd. |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **PoA boundary** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / non renewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the included CPA - DD(s)** | 54,758 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 10,475 $tCO_2e$ |
| **Number of CPA(s) included as on last date of this monitoring period** | 17 (till 31/08/2012) |

[1] http://cdm.unfccc.int/ProgrammeOfActivities/poa_db/OQEHR16A3SIV48T2PDKF0MWJ7G5YNU/view

**Details of CPAs included as on last date of this monitoring period (till 31/08/2012)**

| Sr.no. | UNFCCC REF No. | CPA Titile | Name of the CPA operator | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| 1 | 4041-0001 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 001) | Foods and Inns Limited | 12/01/2011 | 12/01/2011 |
| 2 | 4041-0002 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 002) | Ramdevbaba Solvent Private Limited | 23/03/2012 | 31/03/2012 |
| 3 | 4041-0003 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 011) | Mega Solvent Extractions Limited | 23/03/2012 | 31/03/2012 |
| 4 | 4041-0004 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 003) | Srinivasa Soya Private Limited | 30/04/2012 | 01/05/2012 |
| 5 | 4041-0005 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 004) | Lactose (India) Limited | 30/04/2012 | 01/05/2012 |
| 6 | 4041-0006 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 006) | Sneha Farms Private Limited | 30/04/2012 | 01/05/2012 |
| 7 | 4041-0007 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 007) | Swadisht Oils (P) Limited | 30/04/2012 | 01/05/2012 |
| 8 | 4041-0008 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 008) | Mantora Oil Products Limited | 30/04/2012 | 01/05/2012 |
| 9 | 4041-0009 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 005) | Growel Feeds Private Limited | 31/05/2012 | 01/06/2012 |
| 10 | 4041-0010 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 009) | Vallabh Textiles Company Limited | 31/05/2012 | 01/06/2012 |
| 11 | 4041-0011 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 010) | Shree GRG Oil Mill | 31/05/2012 | 01/06/2012 |
| 12 | 4041-0012 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 012) | Kopran Limited | 29/06/2012 | 01/07/2012 |
| 13 | 4041-0013 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 013) | Shree Sita Edibles Private Limited | 29/06/2012 | 01/07/2012 |
| 14 | 4041-0014 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 014) | Kapil Solvex Pvt. Ltd. | 29/06/2012 | 01/07/2012 |

| | | | | | |
|---|---|---|---|---|---|
| 15 | 4041-0015 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 015) | Skol Breweries Limited | 29/06/2012 | 01/08/2012 |
| 16 | 4041-0016 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 016) | Navadurga Enterprises Private Limited | 31/07/2012 | 01/08/2012 |
| 17 | 4041-0017 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 017) | Shrinivasa Agro Foods Pvt. Ltd. | 30/08/2012 | 01/09/2012 |

**Emission reduction details of the CPAs in the monitoring period**

| Sr. No | UNFCCC REF No. of the included CPA(s) | Estimated GHG emission reductions ($tCO_2e$) as per included CPA- DD | Achieved GHG emission reductions ($tCO_2e$) in the monitoring period |
|---|---|---|---|
| 1 | 4041-0001 | 8,553 | 954 |
| 2 | 4041-0002 | 5,289 | 2,615 |
| 3 | 4041-0003 | 4,650 | 675 |
| 4 | 4041-0004 | 4,705 | ---* |
| 5 | 4041-0005 | 1,458 | 490 |
| 6 | 4041-0006 | 1,445 | 413 |
| 7 | 4041-0007 | 6,284 | 760 |
| 8 | 4041-0008 | 5,275 | ---* |
| 9 | 4041-0009 | 3,200 | 1,891 |
| 10 | 4041-0010 | 3,323 | ---* |
| 11 | 4041-0011 | 3,259 | 2,024 |
| 12 | 4041-0012 | 893 | 546 |
| 13 | 4041-0013 | 2,797 | 74 |
| 14 | 4041-0014 | 1,848 | ---* |
| 15 | 4041-0015 | 1,079 | 33 |
| 16 | 4041-0016 | 700 | ---* |
| 17 | 4041-0017 | 0 | ---* |

Note

* Monitoring report not submitted as CME is not claiming any CERs for these CPA's in the current monitoring period. For these CPA(s), CME will not be claiming any CERs for the monitoring period number 1 in subsequent verification(s).

**List of Monitoring reports for CPA(s) being proposed for verification for this monitoring period**

| Sr.no. | Appendix No. | UNFCCC REF No. | CPA Titile | Monitoring Report version / date | Start date of emission reduction in this monitoring period |
|---|---|---|---|---|---|
| 1 | Appendix-1 | 4041-0001 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 001) | 1.0; 18/10/2012 | 12/01/2011 |
| 2 | Appendix-2 | 4041-0002 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 002) | 1.0; 18/10/2012 | 31/03/2012 |
| 3 | Appendix-3 | 4041-0003 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 011) | 1.0; 18/10/2012 | 31/03/2012 |
| 4 | Appendix-4 | 4041-0005 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 004) | 1.0; 18/10/2012 | 01/05/2012 |
| 5 | Appendix-5 | 4041-0006 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 006) | 1.0; 18/10/2012 | 01/05/2012 |
| 6 | Appendix-6 | 4041-0007 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 007) | 1.0; 18/10/2012 | 01/05/2012 |
| 7 | Appendix-7 | 4041-0009 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 005) | 1.0; 18/10/2012 | 01/06/2012 |
| 8 | Appendix-8 | 4041-0011 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 010) | 1.0; 18/10/2012 | 01/06/2012 |
| 9 | Appendix-9 | 4041-0012 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 012) | 1.0; 09/10/2012 | 01/07/2012 |
| 10 | Appendix-10 | 4041-0013 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 013) | 1.0; 18/10/2012 | 01/07/2012 |
| 11 | Appendix-11 | 4041-0015 | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 015) | 1.0; 18/10/2012 | 01/08/2012 |

**Appendix-1**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

# MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 001) |
| **Reference number of the project activity** | CPA 4041-0001[2] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 12/01/2011 (Inclusion Date of CPA in Registered PoA No.4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 12/01/2011 to 31/08/2012 (first and last days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 8,553 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 954 $tCO_2e$ |

[2] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=N1UVKCLWBFRI429JYHGP76XQEZD03A

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 4 TPH biomass residues (biomass briquettes) fired boiler at Foods and Inns Limited for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 4 TPH Combipac boiler manufactured by Thermax Limited. It is designed to operate at a maximum pressure of 10.54 kg/cm$^2$ and has an external water walled furnace with Horizontal fixed grate. The steam generated from the boiler is utilised in the thermal processing of seasonal fruits like Mango, Guava, Papaya, Tomato etc.

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| PoA-4041 0001 | Foods and Inns Limited | Boiler - 4 TPH (From and At 100$^0$C) | 05/05/2008 | 12/01/2011 | 12/01/2011 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 12/01/2011 to 31/08/2012 (first and last days included) is 954 $tCO_2e$

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| PoA-4041 0001 | Foods and Inns Limited | Gat no. 340, Village- Gonde, Taluka- Sinnar, District- Nasik 422606, Maharashtra, India. | 19˚47'20" North 74˚04'00" East | India |

Fig.A.2.1 Physical Location of the project activity

**A.3. Parties and project participant(s)**

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [3]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[4]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[5]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[6]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[7]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[8]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 12/01/2011, the date of inclusion in the registered PoA

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

[3] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[4] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[5] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[6] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[7] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[8] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 001 |
| CPA Operator | Foods And Inns Limited |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler |
| Project activity | Installation of biomass fired boiler having rated steam Generation Capacity of 4 Tons per Hour (TPH) |
| Boiler Make | Thermax Limited |
| Boiler Model | Combipac |
| Maximum working pressure | 10.54 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 4 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Biomass Briquettes) |
| Type of fuel firing | Manual |
| Furnace type | External Water walled furnace with Horizontal fixed grate |
| Boiler Number | CPD40/10.54/15 |
| Commissioning date | 05/05/2008 |

The boiler consists of mainly the following parts:
1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently Biomass briquettes as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection, water preheating system, flue gas discharge, ash discharge, electrical systems, equipment safeties & controls

The CPA operator has utilized biomasses for heat generation i.e. Biomass Briquettes, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii.**Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**
**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**
There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**
There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**
There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**
There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**
There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**
Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by separate temperature measuring instrument |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meters |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments (sr. no. 1 to 4) are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data has been transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

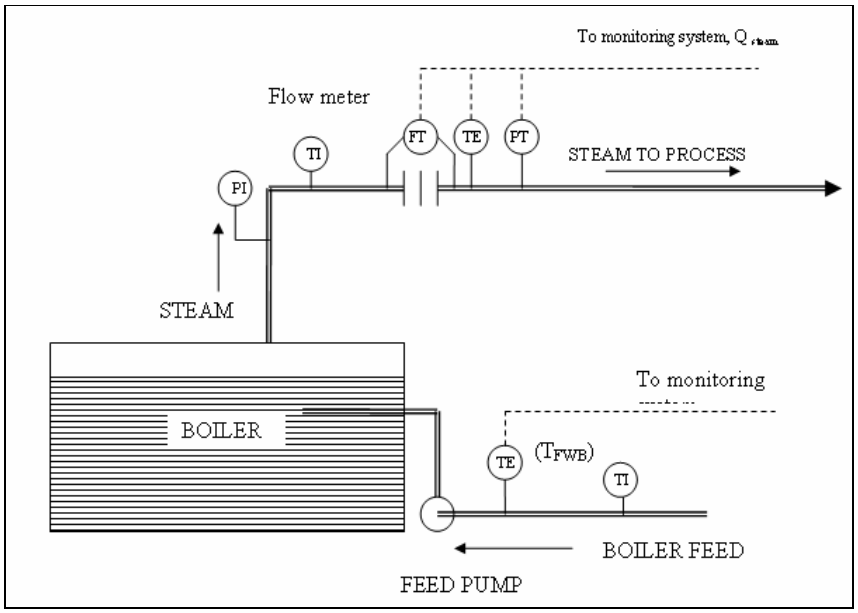


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) have been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Duly calibrated weigh Bridge has been used to weigh the biomass consumed in the project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However no fossil fuel was used in this project activity for the monitoring period.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator). This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

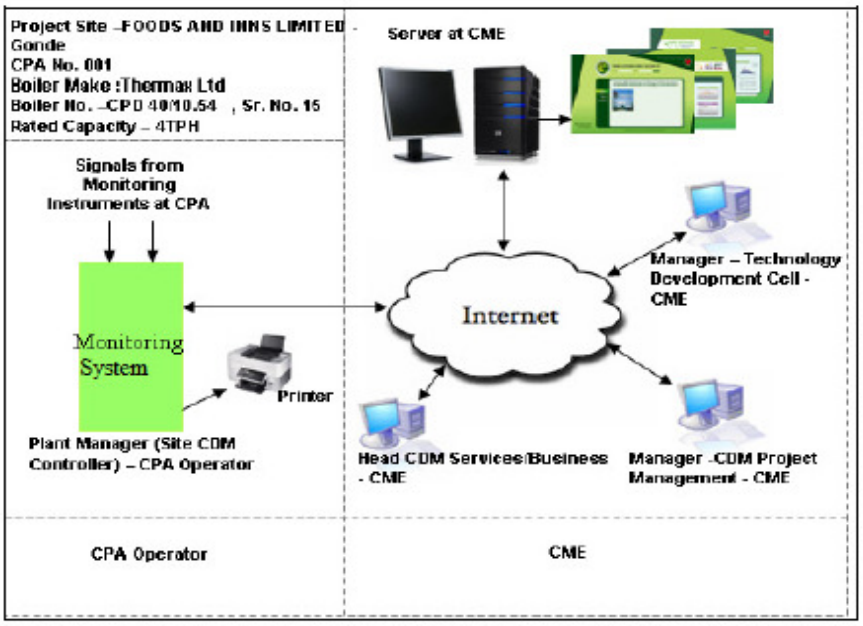


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

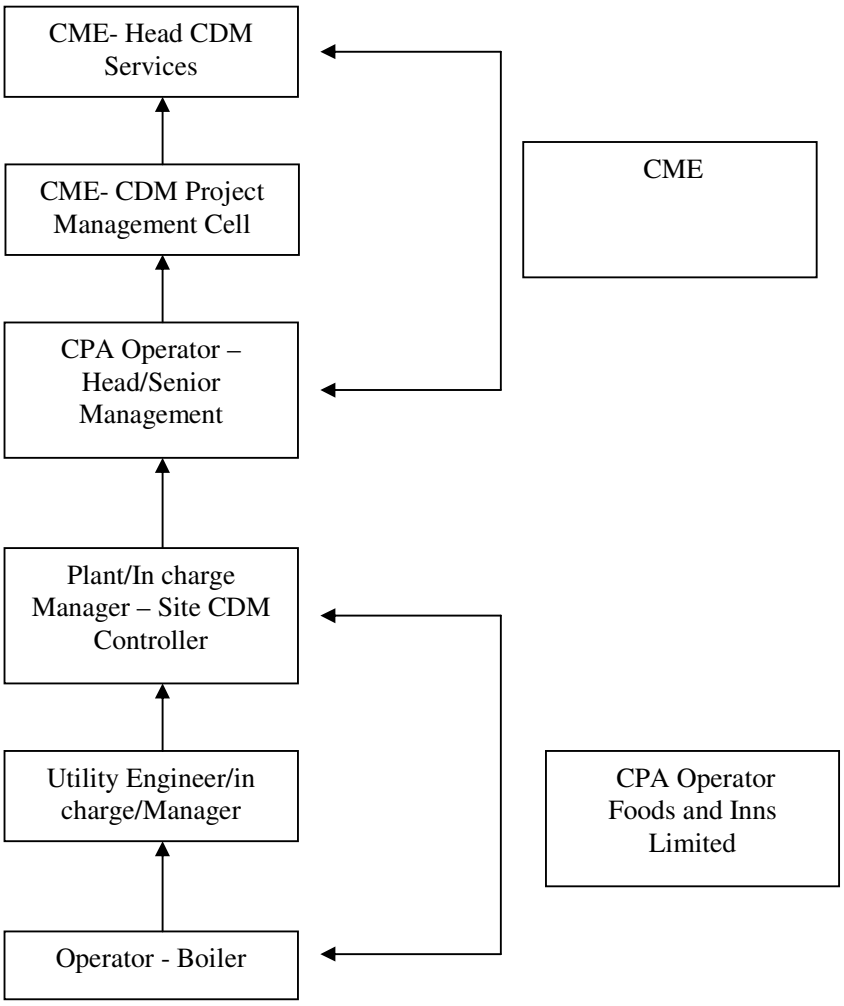


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator – Foods And Inns Limited

| **Key operational roles** | **CPA Management Responsibilities** |
|---|---|
| Head/Senior Management - | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head CDM services for final reporting into emission reduction sheet<br>• Quarterly performance review |
| Plant/In charge/Manager (Site CDM Controller) | • Performance Review- Monthly<br>• Verification/review of data<br>• Internal audits<br>• Review of corrective actions |
| Utility Engineer/In charge/ Manager | • Verifying & archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |

| | |
|---|---|
| Operators - Boiler | • Recording/Collection of data<br>• Daily logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i.e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 4 (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\eta_{BL,thermal}$ |
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4). |
| **Value(s) applied** | 75.5 (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | The value of the Baseline fuel shall be indicated as per the baseline identification test for each Project activity/CPA. The baseline identification test concluded Furnace Oil (FO) as a plausible alternative to the Project activity for baseline emission calculation. EF factor of FO is conservative due to lower EF than those of all coal related EF as per mentioned source. Hence FO EF is considered.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass within 50 km radial distance |
| **Source of data** | Third Party Survey report |
| **Value(s) applied** | 33.77 (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | NEWNE grid – 0.80 (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link - http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system. The ex-ante grid emission factor will be revised at the point of the renewal of crediting period of the PoA. (if so required).<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{LE,l,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption for biomass processing, outside Project boundary |
| **Source of data** | Declaration by biomass supplier / Technical specification of electricity consumption for biomass processing. |
| **Value(s) applied** | 38 |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | The auxiliary electricity consumption for biomass processing from equipment has been calculated in MWh by using the technical specification of electricity consumption for biomass processing from the equipment supplier in MW/Ton multiplied by the total processed biomass consumed in the monitoring period. Not applicable if surplus availability of biomass ex-ante within 50km is >25%.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2$/km |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>For leakage electricity consumption.<br>Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record |
| **Value(s) applied** | 0.00428 for Biomass residues<br>0.00437 for Imported coal (Indonesian)<br>0.00441 for Indian Coal (value applicable for the Project activity as per CPA 001) |
| **Purpose of data** | NA |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| **Data/Parameter** | $Q_{steam}$ |
|---|---|
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam supplied in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 5,227 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $T_{steam}$ |
|---|---|
| **Unit** | °C |
| **Description** | Steam Temperature at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 159.65 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 7.15 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 58.16 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 9 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of the monitoring period and kept as an opening balance in log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 1097.42 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass briquettes have been measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice has been obtained from the fuel supplier and has been mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 19 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic and Paper mode.<br>Monitoring: Biomass briquettes has been measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 1087 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of biomass briquettes consumed will be cross-checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type fossil i on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel delivery note obtained from the fuel supplier |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex _4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i} = FC_{j,PJ,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | The quantity of coal consumed will be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 15.67 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by paper mode.<br>Monitoring: Analysis from accredited or certified independent agency according to relevant national/international standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 3.915 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 38.79 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 7.76 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $FC_{i,j,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed in a process j during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 (No fossil fuel type i consumed in a process j during monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book |
| **Value(s) of monitored parameter** | 38.43 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set or Fossil fuel based power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 1.21 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0001 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data will be archived by Electronic/Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 136 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Check consistency of distance record provided by trucker / supplier by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 112 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,c,y}$ |
| **Unit** | km |
| **Description** | Average round trip distance (from and to) between the biomass fuel supply sites and the site of biomass processing in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 51.7 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be checked for consistency by comparing the quantity delivered (no. of truck, '$N_y$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,c,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the transportation of biomass to the biomass processing site in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 166 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | The CPA operator shall ensure provision of this parameter from the biomass supplier in the form of declaration.<br>Monitoring Frequency: Continuous, at each trip |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be check for consistency of the number of truck trips with quantity of biomass combusted |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since 100% data are monitored and reported.

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg) |

$Q_{steam}$ : 5227Tons
$H_s$ : 659.64 kCal/Kg
$H_w$ : 58.16 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 75.5$tCO_2$/TJ

Thus,
$EG_{thermal}$ = 5227 * (659.64 – 58.16) *4.186 X $10^{-6}$
= 13.161 TJ

Hence;
$BE_{thermal,CO_2,y}$ = (13.161 /100 %) * 75.5
= 993 $tCO_2e$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:

Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 $tCO_2$/MWh for NEWNE grid

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 38.43 MWh
$EF_{grid,CM,y}$ = 0.80 $tCO_2$/MWh
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 1.2 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2$/MWh

$PE_{EC,y}$ = 38.44* 0.80* (1+20/100) + 1.2*1.3* (1+20%)
= 39 tCO2e

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 39 + 0$
$= 39\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

This part of leakage is not considered as the energy generating equipment currently being utilized is not transferred from outside the boundary of the Project activity

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (biomass briquette) consumed in the project activity is not transported to the Project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 993 - 39 - 0$
$= \mathbf{954\ tCO_2e}$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 993 | 39 | 0 | 954 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 8,553* | 954 |

*As the monitoring period is from 12/01/2011 to 31/08/2012 i.e. 600 days (first and last days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation in a year

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0001: Instrument Details**

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Date | Calibration Frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied in year y , ($Q_{steam}$ ) | Differential Pressure Transmitter | Siemens | N1-W728-9026162 | ± 3% | 20/04/2011, 20/04/2012 | Yearly | 20/04/2013 |
| Average Steam Temperature at MSSV (Main steam stop valve) outlet during year,($T_{steam}$ ) | RTD | Eureka | 082783 | ±2% | 20/04/2011, 20/04/2012 | Yearly | 20/04/2013 |
| Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year ($P_{steam}$ ) | Pressure Transmitter | Siemens | A2B/W6135512 | ±2% | 20/04/2011, 20/04/2012 | Yearly | 20/04/2013 |
| | Gauge | Gluck | PG-14 | ±2% | 20/04/2011, 20/04/2012 | Yearly | 20/04/2013 |
| Average Feed Water Temperature at inlet of boiler ($T_{FWB}$) | RTD | Eureka | 13141 | ±2% | 20/04/2011, 20/04/2012 | Yearly | 20/04/2013 |
| | Gauge | MAGNI | TG-09 | ±2% | 20/04/2011, 20/04/2012 | Yearly | 20/04/2013 |
| Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) in year y | Dual source Energy Meter | Cologicx | CGX-DS-10 | Class I | 01/01/2011, 01/01/2012 | Yearly | 31/12/2012 |
| Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge No.1 | Endeavour | 161200 | Class III | 30/06/2011, 21/06/2012 | Yearly | 30/06/2013 |
| Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

**Appendix-2**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 002) |
| **Reference number of the project activity** | CPA 4041-0002[9] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 23/03/2012 (Inclusion Date of CPA in Registered PoA No.4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 31/03/2012 to 31/08/2012 (first and last days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 5,289 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 2,615 $tCO_2e$ |

[9] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=N1UVKCLWBFRI429JYHGP76XQEZD03A

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 12 TPH biomass residues (Rice Husk) fired boiler at Ramdevbaba Solvent Private Limited for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 12 TPH Fluidpac boiler manufactured by Thermax Limited. It is designed to operate at a maximum pressure of 17.5 kg/cm$^2$ and has in bed tubes with refractory furnace. The steam generated from the boiler is utilised in Thermal Processing of various seeds like soyabean, groundnut, cotton seed, linseed, castor seed etc. for the production of oil and De Oiled Cake (DOC).

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| PoA-4041 0002 | Ramdevbaba Solvent Private Limited | Boiler - 12 TPH (From and At 100$^0$C) | 17/04/2010 | 23/03/2012 | 31/03/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 31/03/2012 to 31/08/2012 (first and last days included) is 2,615 $tCO_2e$

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| PoA-4041 0002 | Ramdevbaba Solvent Private Limited | Gat no. 171 & 141, Armori road, Bramhapuri, District-Chandrapur, 441206, Maharashtra, India. | 20°36’7.41” N 79°52’32.87” E | India |

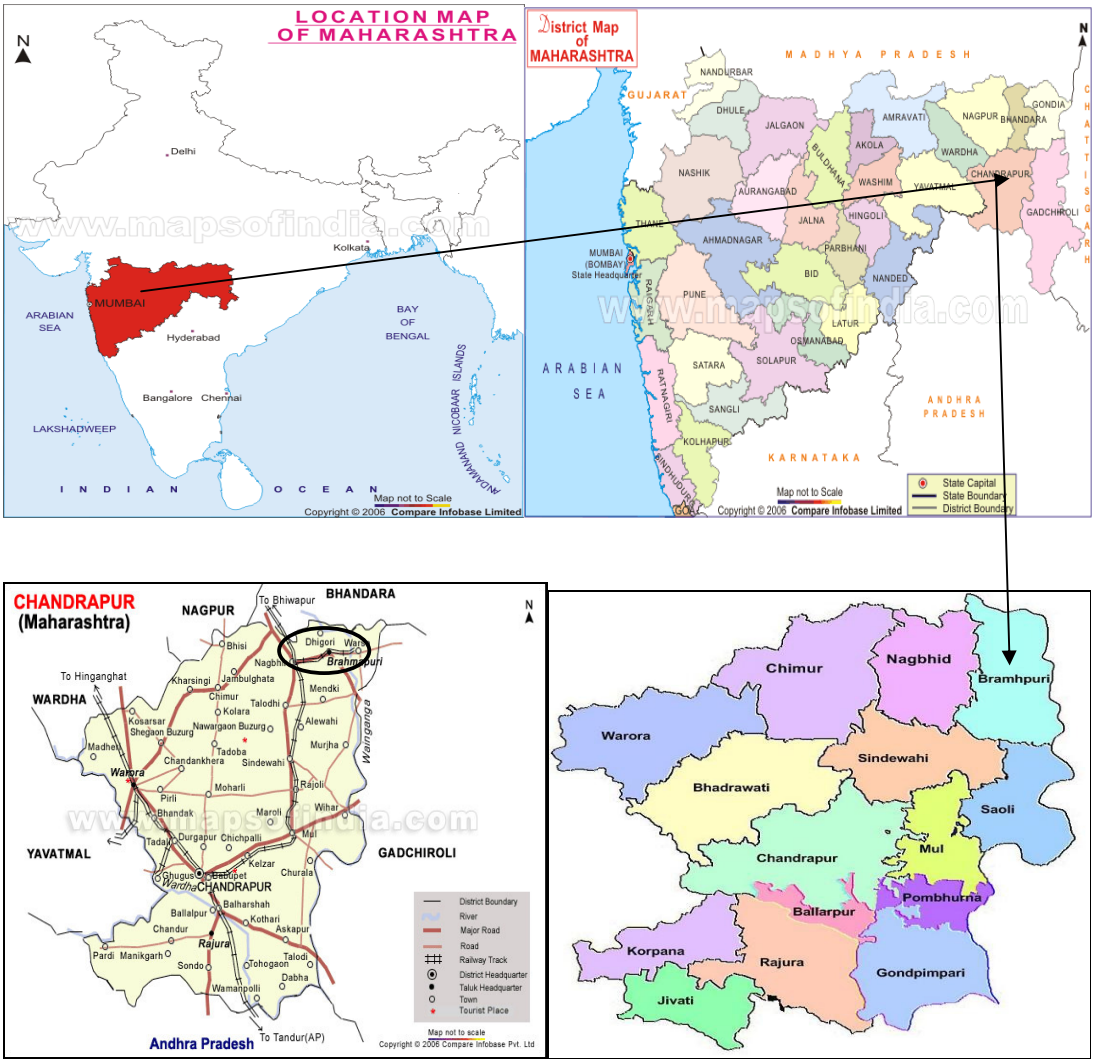


Fig.A.2.1 Physical Location of the project activity

## A.3. Parties and project participant(s)

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment

(boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [10]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[11]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[12]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[13]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[14]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[15]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 31/03/2012, the date of inclusion in the registered PoA

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

[10] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[11] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[12] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[13] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[14] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[15] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 002 |
| CPA Operator | Ramdevbaba Solvent Private Limited |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler |
| Project activity | Installation of biomass fired boiler having rated steam Generation Capacity of 12 Tons per Hour (TPH) |
| Boiler Make | Thermax Limited |
| Boiler Model | Fluidpac |
| Maximum working pressure | 17.5 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 12 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Rice husk) |
| Type of fuel firing | Automatic |
| Furnace type | In bed tubes with refractory |
| Boiler Number | MTFH120B/17.5/10 |
| Commissioning date | 17/04/2010 |

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently Biomass briquettes as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge, electrical systems, equipment safeties & controls.

The CPA operator has utilized biomasses for heat generation i.e. Rice Husk, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**
There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**
There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**
There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**
Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meter |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments (Sr no 1 to 4) are connected to a monitoring system comprising of computer for local data acquisition & computation. This data gets transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

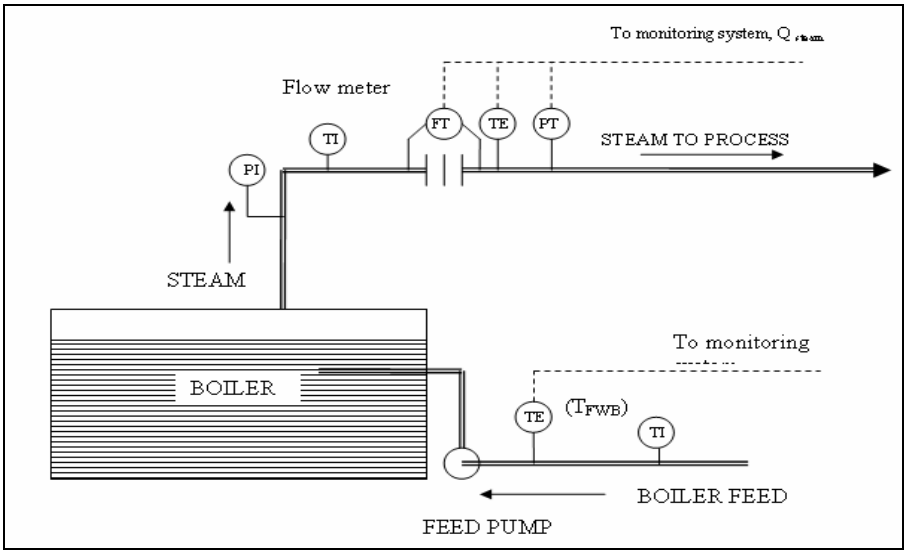


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) have been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid Power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Duly calibrated weigh Bridge has been used to weigh the biomass consumed in the project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However no fossil fuel was used in this project activity for the monitoring period.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator). This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

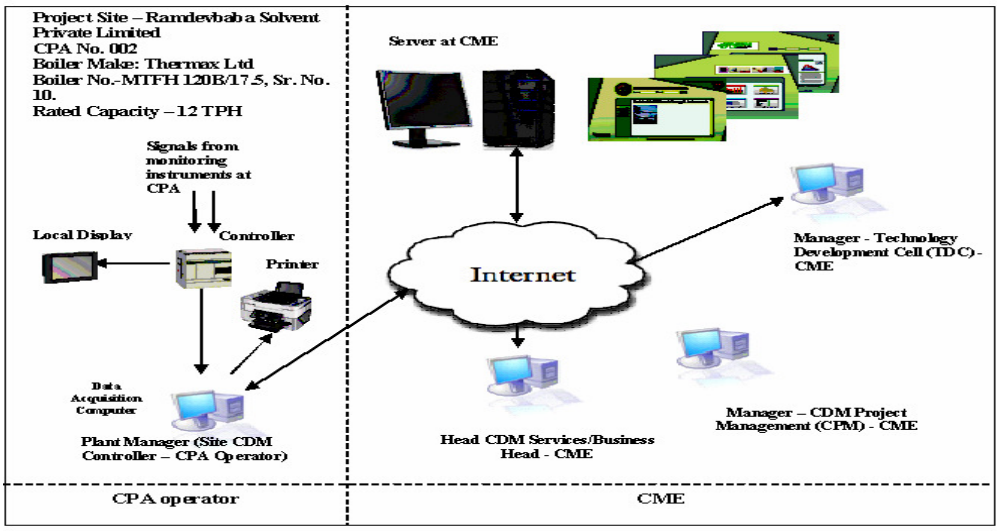


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

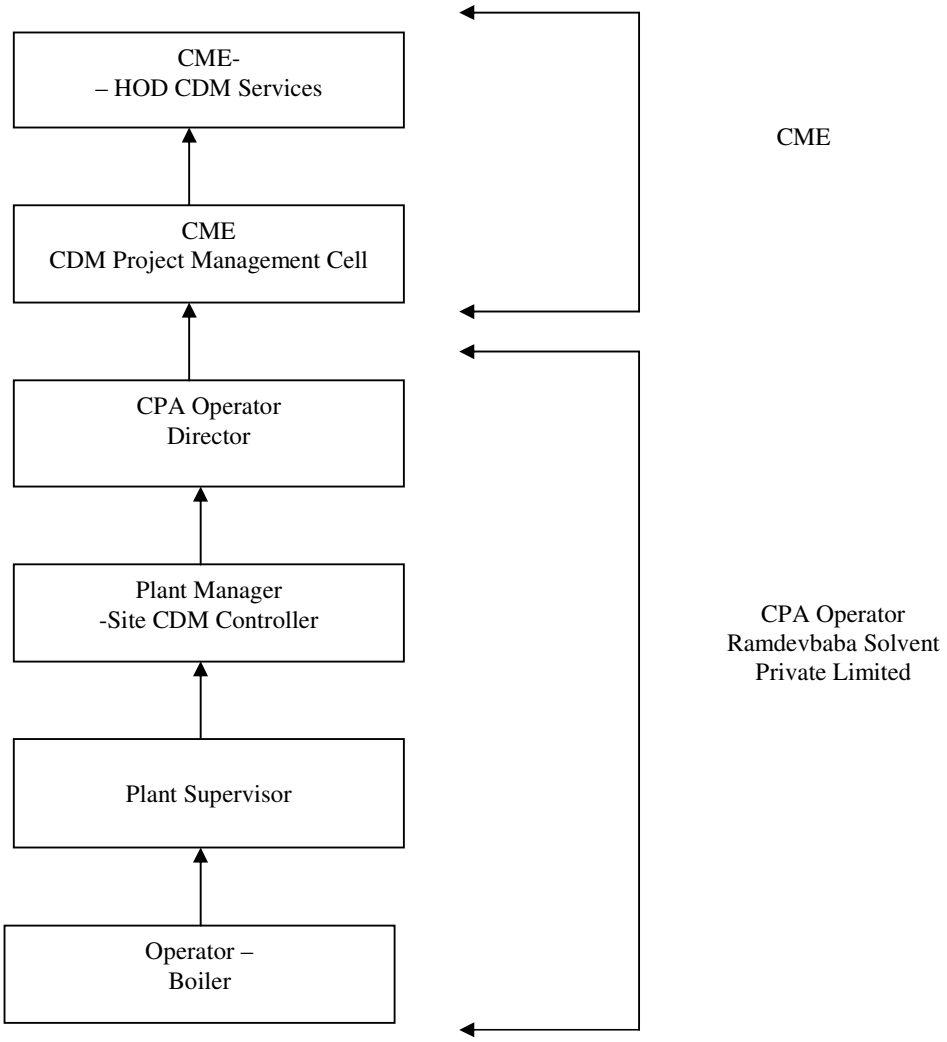


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator – Ramdevbaba Solvent Private Limited

| Key operational roles | CPA Management Responsibilities |
|---|---|
| Director – CPA Operator | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head CDM Services for final reporting into emission reduction sheet.<br>• Quarterly Performance Review |
| Plant Manager<br>(site CDM Controller) | • Performance review -Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions |

| | |
|---|---|
| Plant Supervisor | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Operators – Boiler | • Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

v) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

vi) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i.e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| **Data/Parameter** | $CAP_{boiler}$ |
|---|---|
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 12 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $\eta_{BL,thermal}$ |
|---|---|
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $EF_{FF,CO2}$ |
|---|---|
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4).<br>The lower values has been chosen in conservative manner |
| **Value(s) applied** | 89.5 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $SA_k$ |
|---|---|
| **Unit** | % |
| **Description** | Surplus availability of Biomass |
| **Source of data** | Third Party Survey report |
| **Value(s) applied** | 26.90 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | NEWNE grid – 0.80 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link - http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on "Emissions from India's transport sector: Statewise synthesis"<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturers letter |
| **Value(s) applied** | Indian Coal – 0.004186 (in case of Indian Coal is used)<br>Rice husk – 0.004235 (value applicable for the Project activity as per CPA 002) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| | |
|---|---|
| **Data/Parameter** | $Q_{steam}$ |
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam supplied |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 11,936 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam}$ |
| **Unit** | °C |
| **Description** | Steam Temperature at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 184.58 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 12.0 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 57.64 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 29.995 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived electronic and paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in plant record |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge slip, Log Book and Plant record |
| **Value(s) of monitored parameter** | 3031.84 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and paper mode.<br>Monitoring: Biomass delivery note obtained from the fuel supplier. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 18.21 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: measured at the end of the day |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 3043.625 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of rice husk consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type fossil i on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel delivery note obtained from the fuel supplier |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i} = FC_{j,PJ,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | The quantity of fossil fuel consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory Analysis report |
| **Value(s) of monitored parameter** | 13.63 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by paper mode.<br>Monitoring: Analysis from accredited or certified independent agency according to relevant national/international standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 4.97 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 35.80 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 2.52 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. However since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | --- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $FC_{i,j,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed in a process j during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 (No fossil fuel type i consumed in a process j during monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 100.95 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set or Fossil fuel based power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 2.88 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0002 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 20.87 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Check consistency of distance record provided by trucker / supplier by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 472 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data can be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since 100% data are monitored and reported.

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (Kcal/kg) |

$Q_{steam}$ : 11936Tons
$H_s$ : 665.40 kCal/Kg
$H_w$ : 57.64 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 89.5$tCO_2$/TJ

Thus,
$EG_{thermal}$ = 11936 * (665.40- 57.64) *4.186 X $10^{-6}$
= 30.367 TJ

Hence;
$BE_{thermal,CO_2,y}$ = (30.367 /100 %) * 89.5
= 2,717 $tCO_2$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:

Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 $tCO_2$/MWh for NEWNE grid.

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 100.95 MWh
$EF_{grid,CM,y}$ = 0.80 $tCO_2/MWh$
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 2.88 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2/MWh$

$PE_{EC,y}$ = 100.95* 0.80* (1+20/100) + 2.88*1.3* (1+20/100)
= 102 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2/yr$) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2/GJ$) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 102 + 0$
$= 102\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (Rice Husk) consumed in the project activity is not transported to the Project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 2717 - 102 - 0$
$= \mathbf{2615\ tCO_2e}$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 2717 | 102 | 0 | 2615 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 5,289* | 2615 |

*As the monitoring period is from 31/03/2012 to 31/08/2012 i.e. 154 days (first and last days included), ex-ante emissions have been calculated accordingly for this monitoring period considering 365 days of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0002: Instrument Details**

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Date | Calibration frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied in year y , ($Q_{steam}$ ) | Steam Flow Meter | Endress + Hauser | E400D320000 | +3% | 25/04/2011 | Once in 3 years | 25/04/2014 |
| Average Steam Temperature at MSSV (Main steam stop valve) outlet during year, ($T_{steam}$ ) | RTD | Endress + Hauser | E400D320000 | +3% | 25/04/2011 | Once in 3 years | 25/04/2014 |
| Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year, ($P_{steam}$ ) | Pressure Transmitter | Endress + Hauser | C 907D501052 | +2% | 13/3/2012 | Yearly | 13/03/2013 |
| | Gauge | PRECISION | E-12-6262 | +2% | 5/19/2012 | Yearly | 5/19/2013 |
| Average Feed Water Temperature at inlet of boiler, ($T_{FWB}$) | RTD | Endress + Hauser | E8007D142EA | +2% | 15/05/2012 | Yearly | 14/05/2013 |
| Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) in year y | Dual Energy Meter | HPL-SOCOMEC Pvt. Ltd. | 1K 162128 | CLASS 1.0 | 6/3/2012 | Yearly | 5/3/2013 |
| Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge | Metler Toledo | 2730260001 | Class-III | 23/2/2012 | Yearly | 23/2/2013 |
| Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

**Appendix-3**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 011) |
| **Reference number of the project activity** | CPA 4041-0003[16] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 23/03/2012 (Inclusion Date of CPA in Registered PoA No.4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 31/03/2012 to 31/08/2012 (first and last days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 4,650 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 675 $tCO_2e$ |

[16] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=W604YP71ETQMKGZAR5F2VHO9LCSIB3

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 8 TPH biomass fired boiler at Mega Solvent Extraction Limited for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 8 TPH Combipac boiler manufactured by Thermax Limited. It is designed to operate at a maximum pressure of 17.5kg/cm$^2$ and a screw feeder is used to feed the fuel which is rice husk for this project activity. The steam generated from the boiler is utilised in the plant process such as for oil extraction from rice bran, production of crude oil and de-oiled cake.

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| PoA-4041 0003 | Mega Solvent Extractions Limited | Boiler - 8 TPH (From and At 100$^0$C) | 26/12/2009 | 23/03/2012 | 31/03/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 31/04/2012 to 31/07/2012 (first and last days included) is 675 $tCO_2e$

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| PoA-4041 0003 | Mega Solvent Extractions Limited | S. No. 462/B/3, Village – Kakkiralapally, Wardhannapet Mandal, District Warangal 506 310, Andhra Pradesh, India | 17$^0$ 49’43”N 79$^0$ 35’ 19”E | India |

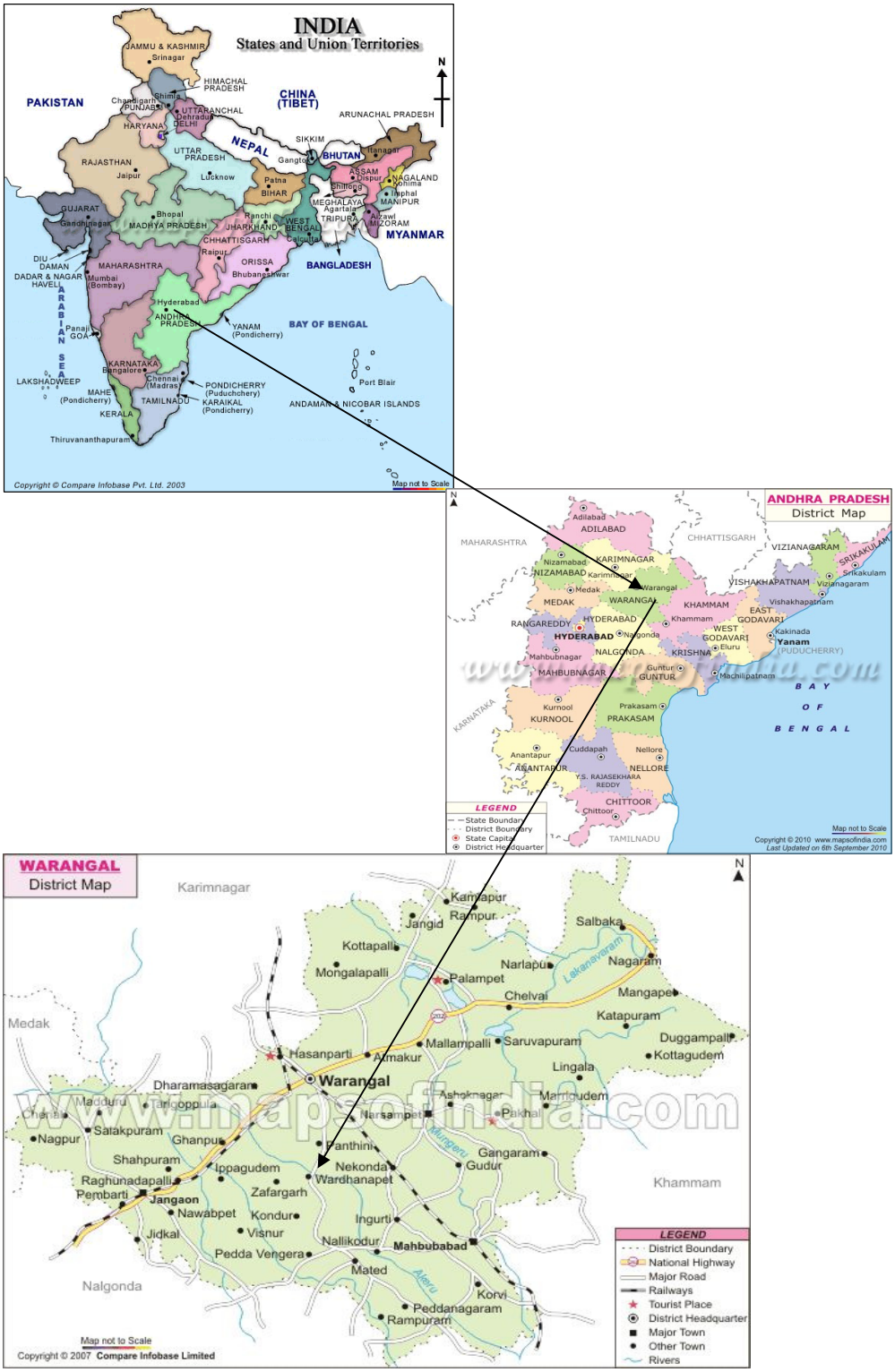


Fig.A.2.1 Physical Location of the project activity

**A.3. Parties and project participant(s)**

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [17]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[18]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[19]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[20]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[21]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[22]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 31/03/2012, the start date of a crediting period for CPA is the date of its inclusion in the registered PoA or any date thereafter.

**Length of the crediting period:** 10 Years

[17] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[18] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[19] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[20] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[21] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[22] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 011 |
| CPA Operator | Mega Solvent Extractions Limited |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler |
| Project activity | Installation of biomass (Rice husk) fired boiler having rated steam generation capacity of 8 tonnes per hour (TPH ) |
| Boiler Make | Thermax Limited |
| Boiler Model | Combipac |
| Maximum working pressure | 17.5 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 8 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residue (hereinafter referred as Rice husk ) |
| Type of fuel firing | Screw feeder |
| Furnace type | Refractory lined furnace with water wall |
| Boiler Number | CPFD 80/17.5/13 |
| Commissioning date | 26/12/2009 |

The boiler consists of mainly the following parts:

. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently Biomass briquettes as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge, electrical systems, equipment safeties & controls.

The CPA operator has utilized biomasses for heat generation i.e. Rice Husk, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events

occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**

There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**

There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**

There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**

Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument and field instrument integral to steam flow meter. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meters |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data has been transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of Project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

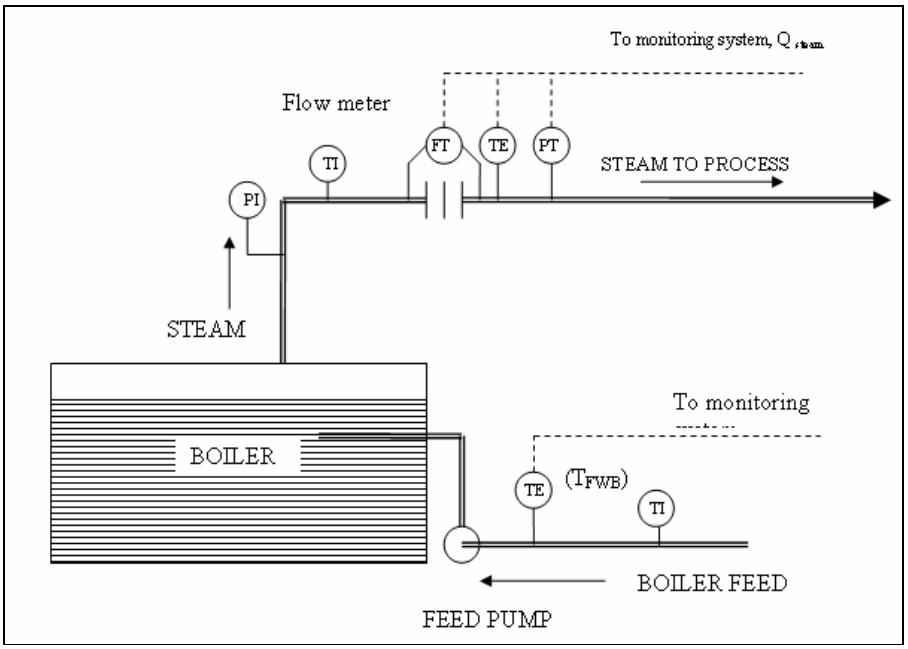


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is mentioned in the logbook.

Duly calibrated weigh bridge has been used to weigh the biomass consumed in the project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However no fossil fuel was used in this project activity for the monitoring period.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator) . This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

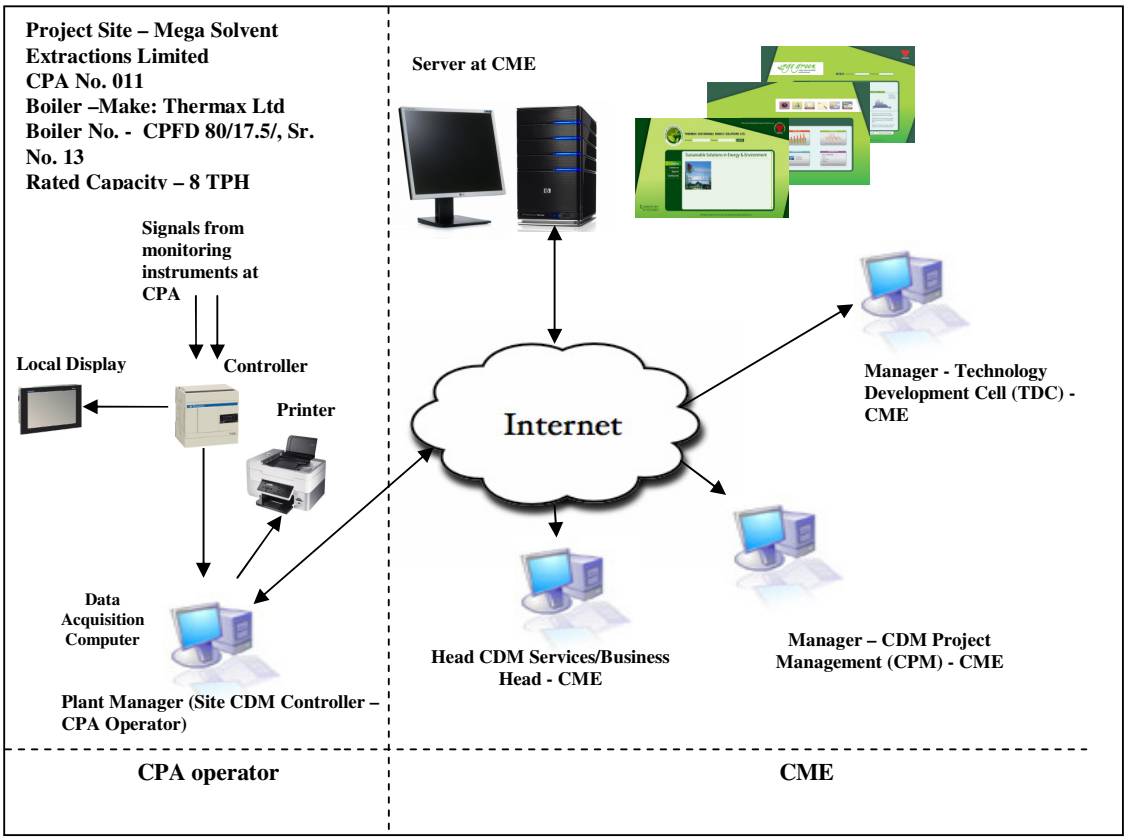


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

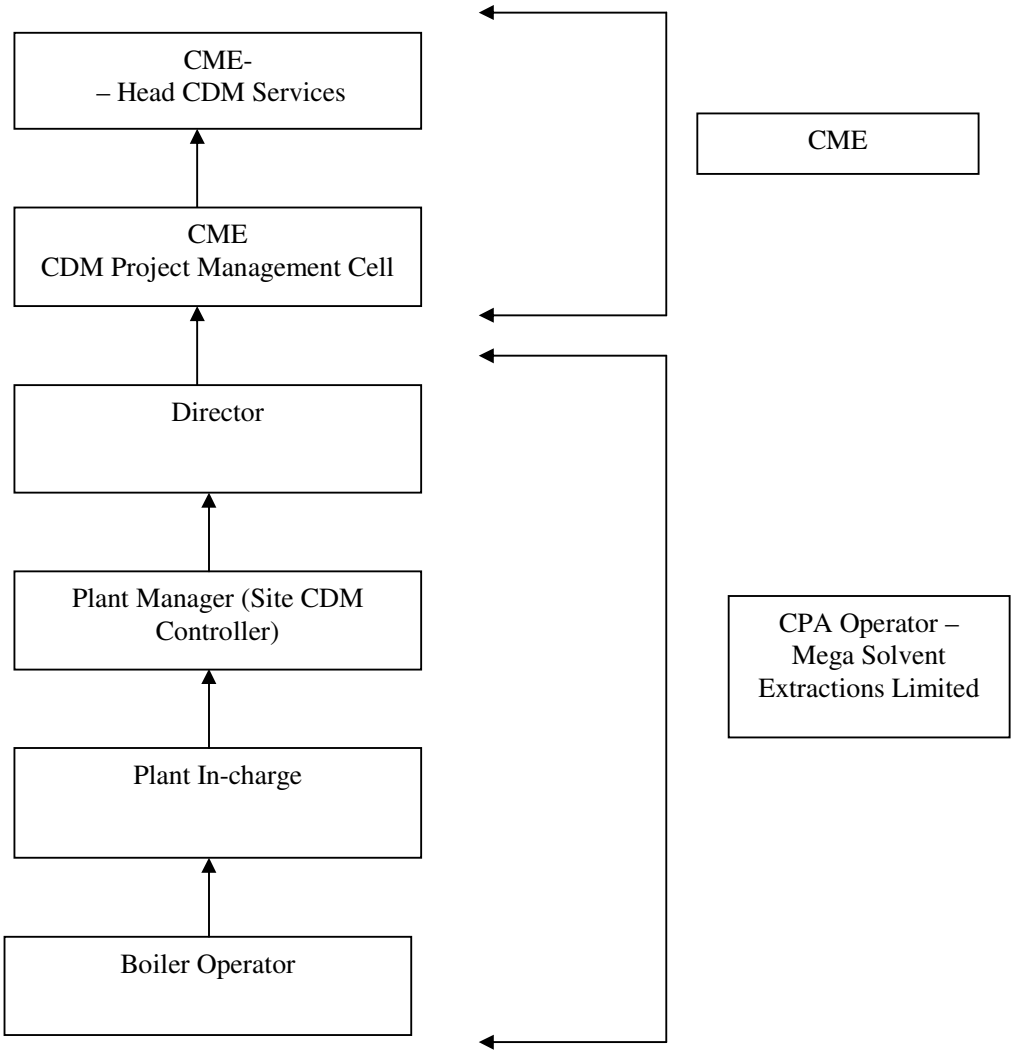


**Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator – Mega Solvent Extractions Limited**

| **Key operational roles** | • **CPA Management Responsibilities** |
|---|---|
| Director | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head CDM Services for final reporting into emission reduction sheet.<br>• Quarterly Performance Review |
| Plant Manager (Site CDM Controller) | • Performance review -Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions |

| | |
|---|---|
| Plant In-charge | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Boiler – Operator | • Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i.e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tons |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 8 (value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\eta_{BL,thermal}$ |
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4).<br>The lower values has been chosen in conservative manner |
| **Value(s) applied** | 89.5 (value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass within 50 km radial distance |
| **Source of data** | Third Party Survey report at the beginning of crediting period |
| **Value(s) applied** | 77.7 (value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | Southern Grid – 0.86 (value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record |
| **Value(s) applied** | 0.004260 – For Rice Husk<br>0.004186 - Indian Coal (in case of Indian Coal is used)<br>(value applicable for the Project activity as per CPA 011) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| **Data/Parameter** | $Q_{steam}$ |
|---|---|
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam supplied |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 3,212 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $T_{steam}$ |
|---|---|
| **Unit** | °C |
| **Description** | Average Steam Temperature at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 154.38 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 9.1 |
| **Monitoring equipment** | Pressure transmitter and Pressure Gauge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Average Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 57 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 18.82 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 867 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass delivery note obtained from the fuel supplier. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 15 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 871 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | This can be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type fossil i on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel delivery note obtained from the fuel supplier |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i} = FC_{j,PJ,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | This can be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. One sample randomly picked up from site. |
| **Value(s) of monitored parameter** | 11 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data will be archived annually by paper mode.<br>Monitoring: Analysis from accredited or certified independent agency according to relevant national/international standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 3.01 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 31.2 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 9.8 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter shall be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average has been calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | --- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $FC_{i,j,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed in a process j during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | -- |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book |
| **Value(s) of monitored parameter** | 51.5 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $EC_{EL,j,y}$ |
|---|---|
| Unit | MWh |
| Description | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set or Fossil fuel based power source) in a year y |
| Measured/Calculated /Default | Measured using calibrated meters |
| Source of data | Log book |
| Value(s) of monitored parameter | 0 |
| Monitoring equipment | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0003 for Measuring Instrument Details* |
| Measuring/Reading/ Recording frequency | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data will be archived by Electronic and Paper mode |
| Calculation method (if applicable) | NA |
| QA/QC procedures | NA |
| Purpose of data | Project Emission Calculation |
| Additional comment | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $AVD_{,y}$ |
|---|---|
| Unit | km |
| Description | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| Measured/Calculated /Default | Calculated |
| Source of data | Plant record |
| Value(s) of monitored parameter | 9.4 |
| Monitoring equipment | - |
| Measuring/Reading/ Recording frequency | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| Calculation method (if applicable) | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| QA/QC procedures | Consistency of distance record provided by trucker / supplier can be checked by comparing recorded distances with other information from other sources (eg. Maps) |
| Purpose of data | Leakage Emission Calculation |
| Additional comment | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 182 |
| **Monitoring equipment** | -- |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data can be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since 100% data are monitored and reported.

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (Kcal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (Kcal/kg) |

$Q_{steam}$ : 3,212Tons
$H_s$ : 663.12 kCal/Kg
$H_w$ : 57 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 89.5$tCO_2$/TJ

$EG_{thermal}$ = 3,212 * (663.12 - 57) *4.186 X $10^{-6}$
= 8.150 TJ

Hence;

$BE_{thermal,CO_2,y}$ = (8.150 /100 %) * 89.5
= **729 $tCO_2e$**

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:

Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.86 $tCO_2$/MWh for Southern grid

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 51.5 MWh
$EF_{grid,CM,y}$ = 0.86 $tCO_2$/MWh
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2$/MWh

$PE_{EC,y}$ = 51.5 * 0.86* (1+20/100) + 0*1.3* (1+20%)
= **54 $tCO_2e$**

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 54 + 0$
$= \mathbf{54\ tCO_2e}$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (Rice Husk) consumed in the project activity is not transported to the Project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

**Therefore;** $\mathbf{ER_y = BE_y - PE_y - LE_y}$
$\mathbf{ER_y = 729-54-0}$
$\mathbf{= 675\ tCO_2e}$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 729 | 54 | 0 | 675 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 4,650* | 675 |

*As the monitoring period is from 31/03/2012 to 31/08/2012, ex-ante emissions have been calculated accordingly for this period considering 365 days of operation in a year

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0003: Instrument Details**

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Accuracy /Class | Calibration Date | Calibration frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied ($Q_{steam}$ ) | Steam Flow Meter | Endress+hauser | E8010620000 | ±3% | 13/10/2011 | Once in 3 years | 12/10/2014 |
| Average Steam Temperature ($T_{steam}$ ) | RTD | Endress+hauser | E8010620000 | ±2% | 13/10/2011 | Once in 3 years | 12/10/2014 |
| Average Steam Pressure ($P_{steam}$ ) | Pressure Transmitter | Endress+hauser | E8002C21129 | ±2% | 22/08/2011 | Yearly | 21/08/2012 |
| Average Feed Water Temperature ($T_{FWB}$) | RTD | Endress+hauser | E8007F142EA | ±2% | - | Yearly | - |
| Auxiliary Electricity Consumption from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) | Energy Meter | Conzerv | 203352/18503-2610 | Class 1.0 | - | Yearly | - |
| $Q_{ob,k}$ (Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site) | Weigh Bridge | Essae Digitronics Private Limited | 950084373 | Class III | 25/03/2012 | Yearly | 24/03/2013 |
| $Q_{np,k}$ (Quantity of subsequent delivery of fuel type k biomass at the Project site) | | | | | | | |
| $Q_{in,k}$ (Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site) | | | | | | | |

**Appendix-4**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 004) |
| **Reference number of the project activity** | CPA 4041-0005[23] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 30/04/2012 (Inclusion Date of CPA in Registered PoA 4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/05/2012 to 31/08/2012 (both days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 1,458 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 490 $tCO_2e$ |

[23] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=5V890IQW7DP1JLU4EAY6HNO2S3CZRK

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of a 3 TPH biomass residues (Biomass Briquette) fired boiler at LACTOSE (INDIA) LIMITED for meeting their in house thermal energy requirement thereby replacing the existing fossil fuel fired equipment. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 3 TPH, Multipac boiler manufactured by Thermax Limited. It works at a maximum pressure of 10.54 kg/cm$^2$ and has horizontal fixed grate furnace. The steam generated from the boiler is utilised in the lactose powder manufacturing plant, tablet manufacturing plant and in liquid manufacturing plant for manufacturing various syrups like Atarax, Zycof and Nootropil and used as heat input to the 425 TR VAM(Vapour Absorption Machine)

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| CPA-4041 0005 | LACTOSE (INDIA) LIMITED | Boiler – 3 TPH ( At 100$^0$C) | 30/08/2009 | 30/04/2012 | 01/05/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/05/2012 to 31/08/2012 (both days included) is 490 t$CO_2$e

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| CPA-4041 0005 | LACTOSE (INDIA) LIMITED | Survey No.5, 6 & 7, Village- Poicha (Rania), Taluka- Savli, District- Vadodara, Gujarat- 391780. | 22°28’31.86” North, 73°6’24.11” East | India |

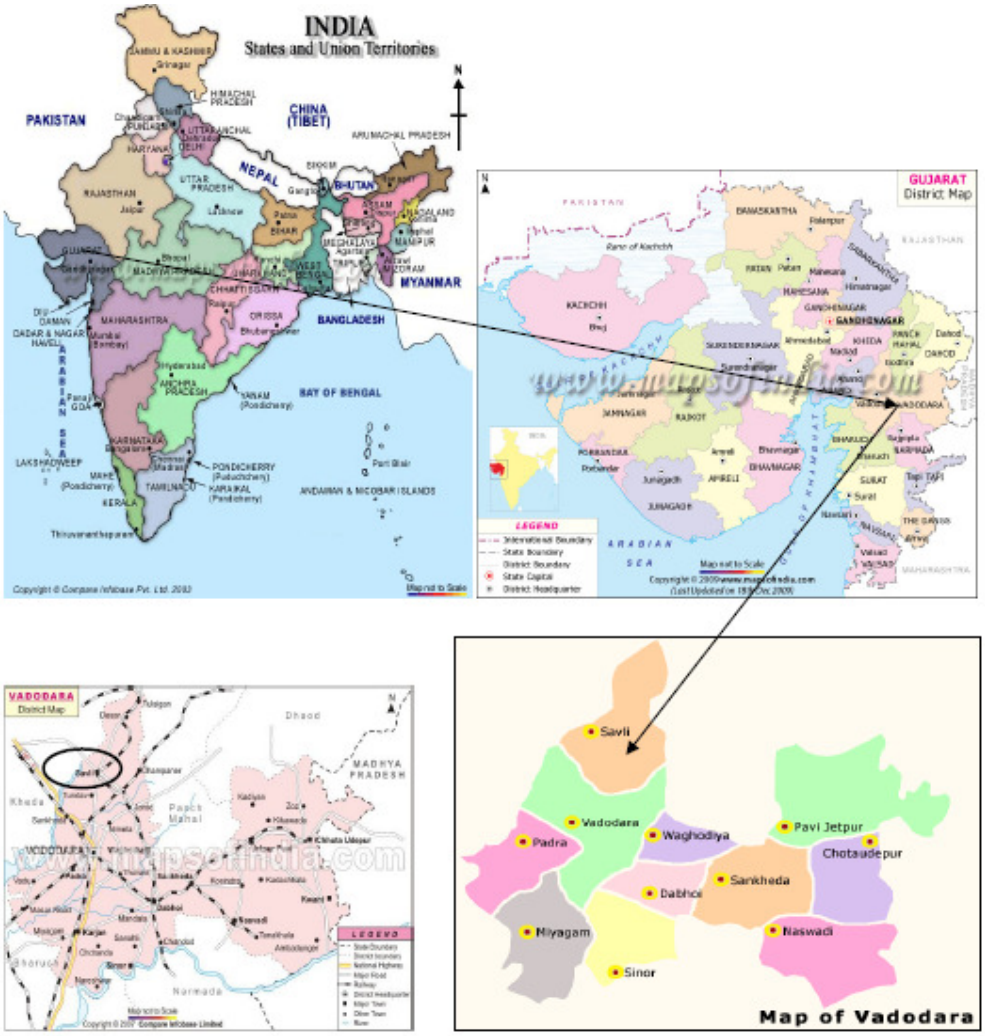


Fig.A.2.1 Physical Location of the project activity

### A.3. Parties and project participant(s)

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [24]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[25]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[26]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[27]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[28]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[29]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/05/2012

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

[24] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[25] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[26] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[27] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[28] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[29] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 004 |
| CPA Operator | LACTOSE (INDIA) LIMITED |
| Project Scenario | Biomass fired thermal energy generation as a replacement of existing fossil fuel fired equipment. |
| Type of equipment | Boiler |
| Project activity | The project activity is installation of biomass fired boiler having rated steam generation capacity of 3 tonnes per hour (TPH ) |
| Boiler Make | Thermax Limited |
| Boiler Model | Multipac |
| Maximum working pressure | 10.54 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 3 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Biomass Briquettes) |
| Type of fuel firing | Manual |
| Furnace type | Horizontal fixed grate |
| Boiler Number | IFB30D/10.54/53 |
| Commissioning date | 30/08/2009 |

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently Biomass briquettes as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge, electrical systems, equipment safeties & controls.

The CPA operator has utilized biomass for heat generation i.e. Biomass Briquettes, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**
There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**
There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**
There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**
Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meter |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments (Sr no 1 to 4) are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data gets transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Ton
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

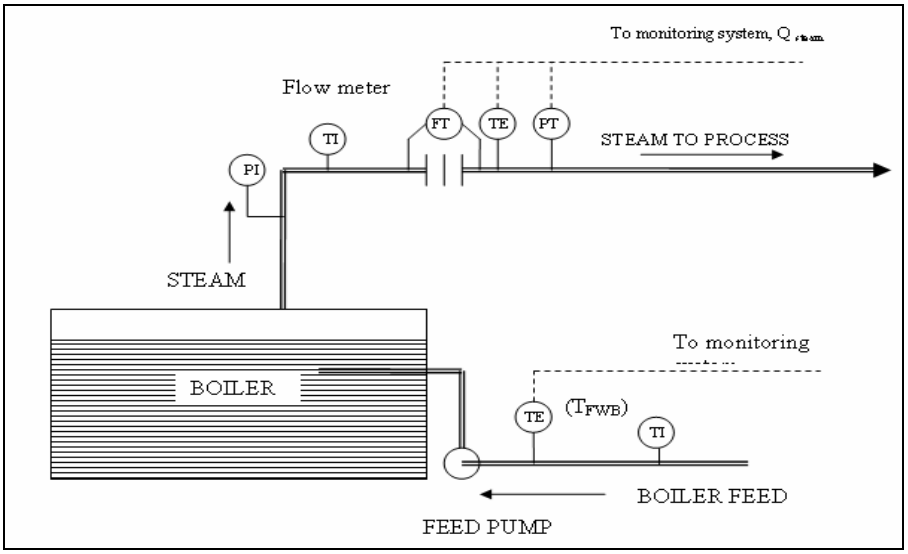


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid power (Diesel Generator).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the outside the Project boundary. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Dully calibrated weigh bridge has been used to weigh the biomass consumed in the for this project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However there was no fossil fuel used the during this monitoring period for this project activity

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator) This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

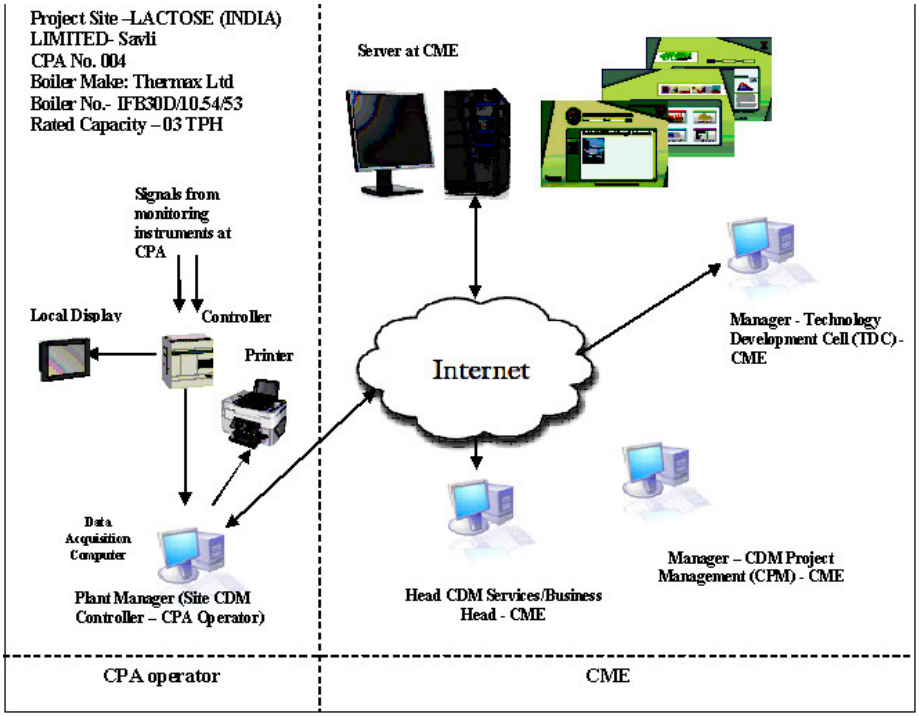


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

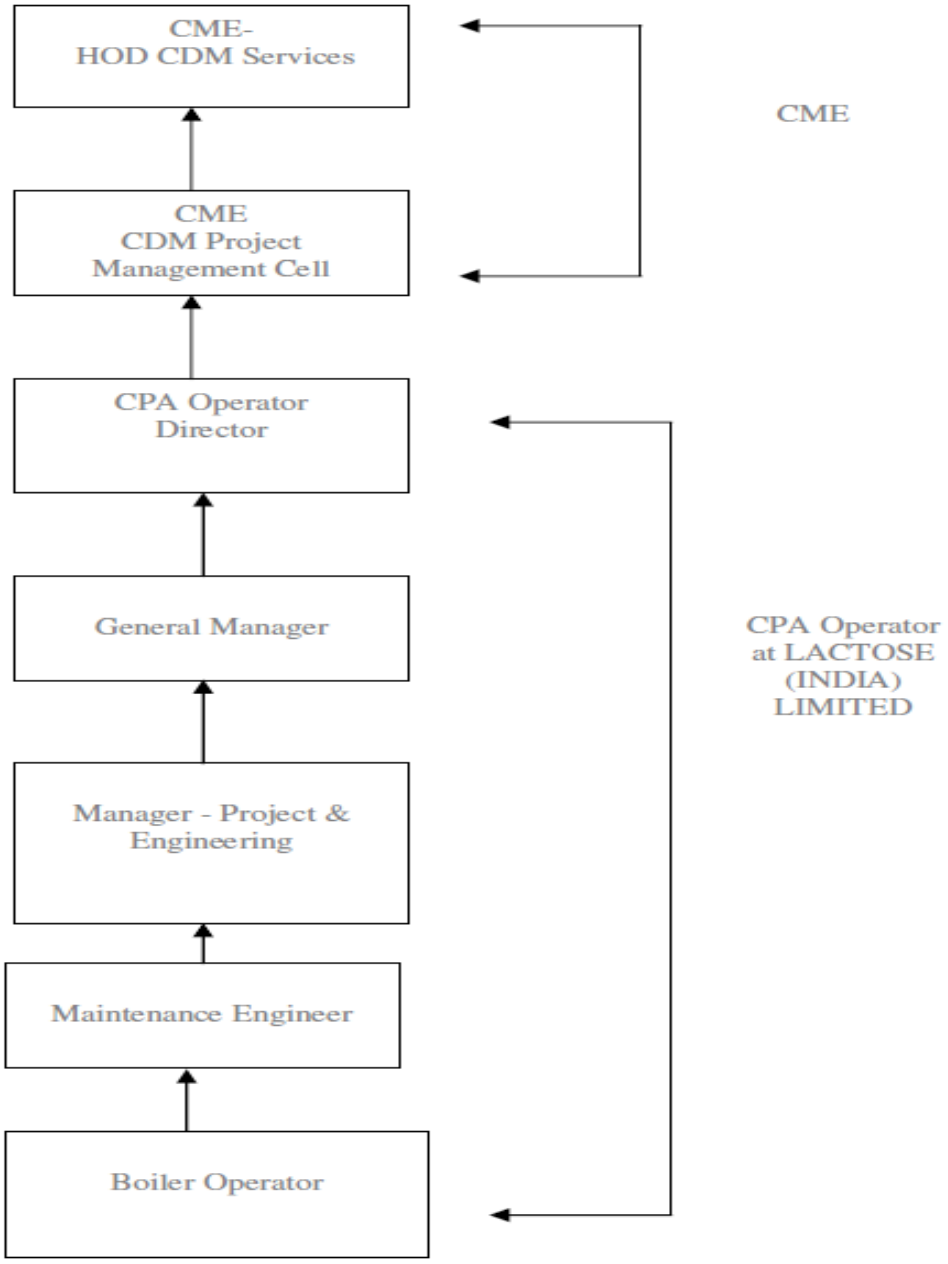


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator

| **Key operational roles** | **CPA Management Responsibilities** |
|---|---|
| Director- CPA operator | • Overall Responsibilities of Operation & Management of Project |
| Plant Manager (site CDM Controller) | • Performance review –Monthly<br>• Verification / review of data |

| | |
|---|---|
| | • Internal audits<br>• Review of corrective actions |
| Plant Supervisor | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Operator – Boiler | • Operation and Maintenance of boiler<br>• Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i.e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**

**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 3 (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\eta_{BL,thermal}$ |
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4 ).<br>The lower values has been chosen in conservative manner |
| **Value(s) applied** | 75.5 (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | The baseline identification test concluded Furnace Oil as a plausible baseline alternative for baseline emission calculation. Therefore Emission factor of Furnace Oil is considered as conservative approach due to lower EF than those of all coal related Emission factor as per the source (IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 2.3).The emission factor of Residual fuel oil (Furance oil) is in between 75.5 T/TJ to 78.8 T/TJ. Hence lower value for baseline and higher for project emission of Residual fuel oil (Furnace oil) has selected in conservative manner.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass |
| **Source of data** | Independent Survey report |
| **Value(s) applied** | 65.5 (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.80 - NEWNE Grid (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link -<br>http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 0.4 (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | The electricity consumption source is a Project electricity consumption source and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is greater than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).<br>However, Project activity is replacement project, hence default value i.e. 0.4 tCO2/MWh is considered for the calculation of project emissions as the auxiliary load of baseline plant is greater than the auxiliary load of the Project activity.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{LE,l,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption for biomass processing, outside project boundary. |
| **Source of data** | Declaration by biomass supplier / Technical specification of electricity consumption for biomass processing. |
| **Value(s) applied** | 30 (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | The auxiliary electricity consumption for biomass processing from equipment shall be calculated in MWh by using the technical specification of electricity consumption for biomass processing from the equipment supplier in MW/Ton multiplied by the total processed biomass consumed in the monitoring period.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on "Emissions from India's transport sector: Statewise synthesis". This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MW |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturer letter |
| **Value(s) applied** | Biomass briquettes - 0.004417<br>Furnace oil – 0.003913<br>(value applicable for the Project activity as per CPA 004) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| | |
|---|---|
| **Data/Parameter** | $Q_{steam}$ |
| **Unit** | Tons or tones |
| **Description** | Quantity of steam supplied |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 2659 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam}$ |
| **Unit** | °C |
| **Description** | Average Steam Temperature at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 150.08 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 5.3 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^{o}C$ |
| **Description** | Average Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 47.89 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 52.3 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. To be checked whether the calibration is required to be conducted or not |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge, Log Book and Plant record. |
| **Value(s) of monitored parameter** | 609.85 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. Monitoring: Biomass briquettes has been measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice has been obtained from the fuel supplier and has been mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 60.3 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: has been measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 602 |
| **Monitoring equipment** | -- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of biomass briquettes consumed will be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 15.95 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by paper mode.<br>Monitoring: Analysis from accredited or certified independent agency according to relevant national/international standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 4.88 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 38.02 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % water |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 3.46 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. However since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $FC_{i,j,y}$ |
| **Unit** | Lit |
| **Description** | Quantity of fossil fuel (Furnace oil) type i consumed in a process j during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | The consumption of furnace oil is measured in liters (Dip Stick Method) and converted to tones by considering density of furnace oil. |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 10.71 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0.96 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0005 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data has been archived by Electronic/Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 300 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Check consistency of distance record provided by trucker / supplier by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 51 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | -- |
| **QA/QC procedures** | The data has been checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,c,y}$ |
| **Unit** | km |
| **Description** | Average round trip distance (from and to) between the biomass fuel supply sites and the site of biomass processing in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 70 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data has been checked for consistency by comparing the quantity delivered (no. of truck, '$N_{cy}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,c,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the transportation of biomass to the biomass processing site in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 91 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | The CPA operator shall ensure provision of this parameter from the biomass supplier in the form of declaration.<br>Monitoring Frequency: Continuous, at each trip |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be check for consistency of the number of truck trips with quantity of biomass combusted |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since **100% data are monitored and reported**.

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg) |

$Q_{steam}$ : 2,659 Tons
$H_s$ : 658.34 kCal/Kg
$H_w$ : 47.89 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 75.5 $tCO_2$/TJ

Thus,

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

$EG_{thermal}$ = 2,659 * (658.34- 47.89) *4.186 X $10^{-6}$
= 6.794 TJ

Hence;

$BE_{thermal,CO_2,y}$ = (6.794 /100 %) * 75.5
= 512 $tCO_2e$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:
Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 $tCO_2$/MWh for NEWNE grid

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 0.4 $tCO_2$/MWh if,

(a) The electricity consumption source is a baseline electricity consumption source; or
(b) The electricity consumption source is a Project electricity consumption source and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power

plant(s) is greater than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 10.71 MWh
$EF_{grid,CM,y}$ = 0.80 $tCO_2$/MWh
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0.96 MWh
$EF_{EL,j,y}$ = 0.4 $tCO_2$/MWh

$PE_{EC,y}$ = 10.71* 0.80* (1+20/100) + 0.96*0.4* (1+20%)
= 11 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |

| | |
|---|---|
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 11 + 0$
$= 11\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity

This part of leakage is not considered as the energy generating equipment currently being utilized is not transferred from outside the boundary of the Project activity

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

This part of leakage is considered as the distance of biomass transportation is more than 200km. Leakage is thus considered to be zero and Biomass (briquettes) consumed in the project activity is not transported to the Project site over a distance of more than 200 km. It is calculated as follows:

$LE = N*AVD*EF_{km,CO2}$

Where,

LE : Leakage Emission
N : No. of truck trips
AVD : Average round trip distance travelled for biomass transportation / collection
$EF_{km,CO2}$ : Average $CO_2$ emission factor for the trucks measured during year y

Therefore,

LE = 142*370*0.0005152
= **11 $tCO_2e$**

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 512 - 11 - 11$

**= 497 $tCO_2e$**

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 512 | 11 | 4 | 497 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 1,458* | 490 |

*As the monitoring period is from 01/05/2012 to 31/08/2012 i.e. 123 days (both days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0005: Instrument Details**

| Sr. No. | Description monitoring parameters | Description Of Instrument | Make/Type/ Model | Sr. No./ Tag no. | Instrument Accuracy /Class | Calibration Date | Calibration frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|---|
| 1 | Quantity of steam supplied in year y , ($Q_{steam}$ ) | Steam Flow Meter | Endress & Hauser | E400D220000 | +3% | 25/04/2011 | Once in 3 years | 24/04/2014 |
| 2 | Average Steam Temperature at MSSV (Main steam stop valve) outlet during year, ($T_{steam}$ ) | RTD | Endress & Hauser | E400D220000 | +3% | 25/04/2011 | Once in 3 years | 24/04/2014 |
| 3 | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year, ($P_{steam}$ ) | Pressure Transmitter | Endress & Hauser | C-907 DE 01052 | ±1% | 6/10/2011 | Yearly | 05/10/2012 |
| | | Gauge | Bourden | B/PG/042 | ±2% | 17/10/2011 | Yearly | 16/10/2012 |
| 4 | Average Feed Water Temperature at inlet of boiler, ($T_{FWB}$) | RTD | PT-100 | TS/02 | ±2% | 16/04/2012 | Yearly | 15/10/2012 |
| 5 | Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) in year y | Energy Meter | Entity (Energy Meter) | 07-09-ENT-6744 | 0.5s | 1/5/2012 | Yearly | 30/04/2013 |
| | | | | 08-09-ENT-383 | 0.5s | 1/5/2012 | Yearly | 30/04/2013 |
| 6 | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge | Jaypan | 1103028-A | Class III | 21/11/2011 | Yearly | 20/11/2012 |
| | Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

**Appendix-5**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 006) |
| **Reference number of the project activity** | CPA 4041-0006[30] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 30/04/2012 (Inclusion Date of CPA in Registered PoA No.4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/05/2012 to 31/08/2012 (both days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 1,445 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 413 $tCO_2e$ |

[30] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=1W04BLP79KGZ582MSUOHVD6QYJXATC

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 3 TPH biomass residues (Rice Husk) fired boiler at Sneha Farms Private Limited for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 3 TPH, Huskpac boiler manufactured by Thermax Limited. It design to operate at a maximum pressure of 10.54 kg/cm$^2$ and has integral furnace with bubbling bed. The steam generated from the boiler is utilised in poultry feed processing and Palletizing.

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| PoA-4041 0006 | Sneha Farms Private Limited | Boiler – 3 TPH (At 100$^0$C) | 19/09/2010 | 30/04/2012 | 01/05/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/05/2012 to 31/08/2012 (both days included) is 413 t$CO_2$e

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| PoA-4041 0006 | Sneha Farms Private Limited | Survey No. 154, Village Chenjerla, Manakondur Mandal, District Karimnagar, Andhra Pradesh – 505469, India | 18°21'15" N 79°14'41" E | India |

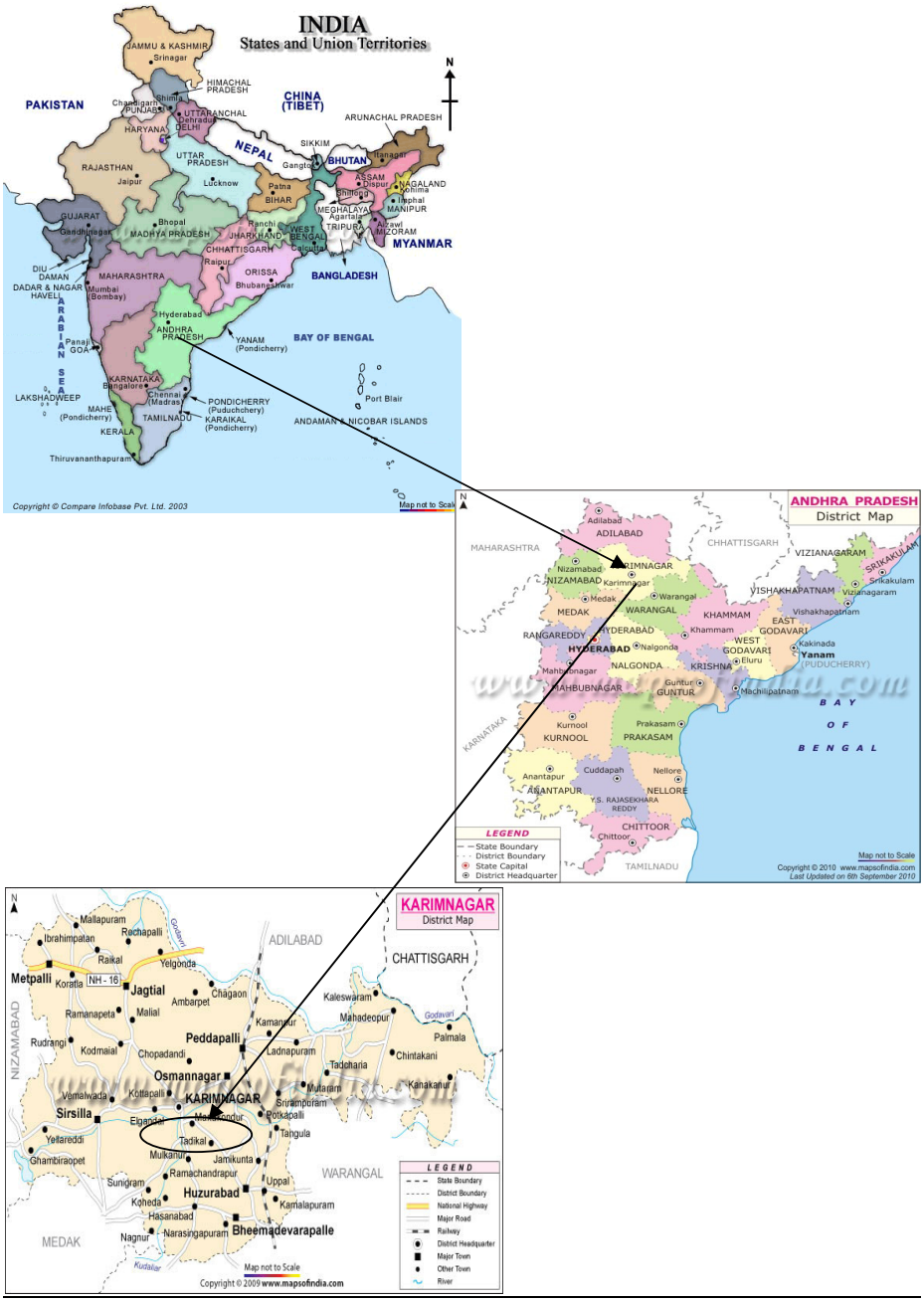


Fig.A.2.1 Physical Location of the project activity

**A.3. Parties and project participant(s)**

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity – Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [31]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[32]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[33]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[34]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[35]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[36]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/05/2012, the start date of a crediting period for CPA is the date of its inclusion in the registered PoA or any date thereafter.

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

[31] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[32] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[33] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[34] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[35] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[36] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 006 |
| CPA Operator | Sneha Farms Pvt. Ltd. |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler |
| Project activity | Installation of biomass fired (rice husk) boiler having rated steam Generation Capacity of 3 Tons per Hour (TPH) |
| Boiler Make | Thermax Limited<br>Boiler Pressure part fabrication by M/s Akshay Dynamix, Pune |
| Boiler Model | Huskpac |
| Maximum working pressure | 10.54 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 3 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Rice husk) |
| Type of fuel firing | Automatic |
| Furnace type | Integral furnace with bubbling bed |
| Boiler Number | HP30BB/10.54/51 |
| Commissioning date | 19/09/2010 |

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently a particular type of biomass fuel
3. Accessories- for various systems like water treatment, storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, flue gas discharge, ash discharge & handling, electrical systems, equipment safety & controls.

The CPA operator has utilized biomasses for heat generation i.e. Rice Husk, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**

There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**

There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**

There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**

Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meters |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data has been transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal}$ = $Q_{steam}$ * ($H_s$ - $H_w$)* 4.186 X $10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

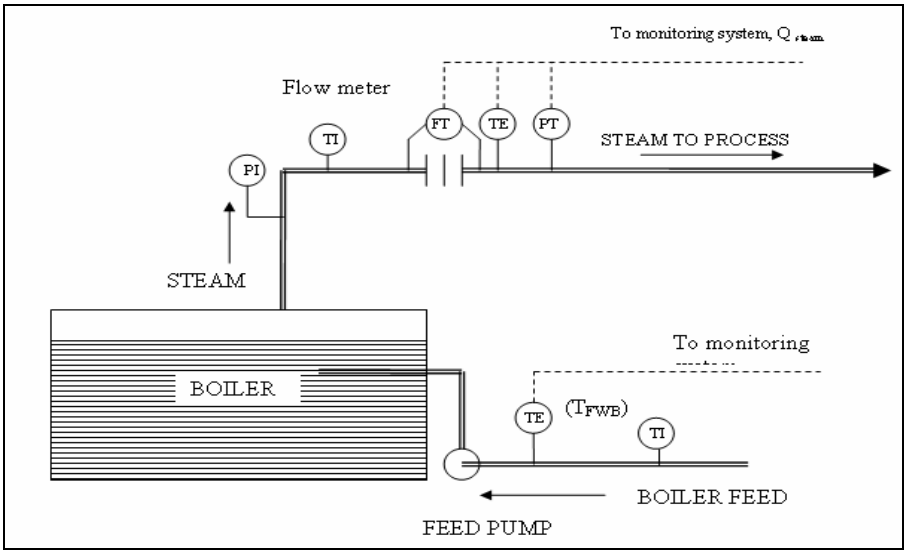


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meters (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site.The quanity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Certified Weigh Bridge has been used for this project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob, k}$
b. Each new delivery of biomass fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass fuel as

$Q_{np,k}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$

c. The consumed biomass is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensure the practical method for monitoring biomass fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However no fossil fuel was used in this project activity for the monitoring period.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator). This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been be archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

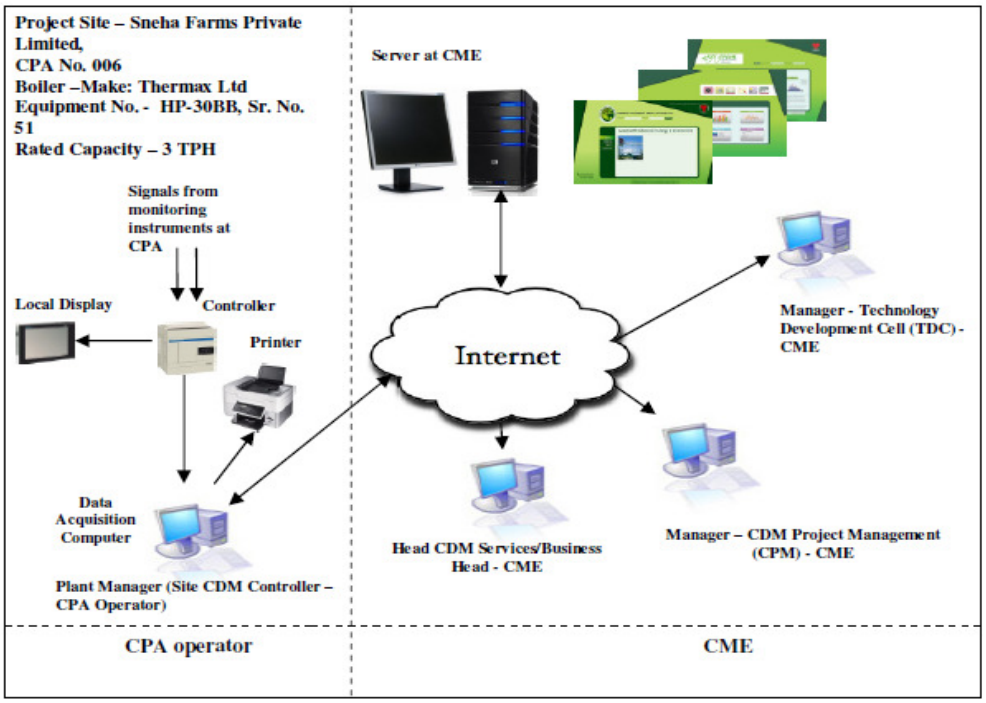

*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

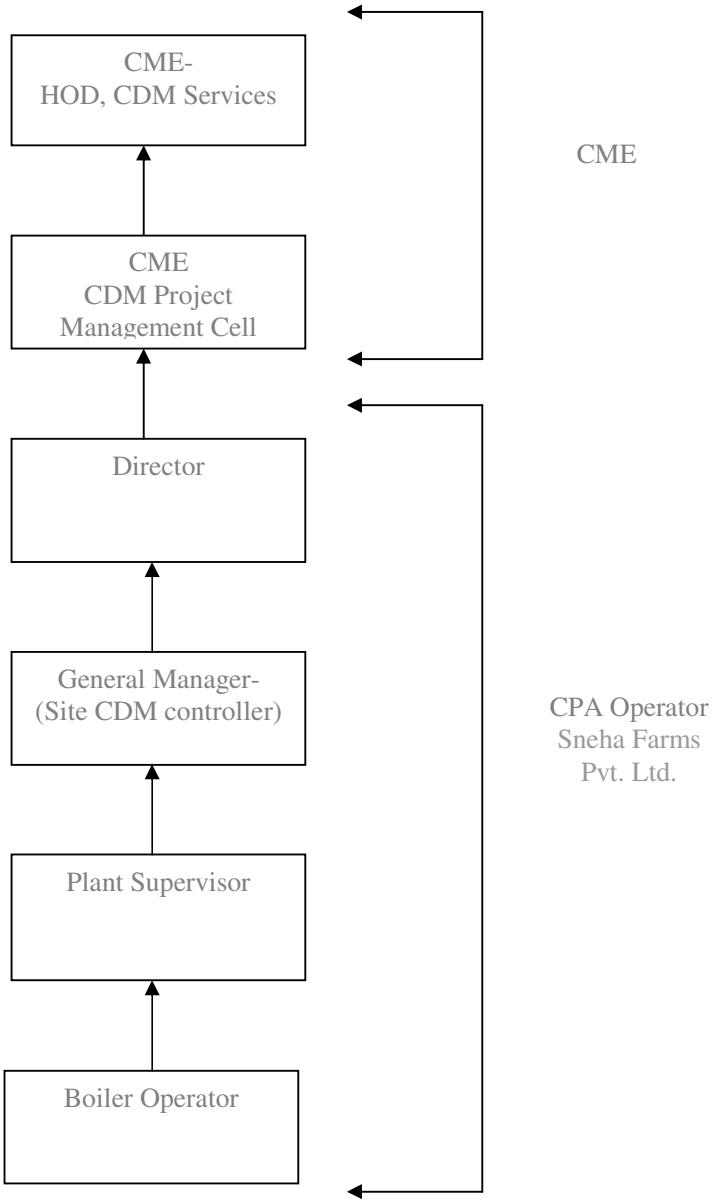


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator

| Key operational roles | CPA Management Responsibilities |
|---|---|
| Director | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head |

| | |
|---|---|
| | CDM Services for final reporting into emission reduction sheet.<br>• Quarterly Performance Review |
| General Manager<br>(Site CDM Controller) | • Performance review -Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions |
| Plant Supervisor | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Operator – Boiler | • Operation and Maintenance of Boiler<br>• Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the

auxiliary electrical connected load of the boiler i. e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| **Data/Parameter** | $CAP_{boiler}$ |
|---|---|
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 3 (value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $\eta_{BL,thermal}$ |
|---|---|
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $EF_{FF,CO2}$ |
|---|---|
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4 ).<br>The lower values has been chosen in conservative manner |
| **Value(s) applied** | 89.5 (value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass |
| **Source of data** | Independent Survey report |
| **Value(s) applied** | 64.29 (value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.86 -Southern Grid (value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link - http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on "Emissions from India's transport sector: Statewise synthesis"<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturers letter |
| **Value(s) applied** | 0.004286 – Rice husk<br>(value applicable for the Project activity as per CPA 006) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| | |
|---|---|
| **Data/Parameter** | $Q_{steam}$ |
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam supplied in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 1889 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam}$ |
| **Unit** | °C |
| **Description** | Steam Temperature at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 145.85 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 7.2 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 39 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 41.615 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of monitoring period and kept as an opening balance in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book and Plant record. |
| **Value(s) of monitored parameter** | 658.67 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass has been measured on weigh bride inside the plant premise. The weighbridge slip with delivery note/invoice has been obtained from the fuel supplier and has been mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 33 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and paper mode.<br>Monitoring: Biomass has been measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 667 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of biomass (rice husk) consumed will be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 11.50 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by Electronic and paper mode.<br>Monitoring: Analysis from accredited agency according to relevant national standards. |
| **Calculation method (if applicable)** | If the NCV report specifies unit other than TJ/Gg , then it will be appropriately converted.<br>$NCV_k = NCV_{j,y}$<br>In case analysis provides GCV and not NCV, then NCV is calculated from GCV.<br>NCV = GCV -0.212H-0.0245M-0.008Y (in GJ/t)<br>Source- http://www.worldcoal.org/pages/content/index.asp?PageID=190<br>Where H = % Hydrogen in fuel, M= % moisture in fuel, Y = % Oxygen in fuel. If there is change in the combination of biomass type the NCV will be tested. |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 3.0 (The actual value calculated during monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by Electronic/Paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. The following chemical equation shall be applicable to convert<br>GCV to NCV<br>NCV = GCV -0.212H-0.0245M-0.008Y (in GJ/t)<br>Source- http://www.worldcoal.org/pages/content/index.asp?PageID=190<br>Where H = % Hydrogen in fuel, M= % moisture in fuel, Y = % Oxygen in fuel |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 31.2(The actual value calculated during monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by Electronic and Paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. The following chemical equation shall be applicable to convert GCV to NCV<br>NCV = GCV -0.212H-0.0245M-0.008Y (in GJ/t)<br>Source- http://www.worldcoal.org/pages/content/index.asp?PageID=190<br>Where H = % Hydrogen in fuel, M= % moisture in fuel, Y = % Oxygen in fuel |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 9.5 (The actual value calculated during monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by Electronic/Paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 25.5 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set or Fossil fuel based power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0006 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data will be archived by Electronic/Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 90 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Check consistency of distance record provided by trucker / supplier by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 69 |
| **Monitoring equipment** | -- |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable). |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since **100% data are monitored and reported**

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (Kcal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (Kcal/kg) |

$Q_{steam}$ : 1889 Tons
$H_s$ : 661.04 kCal/Kg
$H_w$ : 39 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 89.5$tCO_2$/TJ

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

$EG_{thermal}$ = 1,889 * (661.04- 39) *4.186 X $10^{-6}$
= 4.920 TJ

Hence;

$BE_{thermal,CO_2,y}$ = (4.920 /100 %) * 89.5
= 440 $tCO_2$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:
Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.86 $tCO_2/MWh$ (for Southern regional grid)

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2/MWh$ if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power

plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 25.5 MWh
$EF_{grid,CM,y}$ = 0.86 $tCO_2$/MWh
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2$/MWh

$PE_{EC,y}$ = 25.5* 0.86* (1+20/100) + 0*1.3* (1+20%)
= 27 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 27 + 0$
$= 27\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (Rice Husk) consumed in the project activity is not transported to the Project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 440 - 27 - 0$
$= \mathbf{413\ tCO_2e}$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 440 | 27 | 0 | 413 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 1,445* | 413 |

*As the monitoring period is from 01/05/2012 to 31/08/2012 i.e. 123 days (first and last days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 8,000 hrs of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0006: Instrument Details**

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Date | Calibration Frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied in year y, ($Q_{steam}$) | Steam Flow Meter | Endress + Hauser | E8010720000 | ±3% | 11/08/2011 | Once in 3 year | 10/08/2014 |
| Average Steam Temperature at MSSV (Main steam stop valve) outlet during year ,($T_{steam}$) | RTD | Endress + Hauser | E8010720000 | ±3% | 11/08/2011 | Once in 3 year | 10/08/2014 |
| Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year ($P_{steam}$) | Pressure Transmitter | Endress + Hauser | E8002D21129 | ±2% | 22/08/2011 | Yearly | 21/08/2012 |
| Average Feed Water Temperature at inlet of boiler ($T_{FWB}$) | RTD | Endress + Hauser | E80081142EA | ±2% | 18/10/2011 | Yearly | 17/10/2012 |
| Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$) and Off Grid ($EC_{PJ,j,y}$) in year y | Dual source Energy Meter | Schneider Electric Pvt. Ltd. | 34120331355 | Class 1.0 | 13/02/2012 | Yearly | 12/02/2013 |
| Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge | Metler | 2730090466 | Class III | 21/03/2012 | Yearly | 20/03/2013 |
| Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

**Appendix-6**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 007) |
| **Reference number of the project activity** | CPA 4041-0007[37] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 30/04/2012 (Inclusion Date of CPA in Registered PoA No.4041) |
| **Monitoring period number and duratin of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/05/2012 to 31/08/2012 (first and last days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 6,284 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 760 $tCO_2e$ |

[37] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=S7ENUT8QG95POYLR6XKZ2IC3VBW1FH

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 12 TPH biomass residues (Rice Husk) fired boiler at Swadisht Oils (P) Limited for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 12 TPH, Fluidpac boiler manufactured by Thermax Limited. It works at a maximum pressure of 17.5 kg/cm$^2$ and has fluidized bed combustor with refractory lining furnace. The steam generated from the boiler is utilised thermal processing of various seeds like castor seeds, soyabean, sunflower seeds etc. for the production of oil and de oiled cake (DOC)

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| PoA-4041 0007 | Swadisht Oils (P) Limited | Boiler - 12 TPH ( At 100$^0$C) | 20/02/2009 | 30/04/2012 | 01/05/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/05/2012 to 31/08/2012 (first and last days included) is 760 t$CO_2$e

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| PoA-4041 0007 | Swadisht Oils (P) Limited | Village – Chiraura., Rania, District - Kanpur Dehat, Uttar Pradesh - 209304, India | 26$^0$25’16.27”N 80$^0$ 06’ 33.02”E | India |

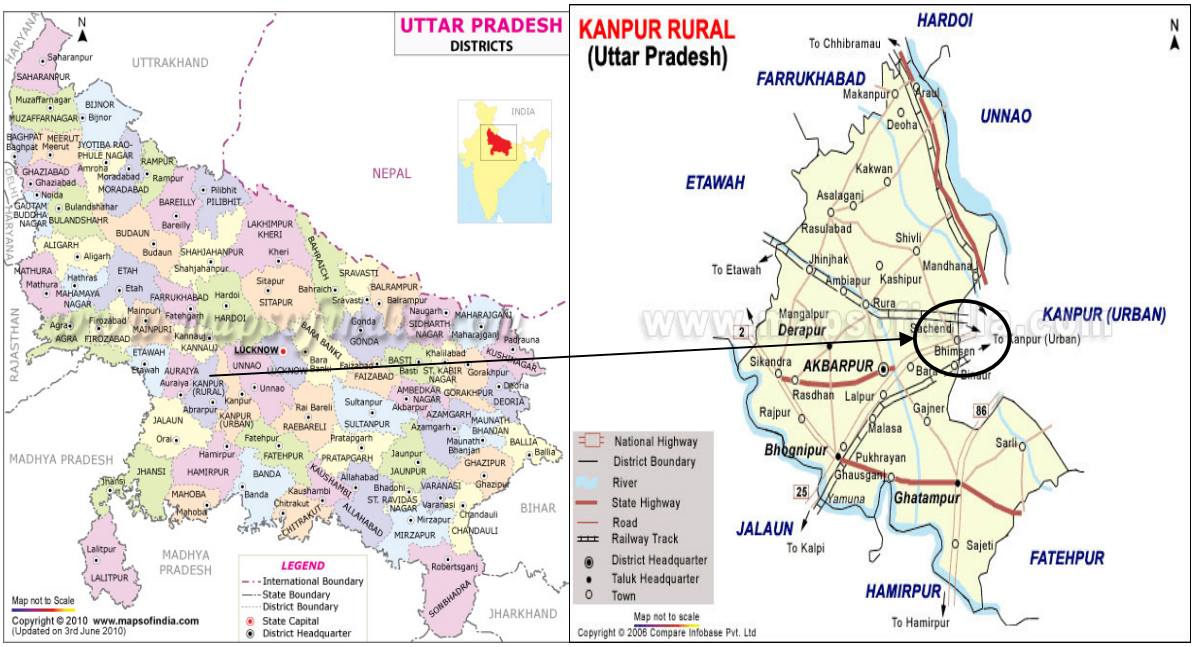


Fig.A.2.1 Physical Location of the project activity

### A.3. Parties and project participant(s)

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity – Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

### A.4. Reference of applied methodology

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [38]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[39]

[38] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[39] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[40]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[41]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[42]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[43]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/05/2012, the start date of a crediting period for CPA is the date of its inclusion in the registered PoA or any date thereafter.

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

[40] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[41] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[42] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[43] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 007 |
| CPA Operator | Swadisht Oils (P) Limited |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler |
| Project activity | The project activity is installation of biomass fired (Rice husk) boiler having rated steam Generation Capacity of 12 Tons per Hour (TPH) |
| Boiler Make | Thermax Limited<br>Boiler Pressure part fabrication by M/s Akshay Dynamix, Pune |
| Boiler Model | Fluidpac |
| Maximum working pressure | 17.5 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 12 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Rice husk) |
| Type of fuel firing | Screw feeder |
| Furnace type | Fluidized bed combustor with refractory lining |
| Boiler Number | MTFH 120A/17.5/27 |
| Commissioning date | 20/02/2009 |

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently Biomass briquettes as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge, electrical systems, equipment safeties & controls.

The CPA operator has utilized biomasses for heat generation i.e. Rice Husk, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**

The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**
There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**
There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**
There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**
Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument or field instrument integral to steam flow meter. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meter |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments (Sr no 1 to 4) are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data gets transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

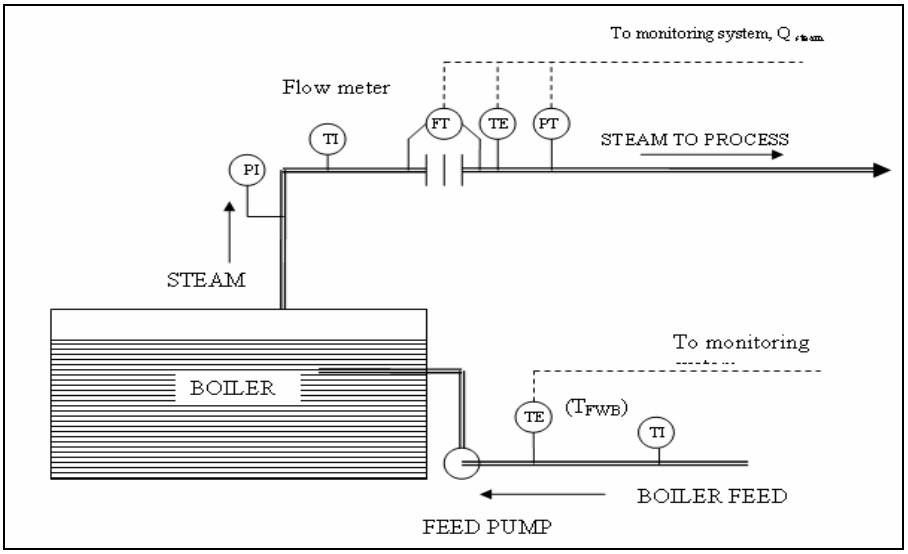


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Duly calibrated weigh bridge has been used to weigh the biomass consumed in thefor this project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However no fossil fuel was used in this project activity for the monitoring period.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator) This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required

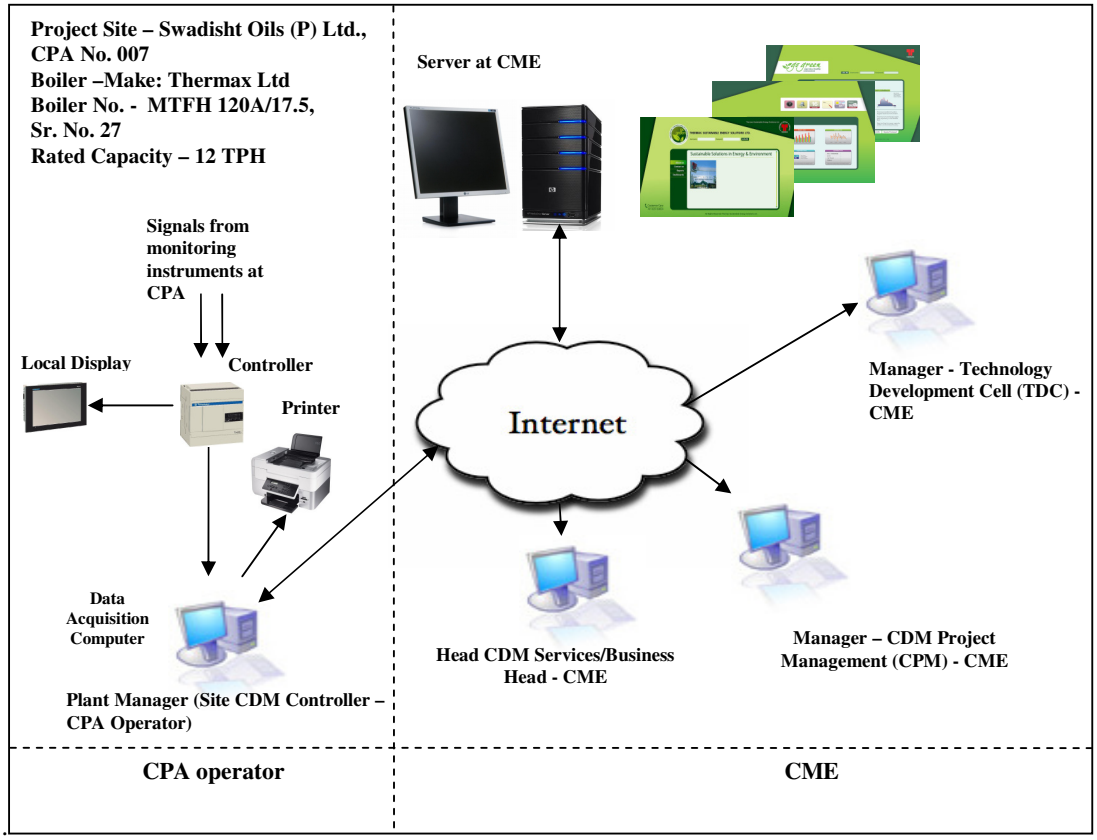


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

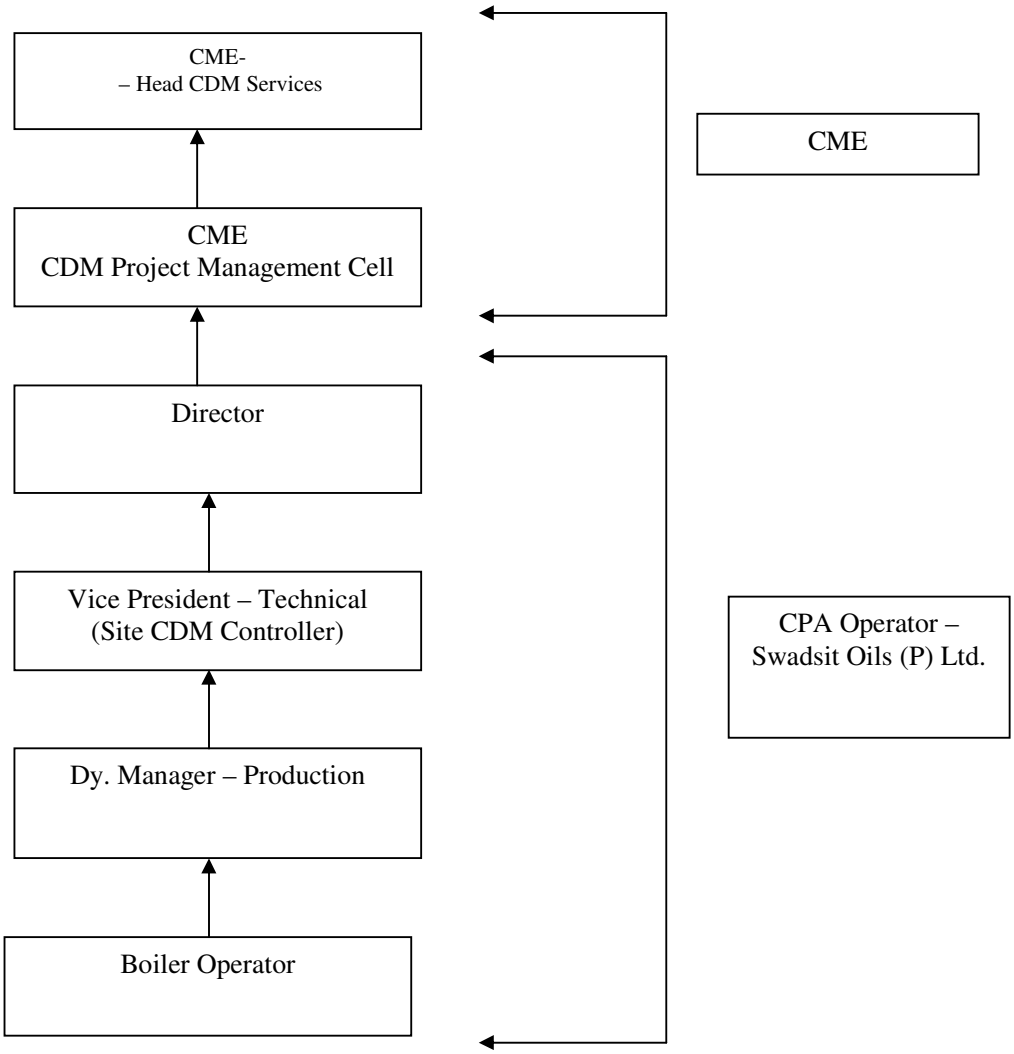


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator

| **Key operational roles** | • **CPA Management Responsibilities** |
|---|---|
| Director | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head CDM Services for final reporting into emission reduction sheet.<br>• Quarterly Performance Review |

| | |
|---|---|
| Vice President – Technical (Site CDM Controller) | • Performance review -Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions |
| Dy. Manager – Production | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Boiler – Operator | • Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i.e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 12 (value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\eta_{BL,thermal}$ |
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the Baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4 ).<br>The lower values has been chosen in conservative manner |
| **Value(s) applied** | 89.5 (value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | The baseline identification test concluded Indian coal as a plausible and only alternative to the Project activity for baseline emission calculation.<br>As there is no data available considering the local circumstances, hence as per methodology AMS I.C ver 16, para 37, the lower of the value of emission factor of coal is chosen within the plausible range considered as conservative manner. Default emission factor of 'other Bituminous coal' as per the IPCC default emission factor (IPCC Guidelines for National Greenhouse Gas Inventories 2006, Volume 2, Chapter 1 (Table 1.4) is between 89.5 T/TJ to 99.7 T/TJ. The selection of the emission factor is based on the conservative value of other Bituminous coal. Hence, the lower of the values of Other bituminous coal, 89.5 T/TJ has been selected in a conservative manner (para 37 AMS I.C ver 16)<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass within 75 km radial distance |
| **Source of data** | Third Party Survey report at the beginning of crediting period |
| **Value(s) applied** | 27.50 (value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.80 -NEWNE Grid (value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link -<br>http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on "Emissions from India's transport sector: Statewise synthesis". This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturers letter |
| **Value(s) applied** | Indian coal – 0.004186 (in case Indian coal is used)<br>Rice husk - 0.004235<br>(value applicable for the Project activity as per CPA 007) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| | |
|---|---|
| **Data/Parameter** | $Q_{steam}$ |
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam supplied during monitoring period |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 3556 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam}$ |
| **Unit** | °C |
| **Description** | Average Steam Temperature at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 144.63 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during monitoring period |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 7.3 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Average feed Water Temperature at inlet of boiler during monitoring period |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 49.07 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the start date of this monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 406 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. To be checked whether the calibration is required to be conducted or not |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 1236.76 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. Monitoring: The weighbridge slip with delivery note/invoice has been obtained from the fuel supplier and has been mentioned in the log book |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of this monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 348 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Has been measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 1294 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of biomass consumed has been cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type fossil i on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel will be measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice will be obtained from the fuel supplier and will be mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i} = FC_{j,PJ,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | This can be verified with the help of steam generation and steam to fuel ratio. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 3120 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been be archived annually by Paper mode.<br>Monitoring: Analysis from accredited independent agency according to relevant national standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 5.34 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by Paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 35.33 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by Paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 15.25 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by Paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $FC_{i,j,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed in a process j during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 (No fossil fuel type i consumed in a process j during monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 28.55 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set power source) |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 8.29 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-007 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data has been archived by Electronic/Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | Km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 39 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Check consistency of distance record provided by trucker / supplier by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 166 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data has been checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since 100% data are monitored and reported

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg) |

$Q_{steam}$ : 3556 Tons
$H_s$ : 650.81 kCal/Kg
$H_w$ : 49.07 kCal/Kg
$\eta_{BL,Thermal}$ : 100 %
$EF_{FF,CO2}$ : 89.5 $tCO_2$/TJ

$EG_{thermal}$ = 3556 * (650.81-49.07) *4.186 X $10^{-6}$
= 8.958 TJ

Hence;

$BE_{thermal,CO_2,y}$ = (8.958/100 %) * 89.5
= 801 $tCO_2e$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:
Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

In this case, the following option has been considered at CPA level, as defined in the tool:

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 tCO2/MWh for NEWNE grid

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power

plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

| | |
|---|---|
| $EC_{PJ,j,y}$ | = 28.55 MWh |
| $EF_{grid,CM,y}$ | = 0.80 $tCO_2$/MWh |
| $TDL_{j,y}$ | = 20 % (Default value) |
| $EC_{EL,j,y}$ | = 8.29 MWh |
| $EF_{EL,j,y}$ | = 1.3 $tCO_2$/MWh |

$PE_{EC,y}$ = 28.55* 0.80* (1+20/100) + 8.29*1.3* (1+20/100)
= **41 $tCO_2e$**

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |

| | |
|---|---|
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 41 + 0$
$\mathbf{= 41\ tCO_2e}$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (Rice Husk) consumed in the project activity is not transported to the Project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 801 - 41 - 0$
$\mathbf{= 760\ tCO_2e}$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 801 | 41 | 0 | 760 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 6,284* | 760 |

*As the monitoring period is from 01/05/2012 to 31/08/2012 i.e. 123 days (first and last days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0007: Instrument Details**

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Frequency | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied in year y, ($Q_{steam}$) | Steam Flow Meter | Endress + Hauser | EC01F720000 | ±3 % | Once in 3 years | 11/01/2012 | 10/01/2015 |
| Average Steam Temperature at MSSV (Main steam stop valve) outlet during year,($T_{steam}$) | RTD | Endress + Hauser | EC01F720000 | ±3 % | Once in 3 Years | 11/01/2012 | 10/01/2015 |
| Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year ($P_{steam}$) | Pressure Transmitter | Endress + Hauser | EC175A01052 | ±2 % | Yearly | 11/01/2012 | 10/01/2013 |
| | Gauge | Gluck | -- | ±2 % | Yearly | -- | -- |
| | Gauge | H-Guru | K09-144 | ±2 % | Yearly | -- | -- |
| Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$) and Off Grid ($EC_{PJ,j,y}$) in year y | Energy Meter | Schneider Electric | 34120630706 | Class 1.0 | Yearly | 07/03/2012 | 06/03/2013 |
| Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge | Essae | 95008311 | Class-III | Yearly | 02/01/2012 | 02/01/2013 |
| Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

**Appendix-7**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 005) |
| **Reference number of the project activity** | CPA 4041-0009[44] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 31/05/2012 (Inclusion Date of CPA in Registered PoA 4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/06/2012 to 31/08/2012 (both days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 3,200 $tCO_2e$ |
| **Actul GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 1,891 $tCO_2e$ |

[44] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=GKM2BJ9UZC8F4EH0LQTW163AOXNDRY

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the Installation of biomass fired (Rice Husk) boilers having rated steam Generation Capacity of 6 Tons per Hour (TPH) and 8 TPH at Growel Feeds Private Limited for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction**.**

**(b) Brief description of the installed technology and equipment:**

The project activity consists of biomass fired thermal energy generation in Greenfield Projects and addition of renewable energy unit at an existing renewable energy facility by installing combipac boilers of 6 TPH and 8 TPH capacity manufactured by Thermax Limited. Both boilers are designed to operate at a maximum pressure of 10.54 kg/cm$^2$ and have an external water walled furnace with horizontal fixed grate furnace. The steam generated from the boilers is utilised for cooking and drying of the grains required for manufacturing the extruded floating fish seed.

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| PoA-4041 0009 | Growel Feeds Private Limited | Boiler- 6 TPH (From & At 100 $^0$C) | 27/01/2010 | 31/05/2012 | 01/06/2012 |
| | | Boiler- 8 TPH (From & At 100 $^0$C) | 25/03/2011 | 31/05/2012 | 01/06/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/05/2012 to 31/08/2012 (first and last days included) is 1,891 $tCO_2e$

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| PoA-4041 0009 | Growel Feeds Private Limited | Sy. No. 57, Village Chevuru, Sriharipuram Panchayat, Taluka Mudinepalli Mandal, District Krishna, State Andhra Pradesh 521325 | 16°25’25” North 81°09’29” East | India |

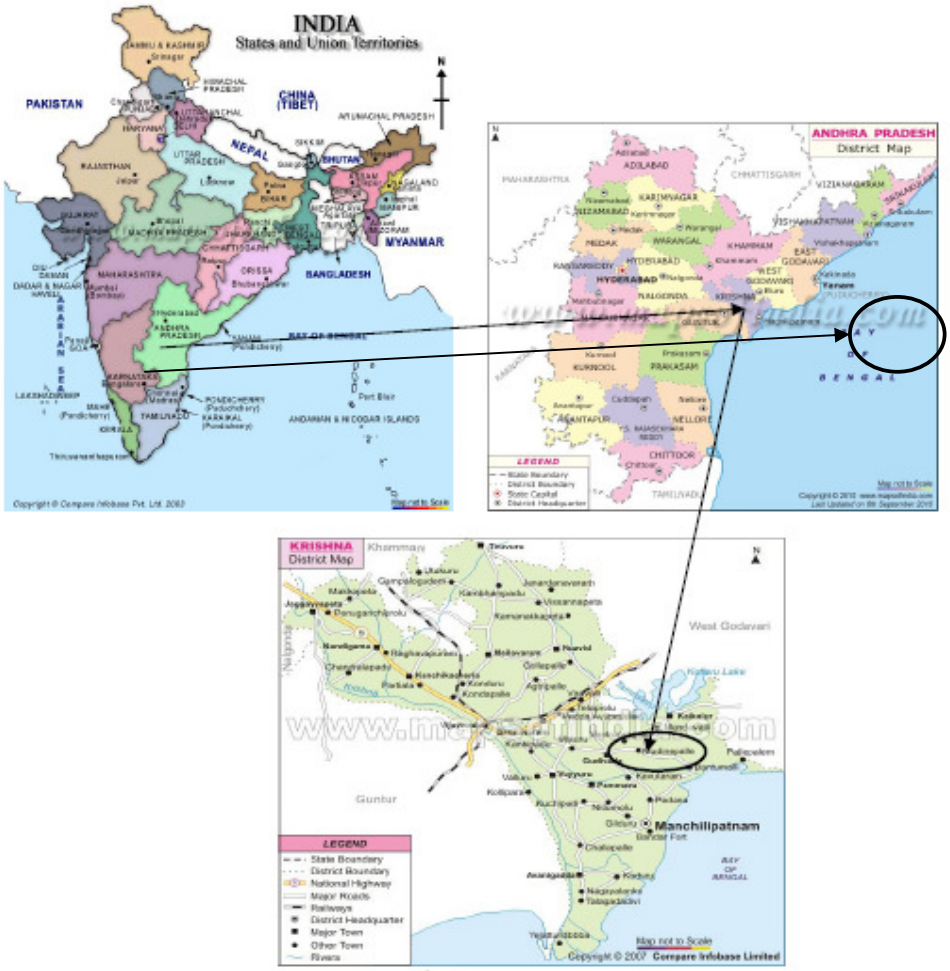


Fig.A.2.1 Physical Location of the project activity

**A.3. Parties and project participant(s)**

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment

(boilers) displacing fossil fuel has been addressed as Project activity and the Equipment (boilers) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [45]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[46]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01
   EB 39 Annex 7)[47]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[48]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[49]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[50]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/06/2012

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

[45] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[46] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[47] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[48] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[49] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[50] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 005 |
| CPA Operator | Growel Feeds Private Limited |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Projects and addition of renewable energy unit at an existing renewable energy facility |
| Type of equipment | Boiler |
| Project activity | Installation of biomass fired boilers having rated steam generation capacity of 6 Tons per Hour (TPH) and 8 TPH |
| Boiler Make | Thermax Limited |
| Boiler Model | Combipac |
| Maximum working pressure | 10.5 4 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 6 TPH and 8 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Rice husk) |
| Type of fuel firing | Automatic |
| Furnace type | External Water walled furnace with Horizontal fixed grate |
| Boiler Number | CPFD60/10.54/18 and CPFD 80/10.54/26 |
| Commissioning date | 27/01/2010 for 6 TPH boiler and 25/03/2011 for 8 TPH boiler |

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently biomass (rice husk) as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge & handling, electrical systems, equipment safeties & controls.

The CPA operator has utilized biomasses for heat generation i.e. Rice Husk, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**

The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**

There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**

There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**

There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**

Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meters |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data has been transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

$EG_{thermal}$ = Net quantity of heat supplied by the Project activity

$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

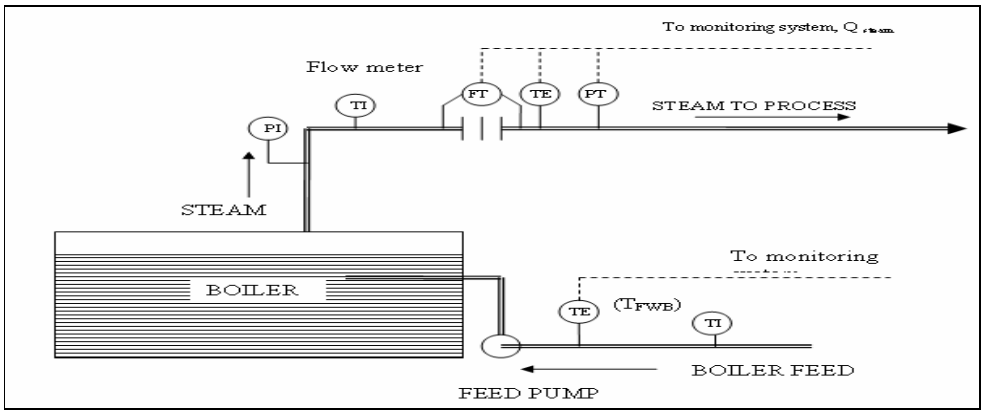


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meters (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Duly calibrated weigh Bridge has been used to weigh the biomass consumed in the project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$
b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$
c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However no fossil fuel was used in this project activity for the monitoring period.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator). This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system. The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually.. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

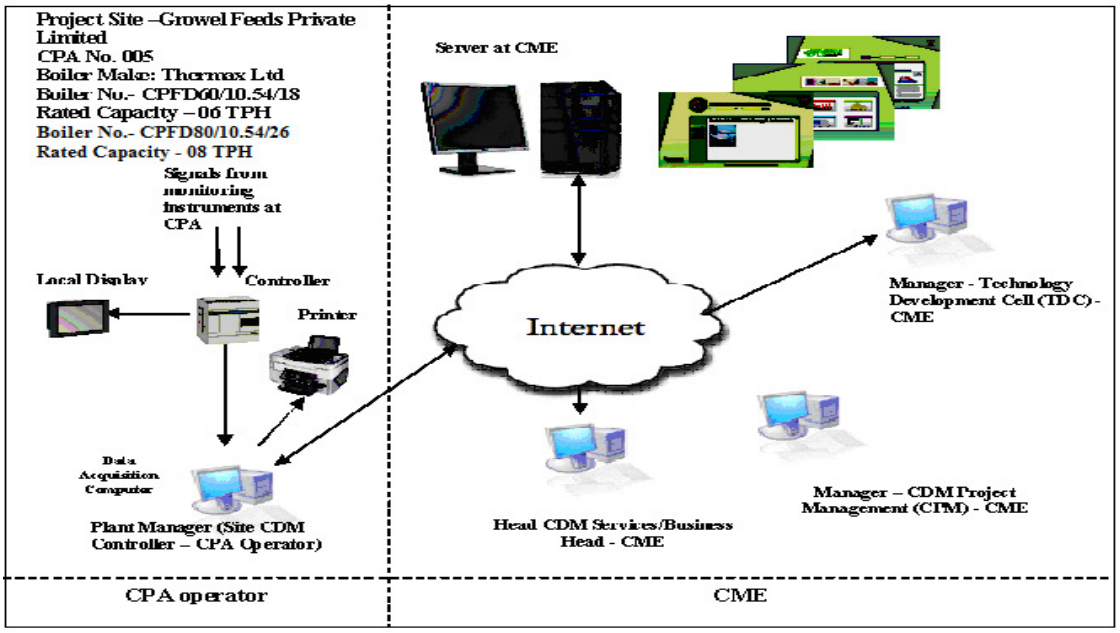


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

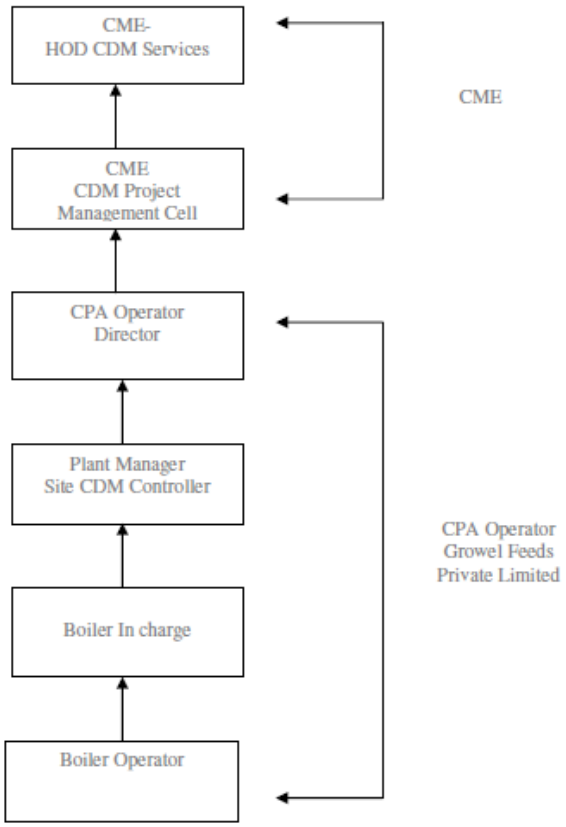


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator

| **Key operational roles** | • **CPA Management Responsibilities** |
|---|---|
| Director – CPA operator | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head CDM Services for final reporting into emission reduction sheet.<br>• Quarterly Performance Review |
| Plant Manager – (Site CDM Controller) | • Performance review -Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions |
| Boiler In charge | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipment<br>• Implementation of corrective action |
| Operators - Boiler | • Operation and maintenance of boiler<br>• Recording/Collection of Data |

| | |
|---|---|
| | • Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i. e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| **Data/Parameter** | $CAP_{boiler}$ |
|---|---|
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 6 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $CAP_{boiler, old}$ |
|---|---|
| **Unit** | Tons/hr |
| **Description** | Rated capacity (output) of the existing renewable fuel fired boiler |
| **Source of data** | Manufacturer's specification/ Plant data |
| **Value(s) applied** | 6 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $CAP_{boiler, add}$ |
|---|---|
| **Unit** | Tons/hr |
| **Description** | Rated capacity (output) of the Boiler added to the existing renewable facility |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 8 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $\eta_{BL,thermal}$ |
|---|---|
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4)<br>The lower values has been chosen in conservative manner |
| **Value(s) applied** | 89.5 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | The baseline identification test concluded Indian coal as a plausible and only alternative to the Project activity for baseline emission calculation.<br>As there is no data available considering the local circumstances, hence as per methodology AMS I.C ver 16, para 37, the lower of the value of emission factor of coal is chosen within the plausible range considered as conservative manner. Default emission factor of 'other Bituminous coal' as per the IPCC default emission factor (IPCC Guidelines for National Greenhouse Gas Inventories 2006, Volume 2, Chapter 1 (Table 1.4) is between 89.5 T/TJ to 99.7 T/TJ. The selection of the emission factor is based on the conservative value of other Bituminous coal. Hence, the lower of the values of Other bituminous coal, 89.5 T/TJ has been selected in a conservative manner (para 37 AMS I.C ver 16)<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass |
| **Source of data** | Third Party Survey report |
| **Value(s) applied** | 28.39 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.86 – Southern Grid (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link -<br>http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s). However, Project activity is Greenfield project hence there is no CPP present at site. Hence default value at the time of PoA validation i.e. 1.3 tCO2/MWh is considered for the calculation of project emissions in conservative manner as the auxiliary load of baseline plant activity is less than the auxiliary load of Project activity. Electricity consumption from the CPP (DG set) is the project emission and not the leakage electricity consumption source. This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on "Emissions from India's transport sector: Statewise synthesis". This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record – Manufacturer's letter |
| **Value(s) applied** | 0.004186 for Indian Coal (in case of Indian coal is used)0.004260 for biomass residues (rice husk) (value applicable for the Project activity as per CPA 005) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16. This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

**Monitoring parameters for 6 TPH Boiler:**

| | |
|---|---|
| **Data/Parameter** | $Q_{steam}$ |
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam supplied |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 3,517 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam}$ |
| **Unit** | °C |
| **Description** | Steam Temperature at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 144.62 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 5.91 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^{o}C$ |
| **Description** | Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 62 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

**Monitoring parameters for 8 TPH Boiler:**

| | |
|---|---|
| **Data/Parameter** | $Q_{steam, old, y}$ |
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam produced by an existing renewable energy unit |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 3,517 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | $Q_{steam,old,y} = Q_{steam}$ |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{steam, add, y}$ |
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam generated by additional renewable energy unit at an existing renewable energy production facility |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 5407 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam, old,y}$ |
| **Unit** | °C |
| **Description** | Steam Temperature at MSSV (Main steam stop valve) outlet of an existing renewable energy production facility |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 144.62 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | $T_{steam,old,y} = T_{steam}$ |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam, add, y}$ |
| **Unit** | °C |
| **Description** | Steam Temperature at MSSV (Main steam stop valve) outlet of additional renewable energy unit (Boiler) at an existing renewable energy production facility |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 153.67 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam, old,y}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet of an existing renewable energy production facility |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 5.91 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | $P_{steam,old,y} = P_{steam}$ |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam, add,y}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet of additional renewable energy unit (boiler) at an existing renewable energy production facility |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 6.4 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | $P_{steam,old,y} = P_{steam}$ |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB,old,y}$ |
| **Unit** | $^oC$ |
| **Description** | Average Feed Water Temperature at inlet an existing renewable energy production facility (boiler) |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 62 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode |
| **Calculation method (if applicable)** | $T_{FWB,old,y} = T_{FWB}$ |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB,add,y}$ |
| **Unit** | $^{o}C$ |
| **Description** | Feed Water Temperature at inlet of additional renewable energy unit (boiler) at an existing renewable energy production facility |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 68 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | $T_{FWB,old,y} = T_{FWB}$ |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

**Monitoring parameters for 6 TPH and 8 TPH Boiler:**

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 145.44 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of monitoring period and kept as opening balance in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge slip, Log book and Plant record. |
| **Value(s) of monitored parameter** | 1955 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and paper mode.<br>Monitoring: Biomass (rice husk) has been measured on the weigh bridge inside the plant premise. The weigh bridge slip with delivery note/invoices has been obtained from the fuel supplier and has been mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 84 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details*. |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and paper mode.<br>Monitoring: has been measured at the end of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | For 6 TPH Boiler : 799<br>For 8 TPH Boiler : 1217.5 |
| **Monitoring equipment** | -- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by paper mode. |

**Calculation method (if applicable)**

It is calculated by the formula for biomass fuel type

$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$

$Q_{c,k} = FC_{biomass,k,y} = Q_{c,k,add} = Q_{c,k,A} + Q_{c,k,B}$

The parameter will be derived to proportionate biomass consumption for 6 TPH and 8TPH boiler on % energy supplied basis, as per following method,

| | | |
|---|---|---|
| Quantity of energy supplied by the 6 TPH boiler | $EG_{thermal\ y}$ | Measured |
| Quantity of energy supplied by the 8 TPH boiler | $EG_{thermal\ add,y}$ | Measured |
| Total quantity of energy supplied by both 6 TPH and 8 TPH boiler | $EG_{thermal,y}$ + $EG_{thermal,add,y}$ | Calculated (Z) |
| % Distribution of energy supplied by each unit | | |
| For 6TPH boiler | $EG_{thermal,y}$ / ($EG_{thermal,y}$ + $EG_{thermal,Add,y}$) * 100 | Calculated (X) |
| For 8TPH boiler | $EG_{thermal,,add,y}$ / ($EG_{thermal,y}$ + $EG_{thermal,Add,y}$) * 100 | Calculated (Y) |

Based on the derived values of 'X' and 'Y', the quantity of biomass consumed will be calculated as;

| | | |
|---|---|---|
| Quantity of biomass fuel type k consumed in a process j during the year y | $Q_{c,k}$ | Calculated (Tons) |
| For 6TPH boiler ($Q_{c,k,A}$) | $Q_{c,k}$ * X | Calculated (Tons) |
| For 8TPH boiler ($Q_{c,k,B}$) | $Q_{c,k}$ * Y | Calculated (Tons) |

**QA/QC procedures**

The quantity of biomass (rice husk) consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier

**Purpose of data**

NA

**Additional comment**

This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later.

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type fossil i on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | $Q_{ob,i} = Q_{ob,i,add}$ |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel will be measured inside the plant premises. The weigh bridge slip with delivery note/invoices will be obtained from the fuel supplier. |
| **Calculation method (if applicable)** | $Q_{np,i} = Q_{np,i,add}$ |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | $Q_{in,i} = Q_{in,i,add}$ |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i} = FC_{j,PJ,y} = FC_{i,j,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |

| | |
|---|---|
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$).<br><br>The parameter will be derived to proportionate fossil fuel consumption for 6 TPH and 8TPH boiler on % energy supplied basis, as per following method,<br><br>Quantity of energy supplied by the 6 TPH boiler — $EG_{thermal\ y}$ — Measured<br>Quantity of energy supplied by the 8 TPH boiler — $EG_{thermal\ add,y}$ — Measured<br>Total quantity of energy supplied by both 6 TPH and 8 TPH boiler — $EG_{thermal,y}$ + $EG_{thermal,add,y}$ — Calculated (Z)<br>% Distribution of energy supplied by each unit<br>For 6TPH boiler — $EG_{thermal,y}$ / ($EG_{thermal,y}$ + $EG_{thermal,Add,y}$) * 100 — Calculated (X)<br>For 8TPH boiler — $EG_{thermal,,add,y}$ / ($EG_{thermal,y}$ + $EG_{thermal,Add,y}$) * 100 — Calculated (Y)<br><br>Based on the derived values of 'X' and 'Y', the quantity of fossil fuel consumed will be calculated as;<br><br>Quantity of Fossil fuel type i consumed in a process j during the year y — $Q_{c,i}$ — Calculated (Tons)<br>For 6TPH boiler ($Q_{c,i,A}$) — $Q_{c,i}$ * X — Calculated (Tons)<br>For 8TPH boiler ($Q_{c,i,B}$) — $Q_{c,i}$ * Y — Calculated (Tons) |
| **QA/QC procedures** | The quantity of coal consumed will be cross-checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 11.51 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by Electronic and paper mode.<br>Monitoring: Analysis from accredited agency according to relevant national standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 3.05 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by Electronic and paper mode. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 31.1 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by Electronic and paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % water |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 10.5 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by Electronic and paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter shall be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | --- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | For 6 TPH : 31.51<br>For 8 TPH : 58.58 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and paper mode. |

| | |
|---|---|
| **Calculation method (if applicable)** | The parameter will be derive to proportionate electricity consumption for 6 TPH and 8TPH boiler on % energy supplied basis, as per following method, |

| | | |
|---|---|---|
| Quantity of energy supplied by the 6 TPH boiler | $EG_{thermal\ y}$ | Measured |
| Quantity of energy supplied by the 8 TPH boiler | $EG_{thermal\ add,y}$ | Measured |
| Total quantity of energy supplied by both 6 TPH and 8 TPH boiler | $EG_{thermal,y} + EG_{thermal,add,y}$ | Calculated (Z) |
| % Distribution of energy supplied by each unit | | |
| For 6TPH boiler | $EG_{thermal,y} / (EG_{thermal,y} + EG_{thermal,Add,y}) * 100$ | Calculated (X) |
| For 8TPH boiler | $EG_{thermal,,add,y} / (EG_{thermal,y} + EG_{thermal,Add,y}) * 100$ | Calculated (Y) |

Based on the derived values of 'X' and 'Y', the parameter (electricity consumption) will be calculated as-

| | | |
|---|---|---|
| Auxiliary Electricity consumption for Project activity from Grid in year | | |
| For 6TPH boiler | $EC_{PJ,j,y}$ | Monitored |
| For 8TPH boiler | $EC_{PJ,j,y}$ | Monitored |
| Auxiliary electricity consumption of the project from Grid in year y for common auxiliary | $EC_{PJ,j,common,y}$ | Monitored |
| For 6TPH boiler | $EC_{PJ,j,common,y} * X$ | Calculated MWh (A) |
| For 8TPH boiler | $EC_{PJ,j,common,y} * Y$ | Calculated MWh (B) |
| Total electricity auxiliary consumption for the each Project activity - | | |
| For 6TPH boiler | $EC_{PJ,j,y} + A$ | Measured and Calculated MWh |
| For 8TPH boiler | $EC_{PJ,j,y} + B$ | Measured and Calculated MWh |

| | |
|---|---|
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set or Fossil fuel based power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | For 6 TPH and 8 TPH : 0 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0009 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data will be archived by Electronic/Paper mode |

| | |
|---|---|
| **Calculation method (if applicable)** | The parameter will be derived to proportionate electricity consumption for 6 TPH and 8TPH boiler on % energy supplied basis, as per following method, |

| | | |
|---|---|---|
| Quantity of energy supplied by the 6 TPH boiler | $EG_{thermal\ y}$ | Measured |
| Quantity of energy supplied by the 8 TPH boiler | $EG_{thermal\ add,y}$ | Measured |
| Total quantity of energy supplied by both 6 TPH and 8 TPH boiler | $EG_{thermal,y} + EG_{thermal,add,y}$ | Calculated (Z) |
| % Distribution of energy supplied by each unit | | |
| For 6TPH boiler | $EG_{thermal,y} / (EG_{thermal,y} + EG_{thermal,Add,y}) * 100$ | Calculated (X) |
| For 8TPH boiler | $EG_{thermal,,add,y} / (EG_{thermal,y} + EG_{thermal,Add,y}) * 100$ | Calculated (Y) |

Based on the derived values of 'X' and 'Y', the parameter (electricity consumption) will be calculated as-

| | | |
|---|---|---|
| Auxiliary Electricity consumption for Project activity from off-Grid in year | | |
| For 6TPH boiler | $EC_{EL,j,y}$ | Monitored |
| For 8TPH boiler | $EC_{EL,j,y}$ | Monitored |
| Auxiliary electricity consumption of the project from off-Grid in year y for common auxiliary | $EC_{EL,j,,common,y}$ | Monitored |
| For 6TPH boiler | $EC_{EL,j,common,y} * X$ | Calculated MWh (A) |
| For 8TPH boiler | $EC_{EL,j,common,y} * Y$ | Calculated MWh (B) |
| Total electricity auxiliary consumption for the each Project activity - | | |
| For 6TPH boiler | $EC_{EL,j,y} + A$ | Measured and Calculated MWh |
| For 8TPH boiler | $EC_{EL,j,y} + B$ | Measured and Calculated MWh |

| | |
|---|---|
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 13.11 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Consistency of distance record provided by trucker / supplier can be checked by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | For 6 TPH : 105<br>For 8 TPH : 160 |
| **Monitoring equipment** | -- |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by paper mode. |
| **Calculation method (if applicable)** | The parameter will be derive to proportionate number of truck trips for biomass fuel for 6 TPH and 8TPH boiler for Project activity on % energy supplied basis, as per following method, |

| | | |
|---|---|---|
| Quantity of energy supplied by the 6 TPH boiler | $EG_{thermal\ y}$ | Measured |
| Quantity of energy supplied by the 8 TPH boiler | $EG_{thermal\ add,y}$ | Measured |
| Total quantity of energy supplied by both 6 TPH and 8 TPH boiler | $EG_{thermal,y} + EG_{thermal,add,y}$ | Calculated (Z) |
| % Distribution of energy supplied by each unit | | |
| For 6TPH boiler | $EG_{thermal,y} / (EG_{thermal,y} + EG_{thermal,Add,y}) * 100$ | Calculated (X) |
| For 8TPH boiler | $EG_{thermal,,add,y} / (EG_{thermal,y} + EG_{thermal,Add,y}) * 100$ | Calculated (Y) |

Based on the derived values of 'X' and 'Y', the parameter (Number of truck trips for biomass fuel) will be calculated as-

| | | |
|---|---|---|
| Number of truck trips during the year y | $N_{,y}$ | Number |
| For 6TPH boiler | $N_{,y} * X$ | Number |
| For 8TPH boiler | $N_{,y} * Y$ | Number |

| | |
|---|---|
| **QA/QC procedures** | The data will be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices / This is the preferred source<br>b) Measurements by the Project participants / If a) is not available<br>c) Regional or national default values / If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories / If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable). |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since 100% data are monitored and reported.

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

Baseline Emission calculation for 6 TPH Boiler capacity:

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg) |

$Q_{steam}$ : 3,517 Tons
$H_s$ : 659.27 kCal/Kg
$H_w$ : 62 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 89.5$tCO_2$/TJ

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

$EG_{thermal}$ = 3517 * (659.27- 62) *4.186 X $10^{-6}$
= 8.793 TJ/yr

Hence;

$BE_{thermal,CO_2,y}$ = (8.793 /100 %) * 89.5
= 786 $tCO_2$

Baseline Emission calculation for 8 TPH Boiler capacity:

In this case of Project activity involves the addition of renewable energy unit at an existing renewable energy production facility, where the existing and new unit share the use of common and limited renewable resources (e.g., biomass residues), the potential for the Project activity to reduce the amount of renewable resource available to, and thus thermal energy production by, existing units must be considered in the determination of baseline emissions, Project emissions, and/or leakage, as relevant.

For Project activities that involve the addition of new energy production units (e.g., turbines) at an existing facility, net increase in thermal energy generation should be calculated as follows:

$EG_{thermal,add,y} = EG_{thermal,pj,y} - EG_{thermal,old,y}$

$EG_{thermal,add,y}$ = Net increase in thermal energy generation at existing plant in year y that should be considered as energy baseline (EGBL) (TJ)
$EG_{thermal,pj,y}$ = Total actual thermal energy produced in year y by all units, existing and new Project units (TJ)
$EG_{thermal,old,y}$ = Estimated thermal energy that would have been produced by existing units (installed before the Project activity) in year y in the absence of the Project activity; TJ

The value $EG_{thermal\ old\ y}$ is given by

$EG_{thermal,old,y} = MAX(EG_{thermal,actual,y}, EG_{thermal,estimated,y})$

$EG_{thermal,actual,y}$, = The actual, measured thermal energy production of the existing units in year y (TJ)
$EG_{thermal,estimated,y}$ = The estimated thermal energy that would have been produced by the existing units under the observed availability of the renewable resource for year y (TJ)

$EG_{thermal,add,y}$ is calculated as = $EG_{thermal,PJ,y} - EG_{thermal,old,y}$

$EG_{thermal,PJ,y} = Q_{steam,\ add} * (H_s - H_w) * 4.186 \times 10^{-6} + EG_{thermal,old,y}$

$EG_{thermal,PJ,y}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)
$EG_{thermal,actual,y}$ is determined from Plant record
$_{thermal,estimated,y}$ is determined from the rated capacity (output) and the operating parameter of the existing Boiler
The Baseline is calculated as per the paragraph 15 of the methodology $EG_{thermal,y} = EG_{thermal,add,y}$

| | | |
|---|---|---|
| $Q_{Steam,add,y}$ | : | 5,407 Tons |
| $H_{s,add,y}$ | : | 6,60.04 kCal/Kg |
| $H_{w,add,y}$ | : | 68 kCal/Kg |
| $\eta_{BL,Thermal}$ | : | 100% |
| $EF_{FF,CO2}$ | : | 89.5t$CO_2$/TJ |

$EG_{thermal,add,y}$ = 5,407 * (660.04- 68) *4.186 X $10^{-6}$
= 13.40 TJ/yr

Hence;

$BE_{thermal,CO_2,y}$ = (13.40 /100 %) * 89.5
= 1,199 $tCO_2$

Thus total $BE_{thermal,CO2,y}$ = (786+1199)
= 1,985 $tCO_2$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:
Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y}$= $EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.86 $tCO_2$/MWh (for southern regional grid)

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2/MWh$ if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,
$PE_{EC,y} = EC_{PJ,j,y}*EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y}*EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

For 6 TPH Boiler :

$EC_{PJ,j,y}$ = 31.51 MWh
$EF_{grid,CM,y}$ = 0.86 $tCO_2/MWh$
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0.0 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2/MWh$

$PE_{EC,y}$ = 31.51* 0.86* (1+20/100) + 0.0*1.3* (1+20%)
= 33 $tCO_2e$

For 8 TPH Boiler :

$EC_{PJ,j,y}$ = 58.6 MWh
$EF_{grid,CM,y}$ = 0.80 $tCO_2/MWh$
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0.0 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2/MWh$

$PE_{EC,y}$ = 58.6* 0.86* (1+20/100) + 0.0*1.3* (1+20%)
= 61 $tCO_2e$

$PE_{EC,y}$ = (33+61)
= 94 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$$PE_{FC,j,y} = 0$$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 94 + 0$
$= 94\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (Rice Husk) consumed in the project activity is not transported to the Project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$$\mathbf{ER_y = BE_y - PE_y - LE_y}$$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 1{,}985 - 94 - 0$
$= \mathbf{1{,}891\ tCO_2e}$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 1,985 | 94 | 0 | 1,891 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 3,200* | 1,891 |

*As the monitoring period is from 01/06/2012 to 31/08/2012 i.e. 92 days (both days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0009: Instrument Details**

For 6 TPH

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Date | Calibration Frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied in year y , ($Q_{steam}$) | Steam Flow Meter | Endress + Hauser | EC03DD20000 | ±3% | 25/01/2011 | Once in 3 year | 24/01/2014 |
| Average Steam Temperature at MSSV (Main steam stop valve) outlet during year,($T_{steam}$) | RTD | Endress + Hauser | EC03DD20000 | ±3% | 25/01/2011 | Once in 3 year | 24/01/2014 |
| Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year ($P_{steam}$) | Pressure Transmitter | Endress + Houser | E8004221129 | ±2% | - | - | - |
| Average Feed Water Temperature at inlet of boiler ($T_{FWB}$) | RTD | Endress + Houser | E80080142EA | ±2% | - | - | - |
| Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) in year y | (Dual Source) Energy Meter | HPL Electric and Power PVT. LTD. | 1L262653 | Class 1 | 1-07-2011 | Yearly | 30/6/2012 |
| Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge | ETL | 950094510 | Class III | 05.01.2012 | Yearly | 04/01/2013 |
| Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

For 8 TPH:

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Date | Calibration Frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied in year y , ($Q_{steam}$) | Steam Flow Meter | Endress + Hauser | E8010120000 | ±3% | 23/09/2011 | Once in 3 year | 22/09/2014 |
| Average Steam Temperature at MSSV (Main steam stop valve) outlet during year,($T_{steam}$) | RTD | Endress + Hauser | E8010120000 | ±3% | 23/09/2011 | Once in 3 year | 22/09/2014 |
| Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year ($P_{steam}$) | Pressure Transmitter | Endress+ Houser | F1000E21129 | ±2% | - | - | - |
| Average Feed Water Temperature at inlet of boiler ($T_{FWB}$) | RTD | Endress + Hauser | EC007E142EA | ±2% | - | - | - |

**Appendix-8**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 0010) |
| **Reference number of the project activity** | CPA 4041-0011[51] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 31/05/2012 (Inclusion Date of CPA in Registered PoA No.4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/06/2012 to 31/08/2012 (first and last days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 3,259 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 2,024 $tCO_2e$ |

[51] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=DKWA3ERVNJ2S71089QG65IHP4OLMTX

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of biomass fired boiler having rated steam generation capacity of 8 tonnes per hour (TPH) and heater having 0.4 million kCal/hour rated capacity at Shree GRG Oil Mill for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of two equipments as follows:
1) **Boiler**: 8 TPH, Combipac boiler, manufactured by Thermax Limited. It is designed to operate at a maximum pressure of 17.5 kg/cm$^2$ and has refractory lined furnace with water wall. Steam is applied for cooking of seeds, distillation and solvent recovery process.

2) **Heater:** 0.4 million kCal/hour rated capacity, thermopac heater manufactured by Thermax Limited and has a refractory lined furnace. Heat produced from heater is utilizing for deodorization for oil refining.

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| CPA-4041 0011 | Shree GRG Oil Mill | Boiler – 8 TPH ( from and at 100$^0$C) | 08/08/2009 | 31/05/2012 | 01/06/2012 |
| | | Heater- 0.4 million kCal/hr | 23/09/2009 | 31/05/2012 | 01/06/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/06/2012 to 31/08/2012 (first and last days included) is 2,024 $tCO_2e$

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| CPA-4041 0011 | Shree GRG Oil Mill | C-371-74, Agro Food Park, RIICO, Sri Ganganagar, Rajasthan – 335 002, India | 29$^0$ 52’ 00.50’’ N, 73$^0$ 55’ 26.17’’ E | India |

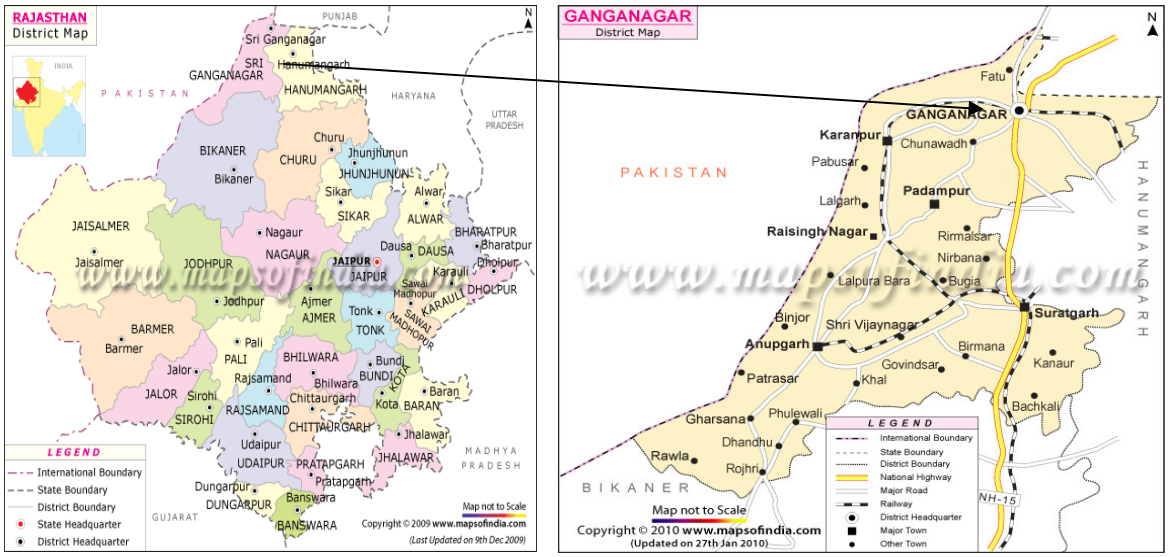


Fig.A.2.1 Physical Location of the project activity

### A.3. Parties and project participant(s)

| Party involved<br>((host) indicates a host Party) | Private and/or public entity(ies) project participants<br>(as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler and heater) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler and heater) Owner has been addressed as 'CPA operator'.

### A.4. Reference of applied methodology

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [52]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[53]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01), EB 39 Annex 7)[54]

[52] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[53] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf

2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[55]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[56]
4. "Tool to calculate Project or leakage $CO^2$ emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[57]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/06/2012

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.
The biomass fired heaters consist of thermic fluid / thermal oil heaters, pressurized and non pressurized hot water generators, which work on closed loop pipe line system, for transferring the thermal energy indirectly, to the process through the heat transfer medium like thermic fluids / thermal oil or pressurized / non pressurized water. The biomass fired heaters are similar to the boilers, as both pick up the heat from the biomass fuel combustion & transfer it to the process/heat utilities. The heaters transfer the thermal energy in the form of heat to the user which could be a process or heat utilities in a closed loop piping system.

[54] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[55] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[56] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[57] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipments:**

| Parameter | Description |
|---|---|
| CPA Number | 010 |
| CPA Operator | Shree GRG Oil Mill |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler and Heater |
| Project activity | The Project activity is installation of biomass fired boiler having rated steam generation capacity of 8 tonnes per hour (TPH ) and heater having 0.4 million kCal/hour rated capacity |
| Boiler and Heater Make | Thermax Limited |
| Boiler and Heater Model | Boiler : Combipac,<br>Heater : Thermopac |
| Maximum working pressure for Boiler and Maximum working Temperature for Thermopac | Boiler : 17.5 $kg/cm^2$<br>Heater : 280 $^0C$ |
| Rated steam and heat generation Capacities for Boiler and Heater | Boiler : 8 TPH From & At $100^0C$<br>Heater :0.4 million kCal/hour |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Boiler : Rice husk and Mustard Husk<br>Heater : Rice Husk |
| Type of fuel firing | Screw feeder |
| Furnace type | Boiler : Refractory lined furnace with water wall<br>Heater : Refractory lined |
| Boiler & Heater Number | Boiler : CP 80/17.5/02<br>Heater: VTB -04/69 |
| Commissioning date | Boiler : 08/08/2009<br>Heater : 23/09/2009 |

**Basic technology of Biomass fuel fired Boiler:**

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently rice husk and mustard husk fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge & handling, electrical systems, equipment safeties & controls.

**Basic technology of Biomass fuel fired Heater:**

The heater consists of mainly the following parts:

1. Heat Exchangers – form the heat transfer surface of the heater,
2. Furnace fuel combustor – designed to burn efficiently a particular type of biomass fuel

3. Accessories - for various systems like fuel storage, fuel handling & feeding, heat transfer fluid/water pipe lines, fans & draught system, flue gas discharge, ash discharge & handling, electrical system, equipment safety & controls, de-aerator & expansion Tank, heat transfer fluid/treated water system and storage.

The CPA operator has utilized biomasses for heat generation i.e. Rice Husk and Mustard Husk which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**

There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**

There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**

There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**

Not applicable

**SECTION C. Description of monitoring system**

The biomass based Steam & Heat generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

**1) Boiler Monitoring Parameters**

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by separate temperature measuring instrument and field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument or field instrument integral to steam flow meter. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meter |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

**2) Heater Monitoring Parameters**

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Fluid Flow | Flow meter |
| 2 | Heat Transfer Fluid/heating medium –inlet & outlet temperature sensors | Directly measured by field instruments integral to the flow meter. |
| 3 | Electrical Energy Consumption | Energy meters |
| 4 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data gets transferred to CME server through internet connectivity.

The following parameters are monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

**a) For Boiler:**
The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Tons
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

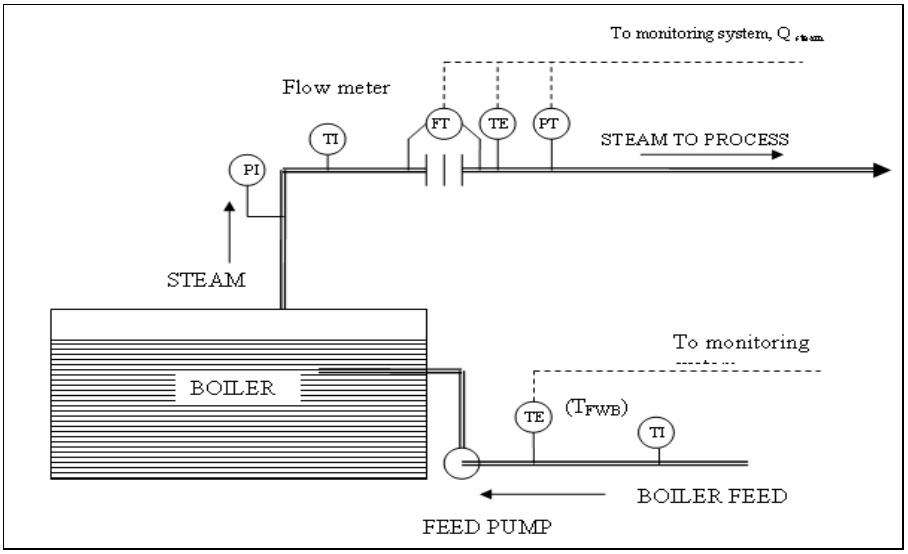


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**b) For Heater:**

The net quantity of heat supplied from a heater is calculated by the product of mass flow of the heat transfer fluid, the specific heat of the fluid at the measuring point and the temperature differential (or rise) across the heater.

Volumetric flow ($Q_{flow}$) is measured in $m^3$ with the help of a flow meter installed at the outlet line of the heater, the flow obtained is then converted to mass flow by multiplying with density (δ) which is computed in the monitoring system which is determined based on data provided by manufacturer at corresponding operating temperature ($T_{out}$) recorded at the heater outlet. No other monitoring parameter is considered to determine this parameter.

Similarly the Cp, specific heat, of the heat transfer fluid is also computed in the monitoring system based on the manufacturer's data corresponding to the operating temperature ($T_{out}$) recorded near the flow measuring point at the heater outlet.

As delta T i.e. ($T_{out} – T_{in}$) is a direct function to account for the heat generated, temperature sensors are installed at the inlet and outlet line (Two each- one working & one stand by) of the heater to measure the rise in temperature of the heat transfer fluid entering the heater and leaving the heater, respectively.

Using the above values the net quantity of heat supplied from the heater is calculated every fifteen minutes with the below mentioned thermodynamic equation & will be totalized for the hour and recorded as hourly heat generation in the daily log book:

$$EG_{thermal} = Q_{flow} * Cp_{out} * \delta_{out} * (T_{out} – T_{in}) * 4.186 \text{ X } 10^{-6}$$

$Q_{flow}$ Flow of heat transfer fluid at the heater outlet ($m^3$).

$Cp_{out}$ The specific heat of heat transfer fluid at Tout temperature (kCal/kg. $^{O}$C).

$\delta_{out}$ Density of heat transfer fluid at Tout temperature of the heater (kg/$m^3$).at the outlet of the heater (kg/$m^3$).

$T_{out}$ Temperature of the heat transfer fluid at the outlet of the heater ($^{O}$C).

$T_{in}$ Temperature of the heat transfer fluid at the inlet of the heater ($^{O}$C).

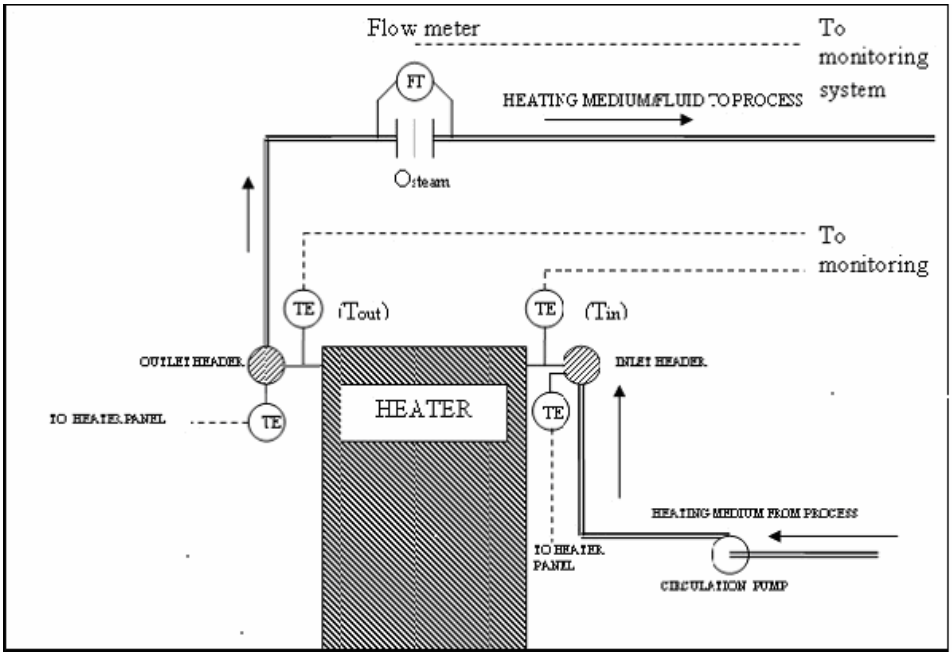


*Figure C.1.2 Schematic Representation of monitoring plan for a heater*

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid power ( Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Duly calibrated weigh bridge has been used to weigh the biomass purchase in the for this project activity.

Monitoring fuel Input in the Boiler & Heater:

The following approach has been taken to measure each type of biomass input to the boiler and heater & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However there was no fossil fuel consumed during the monitoring period for this project activity.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler & heater parameters have been manually recorded as indicated above by the boiler & heater operational staff at site (CPA operator).This manual record of boiler and heater log book has been maintained at site by CPA operator.

2) **Automated boiler and heater performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 for boiler and 1,2 for heater as per table above in Section D) required for monitoring the boiler and heater of this CPA were installed on the heat generating system. The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

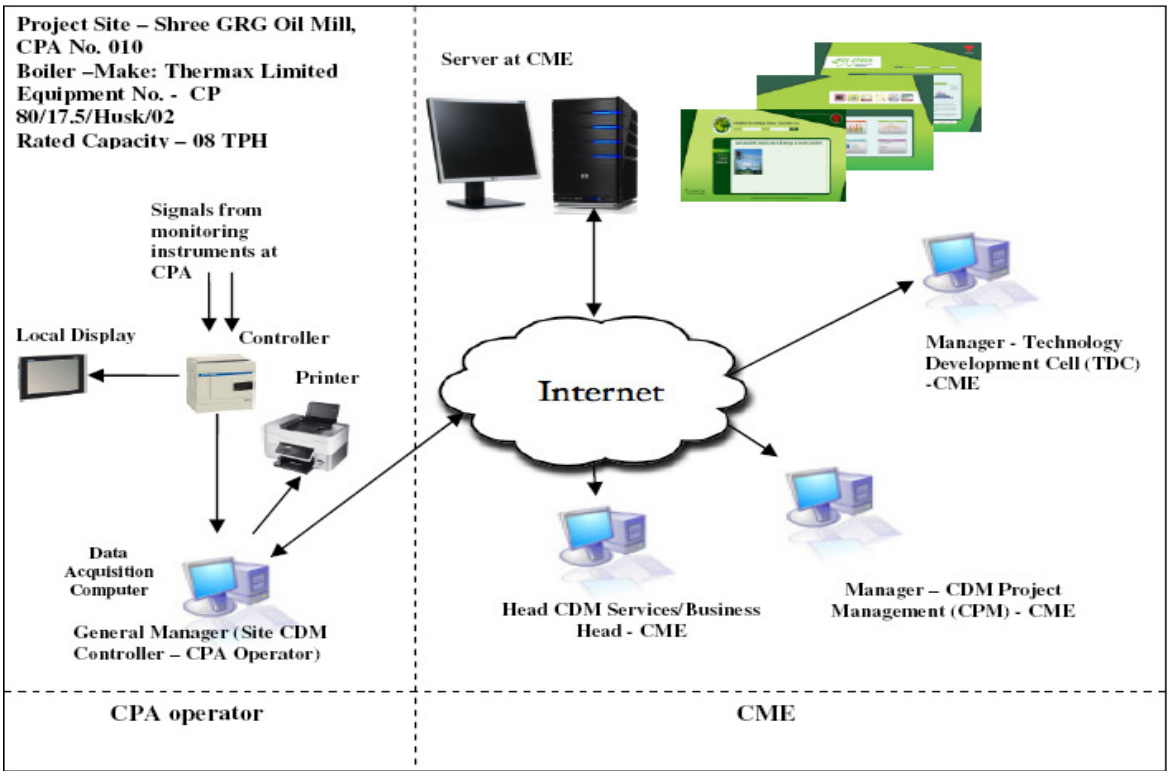


*Figure C.1.1 Schematic Representation of Monitoring Plan for CPA under PoA*

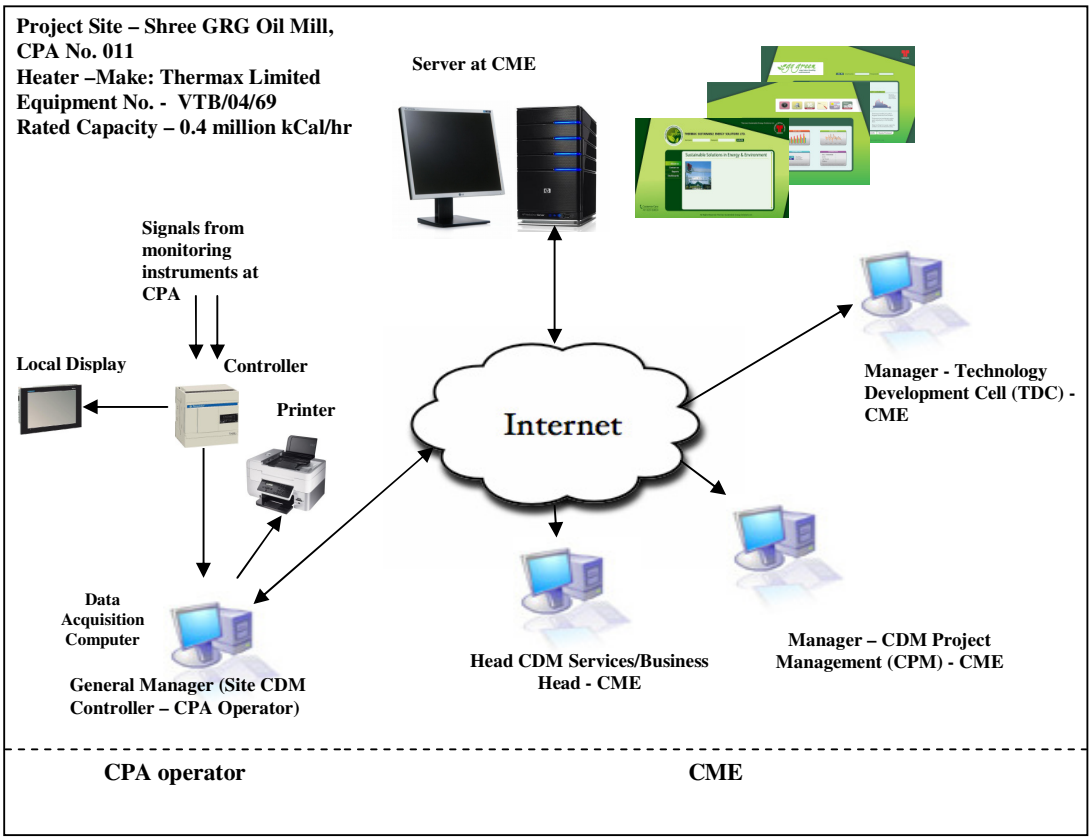


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

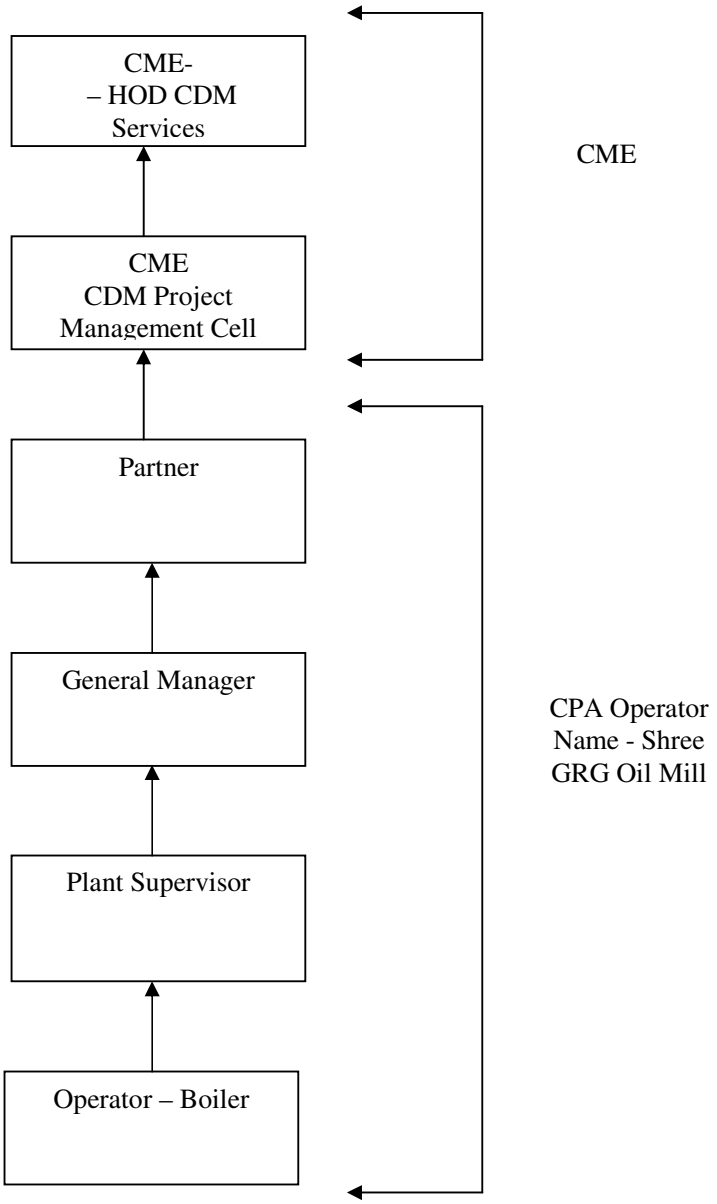


Fig.C.1.3.1 Monitoring Plan for CPA Implementation by CPA Operator for Boiler

| **Key operational roles** | **CPA Management Responsibilities** |
|---|---|
| Partner – CPA Operator | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head CDM Services for final reporting into emission reduction sheet.<br>• Quarterly Performance Review |
| General Manager (site CDM Controller) | • Performance review –Monthly<br>• Verification / review of data |

| | |
|---|---|
| | • Internal audits<br>• Review of corrective actions |
| Plant Supervisor | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipment<br>• Maintenance of key monitoring equipment<br>• Implementation of corrective action |
| Operator – Boiler | • Operation and maintenance of boiler<br>• Recording/Collection of Data<br>• Daily Logbook data maintenance |

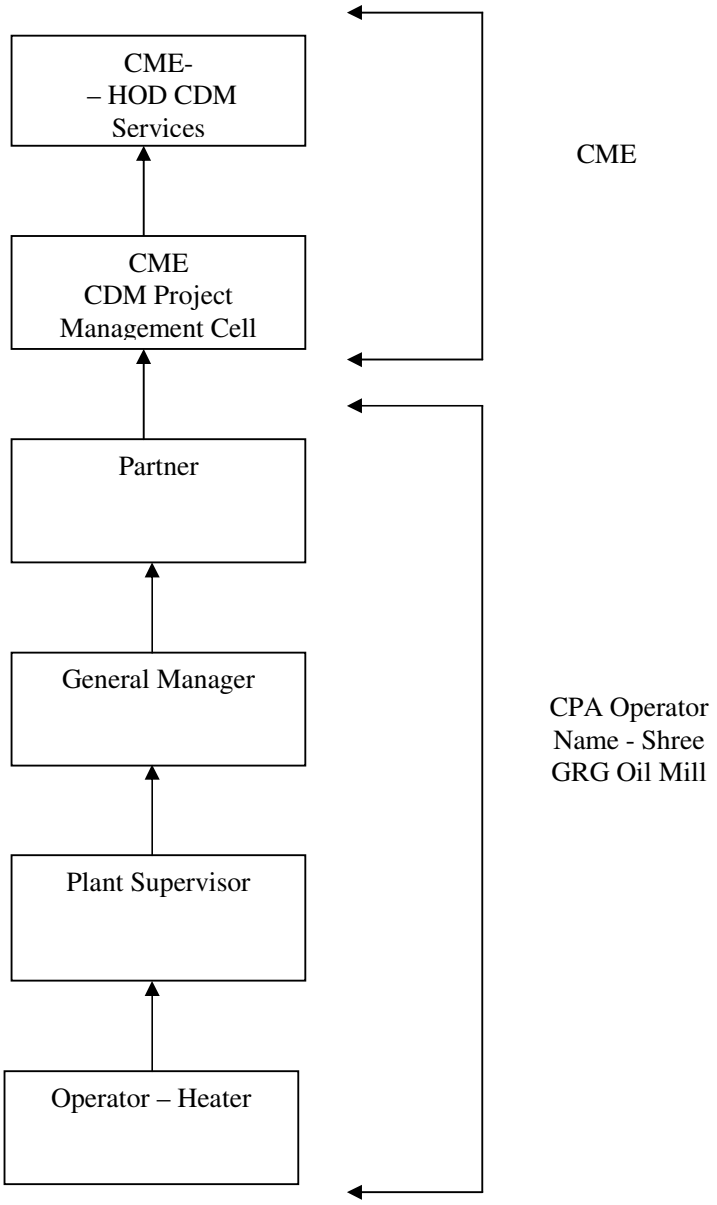


Fig.C.1.3.2 Monitoring Plan for CPA Implementation by CPA Operator for Heater

| **Key operational roles** | **CPA Management Responsibilities** |
|---|---|
| Partner – CPA Operator | • Overall Responsibilities of Operation & Management of Project<br>• Submission of Documents/Data to CME – Head CDM Services for final reporting into emission reduction sheet.<br>• Quarterly Performance Review |
| General Manager (site CDM Controller) | • Performance review -Monthly<br>• Verification / review of data |

| | |
|---|---|
| | • Internal audits<br>• Review of corrective actions |
| Plant Supervisor | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipment<br>• Maintenance of key monitoring equipment<br>• Implementation of corrective action |
| Operator – Heater | • Operation and maintenance of heater<br>• Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler & Heater Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

**a) Emergency Preparedness Plan for Boiler:**
i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i.e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

**b) Emergency Preparedness Plan for Heater:**

i) Heat flow measurement system failure:

In case of heat flow measurement system failure, the heat will be estimated based on the most conservative approach theoretically possible.

ii) Failure of Temperature sensors:

In case of failure of the RTD/ Temp Transmitter, the heater operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on inlet and outlet line of the heater. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years.
Calibration will be carried out by independent accredited third party entity

iii) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the heater i. e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor.
The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 8 (value applicable for the Project activity as per CPA 010) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $CAP_{heater}$ |
|---|---|
| Unit | kCal/hr |
| Description | Rated capacity (thermal output) of the heater of the Project activity. |
| Source of data | Manufacturer's specification |
| Value(s) applied | 0.4 million (value applicable for the Project activity as per CPA 010) |
| Purpose of data | Baseline Emission calculation |
| Additional comment | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $\eta_{BL,thermal}$ |
|---|---|
| Unit | % |
| Description | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| Source of data | Recorded /Manufacturer's specification |
| Value(s) applied | For boiler - 100 (value applicable for the Project activity as per CPA 010)<br>For heater – 100 (value applicable for the Project activity as per CPA 010) |
| Purpose of data | Baseline Emission calculation |
| Additional comment | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $EF_{FF,CO2}$ |
|---|---|
| Unit | $tCO_2e/TJ$ |
| Description | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| Source of data | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4 ).<br>The lower values has been chosen in conservative manner |
| Value(s) applied | 89.5 (value applicable for the Project activity as per CPA 008) |
| Purpose of data | Baseline Emission calculation |
| Additional comment | The baseline identification test concluded Indian coal as a plausible and only alternative to the Project activity for baseline emission calculation.<br><br>As there is no data available considering the local circumstances, hence as per methodology AMS I.C ver 16, para 37, the lower of the value of emission factor of coal has been chosen within the plausible range considered as conservative manner.<br><br>Default emission factor of 'other Bituminous coal' as per the IPCC default emission factor (IPCC Guidelines for National Greenhouse Gas Inventories 2006, Volume 2, Chapter 1 (Table 1.4) is between 89.5 T/TJ to 99.7 T/TJ. The selection of the emission factor is based on the conservative value of other Bituminous coal. Hence, the lower of the values of Other bituminous coal, 89.5 T/TJ has been selected in a conservative manner (para 37 AMS I.C ver 16)<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $SA_k$ |
|---|---|
| Unit | % |
| Description | Surplus availability of Biomass within 50 km radial distance |
| Source of data | Published literature/official reports/Third Party Survey report/ public domain document at the beginning of crediting period |
| Value(s) applied | Rice husk - 46.17 %<br>Mustard husk – 38.45%<br>(values applicable for the Project activity as per CPA 010) |
| Purpose of data | Leakage Emission calculation |
| Additional comment | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.80 -NEWNE Grid (value applicable for the Project activity as per CPA 010) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link -<br>http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 010) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).<br>However, Project activity is Greenfield project hence there is no Captive Power Plant (CPP) present at the site. Hence default value at the time of PoA validation i.e. 1.3 tCO2/MWh is considered for the calculation of project emissions in conservative manner as the auxiliary load of baseline plant activity is less than the auxiliary load of Project activity.<br>Electricity consumption from the CPP (Diesel Generator set) is the project emission and not the leakage electricity consumption source. This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 008) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on "Emissions from India's transport sector: Statewise synthesis"<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TDL_{l,y} = TDL_{j,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Cp_{i,out}$ |
| **Unit** | kCal/kg °C |
| **Description** | Specific heat of heat transfer fluid at heater outlet.<br>The specific heat is a physical property of the fluid 'i' and is a function of temperature for a given fluid. The specific heat value for a given fluid corresponding to the temperature range is provided by the heat transfer fluid manufacturer / for water as heat transfer medium, water specifications from standard tables are to be considered. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 0.6224 (value applicable for the Project activity as per CPA 010) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Determined based on outlet of heat transfer fluid. Value has been derived from Manufacturer's standard based on outlet temperature of $280^0$C.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\delta_{i,out}$ |
| **Unit** | kg /$m^3$ |
| **Description** | Density of heat transfer fluid at Tout temperature of the heater (kg/$m^3$) |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 768 (value applicable for the Project activity as per CPA 010) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Value will be derived from Manufacturer's standard based on outlet temperature.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturers letter |
| **Value(s) applied** | Rice husk - 0.004444 for boiler<br>Mustard husk -0.004736 for boiler<br>Indian coal – 0.004186 for boiler<br>Indian coal – 0.004615 (in case Indian coal is used in heater)<br>Rice husk - 0.004645 for heater<br>(value applicable for the Project activity as per CPA 010) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| | |
|---|---|
| **Data/Parameter** | $Q_{steam}$ |
| **Unit** | Tons |
| **Description** | Quantity of steam supplied |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 8354 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{steam}$ |
| **Unit** | °C |
| **Description** | Steam Temperature at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 183.29 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 11.7 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 68 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{flow}$ |
| **Unit** | $m^3$/hr |
| **Description** | Flow of heat transfer fluid at the heater outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 19847 |
| **Monitoring equipment** | Heat Flow Meter<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $T_{in}$ |
| **Unit** | $^{o}C$ |
| **Description** | Average Inlet Temperature of the heat transfer fluid at the inlet of the heater |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 159.4 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $T_{out}$ |
| **Unit** | $^{o}C$ |
| **Description** | Average Temperature of the heat transfer fluid at the outlet of the heater |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 181 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,rice\ husk}$ |
| **Unit** | Tons |
| **Description** | Quantity of stored fuel type biomass k (Rice Husk) on the starting date of this monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 274.89 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic/Paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in log book |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,mustard\ husk}$ |

| | |
|---|---|
| **Unit** | Tons |
| **Description** | Quantity of stored fuel type biomass k (Mustard Husk) on the starting date of this monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 1202.59 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in log book |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,\ rice\ husk}$ |
| **Unit** | Tons |
| **Description** | Quantity of subsequent delivery of fuel type k (Rice Husk) biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge slip and Plant record. |
| **Value(s) of monitored parameter** | 0 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass delivery note obtained from the fuel supplier. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | CPA operator has not procured the rice husk during this monitoring period hence value has mentioned not applicable. This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,\ mustard\ husk}$ |
| **Unit** | Tons |
| **Description** | Quantity of subsequent delivery of fuel type k (Mustard Husk) biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge slip and Plant record. |
| **Value(s) of monitored parameter** | 1448 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass delivery note obtained from the fuel supplier. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,\ rice\ husk}$ |
| **Unit** | Tons |
| **Description** | Quantity of remaining biomass fuel type k (Rice Husk) available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 79 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been be archived by Electronic and Paper mode.<br>Monitoring: Rice Husk has been measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,\ mustard\ husk}$ |
| **Unit** | Tons |
| **Description** | Quantity of remaining biomass fuel type k (Mustard Husk) available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 1200 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Mustard Husk has been measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,\ rice\ husk} = FC_{biomass,\ rice\ husk,y}$ |
| **Unit** | Tons |
| **Description** | Quantity of biomass fuel type k (Rice Husk) consumed during this monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 608 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,rice\ husk} + \Sigma(Q_{np,rice\ husk}) - Q_{in,rice\ husk}$ |
| **QA/QC procedures** | The quantity of biomass consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,\ rice\ husk,B} = FC_{biomass,\ rice\ husk,B,y}$ |
| **Unit** | Tons |
| **Description** | Quantity of biomass fuel type k (Rice Husk) consumed during the monitoring period for boiler |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | NA (CPA operator has not fired rice husk during this monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | The parameter will be derived based on<br>a. Total rice husk consumption<br>b. Specific energy consumption of heater on Rice husk<br>c. Energy generation by heater (Rice husk) |
| **QA/QC procedures** | The quantity of biomass consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,\ rice\ husk,H} = FC_{biomass,\ rice\ husk,H,y}$ |
| **Unit** | Tons |
| **Description** | Quantity of biomass fuel type k (Rice Husk) consumed during the monitoring period for heater |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 608 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | The parameter has been derived based on<br>a. Specific energy consumption of heater on Rice husk<br>b. Energy generation by heater (Rice husk) |
| **QA/QC procedures** | The quantity of biomass consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,\ mustard\ husk} = FC_{biomass,\ mustard\ husk,y}$ |
| **Unit** | Tons |
| **Description** | Quantity of biomass fuel type k (Mustard Husk) consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record. |
| **Value(s) of monitored parameter** | 1450 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type $Q_{ob,mustard\ husk} + \Sigma\ (Q_{np,mustard\ husk}) - Q_{in,mustard\ husk}$ |
| **QA/QC procedures** | The quantity of biomass consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tons |
| **Description** | Quantity of stored fuel type fossil i on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tons |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel will be measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice will be obtained from the fuel supplier and will be mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tons |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i} = FC_{j,PJ,y}$ |
| **Unit** | Tons |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | The quantity of fossil fuel consumed will be cross checked with payment receipt /invoice obtained from the fuel supplier |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,I,B} = FC_{j,PJ,B}$ |
| **Unit** | Tons |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period for boiler |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | This parameter is basically introduced in conjunction with parameter $Q_{c,i,H}$ to cross verify the fossil fuel (Indian coal) consumption in boiler and heater. It is not utilized directly for emission reduction calculations.<br>Data Archiving: Data will be archived by Paper mode<br>Monitoring: It is calculated based on energy generation and fossil fuel consumed. |
| **QA/QC procedures** | Coal consumption for Project activity can be verified with the help of steam generation and steam to fuel (Indian coal) ratio for boiler plus heat generation and heat to fuel (Indian coal) ratio for heater.<br>As a plausible measure, the CPA operator will measure total quantity of energy generation from boiler and heater corresponding to fossil fuel consumed. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,I,H} = FC_{j,PJ,H}$ |
| **Unit** | Tons |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period for Heater |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | This parameter is basically introduced in conjunction with parameter $Q_{c,i,B}$ to cross verify the fossil fuel (Indian coal) consumption in boiler and heater. It is not utilized directly for emission reduction calculations.<br>Data Archiving: Data will be archived by Paper mode<br>Monitoring: It is calculated based on energy generation and fossil fuel consumed. |
| **QA/QC procedures** | Coal consumption for Project activity can be verified with the help of steam generation and steam to fuel (Indian coal) ratio for boiler plus heat generation and heat to fuel (Indian coal) ratio for heater.<br>As a plausible measure, the CPA operator will measure total quantity of energy generation from boiler and heater corresponding to fossil fuel consumed. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{rice\ husk}$ |
| **Unit** | GJ/ton |
| **Description** | Net calorific value of biomass fuel k (rice husk) used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 13.40 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by Paper mode.<br>Monitoring: Analysis from accredited independent agency according to relevant national standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the GJ/ton |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{mustard\ husk}$ |
| **Unit** | GJ/ton |
| **Description** | Net calorific value of biomass fuel k (mustard husk) used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 14.1 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by Paper mode.<br>Monitoring: Analysis from accredited independent agency according to relevant national standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the GJ/ton |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen $_{\text{rice husk}}$ |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel (rice husk) |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 5.34 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by Paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen $_{\text{mustard husk}}$ |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel (mustard husk) |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 4.77 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by Paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen $_{rice\ husk}$ |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel (rice husk) |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 35.33 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by Paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen $_{\text{mustard husk}}$ |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel (mustard husk) |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 34.89 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by Paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture $_{\text{rice husk}}$ |
| **Unit** | % water |
| **Description** | Moisture content of the biomass residues (rice husk) |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 6.29 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by Paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture $_{\text{mustard husk}}$ |
| **Unit** | % water |
| **Description** | Moisture content of the biomass residues (mustard husk) |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 7.895 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $FC_{i,j,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed in a process j during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 0 (No fossil fuel type i consumed in a process j during monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book |
| **Value(s) of monitored parameter** | 2.24 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set or Fossil fuel based power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0.2 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0011 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y\ rice\ husk}$ |
| **Unit** | Km |
| **Description** | Average return trip distance (from and to) between the source of the biomass (rice husk) and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 32 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Consistency of distance record provided by trucker / supplier can be checked by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | No rice husk was procured during the monitoring period |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y\ mustard\ husk}$ |
| **Unit** | Km |
| **Description** | Average return trip distance (from and to) between the source of the biomass (mustard husk) and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 63 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Consistency of distance record provided by trucker / supplier can be checked by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y\ rice\ husk}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y for rice husk |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 57 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data can checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | No rice husk was procured during the monitoring period |

| | |
|---|---|
| **Data/Parameter** | $N_{,y\ mustard\ husk}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y for Mustard Husk |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 207 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data can be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since 100% data are monitored and reported

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam/heat produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

**a) For Boiler:**

$EG_{thermal,boiler} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg) |

$Q_{steam}$ : 8354 Tons
$H_s$ : 665.19 kCal/Kg
$H_w$ : 68 kCal/Kg
$\eta_{BL,Thermal}$ : 100 %
$EF_{FF,CO2}$ : 89.5 $tCO_2$/TJ

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

$EG_{thermal}$ = 8354 * (665.19- 68) *4.186 X $10^{-6}$
= 20.885 TJ

Hence;

$BE_{thermal,CO_2,y}$ = (20.885 /100 %) * 89.5
= 1,869 $tCO_2e$

**b) For Heater:**

$EG_{thermal} = Q_{flow} * Cp_{out} * \delta_{out} * (T_{out} - T_{in}) * 4.186 X 10^{-6}$

| | |
|---|---|
| $Q_{flow}$ | Flow of heat transfer fluid at the heater outlet ($m^3$). |
| $Cp_{out}$ | The specific heat of heat transfer fluid at Tout temperature (kCal/kg. $^{O}C$). |
| $\delta_{out}$ | Density of heat transfer fluid at Tout temperature of the heater ($kg/m^3$).at the outlet of the heater ($kg/m^3$). |
| $T_{out}$ | Temperature of the heat transfer fluid at the outlet of the heater (°C). |
| $T_{in}$ | Temperature of the heat transfer fluid at the inlet of the heater (°C). |

$EG_{thermal} = 33899.8* 0.622*768* (181- 159.4) * 4.186 X 10^{-6}$

$EG_{thermal} = 1.770$ TJ

$BE_{thermal,CO2,y} = 1.77 *89.5*100\%$

$BE_{thermal,CO2,y} = 158$

Thus total $BE_{thermal,CO2,y}$ for the project activity = 1,869 + 158 = 2,027 $tCO_2e$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:
Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source

and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**Scenario A: Electricity consumption from the grid**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 $tCO_2$/MWh for NEWNE grid

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$$PE_{EC,y} = EC_{PJ,j,y}*EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y}*EF_{EL,j,y} * (1+TDL_{j,y})$$

Where;

| | |
|---|---|
| $EC_{PJ,j,y}$ | = 2.24 MWh |
| $EF_{grid,CM,y}$ | = 0.80 $tCO_2$/MWh |
| $TDL_{j,y}$ | = 20 % (Default value) |
| $EC_{EL,j,y}$ | = 0.2 MWh |
| $EF_{EL,j,y}$ | = 1.3 $tCO_2$/MWh |

$PE_{EC,y}$ = 2.24* 0.80* (1+20/100) + 0.2*1.3* (1+20%)
= 3 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$$PE_{FC,j,y} = 0$$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 3 + 0$
$= 3\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (Rice Husk and mustard husk) consumed in the project activity is not transported to the project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$$ER_y = BE_y - PE_y - LE_y$$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 2,027 | 3 | 0 | 2,024 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 3,259* | 2,024 |

*As the monitoring period is from 01/06/2012 to 31/08/2012 i.e. 92 days (first and last days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation each for boiler & heater in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0011: Instrument Details**

| Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Frequency | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|---|---|
| Quantity of steam supplied in year y , ($Q_{steam}$) | Steam Flow Meter | Endress + Hauser | E8010420000 | ±3% | Once in 3 year | 23/09/2011 | 22/09/2014 |
| Average Steam Temperature at MSSV (Main steam stop valve) outlet during year, ($T_{steam}$) | RTD | Endress + Hauser | E8010420000 | ±3% | Once in 3 year | 23/09/2011 | 22/09/2014 |
| Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year ($P_{steam}$) | Pressure Transmitter | Endress + Hauser | E8002B21129 | ±2% | Yearly | 23/09/2011 | 26/03/2012 |
| | Gauge | WAAREE | 1347PG1000084 | ±2% | Yearly | | |
| Average Feed Water Temperature at inlet of boiler ($T_{FWB}$) | RTD | Endress + Hauser | E8007C142EA | ±2% | Once in 3 year | 23/09/2011 | 26/03/2012 |
| Average Feed Water Temperature at inlet of boiler ($T_{FWB}$) | Gauge | WAAREE | 2436TG100005 | ±2% | Yearly | | |
| Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) in year y | Energy Meter (Boiler) | Larsen & Toubro | 10895723 | Class 1.0 | Yearly | -- | -- |
| | Energy Meter (Heater) | Larsen & Toubro | 10895170 | Class 1.0 | Yearly | -- | -- |
| Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge No.1, No.2 & No.3 | Avery India Limited | EBO5S121 | Class- III | Yearly | 20/12/2011 | 23/12/2012 |
| Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | TEF Systems | -- | Class- III | Yearly | 20/12/2011 | 20/12/2012 |
| Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | Leotronic Scales (P) Ltd. | 0508002 | Class- III | Yearly | 20/12/2011 | 20/12/2012 |

**Appendix-9**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

# MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 012) |
| **Reference number of the project activity** | CPA 4041-0012[58] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 09/10/2012 |
| **Registration date of the project activity** | 29/06/2012 (Inclusion Date of CPA in Registered PoA 4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/07/2012 to 31/08/2012 (both days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 893 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 546 $tCO_2e$ |

[58] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=0ZOF2EL3H6WCNAT5BVYSXD4KI9P7UG

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 4 TPH biomass residues (Biomass Briquette) fired boiler at KOPRAN LIMITED as a replacement of existing 3 TPH furnace oil fired equipment for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 4 TPH, Multipac boiler manufactured by Thermax Limited. It is designed to operate at a maximum pressure of 10.54 kg/cm$^2$ and has a horizontal fixed grate furnace. The steam generated from the boiler is utilized in solvent recovery plant for distillation purpose, sanitization plant, purification plant and in other heating processes.

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| CPA-4041 0012 | KOPRAN LIMITED | Boiler – 4 TPH ( From and At 100$^0$C) | 09/12/2010 | 29/06/2012 | 01/07/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/07/2012 to 31/08/2012 (both days included) is 546 t$CO_2$e

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| CPA-4041 0012 | KOPRAN LIMITED | Plot No. K4/4, Additional MIDC Industrial Area, Village - Birwadi, Taluka - Mahad, District - Raigad 402302, Maharashtra | 18.1081$^0$ North, 73.5189$^0$ East | India |

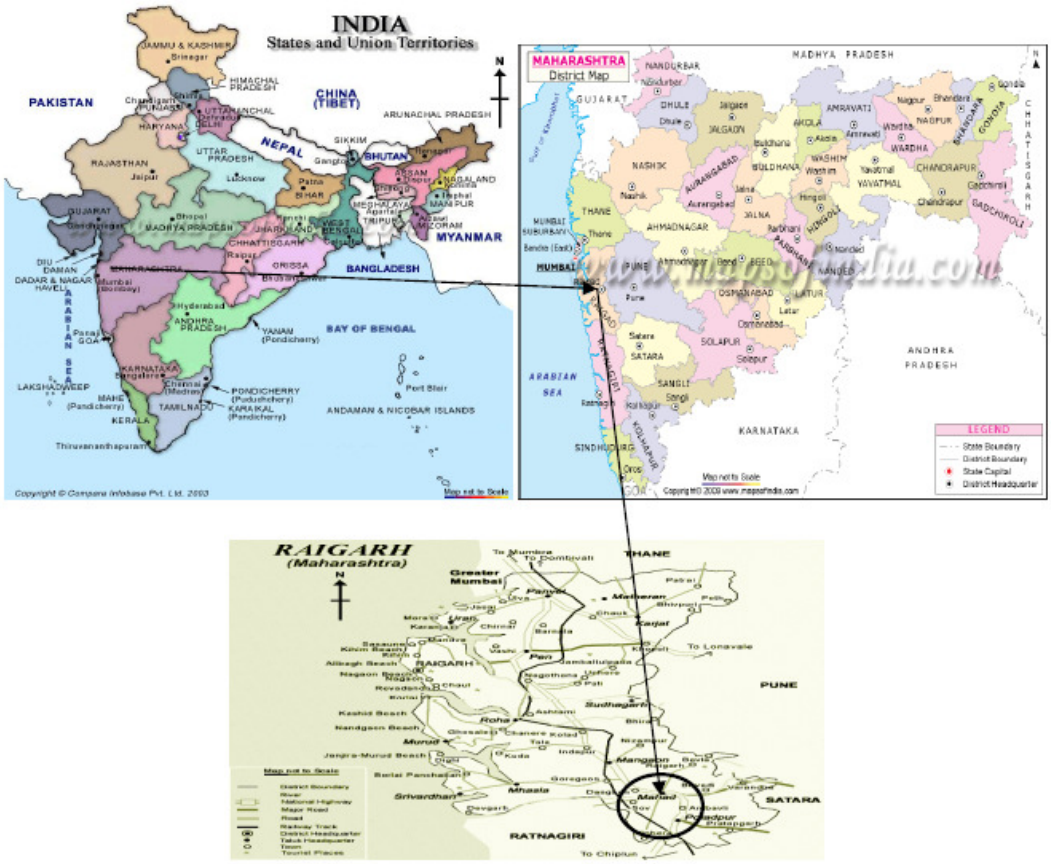


Fig.A.2.1 Physical Location of the project activity

### A.3. Parties and project participant(s)

| Party involved<br>((host) indicates a host Party) | Private and/or public entity(ies) project participants<br>(as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [59]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[60]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[61]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[62]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[63]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[64]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/07/2012

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

[59] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[60] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[61] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[62] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[63] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[64] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 012 |
| CPA Operator | KOPRAN LIMITED |
| Project Scenario | Biomass fired thermal energy generation as a replacement of existing fossil fuel fired equipment. |
| Type of equipment | Boiler |
| Project activity | The project activity is installation of 4 Tonnes Per Hour (TPH) biomass briquettes fired boiler |
| Boiler Make | Thermax Limited |
| Boiler Model | Multipac |
| Maximum working pressure | 10.54 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 4 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Biomass Briquettes) |
| Type of fuel firing | Manual |
| Furnace type | Horizontal fixed grate |
| Boiler Number | IFB40D/10.54/57 |
| Commissioning date | 09/12/2010 |

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently Biomass briquettes as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge, electrical systems, equipment safeties & controls

The CPA operator has utilized biomass for heat generation i.e. Biomass Briquettes, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**

The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**
There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**
There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**
There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**
Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meter |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments (sr. no. 1 to 4) are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data gets transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Ton
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

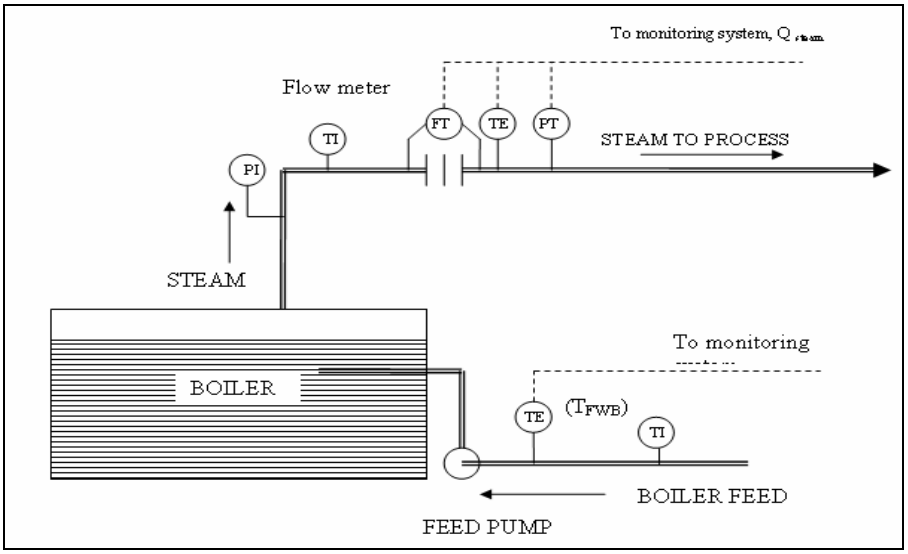


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid Power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available outside the Project boundary. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Duly calibrated weigh bridge has been used to weigh the biomass consumed in the project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,k}$/ $Q_{ob,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However there was no fossil fuel used the during this monitoring period for this project activity.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator). This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

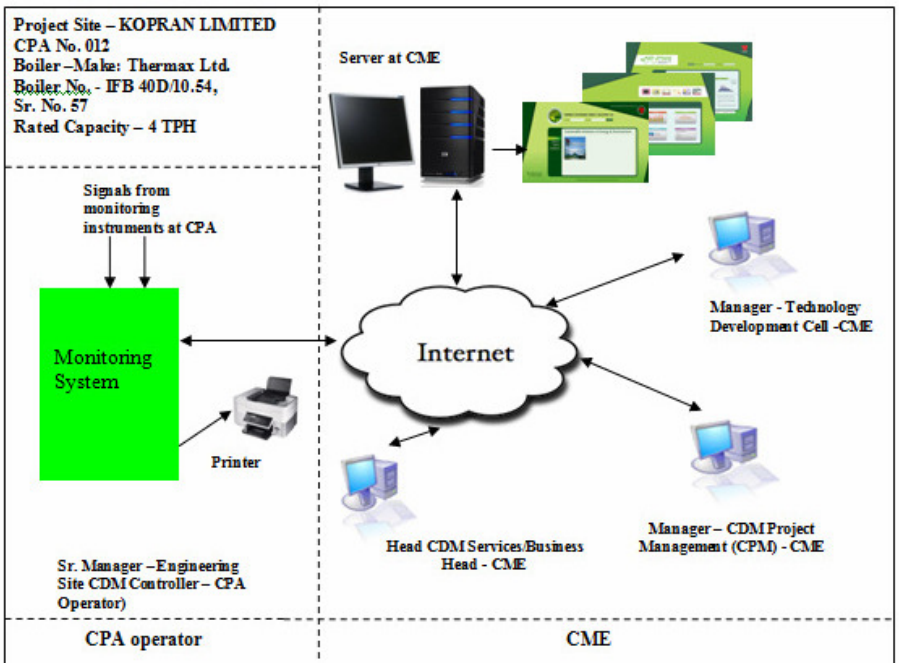


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

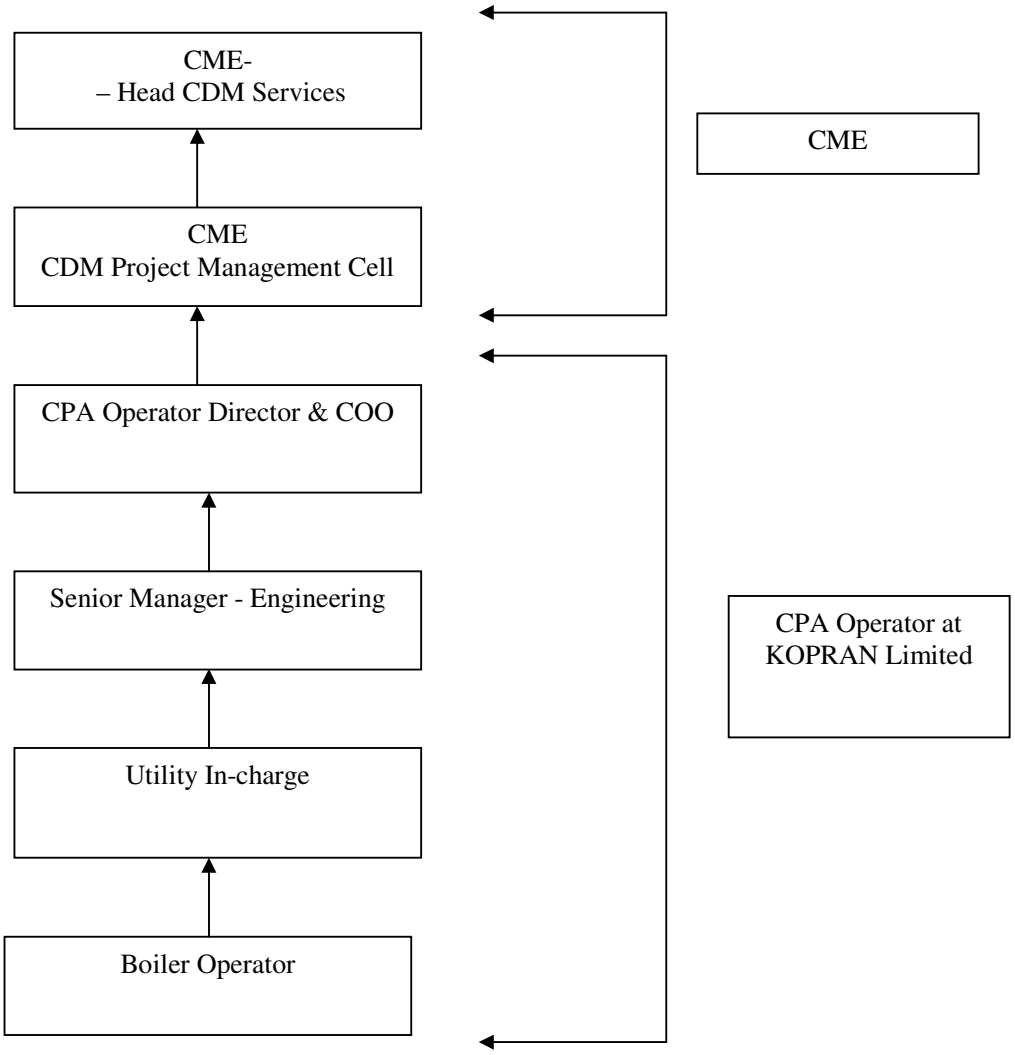


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator

| **Key operational roles** | **CPA Management Responsibilities** |
|---|---|
| Director & COO- CPA operator | • Overall Responsibilities of Operation & Management of Project |
| V. P. Operation | • Quarterly Performance Review<br>• Submission of Documents/Data to CME |
| Sr. Manager- Engineering (site CDM Controller) | • Performance review –Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions |
| Utility- In charge | • Verifying & Archiving the data<br>• Checking of monitored data |

| | |
|---|---|
| | • Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Boiler Operator | • Operation and Maintenance of boiler<br>• Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i.e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tonnes/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 4 (value applicable for the Project activity as per CPA 012) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\eta_{BL,thermal}$ |
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 012) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4 ).<br>The lower value has been chosen in conservative manner |
| **Value(s) applied** | 75.5 (value applicable for the Project activity as per CPA 012) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | The baseline identification test concluded Furnace Oil as a plausible baseline alternative for baseline emission calculation. Therefore Emission factor of Furnace Oil is considered as conservative approach due to lower EF than those of all coal related Emission factor as per source (IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 2.3).The emission factor of Residual oil (Furnace oil) is in between 75.5 T/TJ to 78.8 T/TJ. Hence lower value for baseline and higher value for Project emission of Residual oil (Furnace oil) has selected in conservative manner.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass within identified region |
| **Source of data** | Independent Survey report |
| **Value(s) applied** | 82.97 (value applicable for the Project activity as per CPA 012) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.80 - NEWNE Grid (value applicable for the Project activity as per CPA 012) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link - http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 012) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | For this project activity, the electricity consumption source is a Project or leakage electricity consumption source as per the above mentioned Tool, This is inline with the registered PoA-DD, Hence this value is used for the calculating the off-grid (DG) emissions. Presently, available off-grid (DG) is not used for the project activity, hence emissions attributable to the Project activity has been neglected.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $EC_{LE,l,y}$ |
|---|---|
| Unit | MWh |
| Description | Auxiliary Electricity Consumption for biomass processing, outside Project boundary. |
| Source of data | Third party report based on the field measurement on various equipments for biomass briquettes for electricity consumption for biomass processing. |
| Value(s) applied | 16 |
| Purpose of data | Project Emission calculation |
| Additional comment | This value has been determined based on total briomass briquette consumption in kgs multiplied by ex-ante value of electivity consumption for biomass processing as 0.45 kWh/kg as per third party report and valid for the full crediting period as per the registered CPA DD.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| Data/Parameter | $EF_{km,CO2}$ |
|---|---|
| Unit | $tCO_2$/km |
| Description | Average $CO_2$ emission factor for the trucks measured during the year y |
| Source of data | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| Value(s) applied | 0.0005152 (value applicable for the Project activity as per CPA 012) |
| Purpose of data | Leakage Emission calculation |
| Additional comment | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on “Emissions from India’s transport sector: Statewise synthesis”<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MW |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturer letter |
| **Value(s) applied** | Biomass briquettes - 0.004417<br>Coal - 0.004390<br>(value applicable for the Project activity as per CPA 012) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16 and declared in a letter by the manufacturer.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| **Data/Parameter** | $Q_{steam}$ |
|---|---|
| **Unit** | Tonnes or t |
| **Description** | Quantity of steam supplied in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 3164.78 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $T_{steam}$ |
|---|---|
| **Unit** | °C |
| **Description** | Average Steam Temperature at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 171.25 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 7.4 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Average Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 72 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data will be archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 108 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge slip, Log Book and Plant record. |
| **Value(s) of monitored parameter** | 756.84 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass briquettes have been measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice has been obtained from the fuel supplier and has been mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book |
| **Value(s) of monitored parameter** | 511 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: has been measured on the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book. |
| **Value(s) of monitored parameter** | 353.72 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of biomass briquettes consumed will be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of stored fuel type fossil i on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel will be measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice will be obtained from the fuel supplier and will be mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of fossil fuel type i (Coal) consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$.<br>Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | The quantity of coal consumed will be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass |
| **Value(s) of monitored parameter** | 14.95 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by paper mode.<br>Monitoring: Analysis from accredited agency according to relevant national standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 3.91 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 38.12 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % water |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 4.96 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 31.58 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0012 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data will be archived by Electronic/Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 537 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Consistency of distance record provided by trucker / supplier can be checked by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 30 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data can be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,c,y}$ |
| **Unit** | km |
| **Description** | Average round trip distance (from and to) between the biomass fuel supply sites and the site of biomass processing in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 73 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data can be checked for consistency by comparing the quantity delivered (no. of truck, '$N_y$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,c,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the transportation of biomass to the biomass processing site in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 122 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | The CPA operator shall ensure provision of this parameter from the biomass supplier in the form of declaration.<br>Monitoring Frequency: Continuous, at each trip |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be check for consistency of the number of truck trips with quantity of biomass combusted |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA(No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since **100% data are monitored and reported**

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg) |

$Q_{steam}$ : 3164.78Tons
$H_s$ : 661.28 kCal/Kg
$H_w$ : 72 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 75.5$tCO_2$/TJ

Thus,
$EG_{thermal}$ = 3164.78 * (661.28- 72) *4.186 X $10^{-6}$
= 7.81TJ

Hence;
$BE_{thermal,CO_2,y}$ = (7.81/100 %) * 75.5
= 589 $tCO_2$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:

Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 $tCO_2$/MWh for NEWNE grid

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 31.577 MWh
$EF_{grid,CM,y}$ = 0.80 $tCO_2$/MWh
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2$/MWh

$PE_{EC,y}$ = 31.577* 0.80* (1+20/100) + 0*1.3* (1+20%)
= 30 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 30 + 0$
$=$ **30 $tCO_2e$**

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity

This part of leakage is not considered as the energy generating equipment currently being utilized is not transferred from outside the boundary of the Project activity

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

This part of leakage is considered as the distance of biomass transportation is more than 200km. It is calculated as follows:

$LE = N*AVD*EF_{km,CO2}$

Where,

LE : Leakage Emission
N : No. of truck trips
AVD : Average round trip distance travelled for biomass transportation / collection
$EF_{km,CO2}$ : Average $CO_2$ emission factor for the trucks measured during year y

Therefore,

LE = 152*610*0.0005152
= **13 $tCO_2e$**.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 589 - 30 - 13$

**= 546 $tCO_2e$**

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 589 | 30 | 13 | 546 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 893* | 546 |

*As the monitoring period is from 01/07/2012 to 31/08/2012 i.e. 62 days (both days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1_4041-0012: Instrument Details**

| Sr. No. | Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Accuracy /Class | Calibration Date | Calibration frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|---|
| 1 | Quantity of steam supplied ($Q_{steam}$ ) | Steam Flow Meter | Endress + Hauser | E8010220000 | ±3% | 23/09/2011 | Once in 3 years | 22/09/2014 |
| 2 | Average Steam Temperature ($T_{steam}$ ) | RTD | Endress + Hauser | E8010220000 | ±3% | 23/09/2011 | Once in 3 years | 22/09/2014 |
| | | Gauge | STENCO | KOP/TG/002 | ± 2 % | 15/05/2012 | Yearly | 14/05/2013 |
| 3 | Average Steam Pressure ($P_{steam}$ ) | Pressure Transmitter | Endress + Hauser | E8004121129 | ± 2 % | 15/05/2012 | Yearly | 14/05/2013 |
| | | Gauge | ALTOP | P027.A10 | ± 2 % | 15/05/2012 | Yearly | 14/05/2013 |
| 4 | Average Feed Water Temperature ($T_{FWB}$) | RTD | Endress + Hauser | E8007D142EA | ± 2 % | 15/05/2012 | Yearly | 14/05/2013 |
| | | Gauge | STENCO | KOP/TG/001 | ± 2 % | 15/05/2012 | Yearly | 14/05/2013 |
| 5 | Auxiliary Electricity Consumption from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) | Energy Meter | Schneider Electric | 203352/18509-2610 | Class 1.0 | 22/02/2012 | Yearly | 21/01/2013 |
| 6 | $Q_{ob,k}$ (Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site) | Weigh Bridge | Deligant | SB9831 | Class III | 05/01/2012 | Yearly | 05/01/2013 |
| | $Q_{np,k}$ (Quantity of subsequent delivery of fuel type k biomass at the Project site) | | | | | | | |
| | $Q_{in,k}$ (Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site) | | | | | | | |

**Appendix-10**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

## MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 013) |
| **Reference number of the project activity** | CPA 4041-0013[65] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 29/06/2012 (Inclusion Date of CPA in Registered PoA No.4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/07/2012 to 31/08/2012 (both days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 2,797 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 74 $tCO_2e$ |

[65] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=LSPUMIGECTXQ0N8F3JH9V7RO652AWB

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 12 TPH biomass residues (Rice Husk) fired boiler at SHREE SITA EDIBLES PRIVATE LIMITED for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 12 TPH, Combipac boiler manufactured by Thermax Limited. It is designed to work at a maximum pressure of 17.5 kg/cm$^2$ and has in bed tubes with refractory furnace. The steam generated from the boiler is utilised Thermal Processing of various seeds like soyabean, groundnut, cotton seed, linseed, castor seed etc. for the production of oil and De Oiled Cake (DOC).

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| CPA-4041 0013 | SHREE SITA EDIBLES PRIVATE LIMITED | Boiler - 12 TPH ( from and At 100$^0$C) | 19/03/2012 | 29/06/2012 | 01/07/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/07/2012 to 31/08/2012 (both days included) is 74 $tCO_2e$

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| CPA-4041 0013 | SHREE SITA EDIBLES PRIVATE LIMITED | Village-Arasnara, Dhamdha road, District-Durg 491001, Chhattisgarh, India | 21.3016 $^0$ North, 81.3305 $^0$ East | India |

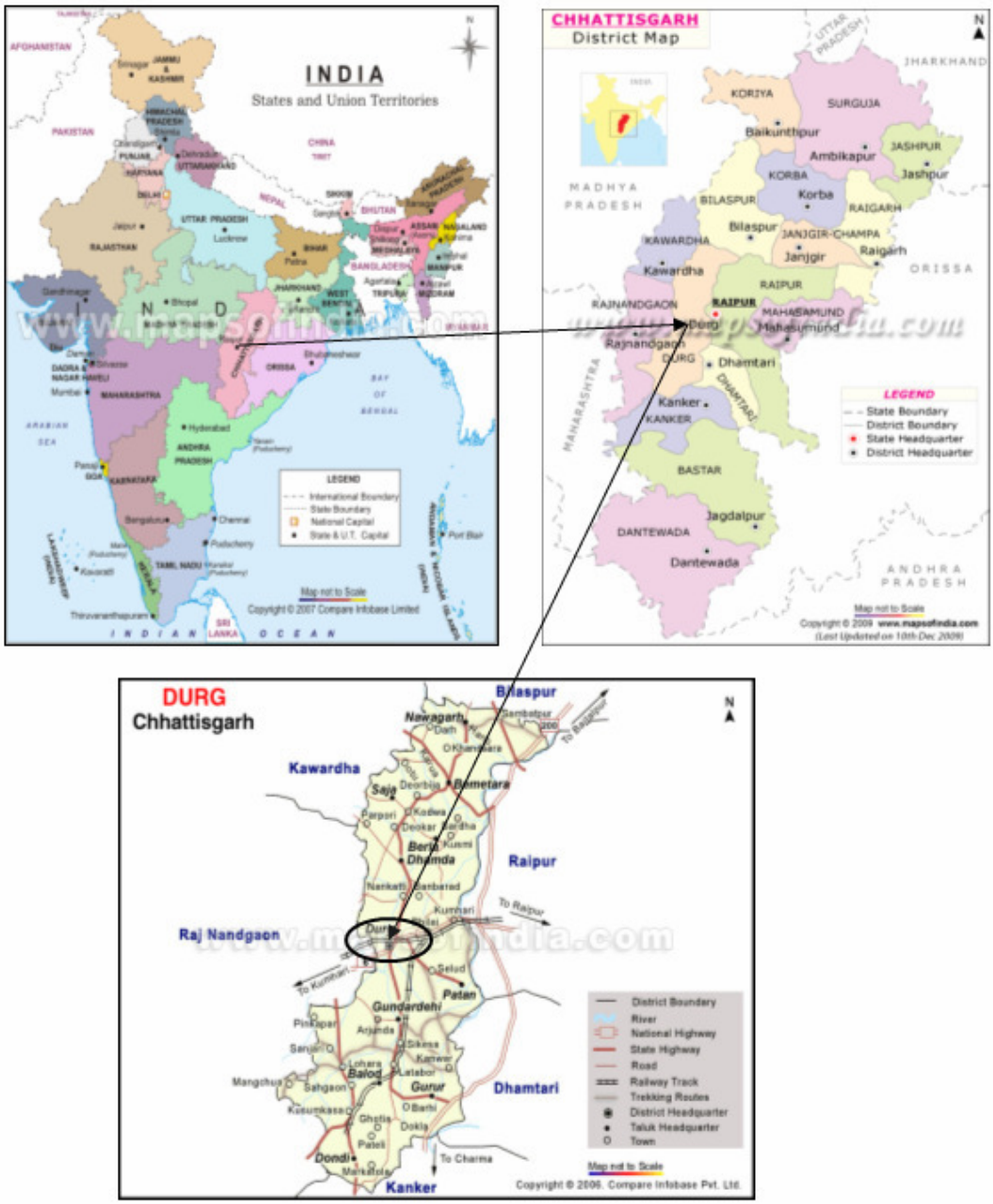


Fig.A.2.1 Physical Location of the project activity

**A.3. Parties and project participant(s)**

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment (boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51[66]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[67]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[68]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[69]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[70]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[71]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/07/2012

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

[66] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[67] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[68] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[69] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[70] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[71] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 013 |
| CPA Operator | SHREE SITA EDIBLES PRIVATE LIMITED |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler |
| Project activity | Installation of biomass fired boiler having rated steam generation capacity of 12 tonnes per hour (TPH ) |
| Boiler Make | Thermax Limited |
| Boiler Model | Combipac |
| Maximum working pressure | 17.5 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 12 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as Rice husk) |
| Type of fuel firing | Automatic firing |
| Furnace type | In bed tubes with refractory |
| Boiler Number | CPFD-120/17.5/5 |
| Commissioning date | 19/03/2012 |

The boiler consists of mainly the following parts:

1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently a particular type of biomass fuel
3. Accessories- for various systems like water treatment, storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, flue gas discharge, ash discharge & handling, electrical systems, equipment safety & controls.

The CPA operator has utilized biomasses for heat generation i.e. Rice Husk, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**

**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**

There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**

There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**

There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**

There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**

Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument or field instrument integral to steam flow meter. |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meter |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data has been transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the

Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Ton
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

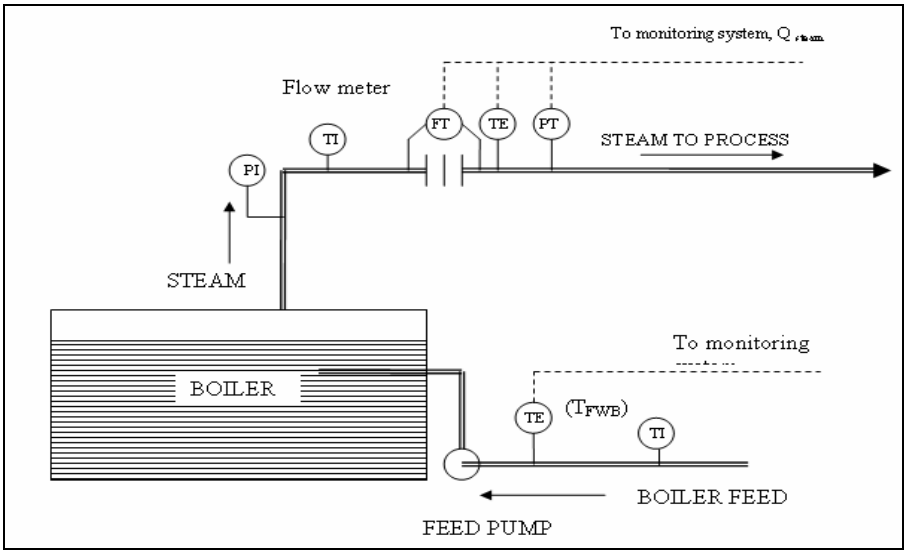


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off-grid power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured on the weigh bridge and the same is recorded in the logbook.
Duly calibrated weigh bridge has been used to weigh the biomass consumed in the project activity

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil

fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensures the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However there was no fossil fuel used during this monitoring period for this project activity.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator). This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

All the necessary instruments required for monitoring the boiler of this CPA was installed on the heat generating system. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

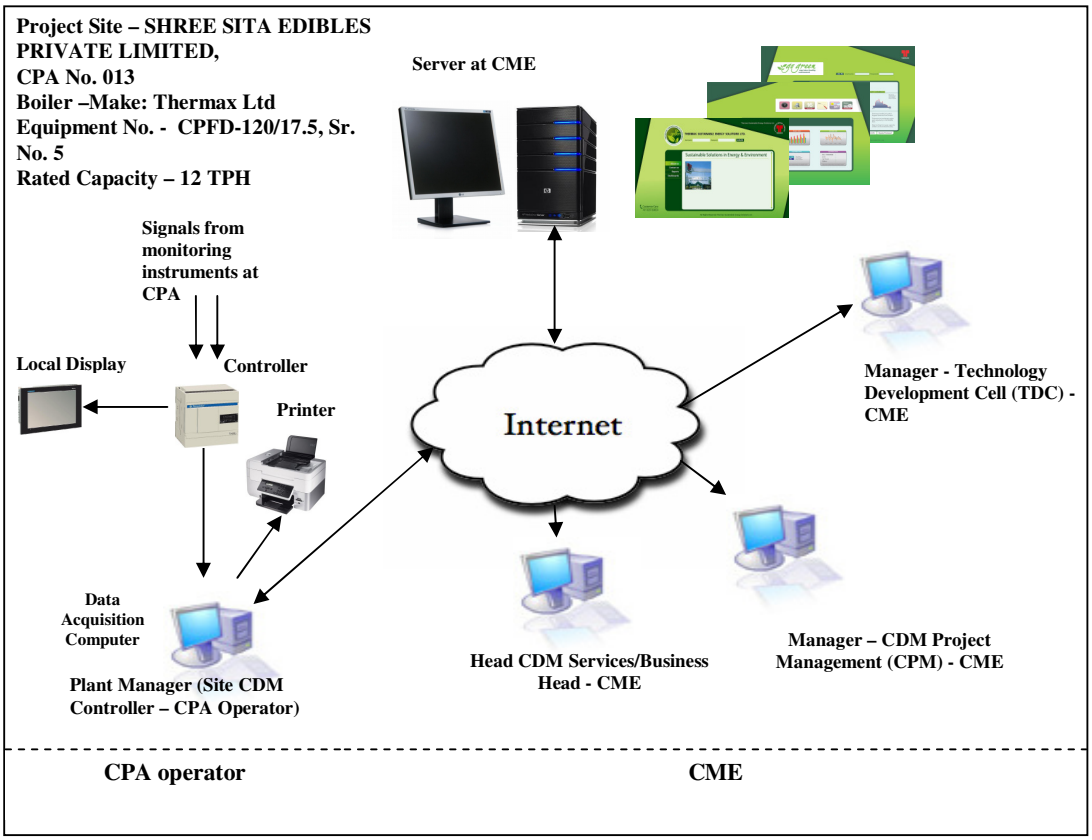


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

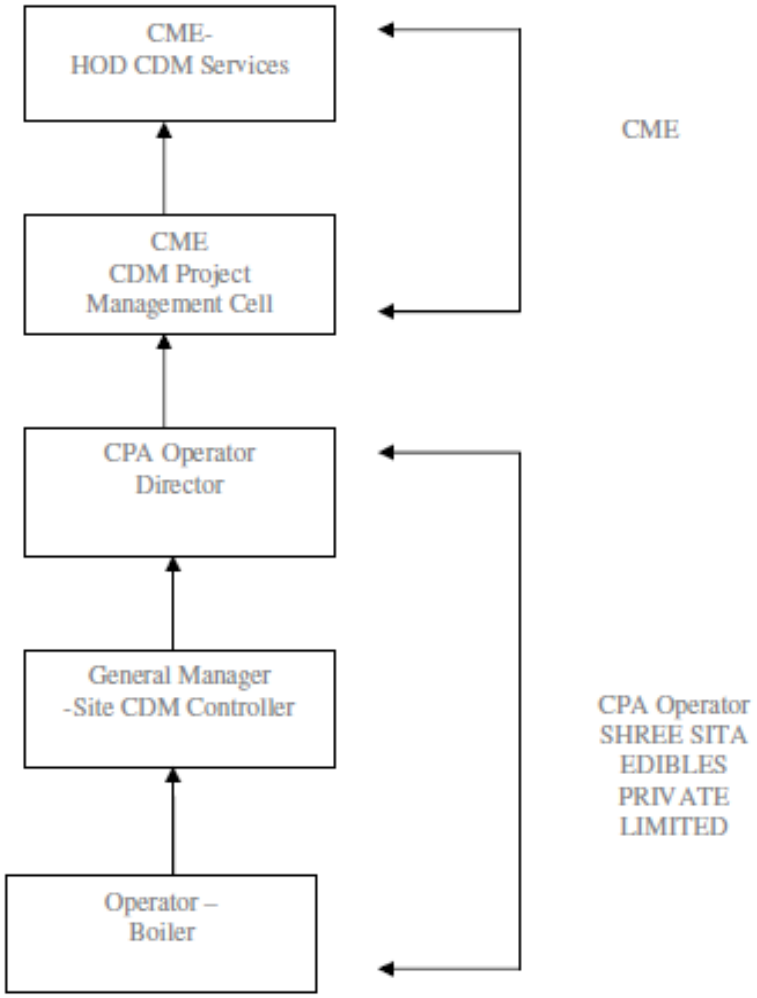


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator

| Key operational roles | CPA Management Responsibilities |
|---|---|
| Director- CPA Operator | • Overall Responsibilities of Operation & Management of Project<br>• Quarterly Performance Review<br>• Submission of Documents/Data to CME |
| General Manager (Site CDM Controller) | • Performance review –Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions<br>• Verifying & Archiving the data<br>• Verifying & Archiving the data<br>• Checking of monitored data |

| | |
|---|---|
| | • Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Operator – Boiler | • Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tons/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 12 (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\eta_{BL,thermal}$ |
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4 ).<br>The lower value has been chosen in conservative manner |
| **Value(s) applied** | 89.5 (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass within 75 km radial distance |
| **Source of data** | Third Party Survey report |
| **Value(s) applied** | 55.06 (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.80 -NEWNE Grid (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link -<br>http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y} = EF_{EL,l,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j and/or l in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature / National data in conservative manner<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on "Emissions from India's transport sector: Statewise synthesis"<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MWh |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturers letter |
| **Value(s) applied** | Indian Coal – 0.004211 (in case of Indian Coal is used)<br>Rice husk – 0.004260. (value applicable for the Project activity as per CPA 013) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| **Data/Parameter** | $Q_{steam}$ |
|---|---|
| **Unit** | Tons or tonnes |
| **Description** | Quantity of steam supplied in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 413 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $T_{steam}$ |
|---|---|
| **Unit** | °C |
| **Description** | Quantity of steam supplied in year y |
| **Measured/Calculated /Default** | Measured using calibrated meter |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 81.66 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details.* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 4.15 |
| **Monitoring equipment** | Pressure transmitter & Pressure Gauge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 29.53 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 65 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic/Paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of start of monitoring period and kept as an opening balance in log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 46.8 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass has been measured on Weighbridge in the plant premise and has been mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 19 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: measured at the end date of monitoring period and recorded in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 93 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of biomass consumed can be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of stored fuel type fossil i (coal) on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book / Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel will be measured on Weighbridge in the plant premise and will be mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of remaining fossil fuel type i available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i} = FC_{j,PJ,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | The quantity of fossil fuel consumed will be cross checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass |
| **Value(s) of monitored parameter** | 13.29 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by paper mode.<br>Monitoring: Analysis from accredited according to relevant national/international standards. |
| **Calculation method (if applicable)** | Analysis report provides GCV and not NCV. Hence NCV is calculated from GCV.<br>NCV = GCV -0.212H-0.0245M-0.008Y (in GJ/t)<br>Source- http://www.worldcoal.org/pages/content/index.asp?PageID=190<br>Where H = % Hydrogen in fuel, M= % moisture in fuel, Y = % Oxygen in fuel. |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 4.03 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and is applied since the laboratory analysis mentions GCV in their analysis report. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 31.49 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and is applied since the laboratory analysis mentions GCV in their analysis report. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 8.235 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and is applied since the laboratory analysis mentions GCV in their analysis report. |
| **QA/QC procedures** | Laboratory analysis as per national standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | -- |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $FC_{i,j,y}$ |
| **Unit** | Tons or t |
| **Description** | Quantity of fossil fuel type i consumed in a process j during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 (No fossil fuel type i consumed in a process j during monitoring period) |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | -- |
| **QA/QC procedures** | -- |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 22.28 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0013 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data will be archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 14 |
| **Monitoring equipment** | - |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Consistency of distance record provided by trucker / supplier can be checked by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 10 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data has been archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data can be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type has been consumed during this monitoring period. Hence not applicable) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since 100% data are monitored and reported

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (kCal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg) |

$Q_{steam}$ : 413 Tons
$H_s$ : 656.13 kCal/kg
$H_w$ : 29.53 kCal/kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 89.5 $tCO_2$/TJ

Thus,

$EG_{thermal}$ = 413 * (656.13- 29.53) *4.186 X $10^{-6}$
= 1.084 TJ

Hence;

$BE_{thermal,CO_2,y}$ = (1.084 /100 %) * 89.5
= 96 $tCO_2$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:

Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 $tCO_2$/MWh for NEWNE grid

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 22.28 MWh
$EF_{grid,CM,y}$ = 0.80 $tCO_2$/MWh
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2$/MWh

$PE_{EC,y}$ = 22.28* 0.80* (1+20/100) + 0*1.3* (1+20%)
= 22 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 22 + 0$
$= 22\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity and

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

Leakage is thus considered to be zero as the energy generating equipment currently being utilised is not transferred from outside the boundary of the Project activity and Biomass (Rice Husk) consumed in the project activity is not transported to the Project site over a distance of more than 200 km.

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 96 - 22 - 0$
$= \mathbf{74\ tCO_2e}$

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 96 | 22 | 0 | 74 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 2,797* | 74 |

*As the monitoring period is from 01/07/2012 to 31/08/2012 i.e. 62days (first and last days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1**_4041-0013**: Instrument Details**

| Sr. No. | Description monitoring parameters | Description Of Instrument | Make | Sr. No. | Instrument Accuracy /Class | Calibration Date | Calibration frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|---|
| 1. | Quantity of steam supplied in year y ($Q_{steam}$) | Steam Flow Meter | Endress + Hauser | ECO29320000 | ± 3% | 07/02/2012 | Once in 3 years | 07/02/2015 |
| 2. | Average Steam Temperature at MSSV (Main steam stop valve) outlet during year,($T_{steam}$) | RTD | Endress + Hauser | ECO29320000 | ± 3% | 07/02/2012 | Once in 3 years | 07/02/2015 |
| 3. | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year ($P_{steam}$) | Pressure Transmitter | Endress + Hauser | EC172101052 | ± 1.0% | 15/06/2012 | Yearly | 14/06/2013 |
| 4. | Average Feed Water Temperature at inlet of boiler ($T_{FWB}$) | RTD | Bellofram | RTD-01 | ± 1.0% | 15/06/2012 | Yearly | 14/06/2013 |
| | | Gauge | STENCO | 7221/02 | ± 2% | 30/04/2012 | Yearly | 29/04/2013 |
| 5. | Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$) and Off Grid ($EC_{PJ,j,y}$) in year y | Energy Meter | Schneider Electric | 203352/18502-2670 | Class 1.0 | 13/06/2012 | Yearly | 12/06/2013 |
| 6. | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge | Essae-toraika | 950041998 | Class-III | 24/09/2011 | Yearly | 23/09/2012 |
| | Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

**Appendix-11**

**MONITORING REPORT FORM (F-CDM-MR)**
**Version 02.0**

# MONITORING REPORT

| | |
|---|---|
| **Title of the project activity** | "Promotion of Biomass Based Heat Generation Systems in India" (CPA Number 015) |
| **Reference number of the project activity** | CPA 4041-0015[72] |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 18/10/2012 |
| **Registration date of the project activity** | 29/06/2012 (Inclusion Date of CPA in Registered PoA 4041) |
| **Monitoring period number and duration of this monitoring period** | Monitoring Period No. 1<br>Monitoring Period : 01/08/2012 to 31/08/2012 (both days included) |
| **Project participant(s)** | 1. Thermax Sustainable Energy Solutions Ltd.<br>2. RWE Power Aktiengesellschaft |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope:<br>1 : Energy industries (renewable - / nonrenewable sources)<br>Applied methodology: AMS I.C. "Thermal energy production with or without electricity" (Version 16) |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 1079 $tCO_2e$ |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 33 $tCO_2e$ |

[72] http://cdm.unfccc.int/ProgrammeOfActivities/gotoCPA?id=S7B6NRHPY5UCTFEWL1MAZIQ28JDGX0

**SECTION A. Description of project activity**
**A.1. Purpose and general description of project activity**

**(a) Purpose of the project activity:**

The purpose of this small scale CDM Programme Activity (CPA) is to displace fossil fuel utilization for thermal energy generation by the Promotion of Biomass Based Heat Generation Systems thereby reducing GHG emissions. Project activity consists of the installation of 12 TPH biomass residues (biomass briquettes) fired boiler at SKOL BREWERIES LIMITED as a replacement of existing 10 TPH furnace oil fired boiler for meeting their in house thermal energy requirement. Thus the implementation of the project activity results in displacing the thermal energy that would have been generated using fossil fuel based boilers and therefore contributes in GHG emission reduction.

**(b) Brief description of the installed technology and equipment:**

The project activity consists of installation of 12 TPH, Combipac boiler manufactured by Thermax Limited. It designed to operate at a maximum pressure of 10.54 kg/cm$^2$ and has rectangular, refractory lined water cooled furnace. The steam generated from the boiler is utilised in different processes like pasteurization, sterilization, wart boiling and Clean In Place (CIP)

**(c) Relevant dates for the project activity:**

| UNFCCC ref no. | Name of the CPA operator | Technology details | Date of Commissioning | Date of Inclusion | Start Date of Crediting Period |
|---|---|---|---|---|---|
| CPA-4041 0015 | SKOL BREWERIES LIMITED | Boiler – 12TPH ( At 100$^0$C) | 25/07/2012 | 29/06/2012 | 01/08/2012 |

**(d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** i.e. 01/08/2012 to 31/08/2012 (both days included) is 34 t$CO_2$e

**A.2. Location of project activity**

| UNFCCC ref no. | Name of the CPA operator | Location of Project Activity | Geographic Coordinate | Host Party (ies) |
|---|---|---|---|---|
| CPA-4041 0015 | SKOL BREWERIES LIMITED | L-5, MIDC Area, Waluj, Aurangabad – 431136, Maharashtra, India. | 19.8444$^0$ North, 75.2000$^0$ East | India |

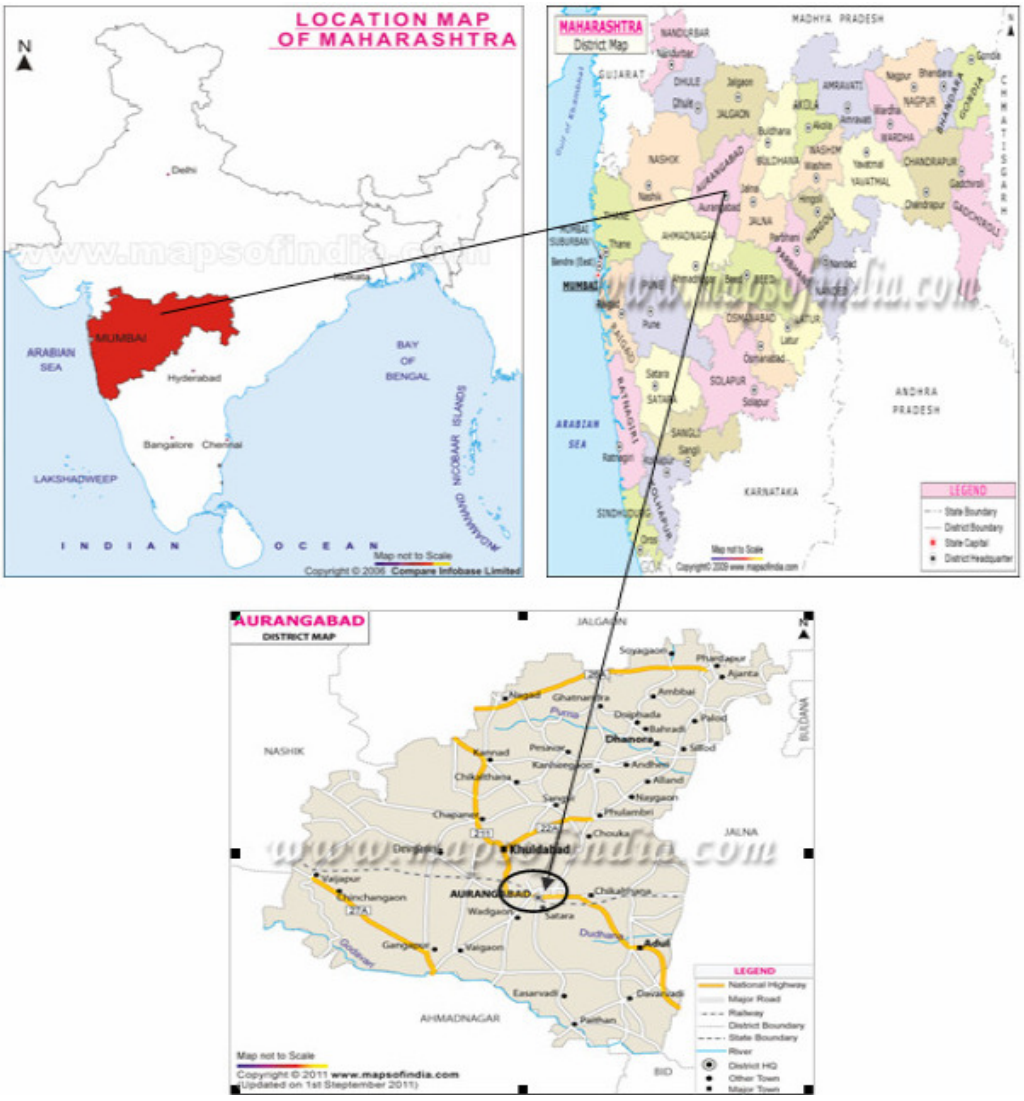


Fig.A.2.1 Physical Location of the project activity

### A.3. Parties and project participant(s)

| Party involved ((host) indicates a host Party) | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| India (host) | Private entity - Thermax Sustainable Energy Solutions Ltd. | No |
| United Kingdom | Private entity- RWE Power Aktiengesellschaft | No |

Thermax Sustainable Energy Solutions Ltd. (hereafter referred to as TSESL) India is the Coordinating / Managing Entity (CME) of the PoA. The thermal energy generation from biomass based equipment

(boiler) displacing fossil fuel has been addressed as Project activity and the Equipment (boiler) Owner has been addressed as 'CPA operator'.

**A.4. Reference of applied methodology**

Title: AMS- I.C. "Thermal energy production with or without electricity" (Version 16) EB 51 [73]

Reference: The Project activity is a small scale PoA Project activity and confirms to Appendix B of the simplified modalities and procedures for small-scale CDM Project activities.[74]

Relevance Tools:
1. "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" (version 01 EB 39 Annex 7)[75]
2. "Tool to calculate the emission factor for an electricity system" (Version 02), EB 50 Annex 14[76]
3. "General Guidance on leakage in Biomass Project activities" (Version 03); EB 47; Annex 28[77]
4. "Tool to calculate Project or leakage CO2 emissions from fossil fuel combustion" (version 02) EB 41 Annex 11[78]

**A.5. Crediting period of project activity**

**Type:** Fixed Crediting period

**Start date of Crediting Period:** 01/08/2012

**Length of the crediting period:** 10 Years

**SECTION B. Implementation of project activity**
**B.1. Description of implemented registered project activity**

**i. Description of installed technology:**

The thermal energy generated from biomass firing in the boiler furnace is transferred to the boiler water, through the heat transfer surfaces of pressure parts, which is converted to steam. This steam acts as a medium of transfer of thermal energy in the process for heating.

[73] http://cdm.unfccc.int/UserManagement/FileStorage/JPDYLFAR5MKUVZ97G31H84TS0CEBQN
[74] cdm.unfccc.int/Projects/pac/ssclistmeth.pdf
[75] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
[76] http://cdm.unfccc.int/EB/050/eb50_repan14.pdf
[77] http://cdm.unfccc.int/EB/047/eb47_repan28.pdf
[78] http://cdm.unfccc.int/EB/041/eb41_repan11.pdf

**Technical Specification of installed equipment (Biomass Fired Boiler):**

| Parameter | Description |
|---|---|
| CPA Number | 015 |
| CPA Operator | SKOL BREWERIES LIMITED |
| Project Scenario | Biomass fired thermal energy generation in Greenfield Project |
| Type of equipment | Boiler |
| Project activity | Installation of biomass fired boiler having rated steam generation capacity of 12 tonnes per hour (TPH ) |
| Boiler Make | Thermax Limited |
| Boiler Model | Combipac |
| Maximum working pressure | 10.54 kg/cm$^2$ (Safety Valve Lift Pressure) |
| Rated steam generation Capacity | 12 TPH From and At 100$^0$C |
| Saturated OR Superheated steam temperature (applicable for boiler only) | Saturated steam temperature |
| Type of Biomass Fuel | Biomass residues (hereinafter referred as biomass briquettes) |
| Type of fuel firing | Automatic firing |
| Furnace type | Rectangular, refractory lined water cooled |
| Boiler Number | CPMG120/10.54/5 |
| Commissioning date | 25/07/2012 |

The boiler consists of mainly the following parts:
1. 1. Pressure parts –form heat transfer area, holds steam, water and various mountings.
2. Furnace/ fuel combustor – designed to burn efficiently Biomass briquettes as fuel
3. Accessories- for various systems like water storage & feeding, fuel storage, fuel handling & feeding, steam piping, water & fuel piping, drain lines, fans & draught system, dust collection , water preheating system, flue gas discharge, ash discharge, electrical systems, equipment safeties & controls

The CPA operator has utilized biomass for heat generation i.e. Biomass briquettes, which is in compliance with "Definition of Renewable Biomass Annex 18 of EB 23" and "Glossary of CDM Terms – Version -05.

This CPA involves no technology transfer from Annex 1 country to the host country.

ii. **Actual operation of the project activity during this monitoring period:**
The project is currently operational as per the registered monitoring plan and is implemented in compliance with the registered CPA-DD. The project complied with all legal requirements during the current monitoring period. The project performance is normal and there was no any such major events occurred during the monitoring period, which affects the monitoring plan of the project activity like equipment retrofitting, Capacity addition etc.

**B.2. Post registration changes**
**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**
There are no temporary deviations applied for the registered monitoring plan during this monitoring period

**B.2.2. Corrections**
There are no corrections to project information or parameters fixed at validation that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**
There are no permanent changes from the registered monitoring plan or applied methodology that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.4. Changes to project design of registered project activity**
There are no changes to the project design of the project activity that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.5. Changes to start date of crediting period**
There are no changes to the start date of the crediting period that have been approved during this monitoring period or submitted with this monitoring report.

**B.2.6. Types of changes specific to afforestation or reforestation project activity**
Not applicable

**SECTION C. Description of monitoring system**

The biomass based steam generation system parameters are monitored using Field Instruments, Hardware & Software installed at Project site and Manual data recording in the log book. Measuring instruments used for Monitoring Parameters are listed as follows

| Sr. no. | Monitoring Parameters | Measuring instruments |
|---|---|---|
| 1 | Steam Flow | Flow meter |
| 2 | Steam Temperature | Directly measured by field instrument integral to steam flow meter. |
| 3 | Steam Pressure | Directly measured by separate pressure measuring instrument |
| 4 | Feed Water Temperature | Temperature measuring instruments |
| 5 | Electrical Energy Consumption | Energy meters |
| 6 | Fuel Weighing | Weighing machine (mass meter) |

The monitoring parameters from the field instruments (sr. no. 1 to 4) are connected to a monitoring system comprising of computer for local data acquisition &, computation. This data has been transferred to CME server through internet connectivity.

The following parameters has been monitored and recorded during the implementation of project activity.

**1) Thermal energy Produced by the System**:

The steam flow generated from the biomass boiler has been measured with the help of a steam flow meter. Thus the thermal energy generated from the biomass fired boiler is calculated as the differential value between the thermal energy of the steam at the outlet of the main steam stop valve (MSSV) and the Thermal Energy (Specific enthalpy) of the feed water, measured at the inlet of the boiler at corresponding feed water temperature. The equation is expressed as below:

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$
$EG_{thermal}$ = Net quantity of heat supplied by the Project activity
$Q_{steam}$ = Quantity of steam supplied in Ton
$H_s$ = Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (Kcal/kg)
$H_w$ = Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (kCal/kg)

This applies to net quantity of heat supplied calculation for the entire year & the crediting year(s).

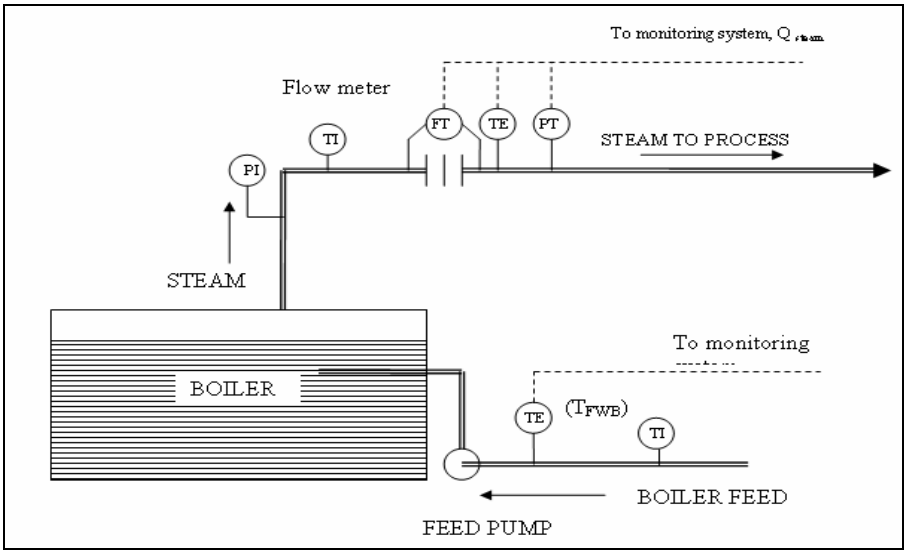


Fig. C.1.1 Schematic Representation of monitoring plan for a boiler

**2) Measurement of Electrical Energy Consumption:**

Energy meter (dual source type) has been installed for the measurement of electrical energy consumption by the auxiliary equipment of the Project activity, supplied by Grid power and off grid power (Diesel Generator power).

**3) Measurement of Biomass input for the Project activity:**

The weigh bridge is available at the Project site. The quantity of biomass coming to the project site is measured in the weigh bridge and the same is recorded in the logbook.

Duly calibrated weigh bridge has been used to weigh the biomass consumed in the project activity.

Monitoring fuel Input in the Boiler:

The following approach has been taken to measure Biomass input to the boiler & also to ensure conservative value applied for Project Emission (PE) / Leakage Emission (LE) calculation:

a. The stored biomass / fossil fuel on the starting date of each monitoring period was measured at the Project site for opening balance as $Q_{ob,\,k}$/ $Q_{ob,\,i}$

b. Each new delivery of biomass/ fossil fuel within the monitoring period have a delivery note that was obtained and recorded from the supplier and a cumulative record of new input biomass / fossil fuel as $Q_{np,k}$ / $Q_{np,,i}$. At the end of each monitoring period, the inventory (remaining quantity of biomass / in storage) is measured as $Q_{in,k}$/ $Q_{in,i}$

c. The consumed biomass / fossil fuel is calculated as $Q_{c,k} = Q_{ob,k} + \Sigma(Q_{np,k}) - Q_{in,k}$, / $Q_{c,k,i} = Q_{ob,i} + \Sigma(Q_{np,i}) - Q_{in,i}$ and has applied for PE / LE calculation

Moisture gain or loss by the biomass is season dependent. Moisture sample is monitored on a monthly basis. The above measurement method ensure the practical method for monitoring biomass / fossil fuel.

**4) Measurement of Fossil fuel input for the Project activity:**

The monitoring of the quantity of fossil fuel input is also based on above method (Sr. no. 3) of measurement. However there was no fossil fuel used the during this monitoring period for this project activity.

**Description of the Monitoring procedure:**

1) **Manual recording:** The boiler parameters have been manually recorded as indicated above by the boiler operational staff at site (CPA operator). This log book have been duly maintained, checked & signed by the operational staff & the site CDM controller (CPA Operator). This manual record of boiler log book has been maintained at site by CPA operator.

2) **Automated boiler performance parameter recording:** The monitoring parameters from the field instruments have been connected to a monitoring system for computation and automatic data acquisition on daily basis. The data archived is transferred to the server of CME periodically (monthly basis) using internet connection. The data has been archived by the CPA Operator and CME.

The Measuring instruments (Sr no 1 to 4 as per table above in Section D) required for monitoring the boiler of this CPA were installed on the heat generating system.The electrical energy consumption is being recorded by the energy meter installed and the readings are being recorded manually on monthly basis. The fuel purchase records are being maintained manually. The source of data collection, frequency of data collection and calibration frequency is as per section D.2 of this document. All field monitoring instruments are connected to a monitoring system for readings display. The reports can be obtained from the monitoring system as and when required.

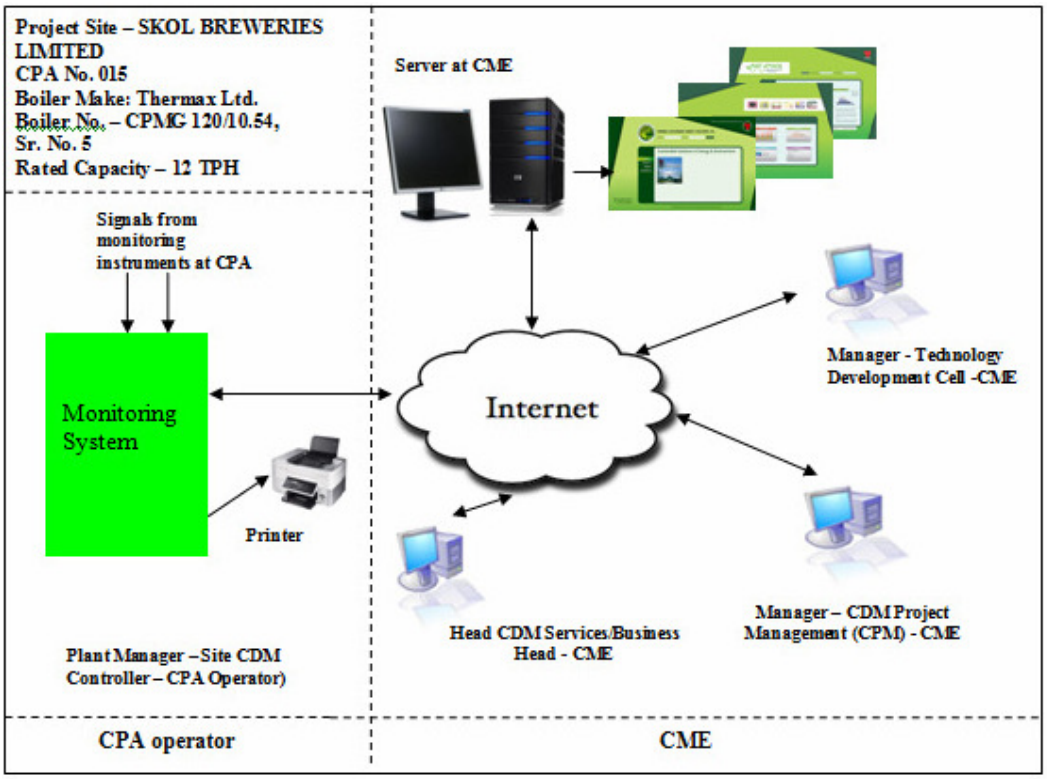


*Figure C.1.2 Schematic Representation of Monitoring Plan for CPA under PoA*

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

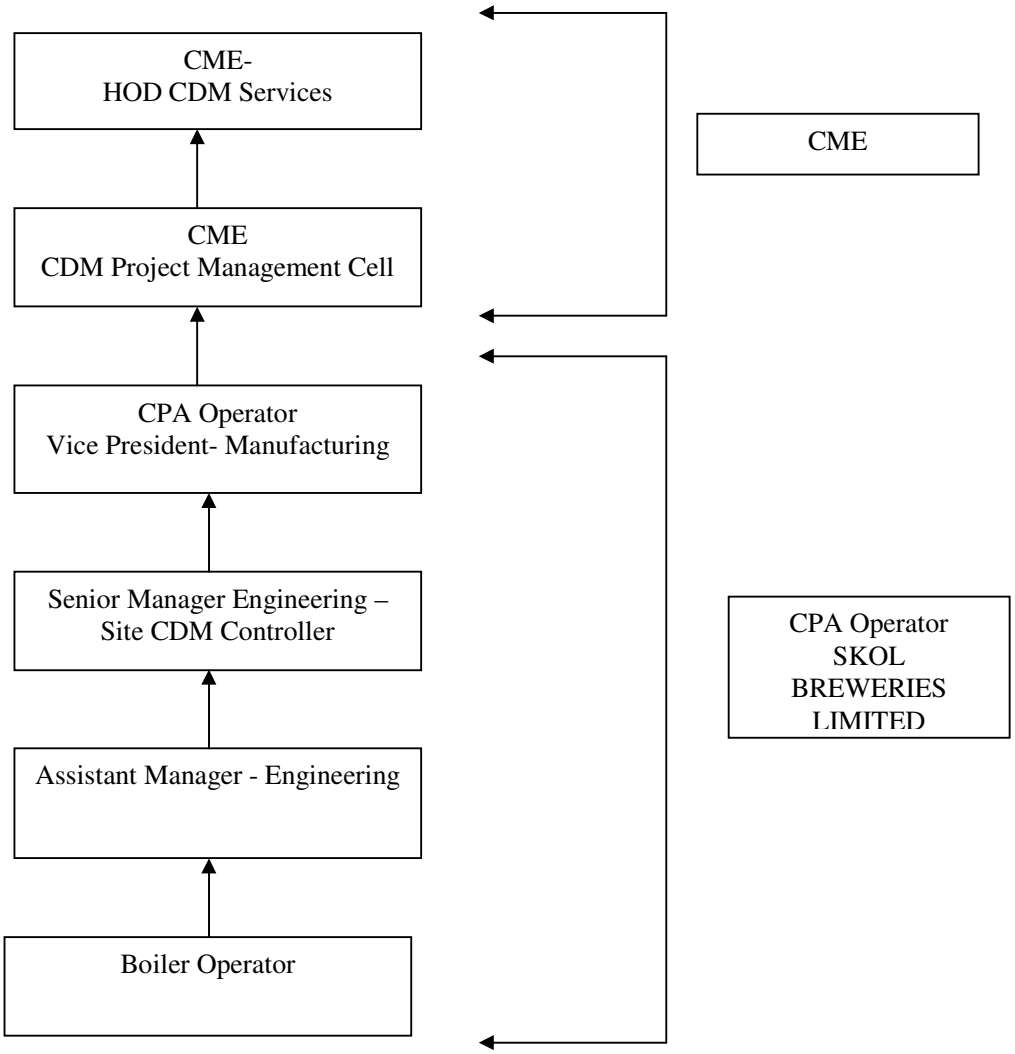


Fig.C.1.3 Monitoring Plan for CPA Implementation by CPA Operator

| **Key operational roles** | **CPA Management Responsibilities** |
|---|---|
| Vice President- (Manufacturing) CPA Operator | • Overall Responsibilities of Operation & Management of Project. Quarterly Performance Review<br>• Submission of Documents/Data to CME |
| Senior Manager Engineering – (Site CDM Controller) | • Performance review –Monthly<br>• Verification / review of data<br>• Internal audits<br>• Review of corrective actions |

| | |
|---|---|
| Assistant Manager - Engineering | • Verifying & Archiving the data<br>• Checking of monitored data<br>• Calibration of key monitoring equipments<br>• Maintenance of key monitoring equipments<br>• Implementation of corrective action |
| Operator – Boiler | • Operation and Maintenance of boiler<br>• Recording/Collection of Data<br>• Daily Logbook data maintenance |

**3) Emergency Preparedness Plan: Boiler Monitoring Data Collection and Archiving:**

This plan is prepared in case of partial or total monitoring system failure:

i) Steam flow measurement system failure:

In case of Steam flow measurement system failure, the thermal energy supplied by the Project activity will be estimated based on the most conservative approach theoretically possible.

ii) Failure of RTD/ Temperature Transmitter:

In case of failure of the RTD/ Temp Transmitter, the boiler operational staff (CPA operator) will manually record the reading on hourly basis in the log book from the temperature gauge already installed on feed water/steam line of the boiler. The temperature gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration will be carried out by independent accredited third party entity

iii) Failure of Pressure Transmitter:

For pressure transmitter failure, the pressure shall be manually noted from the installed pressure gauges already provided which shall be considered for calculation of emission reduction. The pressure gauge shall be calibrated as per local/national standard or as per manufacturer's specifications. If local/national standards and manufacturer's specification is not available, it will be as per international standard, but at least once in 3 years. Calibration shall be carried out by independent accredited third party entity

iv) Failure of Energy Meter:

In case of failure of energy meter, the CPA operator will record the failure period of the energy meter. The energy (kWh) consumed in the absence of meter will be calculated considering failure hours and the auxiliary electrical connected load of the boiler i. e. Failure hours*Electrical connected load*Grid/Diesel Generator (DG) emission factor. The time lost in the meter correction / replacement will be recorded in log book and this shall be used for emission reduction calculation.

4) No data transfer to CME's server or Hardware, Software failure at Project Site:

In this case, Project site will continue to record the data automatically. CPA Operator will copy the locally archived data and send it to CME.

During this monitoring period there was no any partial or total monitoring system failure occurred.

**SECTION D. Data and Parameters**
**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

| | |
|---|---|
| **Data/Parameter** | $CAP_{boiler}$ |
| **Unit** | Tonnes/hr |
| **Description** | Rated capacity (thermal output) of the boiler of the Project activity. |
| **Source of data** | Manufacturer's specification |
| **Value(s) applied** | 12 (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $\eta_{BL,thermal}$ |
| **Unit** | % |
| **Description** | The Efficiency of the plant using fossil fuel that would have been used in the absence of the Project activity |
| **Source of data** | Recorded /Manufacturer's specification |
| **Value(s) applied** | 100 (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{FF,CO2}$ |
| **Unit** | $tCO_{2e}/TJ$ |
| **Description** | $CO_2$ Emission Factor of the fossil fuel that would have been used in the baseline plant |
| **Source of data** | IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 1.4 ).<br>The lower values has been chosen in conservative manner |
| **Value(s) applied** | 75.5 (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | The baseline identification test concluded Furnace Oil as a plausible baseline alternative for baseline emission calculation. Therefore Emission factor for Furnace Oil is considered as conservative approach due to lower Emission Factor than those of coal. Emission factor as per the source (IPCC Default value from 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1 (Table 2.3).The default emission factor of Residual fuel oil (Furnace oil) is ranges between 75.5 T/TJ to 78.8 T/TJ.<br>Hence lower value for baseline and higher value for project emissions due to Residual fuel oil (Furnace oil) has been selected in conservative manner.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SA_k$ |
| **Unit** | % |
| **Description** | Surplus availability of Biomass within identified region |
| **Source of data** | Independent Survey report |
| **Value(s) applied** | 87.81 (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | This value has been determined ex-ante and valid for the full crediting period as per the registered CPA DD. |

| | |
|---|---|
| **Data/Parameter** | $EF_{grid,CM,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Ex-ante Grid Emission Factor in a year y |
| **Source of data** | Central Electricity Authority's (CEA's) $CO_2$ baseline database for the Indian Power sector User Guide |
| **Value(s) applied** | 0.80 -NEWNEGrid (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | Grid Emission factor is officially published by CEA, Ministry of Power, Government of India.<br>Web link - http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.html<br>The $EF_{grid,CM,y}$ is calculated by CEA based on the latest UNFCCC tool to calculate the emission factor for an electricity system.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{EL,j,y}$ |
| **Unit** | $tCO_2/MWh$ |
| **Description** | Emission Factor for fossil fuel based electricity generation for source j in year y |
| **Source of data** | The value has been considered as per " Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" |
| **Value(s) applied** | 1.3 (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | For this project activity, the electricity consumption source is a Project or leakage electricity consumption source as per the above mentioned Tool, This is inline with the registered PoA-DD, Hence this value is used for the calculating the off-grid (DG) emissions.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{LE,l,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption for biomass processing, outside Project boundary |
| **Source of data** | Technical specification of electricity consumption for biomass processing. |
| **Value(s) applied** | 11 |
| **Purpose of data** | Project Emission calculation |
| **Additional comment** | This value has been determined based on total briomass briquette consumption in kgs multiplied by ex-ante value of electivity consumption for biomass processing as 0.45 kWh/kg as per third party report and valid for the full crediting period as per the registered CPA DD.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{km,CO2}$ |
| **Unit** | $tCO_2/km$ |
| **Description** | Average $CO_2$ emission factor for the trucks measured during the year y |
| **Source of data** | Available literature<br>(Reference: Atmospheric Environment, Volume 43, Issue 34, November 2009, Pages 5510-5517) |
| **Value(s) applied** | 0.0005152 (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | There is no National published data available. Hence, the value applied is from the published literature i.e. published research paper on “Emissions from India’s transport sector: Statewise synthesis”<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $TD_{Ll,y} = TD_{Lj,y}$ |
| **Unit** | % |
| **Description** | Average technical transmission and distribution losses for providing electricity to source l and/or j in year y |
| **Source of data** | Use recent, accurate and reliable data available within the host country;<br>Use as a default value of 20 % ,<br>a) For leakage electricity consumption.<br>b) Baseline electricity consumption sources if the electricity consumption by all Project and leakage electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies is larger than the electricity consumption of all baseline electricity consumption sources to which scenario A or scenario C (cases C.I or C.III) applies |
| **Value(s) applied** | 20 % (if host country data is not available) |
| **Purpose of data** | Leakage Emission calculation |
| **Additional comment** | Value is considered as per EB 39 Annex 7, "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption" because, recent, accurate and reliable data within the host country is not available.<br><br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $SEC_{PJ,j,y,measured}$ |
| **Unit** | TJ/MW |
| **Description** | Specific energy consumption of fuel type j of the Project activity in year y |
| **Source of data** | Plant record, Manufacturers letter |
| **Value(s) applied** | Biomass briquettes - 0.004337<br>Coal – 0.004311 (value applicable for the Project activity as per CPA 015) |
| **Purpose of data** | Baseline Emission calculation |
| **Additional comment** | Data type: Calculated as per para 34 equation 14 of AMS I.C ver. 16. and declared in a letter by manufacturer.<br>This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.2. Data and parameters monitored**

| **Data/Parameter** | $Q_{steam}$ |
|---|---|
| **Unit** | Tonnes or t |
| **Description** | Quantity of steam supplied in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 275 |
| **Monitoring equipment** | Steam flow meter<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic/Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| **Data/Parameter** | $T_{steam}$ |
|---|---|
| **Unit** | °C |
| **Description** | Average Steam Temperature at MSSV (Main steam stop valve) outlet |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 83.2 |
| **Monitoring equipment** | RTD & Temperature Gauge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data will be archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $P_{steam}$ |
| **Unit** | $kg/cm^2g$ |
| **Description** | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 3.0 |
| **Monitoring equipment** | Pressure transmitter& Pressure Gauge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Detail* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $T_{FWB}$ |
| **Unit** | $^oC$ |
| **Description** | Average Feed Water Temperature at inlet of boiler |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | On site measurement |
| **Value(s) of monitored parameter** | 48 |
| **Monitoring equipment** | RTD<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Detail* |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Daily<br>Monitoring Frequency: Continuous<br>Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | Calibration certificate has been checked on quarterly basis towards validity of the certificate. |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,k}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 61.04 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Detail* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Biomass stored has been recorded on the first day of the monitoring period and kept as a opening balance in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,k}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of subsequent delivery of fuel type k biomass at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log Book and Plant record. |
| **Value(s) of monitored parameter** | 369.67 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic/Paper mode.<br>Monitoring: Biomass briquettes have been measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice has been obtained from the fuel supplier and has been mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,k}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 177 |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic and Paper mode.<br>Monitoring: will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | --- |
| **QA/QC procedures** | -- |
| **Purpose of data** | Baseline Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,k} = FC_{biomass,k,y}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of biomass fuel type k consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book |
| **Value(s) of monitored parameter** | 253.7 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for biomass fuel type<br>$Q_{ob,k}+\Sigma(Q_{np,k})-Q_{in,k}$ |
| **QA/QC procedures** | The quantity of biomass briquettes consumed will be cross-checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{ob,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of stored fuel type fossil i (coal) on the starting date of each monitoring period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: Fossil fuel stored will be measured (by using calibrated Weigh bridge) |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{np,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of subsequent delivery of fuel type fossil fuel i (coal) |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Fossil fuel will be measured on Weighbridge outside the plant premise. The weighbridge slip with delivery note/invoice will be obtained from the fuel supplier and will be mentioned in the log book. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{in,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of remaining fossil fuel type i (coal) available at the end date of each monitored period measured at the Project site |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Weigh bridge / Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | Weigh bridge<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data has been archived by Electronic and Paper mode.<br>Monitoring: It will be measured by using calibrated weigh bridge. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $Q_{c,i}$ |
| **Unit** | Tonnes or t |
| **Description** | Quantity of fossil fuel type i (coal) consumed during the monitoring period |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Log Book/Plant record. |
| **Value(s) of monitored parameter** | 0 (no fossil fuel was consumed during this monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | It is calculated by the formula for fossil fuel type $Q_{ob,i}+\Sigma(Q_{np,i})- Q_{in,i}$ Measured Quantity of Fossil fuel type i available at site on the starting date of the monitoring period ($Q_{ob,i}$) in a year y + Quantity of subsequent delivery of Fossil fuel type i at site throughout monitoring period in a year y ($\Sigma(Q_{np,i})$)- Quantity of remaining Fossil fuel type i available at the end date of each monitored period measured at the Project site in a year y ($Q_{in,i}$). |
| **QA/QC procedures** | The quantity of coal consumed will be cross-checked with payment receipt /invoice obtained from the fuel supplier. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_k$ |
| **Unit** | TJ/Gg |
| **Description** | Net calorific value of biomass fuel k used in the Project activity |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Analysis report of the biomass. |
| **Value(s) of monitored parameter** | 14.89 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Analysis Frequency: Annually.<br>Data Archiving: Data has been archived annually by paper mode.<br>Monitoring: Analysis from accredited agency according to relevant national standards. |
| **Calculation method (if applicable)** | NCV report specifies in kCal/kg and accordingly the same is converted to the TJ/Gg |
| **QA/QC procedures** | NA |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Hydrogen |
| **Unit** | % |
| **Description** | Percentage of hydrogen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 4.06 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived annually by paper mode. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Oxygen |
| **Unit** | % |
| **Description** | Percentage of Oxygen in biomass fuel |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 38.92 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data has been archived Annually by paper mode.<br>Monitoring: Annual Analysis report. |
| **Calculation method (if applicable)** | The purpose of this parameter is to convert the GCV of the fuel to NCV, and will be applied only when the laboratory analysis mentions GCV in their analysis report. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | Moisture |
| **Unit** | % water |
| **Description** | Moisture content of the biomass residues |
| **Measured/Calculated /Default** | On-site measurement |
| **Source of data** | Laboratory analysis report |
| **Value(s) of monitored parameter** | 9.05 |
| **Monitoring equipment** | --- |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Monthly<br>Data Archiving: Data has been archived by paper mode.<br>Monitoring: Monthly report. |
| **Calculation method (if applicable)** | This parameter is a monitored parameter. This parameter shall also be used to convert the GCV of the fuel to NCV, and will be applied if the laboratory analysis mentions GCV in their analysis report. The weighted average should be calculated for each monitoring period and used in the calculations. Since the report gives the NCV, this value is not applied. |
| **QA/QC procedures** | Laboratory analysis as per national or international standards |
| **Purpose of data** | NA |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/Gg or GJ/t |
| **Description** | Weighted average net calorific value of the fuel type i (coal) in year y |
| **Measured/Calculated /Default** | Calculated or Measured |
| **Source of data** | |

| **Data source** | **Conditions for using the data source** |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the Project participants | If a) is not available |
| c) Regional or national default values | If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| **Value(s) of monitored parameter** | NA |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Recording Frequency: Annually<br>Data Archiving: Data will be archived by Electronic/Paper mode.<br>Monitoring: Analysis by an independent agency. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | If the NCV report specifies unit other than TJ/Gg, then it will be appropriately converted.<br>$NCV_i = NCV_{j,y}$<br>i is the fuel type combusted in process j during the year y. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{,PJ,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the Grid in year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 15.646 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Detail* |
| **Measuring/Reading/ Recording frequency** | Recording: Monthly<br>Monitoring frequency : Continuous<br>Data Archiving: Data has been archived by Electronic/Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EC_{EL,j,y}$ |
| **Unit** | MWh |
| **Description** | Auxiliary Electricity Consumption of the Project activity from the off grid Captive Power Plant (Diesel Generator set or Fossil fuel based power source) in a year y |
| **Measured/Calculated /Default** | Measured using calibrated meters |
| **Source of data** | Log book/Plant record |
| **Value(s) of monitored parameter** | 0 |
| **Monitoring equipment** | Electronic Energy Meter<br>*Kindly refer annex 1_4041-0015 for Measuring Instrument Details* |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency : Continuous, during power failure<br>Data Archiving: Data will be archived by Electronic/Paper mode |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | NA |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,y}$ |
| **Unit** | km |
| **Description** | Average return trip distance (from and to) between the source of the biomass and the site of the Project plant during the year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Plant record |
| **Value(s) of monitored parameter** | 236.4 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | If biomass is supplied from different sites this parameter will corresponds to the mean value of kilometer travelled by trucks that supply the biomass plant.<br>Calculated based on the distance kilometres provided buy trucker / supplier |
| **QA/QC procedures** | Check consistency of distance record provided by trucker / supplier by comparing recorded distances with other information from other sources (eg. Maps) |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Log book/Plant record. |
| **Value(s) of monitored parameter** | 28 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring Frequency: Continuous, at each trip<br>Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be checked for consistency by comparing the quantity delivered (no. of truck, '$N_{,y}$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $AVD_{,c,y}$ |
| **Unit** | km |
| **Description** | Average round trip distance (from and to) between the biomass fuel supply sites and the site of biomass processing in year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 60 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Monitoring frequency : Continuous, at each trip<br>Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be checked for consistency by comparing the quantity delivered (no. of truck, '$N_y$') from invoice / delivery note with the quantity of biomass combusted. |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $N_{,c,y}$ |
| **Unit** | -- |
| **Description** | Number of truck trips during the transportation of biomass to the biomass processing site in year y |
| **Measured/Calculated /Default** | Measured |
| **Source of data** | Data / declaration from supplier |
| **Value(s) of monitored parameter** | 53 |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | The CPA operator shall ensure provision of this parameter from the biomass supplier in the form of declaration.<br>Monitoring Frequency: Continuous, at each trip |
| **Calculation method (if applicable)** | NA |
| **QA/QC procedures** | The data will be check for consistency of the number of truck trips with quantity of biomass combusted |
| **Purpose of data** | Leakage Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

| | |
|---|---|
| **Data/Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | $tCO_2/GJ$ |
| **Description** | Weighted average $CO_2$ emission factor of fuel type i (coal) year y |
| **Measured/Calculated /Default** | Calculated |
| **Source of data** | The following data sources may be used if the relevant conditions apply:<br><br>**Data source** / **Conditions for using the data source**<br>a) Values provided by the fuel supplier in invoices — This is the preferred source<br>b) Measurements by the Project participants — If a) is not available<br>c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available |
| **Value(s) of monitored parameter** | NA (No fossil fuel type i (coal) consumed in a process j during monitoring period) |
| **Monitoring equipment** | NA |
| **Measuring/Reading/ Recording frequency** | Data Archiving: Data will be archived by Paper mode. |
| **Calculation method (if applicable)** | For a) and b): Measurements should be undertaken in line with national or international fuel standards<br>For a) and b): The $CO_2$ emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| **QA/QC procedures** | Applicable where Option B is used.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |
| **Purpose of data** | Project Emission Calculation |
| **Additional comment** | This data will be archived up to 2 years after the completion of crediting period or last issuance whichever is later. |

**D.3. Implementation of sampling plan**

No sampling plan needed over the monitoring period since **100% data are monitored and reported**.

**SECTION E. Calculation of emission reductions or GHG removals by sinks**

**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The baseline emissions are calculated as per paragraph 15 of the methodology:
For steam produced using fossil fuels the baseline emissions are calculated as below:

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

| | |
|---|---|
| $BE_{thermal,CO_2,y}$ | The baseline emissions from steam/heat displaced by the Project activity during the year y ($tCO_2$) |
| $EG_{thermal,y}$ | The net quantity of steam/heat supplied by the Project activity during the year y (TJ) |
| $EF_{FF,CO_2}$ | 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 |

$EG_{thermal} = Q_{steam} * (H_s - H_w) * 4.186 \times 10^{-6}$

| | |
|---|---|
| $EG_{thermal}$ | Net quantity of heat supplied by the Project activity (TJ) |
| $Q_{steam}$ | Quantity of steam supplied in Tons |
| $H_s$ | Specific enthalpy of steam at corresponding absolute pressure and temperature at the outlet (Kcal/kg) |
| $H_w$ | Specific Enthalpy of feed water at corresponding temperature at the Boiler inlet (Kcal/kg) |

$Q_{steam}$ : 275 Tons
$H_s$ : 653.40 kCal/Kg
$H_w$ : 48 kCal/Kg
$\eta_{BL,Thermal}$ : 100%
$EF_{FF,CO2}$ : 75.5$tCO_2$/TJ

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

$EG_{thermal}$ = 275 * (653.40- 48) *4.186 X $10^{-6}$
= 0.698 TJ

Hence;

$BE_{thermal,CO_2,y}$ = (0.698 /100 %) * 75.5
= 53 $tCO_2$

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

The Project emissions are calculated as per paragraph 26 of the methodology:
Project emissions include:

- $CO_2$ emissions from on-site consumption of fossil fuels due to the Project activity are calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion";
- $CO_2$ emissions from electricity consumption by the Project activity using the latest version of "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with Project activity within the Project boundary;

**Project emissions due to electricity consumption**

$CO_2$ emissions from electricity consumption by the Project activity will be calculated using the "Tool to calculate baseline, Project and/or leakage emissions from electricity consumption (version 01)" (refer Annex 7, EB 39) as referred in the methodology.

For this CPA the following Scenario applies:

**Scenario A: Electricity consumption from the grid.** The electricity is purchased from the grid only. Either no captive power plant is installed at the site of electricity consumption or, if any onsite captive power plant exits, it is not operating or it can physically not provide electricity to the source of electricity consumption.

**Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the site of the electricity consumption source and supply the source with electricity. The captive power plant(s) is/are not connected to the electricity grid.

**<u>Scenario A: Electricity consumption from the grid</u>**

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by grid emission factor ($EF_{grid,CM,y}$).

$$PE_{EC,y} = \sum_{J} EC_{PJ,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$$

As per the registered monitoring plan, $EF_{EL,j,y} = EF_{grid,CM,y}$ . The combined margin emission factor has been already fixed ex-ante and the value is 0.80 $tCO_2$/MWh for NEWNE grid.

**<u>Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s):</u>**

The Source for off-grid fossil fuel fired captive power plant is Diesel Generator (DG) set (in case of grid failure). The following option has been considered at CPA level, as defined in the tool:

Option B2: Use the following conservative default values:

A value of 1.3 $tCO_2$/MWh if,

(a) The electricity consumption source is a Project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power

plant(s) is less than the electricity consumption of all Project electricity consumption sources at the site of the captive power plant(s).

The emissions for the boiler accessories has been calculated based on electrical energy consumption by accessories measured by energy meter multiplied by off-grid emission factor ($EF_{EL,J,Y}$ as per option B2)

Thus,

$PE_{EC,y} = EC_{PJ,j,y} * EF_{grid,CM,y} * (1+TDL_{j,y}) + EC_{EL,j,y} * EF_{EL,j,y} * (1+TDL_{j,y})$

Where;

$EC_{PJ,j,y}$ = 15.6 MWh
$EF_{grid,CM,y}$ = 0.80 $tCO_2$/MWh
$TDL_{j,y}$ = 20 % (Default value)
$EC_{EL,j,y}$ = 0 MWh
$EF_{EL,j,y}$ = 1.3 $tCO_2$/MWh

$PE_{EC,y}$ = 15.6* 0.80* (1+20/100) + 0*1.3* (1+20%)
= 15 $tCO_2e$

**Project emissions from fossil fuel combustion**

$CO_2$ emissions from on-site consumption of fossil fuel by the Project activity is calculated using the latest version of "Tool to calculate Project or leakage $CO_2$ emissions from fossil fuel combustion"

$CO_2$ emissions from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} * COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FC,j,y}$ | Are the $CO_2$ emissions from fossil fuel combustion in process j during the year y ($tCO_2$/yr) |
| $FC_{i,j,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | The $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$ / mass or volume unit) |
| i | Are the fuel types combusted in process j during the year y |

The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated using option B

Option B: The $CO_2$ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where,

| | |
|---|---|
| $COEF_{i,y}$ | Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit) |
| $NCV_{i,y}$ | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| $EF_{CO2,i,y}$ | Is the weighted average $CO_2$ emission factor of fuel type i in year y ($tCO_2$/GJ) |

| | |
|---|---|
| i | Are the fuel types combusted in process j during the year y |

As no fossil fuel was used in this monitoring period, project emission from on-site consumption of fossil fuel by the project activity is zero.

$PE_{FC,j,y} = 0$

Thus,

**Total Project Emissions** $PE_y = PE_{EC,y} + PE_{FC,j,y}$
$= 15 + 0$
$= 15\ tCO_2e$

**E.3. Calculation of leakage**

As per para 28 and 29 of the methodology applied, leakage emissions are applicable if:

1. The energy generating equipment currently being utilised is transferred from outside the boundary to the Project activity

This part of leakage is not considered as the energy generating equipment currently being utilized is not transferred from outside the boundary of the Project activity

2. In case collection/processing/transportation of biomass residues is outside the Project boundary, $CO_2$ emissions from collection/processing/transportation of biomass residues to the Project site.

This part of leakage is considered as the distance of biomass transportation is more than 200km. Leakage is thus considered to be zero and Biomass (briquettes) consumed in the project activity is not transported to the Project site over a distance of more than 200 km. It is calculated as follows:

$LE = N*AVD*EF_{km,CO2}$

Where,

LE : Leakage Emission
N : No. of truck trips
AVD : Average round trip distance travelled for biomass transportation / collection
$EF_{km,CO2}$ : Average $CO_2$ emission factor for the trucks measured during year y

Therefore,

$LE = 56*237*0.0005152$
$= \mathbf{5\ tCO_2e}$

**E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks**

The emission reductions have been calculated as per paragraph 30 of the methodology.

$\mathbf{ER_y = BE_y - PE_y - LE_y}$

Where,

$ER_y$ = Emission reduction in year y ($tCO_2e$).
$LE_y$ = Leakage in year y ($tCO_2e$).
$PE_y$ = Project emissions in year *y* ($tCO_2e$).

Therefore; $ER_y = BE_y - PE_y - LE_y$
$= 53 - 15 - 5$

**= 33 $tCO_2e$**

| Time Period | Baseline emissions or baseline net GHG removals by sinks ($tCO_2e$) | Project emissions or actual net GHG removals by sinks ($tCO_{2e}$) | Leakage ($tCO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks ($tCO_2e$) |
|---|---|---|---|---|
| **Total** | 53 | 15 | 5 | 33 |

**E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered CPA-DD**

| Item | Values estimated in ex-ante calculation of registered CPA-DD | Actual values achieved during this monitoring period |
|---|---|---|
| **Emission reductions or GHG removals by sinks ($tCO_2e$)** | 1,079* | 33 |

*As the monitoring period is from 01/08/2012 to 31/08/2012 i.e. 31 days (both days included), ex-ante emissions have been calculated accordingly for this Monitoring period considering 365 days of operation in a year.

**E.6. Remarks on difference from estimated value in registered CPA-DD**

The achieved emission reductions, once averaged over the length of the monitoring period, are lower than the ex-ante value of emission reductions in the registered CPA-DD. Hence there is no excess of emission reductions to report.

**Annex-1**_4041-0015**: Instrument Details**

| Sr. No. | Description monitoring parameters | Description Of Instrument | Make | Sr. No./tag no. | Instrument Accuracy /Class | Calibration Date | Calibration Frequency | Calibration Due Date |
|---|---|---|---|---|---|---|---|---|
| 1 | Quantity of steam supplied in year y , ($Q_{steam}$ ) | Steam Flow Meter | Endress + Hauser | EC002520000 | ± 3% | 16/1/2012 | Once in 3 year | 15/1/2015 |
| 2 | Average Steam Temperature at MSSV (Main steam stop valve) outlet during year, ($T_{steam}$ ) | RTD | Endress + Hauser | EC002520000 | ± 3% | 16/1/2012 | Once in 3 year | 15/1/2015 |
| | | Gauge | General | BB/TG/003 | ± 2 % | 2/4/2012 | Yearly | 1/4/2013 |
| 3 | Average Steam Pressure (gauge) at MSSV (Main steam stop valve) outlet during year, ($P_{steam}$ ) | Pressure Transmitter | Endress + Hauser | EC004321128 | ± 2 % | 2/4/2012 | Yearly | 1/4/2013 |
| | | Gauge | Wika | BB-PG-002 | ± 2 % | 2/4/2012 | Yearly | 1/4/2013 |
| 4 | Average Feed Water Temperature at inlet of boiler, ($T_{FWB}$) | Temperature transmitter | Endress + Hauser | F201AB14150 | ± 2 % | 02/03/2012 | Yearly | 01/03/2013 |
| 5 | Auxiliary Electricity Consumption of the Project activity from the from Grid ($EC_{EL,j,y}$ ) and Off Grid ($EC_{PJ,j,y}$) in year y | Energy Meter | Krykard | 80348 | Class 1.0 | 20/04/2012 | Yearly | 19/04/2013 |
| 6 | Quantity of stored fuel type biomass k on the starting date of each monitoring period measured at the Project site ($Q_{ob,k}$,) | Weigh Bridge | J.K. | 1932780 | Class II | 06/09/2011, 06/09/2012 | Yearly | 6/9/2013 |
| | Quantity of subsequent delivery of fuel type k biomass at the Project site($Q_{np,k}$) | | | | | | | |
| | Quantity of remaining biomass fuel type k available at the end date of each monitored period measured at the Project site ($Q_{in,k}$) | | | | | | | |

**History of the document**

| Version | Date | Nature of revision |
|---|---|---|
| 02.0 | EB 66<br>13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20). |
| 01 | EB 54, Annex 34<br>28 May 2010 | Initial adoption. |
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