BIOMASS BASED COGENERATION PLANT AT GODREJ AGROVET LTD. CHINTAMPALLI

Document Prepared by (Infinite Solutions)

Project Title	Biomass based cogeneration plant at Godrej Agrovet Ltd. Chintampalli
Version	03
Report ID	Godrej-VCS-MP2
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Monitoring Period	01-Apr-2016 to 31-March-2019
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Godrej Agrovet Limited (GAVL) is a diversified agribusiness company dedicated to improving the productivity of Indian farmers by innovating products and services that sustainably increase crop and livestock yields. GAVL has interests in animal feed, oil palm plantations, agri-inputs and poultry.

GAVL has set up a new Greenfield palm oil production plant at project activity location. The plant has a production capacity to process 60 TPH palm fruit. The new plant has a steam and electricity demand of 35 TPH and 2.5 MW. The project will use in-house generated renewable biomass fibre, shell and empty fruit bunches (EFB) in the palm fruit processing facility. As the biomass is generated from agro processing industry, it is a renewable biomass as per definitions in 'Glossary of CDM Terms Ver 07.0'1.

At the time of project planning, GAVL had option to choose a coal based cogen plant for meeting the captive energy demand. However, considering the GHG emission reduction opportunity, the project proponent has chosen a renewable energy-based project.

Project Location: Chintampalli village, District –West Godavari, Andhra Pradesh, India

Pre-project scenario: The project is located at a Greenfield palm oil production plant. Thus, no energy generating units or the energy demand (user plant) existed at the project location in pre-project scenario.

The project leads to an annual emission reduction of 70,314 tCO2e per annum as per the registered VCS PD.

As the project is a cogeneration plant, only after commissioning of turbine, the project is considered to have started reducing emissions. The commissioning date of turbine in the project is 18-Aug-2012. Thus, the project activity was considered fully commissioned on 18-Aug-2012 and has been under operation since then except for regular shutdowns considering O&M requirements.

GHG emission reduction by the Project in this monitoring period

The monitoring period is from 01-Apr-2016 to 31-March-2019. The total GHG emission reductions or removals generated in this monitoring period are 121,083 tCO_2.

1.2 Sectoral Scope and Project Type

As per simplified modalities and procedures for small scale CDM project activities, the project qualifies under the:

Sectoral Scope : 01- Energy industries (renewable-/non-renewable sources)

Type : I- Renewable Energy Projects

Category : C- Thermal energy production with or without electricity

Project is neither an AFOLU project nor a grouped project.

1.3 Project Proponent

Organization name	Godrej Agrovet Limited
Contact person	Mr. M.S.M.S Kumar
Title	ASSOCIATE VICE PRESIDENT (Production &Projects)
Address	Ch. Pothepalli, Dwaraka Tirumala Mandal, Andhra Pradesh
Telephone	+91-9849134227
Email	msms.kumar@godrejagrovet.com

1.4 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the Project	Carbon Consultant
Contact person	Mr. Jimmy Sah
Title	Head Sustainability
Address	611, Chetak Centre Main, RNT Marg, Indore - 452001, India
Telephone	+91-9644130430
Email	jimmy@infisolutions.org

1.5 Project Start Date

18-08-2012.

This is the commissioning date of turbine in the project. Even though the boiler in this project boiler was commissioned on 30-06-2012, as the project is a cogeneration plant, only after commissioning of turbine, the project is considered to have started reducing emissions.

1.6 Project Crediting Period

The project chooses a renewable crediting period of 10 years. After 10 years, the crediting period will be renewed twice considering project life of 25 years.

Crediting period start date : 18-08-2012
Crediting period end date : 17-08-2022

This is the date when turbine generator was commissioned completing the project in cogeneration mode.

1.7 Project Location

Plant location: Village - Chintampalli, District - West Godavari, State - Andhra Pradesh, Country - India

Latitude - 17° 12' 36'' N and longitude: 80° 56' 34'' E

Plant location from major town/ district headquarter - Eluru - 70 Km

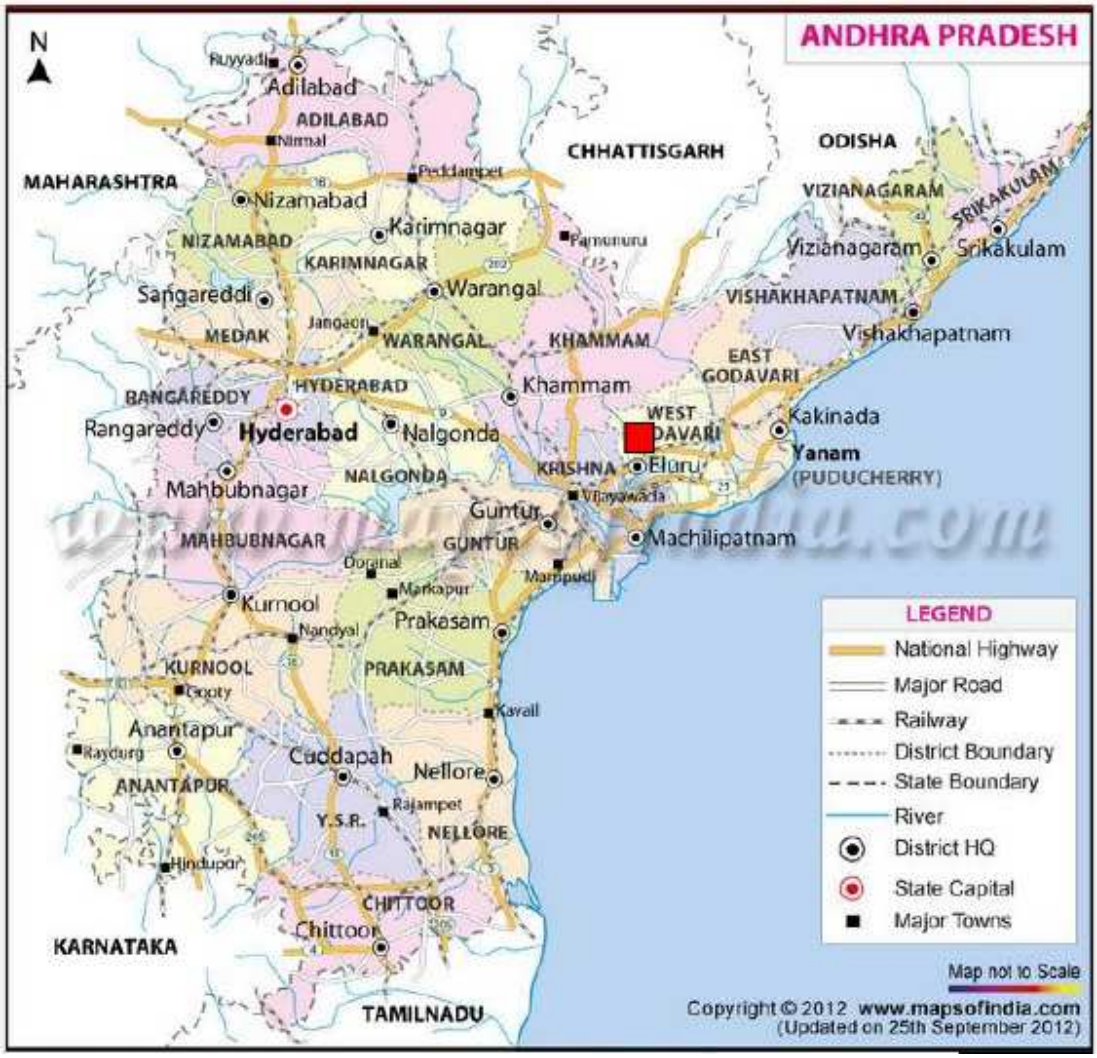

Figure 1: project location in Andhra Pradesh (■)

1.8 Title and Reference of Methodology

Type : AMS-I.C
Title : Thermal energy production with or without electricity
Sectoral Scope : 01
Version : 19
EB : 61
Reference : http://cdm.unfccc.int/methodologies/DB/6EL4AG49US2S1DNH55Y4S7GDQFA2JF

In line with the applied methodology, following tools and guidelines are referred in this PD:

1. Title: Guidelines on the demonstration of additionality of small-scale project activities
   Version: 09
   Reference: EB 68, Annex 27
2. Title: Tool to calculate baseline, project and/or leakage emissions from electricity consumption
   Version: 01
   Reference: EB 39, Annex 7
3. Title: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion
   Version: 02
   Reference: EB 41, Annex 11
4. Title: Tool to calculate the emission factor for an electricity system
   Version: 04.0
   Reference: EB 75, Annex 15

1.9 Participation under other GHG Programs

PP is submitting the undertaking confirming that project has not participated in any other binding and/or non-binding GHG program and any national REC scheme. Hence, there is no double accounting of emission reduction has happened.

Participation under Other GHG Programs:
The project activity has never participated in any other GHG programs.

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits:
The project proponent is not part of any emission trading program. GAVL also does not have any binding GHG emission limits. The net GHG emission reductions from the project will not be used for compliance with emission trading programs or to meet binding limits on GHG emissions. A letter of this effect from the project proponent has been submitted to the validator.

The project activity has not participated under any other GHG programs. A letter of this effect from the project proponent has been submitted to the validator during validation.

Other Forms of Environmental Credit:
The project activity does not result in creation of any other kind of environmental credits. A letter from the project proponent has been submitted to the validator with an undertaking that the project has not created another form of environmental credit. PP has not participated in REC mechanism. Hence, not eligible to claim REC benefits.

1.11 Sustainable Development

The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment, Forests and Climate Change (MoEFCC), has mentioned four indicators for the sustainable development in the interim approval guidelines for Clean Development Mechanism (CDM/VCS) projects from India[1].Thus the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

Social well-being: The project activity provided / provides job opportunity to local people during erection, commissioning and maintenance of the biomass project. Frequency of visiting villages and nearby areas by skilled, technical and industrialist increase due to installation /site visit/operation and maintenance work related to biomass plant. This directly and indirectly positively effects the economy of villages and nearby area.

Environmental well-being: Biomass power is one of the cleanest renewable energy powers and does not involve any fossil fuel. There are no GHG emissions. The impact on land, water, air and soil is negligible. Thus the project activity contributes to environmental well-being without causing any negative impact on the surrounding environment.

Economic well-being: The VCS project activity generates permanent and temporary employment opportunity within the vicinity of the project. The electricity supply in the nearby area improves which directly and indirectly improves the economy and life style of the area.

Technological well-being: The project activity is step forward in harnessing the untapped biomass potential and further diffusion of the biomass technology in the region. The project activity leads to the promotion and demonstrates the success of biomass projects in the region which further motivate more investors to invest in biomass power projects. Hence, the project activity leads to technological well-being.

2 SAFEGUARDS

2.1 No Net Harm

Project does not have any negative environmental and socio-economic impacts. Thus, this is not applicable for this project activity.

2.2 Local Stakeholder Consultation

Local stakeholder consultation already done during registration of project activity. The project proponent had organized stakeholders meeting in order to take into account the concerns of

[1] http://www.cdmindia.gov.in/approval_process.php

the nearby villagers regarding the project implementation however there were no major comments or protest raised by the stakeholders and they were totally in support for setting up of these kinds of projects in the region.

Also, as a part of continuous feedback from stakeholders, the PP also placed a feedback/complaint register onsite in where the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately.

However, there is no comments received in the current monitoring period.

2.3 AFOLU-Specific Safeguards

This is not applicable to the project activity as for non-AFOLU projects, this section is not required.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project activity has been successfully commissioned by GAVL and was registered by VCS Board subsequently (Project ID: Ref No. 1315).

The project is a cogeneration unit and had commissioned one 35 TPH biomass-based boiler and a 2.5 MW turbine generator (TG). The generated steam and electricity are used to meet the captive demand of a greenfield palm oil production unit.

The detailed specifications of boiler and TG are as below:

Table 1: Specification of 35 TPH boiler

S.No	Specification	Value	Unit
1	Type – Pulsating grate bi-drum air cooled boiler	-	-
2	Design steam generation capacity at MCR	35	TPH
3	Steam pressure at MCR	35	Kg/cm^2
4	Steam Temperature	350±10	°C
5	Make and Model - Thermax Ltd. BDPG - 350	-	-
6	Fuel requirement Fuel 1: 75% palm fibre + 25% palm shell Fuel 2: 70% palm fibre + 30% empty bunches	250	TPD mixed biomass
7	Efficiency of boiler (for fuel 1 and fuel 2)	73	%
8	Feed water temperature to economiser	105	°C

Table 2: Specification of 2.5 MW turbine generator

S.No	Specification	Value	Unit
1	Type – multistage, impulse, nozzle governed back pressure	-	-
2	Design Capacity	2.5	MW
3	Inlet Steam pressure	33	Kg/cm^2
4	Inlet Steam Temperature	350±10	°C
5	Specific steam consumption	13.9	Kg/kWh
6	Make and Model – Triveni Turbine Limited	-	-
7	Outlet steam pressure	4.5	Kg/cm^2
8	Electrical output at AC generator terminal (3 phase, 4 wire system, 0.8 PF)	2500 kW (415 V, 50 Hz)	-
9	Load Factor	80	%

The project activity has been in operation continuously (with outages – forced & planned) since its commissioning. The monthly running hours of the boilers and turbines included in the project activity are being submitted to the verifier. During the present monitoring period i.e. 01-Apr-2016 to 31-March-2019 (Both days included), the project is in normal operation status; there have been no emergencies happened to the monitoring system. There are no events or situation that occurred during the monitoring period which may impact the applicability of the methodology.

However, there were 5 majors shut downs taken during the current monitoring period which are as follows:

S.No	Months	Reason
1	Feb-17	Shutdown for routine annual maintenance.
2	Jan-18	Shutdown for routine annual maintenance.
3	Feb-18	Shutdown for routine annual maintenance.
4	Jan-19	Shutdown for routine annual maintenance.
5	Feb-19	Shutdown for routine annual maintenance.

No Generations has occurred during the shut down period.

3.2 Deviations

2.3.1 Methodology Deviations

There has been no methodology deviation applied during this monitoring period of the project activity.

2.3.2 Project Description Deviations

There has been no project description deviation applied during this monitoring period of the project activity.

3.3 Grouped Projects

The project is not a grouped project hence this section is not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$\eta_{BL,Cogen}$
Data unit	%
Description	The total annual average efficiency of the cogeneration plant using coal
Source of data	Default efficiency of new coal fired boiler as per 'Tool to determine the baseline efficiency of thermal or electric energy generation systems', Ver. 01, EB 48, Annex 12 and taking steam turbine efficiency of 100% as per Para 29(b) of SSC methodology
Value applied	85%
Justification of choice of data or description of measurement methods and procedures applied	Default value as per SSC methodology guidance is used here. Efficiency of a new coal fired boiler = 85% (as per 'Tool to determine the baseline efficiency of thermal or electric energy generation systems', Ver. 01) Efficiency of turbine = 100% (as per Para 29(b) of SSC methodology AMS I.C) Thus, efficiency of cogeneration plant = 85 x 100 = 85%
Purpose of Data	Baseline emission estimations
Comments	NA

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO2/MWh
Description	Combined margin emission factor of the southern grid
Source of data	CEA “CO2 baseline database for the Indian Power Sector, Version 09, January 2014”
Value applied	0.9593
Justification of choice of data or description of measurement methods	Calculated using “Tool to calculate the emission factor for an electricity system”

and procedures applied	
Purpose of Data	Baseline emission estimations
Comments	The emission factor will be fixed ex-ante and will not be monitoring throughout the crediting period

4.2 Data and Parameters Monitored

Data / Parameter	$EF_{CO2,i,y}$
Data unit	tCO2 / TJ
Description	CO2 emission factor of fossil fuels: coal and diesel
Source of data	Central Electricity Authority (CEA) CO2 Baseline Database for the Indian Power Sector
Description of measurement methods and procedures to be applied	The database is an official publication of the Government of India for the purpose of CDM baselines. Thus, the value is taken as country specific emission factor of coal.
Frequency of monitoring/recording	Once in a monitoring period – latest database version will be used. For this monitoring period: CEA Database Version 15 is Used. http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver15.pdf
Value monitored	Coal = 95.80 Diesel: 72.6
Monitoring equipment	Default value
QA/QC procedures to be applied	The data is taken from Indian National Communication to UNFCCC and is available from authentic source, thus no additional QC is required
Purpose of the data	Project emission estimations
Calculation method	NA
Comments	NA

Data / Parameter	$EG_{PJ,\ thermal,\ y}$
Data unit	TJ
Description	Net quantity of thermal energy supplied by project
Source of data	Calculated parameter. Parameter $EG_{PJ,thermal,y}$ for project activity is calculated from net steam output (ton) and its net enthalpy. Source for net steam output is steam production data log and corresponding enthalpy (at operating temperature) is inferred from steam table with respect to operating pressure and temperature.

Description of measurement methods and procedures to be applied	Monitoring: This will be calculated on the monthly basis. The monthly average value of steam flow meter and pressure gauge will be used to calculate enthalpy of the steam supplied using steam table in tonnes/TJ. This value will be multiplied with the monthly average of steam generated by project activity boiler Q_{steam}, to calculate enthalpy of steam supplied in a month. The enthalpy of feed water calculated using the measured values of flow meter (1 number) and its temperature (using meter: 1 number) will be subtracted to get $EG_{PJ,thermal,y}$. The sum of $EG_{PJ,thermal,y}$ of all the months will provide a yearly value. Data Type: Calculated and archived Archiving Procedure: Electronic
Frequency of monitoring/recording	Monitoring Frequency: Continuous measurement for steam flow and pressure Recording Frequency: Monthly calculation for enthalpy
Value monitored	1017.09 TJ
Monitoring equipment	Equipment accuracy class Steam flow meter: ±0.5% pressure gauges : ± 1%
QA/QC procedures to be applied	The steam temperature and steam mass flow meters will be calibrated once in three years.
Purpose of the data	Baseline emission estimations
Calculation method	Steam generated in a year (ton) x average enthalpy of steam (kJ/kg) / 10^6
Comments	NA

Data / Parameter	$EG_{PJ, electrical}$
Data unit	MWh
Description	Net electricity supplied by the project activity
Source of data	Cogen plant log book
Description of measurement methods and procedures to be applied	Monitoring: Electricity meter in control room will measure the net quantity of electricity supplied by the project activity cogen plant. Data type: Measure Archiving procedure: Paper and Electronic Responsibility: Turbine operator would be responsible for monitoring and checks for regular calibration of electricity meter and Shift In-charge will be responsible for calibration of the electricity meters. Calibration Frequency: Once in three years

Frequency of monitoring/recording	Continuous monitoring with monthly recording
Value monitored	21,268.81232
Monitoring equipment	Electric meter Accuracy class: 0.2s
QA/QC procedures to be applied	Electric meter/s would be calibrated once in three years at accredited third-party laboratory
Purpose of the data	Baseline emission estimations
Calculation method	The total generation of from the project activity – auxiliary consumption – import from grid – electricity from DG.
Comments	NA

Data / Parameter	$Q_{k, biomass\_Palm\ fibre}$
Data unit	Ton
Description	Net Quantity of biomass type k (Palm Fiber) consumed in the boiler in year y
Source of data	Measured using weighbridge
Description of measurement methods and procedures to be applied	Will be monitored ex-post
Frequency of monitoring/recording	Monitoring: The quantity of the palm fiber consumed will be measured using weigh bridge. Data Type: Measured and archived Archiving Procedure: Electronic Responsibility: Stores in-charge will be responsible for maintaining the records of the palm fiber consumed in project. Stock in charge will maintain a palm fiber inventory recording the opening and closing balance. Cross-check: Cross checking the measurements using mass/energy balance.
Value monitored	97311.64
Monitoring equipment	Weighbridge Accuracy class: ±1%
QA/QC procedures to be	Weigh bridge used will be calibrated by an external agency once in a

applied	year.
Purpose of the data	Baseline Emissions estimations
Calculation method	Sum of quantities of palm fiber consumption in a monitoring period
Comments	The parameter will monitor quantities of all biomass used palm fiber, palm shell and EFB separately

Data / Parameter	$Q_{k, biomass\_Shredded\ fibre}$
Data unit	Ton
Description	Net Quantity of biomass type k (Shredded fiber) consumed in the boiler in year y
Source of data	Measured using weighbridge
Description of measurement methods and procedures to be applied	Will be monitored ex-post
Frequency of monitoring/recording	Monitoring: The quantity of the Shredded fibre consumed will be measured using weigh bridge. Data Type: Measured and archived Archiving Procedure: Electronic Responsibility: Stores in-charge will be responsible for maintaining the records of the Shredded fibre consumed in project. Stock in charge will maintain a Shredded fibre inventory recording the opening and closing balance. Cross-check: Cross checking the measurements using mass/energy balance.
Value monitored	31, 688.70
Monitoring equipment	Weighbridge Accuracy class: ±1%
QA/QC procedures to be applied	Weigh bridge used will be calibrated by an external agency once in a year.
Purpose of the data	Baseline emission estimations
Calculation method	Sum of quantities of Shredded fibre consumption in a monitoring period
Comments	The parameter will monitor quantities of all biomass used palm fibre, palm shell and EFB separately

Data / Parameter	$Q_{k, biomass\_Palm\ shell}$
Data unit	Ton
Description	Net Quantity of biomass type k (Palm Shell) consumed in the boiler in year y
Source of data	Measured using weighbridge
Description of measurement methods and procedures to be applied	Will be monitored ex-post
Frequency of monitoring/recording	Monitoring: The quantity of the palm shell consumed will be measured using weigh bridge. Data Type: Measured and archived Archiving Procedure: Electronic Responsibility: Stores in-charge will be responsible for maintaining the records of the palm shell consumed in project. Stock in charge will maintain a palm shell inventory recording the opening and closing balance. Cross-check: Cross checking the measurements using mass/energy balance.
Value monitored	13, 657.60
Monitoring equipment	Weighbridge Accuracy class: ±1%
QA/QC procedures to be applied	Weigh bridge used will be calibrated by an external agency once in a year.
Purpose of the data	Baseline Emission estimations
Calculation method	Sum of quantities of palm shell consumption in a monitoring period
Comments	The parameter will monitor quantities of all biomass used palm shell.

Data / Parameter	$NCV_{k, biomass, Palm\ fiber}$
Data unit	kcal/kg
Description	Net Calorific Value of biomass type k

Source of data	Lab analysis report of NCV
Description of measurement methods and procedures to be applied	Monitoring: The NCV of palm fiber will be measured once in the first year of the crediting period (3 samples in each quarter) by third party laboratory/ inhouse as per national/ international standard. Data Type: Measured and Archived Archiving Procedure: Electronic Recording frequency: once in the first year of the crediting period Responsibility: Chief Chemist will be responsible for getting the lab analysis for the NCV.
Frequency of monitoring/recording	once in the first year of the crediting period. The value is in line with the first verification for the project.
Value monitored	2809
Monitoring equipment	Calorimetry – third party lab analysis
QA/QC procedures to be applied	Average value obtained using third party analysis using three samples for each measurement every quarter in the first year of operation and will be compared with any public literature if available and IPCC default values. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conducted.
Purpose of the data	Baseline Emission estimations
Calculation method	Calorimetry
Comments	The parameter will monitor NCV of all biomass used palm fibre, palm shell and EFB separately

Data / Parameter	$NCV_{k,\ biomass\ shredded\ fiber}$
Data unit	kcal/kg
Description	Net Calorific Value of biomass type k
Source of data	Lab analysis report of NCV
Description of measurement methods and procedures to be applied	Monitoring: The NCV of palm fiber will be measured once in the first year of the crediting period (3 samples in each quarter) by third party laboratory/ inhouse as per national/ international standard. Data Type: Measured and Archived Archiving Procedure: Electronic Recording frequency: once in the first year of the crediting period Responsibility: Chief Chemist will be responsible for getting the lab

	analysis for the NCV.
Frequency of monitoring/recording	once in the first year of the crediting period. The value is in line with the first verification for the project.
Value monitored	1318
Monitoring equipment	Calorimetry – third party lab analysis
QA/QC procedures to be applied	Average value obtained using third party analysis using three samples for each measurement every quarter in the first year of operation and will be compared with any public literature if available and IPCC default values. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conducted.
Purpose of the data	Baseline emissions estimations
Calculation method	Calorimetry
Comments	The parameter will monitor NCV of all biomass used palm fibre, palm shell and EFB separately

Data / Parameter	$NCV_{k, \text{biomass palm shell}}$
Data unit	kcal/kg
Description	Net Calorific Value of biomass type k
Source of data	Lab analysis report of NCV
Description of measurement methods and procedures to be applied	Monitoring: The NCV of palm fiber will be measured once in the first year of the crediting period (3 samples in each quarter) by third party laboratory/ inhouse as per national/ international standard. Data Type: Measured and Archived Archiving Procedure: Electronic Recording frequency: once in the first year of the crediting period Responsibility: Chief Chemist will be responsible for getting the lab analysis for the NCV.
Frequency of monitoring/recording	once in the first year of the crediting period. The value is in line with the first verification for the project.
Value monitored	3325
Monitoring equipment	Calorimetry
QA/QC procedures to be applied	Average value obtained using third party analysis using three samples for each measurement every quarter in the first year of operation and

	will be compared with any public literature if available and IPCC default values. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conducted.
Purpose of the data	Baseline Emission estimations
Calculation method	Calorimetry
Comments	The parameter will monitor NCV of all biomass used palm fibre, palm shell and EFB separately

Data / Parameter	**Extracted steam Enthalpy**
Data unit	kJ/kg
Description	Enthalpy of exhaust steam at the outlet of the steam turbine
Source of data	Plant log books
Description of measurement methods and procedures to be applied	Calculation Procedure: Enthalpy of steam from turbine is calculated from steam tables based on the corresponding values of quantity of steam and pressure. Data type: Calculate Recording Frequency: Daily Archiving procedure: Paper and/or Electronic Responsibility: Boiler operator would be responsible for monitoring and checks for regular calibration of temperature meter and pressure gauge. The Shift In-charge will be responsible for calibration of the temperature meter and pressure gauge.
Frequency of monitoring/recording	Continuous monitoring with monthly recording
Value monitored	2009
Monitoring equipment	Pressure of steam will be measured by pressure gauge and temperature by temperature transducer
QA/QC procedures to be applied	QA/QC procedures will be ensured as the temperature meter and pressure gauge would be calibrated at regular intervals.
Purpose of the data	Baseline Emission estimations
Calculation method	Enthalpy of steam at end of TG – enthalpy of feed water
Comments	NA

Data / Parameter	**Pressure**
Data unit	Kg/cm^2
Description	Pressure of flowing exhaust steam at the outlet of steam turbine
Source of data	Pressure gauge
Description of measurement methods and procedures to be applied	Monitoring: Pressure gauge will measure the pressure of the steam at the turbine outlet Data type: Measured and archived Recording Frequency: Hourly Archiving procedure: Paper and Electronic Responsibility: Turbine operator would be responsible for monitoring and checks for regular calibration of pressure gauge and Shift In-charge will be responsible for calibration of the pressure gauge. Calibration Frequency: Calibration will be carried out once in a year.
Frequency of monitoring/recording	Continuous monitoring with monthly recording
Value monitored	2. 13
Monitoring equipment	Pressure gauge Accuracy class: 1%
QA/QC procedures to be applied	Pressure gauge will be calibrated annually
Purpose of the data	Baseline Emission estimations
Calculation method	Direct reading from Pressure gauge
Comments	NA

Data / Parameter	**$FC_{i,j,y}$**
Data unit	MT/year
Description	Quantity of fossil fuel combusted in the project in year y
Source of data	Measured using weigh bridge for coal and level guage for diesel
Description of measurement methods and procedures to be applied	Monitoring: Type and quantity of fossil fuel combusted in the project activity will be measured using electronic weigh bridge (or recorded in challans provided by the supplier and handed over to the plant people by the truck driver).

	Data Type: Continuously Measured and archived Archiving Procedure: Electronic Responsibility: plant head with Officer (stores) would be responsible for monitoring and checks for regular calibration of weigh bridge
Frequency of monitoring/recording	Continuous measurement with monthly recording/ compilation
Value monitored	71.8546[2]
Monitoring equipment	weigh bridge for coal and level guage[3] for diesel Accuracy class: ±1%
QA/QC procedures to be applied	Weigh bridge will be calibrated by an external agency once in a year. The consistency of metered fuel consumption quantities will be cross-checked by an annual energy balance that is based on purchased quantities and stock changes.
Purpose of the data	Project Emission estimations
Calculation method	Sum of total fuel consumed in boiler
Comments	NA

Data / Parameter	$NCV_{fossil\ fuels}$
Data unit	kcal/kg
Description	Net Calorific Value of fossil fuels
Source of data	Lab analysis report of NCV
Description of measurement methods and procedures to be applied	Monitoring: The NCV of fossil fuel will be measured once in the first year of the crediting period (3 samples in each quarter) by third party laboratory/ inhouse as per national/ international standard. Data Type: Measured and Archived Archiving Procedure: Electronic Recording frequency: once in the first year of the crediting period Responsibility: Chief Chemist will be responsible for getting the lab analysis for the NCV.

[2] No fossil Fuel (Coal) has been used in the project activity Boiler. Only diesel consumed in onsite DG set. Hence, considered the diesel consumption (86572 Lit converted to 71.8546 MT) in project emission.

[3] The diesel quantity available in the diesel storage tanks is recorded as initial and final reading as and when issued to the DG dept on the basis of level gauge by the store in charge. Diesel consumption is measured using a level gauge attached to the diesel storage tank. As the level gauge is based on a fixed scale and it does not need to be calibrated as it does not lose measurement accuracy over time. The reading of scale is converted into the liter with the help of standard Tank dip chart which is fixed since installation of tank and does not required calibration.

Frequency of monitoring/recording	once in the first year of the crediting period
Value monitored	-[4]
Monitoring equipment	Calorimetry –
QA/QC procedures to be applied	Average value obtained using third party analysis using three samples for each measurement every quarter in the first year of operation and will be compared with any public literature if available and IPCC default values. If the measurement results differ significantly from previous measurements or other relevant data sources, additional measurements will be conducted.
Purpose of the data	Project Emission estimations
Calculation method	Calorimetry
Comments	The parameter will monitor NCV of all fossil fuels used separately

Data / Parameter	$EC_{PJ,j,y}$
Data unit	MWh
Description	Electricity taken from grid for the cogen plant start-up/ emergency operations.
Source of data	Cogen plant log book
Description of measurement methods and procedures to be applied	Monitoring: Electricity meter in control room Data type: Measure Archiving procedure: Paper and Electronic Responsibility: Turbine operator would be responsible for monitoring and checks for regular calibration of electricity meter and Shift In-charge will be responsible for calibration of the electricity meters. Calibration Frequency: Once in three years
Frequency of monitoring/recording	Continuous monitoring with monthly recording
Value monitored	1815.*135*
Monitoring equipment	Electric meter Accuracy class: 0.2s
QA/QC procedures to be	Electric meter/s would be calibrated once in three years at accredited

[4] No fossil Fuel has been used in the project activity Boiler.

applied	third-party laboratory
Purpose of the data	Baseline Emission estimations
Calculation method	The trivector meter will give net generation directly by doing above calculation.
Comments	NA

4.3 Monitoring Plan

The Monitoring and Verification procedures define a project-specific standard against which the project's performance and conformance with all relevant criteria will be monitored and verified. It includes

- Suitable data collection, collation and archiving methods consistent with good practices
- Data interpretation techniques for monitoring and verification of GHG emissions.

These procedures provide for a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of the key performance indicator for the project, i.e. Greenhouse Gas (GHG) emission reductions.

All instruments will be calibrated and marked in accordance with information in Section 4.2 so that the accuracy of measurement can be ensured all the time.

The general monitoring principles are based on:

- Frequency of monitoring
- Minimizing uncertainties and increasing reliability of performance of the project by an emergency preparedness plan
- Reporting and archiving the data used in monitoring and accounting for the emission reduction from the Project
- QA/QC

Frequency of monitoring

The project developer has installed all metering facilities within the plant premises. The measurements are monitored as per the frequency described in above sections, and the values of the parameters are recorded in the automatic reports generated by the PLC (only for parameters: Steam flow, Steam pressure and temperature at boiler, feed water temperature) and in log books. The monitored values will be transferred to the excel spreadsheet on monthly basis to prepare monthly reports. These monthly reports are used by the VCS Coordinator to calculate the reduction in GHG emissions and to generate monthly reports that form a necessary component of the Management Information System.

The VCS Coordinator will be responsible for

• Monitoring the project on a day to day basis,

• Co-coordinating with the Sr. Manager/Manager- projects and other internal and external agencies/authorities for the purpose of smooth operation of the project and accrual of emission reduction.

Emergency preparedness plan

The amount of emission reduction units is proportional to the steam generation using the biomass residues in the Project. Measurement devices having good accuracy and procured from reputed manufacturers have been installed at site for the purpose of monitoring the various parameters of the project. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment for reproducibility, all instruments will be calibrated as per the planned frequency for ensuring reliability of the system.

In the event that a particular instrument malfunctions or breaks down, all efforts will be made to restore or replace that instrument within short span of time of such eventuality. The data used in calculating the emission reduction for that particular parameter will be taken as zero from the last recorded reading.

This will ensure that the uncertainties in the parameters used for calculating the emission reductions from the project are consistent, verifiable and reliable, and any uncertainty is minimal.

Reporting and archiving

General Guidelines to SSC CDM Methodologies, Ver 17 Para 17 states that: Monitoring: The monitoring requirements are maintained in line with SSC methodology AMS I.C and comply with requirements of electronic archiving for two years from end of crediting period; continuous monitoring of thermal energy generated; use of measuring equipment's certified by national standards and calibration as per.

Verification is done on the basis of monthly reports that are prepared by the concerned sections covering all the monitoring parameters.

The VCS coordinator will be responsible for

- Collection and updating of all data in the project monitoring worksheet,
- Generation and distribution of monthly reports to the Management accounting for the actual emission reduction achieved during the month,
- Any specific event affecting emission reduction due to the project during the month
- Reporting data on monthly basis for the calculation and estimation of emission reductions.

This data will be checked against initial estimates. If the project is not performing as expected or if there are any negative impacts on the volume of emission reductions obtained, on the basis of the monthly data being monitored, analysis will be carried out to identify where the project is deviating in its generation of emission reductions and the immediate measures will be taken to maintain the expected generation of emission reductions from the operation of this project.

All data will be kept for a minimum of 2 years following last issuance of VCUs or the end of the crediting period, whichever is later, and the storage of this data will be the responsibility of the project proponents.

QA/QC procedures

The quality assurance and quality control over the data monitored will be done by the manager as follows:

- The monitored data will be verified for the completeness and consistency.
- It will be ensured that the plant personnel receive adequate training

- It will be ensured that the equipment's in the project activity undergo periodic maintenance as recommended by the manufacturer.
- It will be ensured that the monitoring instruments are calibrated as per the frequency specified in the B.7.1. The calibration reports for the monitoring period have been provided to the DOE.
- It will be ensured that the there is an adequate storage of the data monitored.

Any non-conformance will be identified and a corrective action will be taken.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

As per para 27 of the SSC methodology

"For electricity and thermal energy (steam/heat) produced in a baseline cogeneration unit, using fossil fuel (case 19 (d)), the following equation shall be used to determine baseline emissions:

$BE_{cogen,CO2,y} = [(EG_{PJ,thermal,y} + EG_{PJ,electrical,y} * 3.6) / \eta_{BL,Cogen}] * EF_{FF,CO2}$

Now,

$\eta_{BL,Cogen}$ = 85% (using default efficiency of new coal fired boiler as per 'Tool to determine the baseline efficiency of thermal or electric energy generation systems', Ver. 01, EB 48, Annex 12

$EF_{FF,CO2}$ = 95.80 tCO_2/TJ (as per Central Electricity Authority (CEA) CO2 Baseline Database for the Indian Power Sector; Ver. 15)

During this monitoring period

$EG_{PJ,thermal,y}$ = 1,017.09 TJ

$EG_{PJ,electrical,y}$ = 21.27 GWh

Thus,

$BE_{cogen,CO2,y}$ = 123,260 tCO_2 (Rounded Down Value)

Refer the ER sheet for detailed calculations.

5.2 Project Emissions

During the project operation, there are two sources for project emissions;

1. Coal Consumption in Boiler: There was no coal consumption in bolier.

2. Diesel consumption in DG:

$PE_{diesel,y}$ = Quantity of diesel consumed (Lit) X Density of diesel X NCV of diesel X EF of diesel

= 86,572 (L)X 0.83 (kg/L) X 9975 (kJ/kg) X 72.6 (tCO_2/TJ) / 10^9

= 52 tCO_{2e}

3. $PE_{grid,import,y}$ = Total Electricity Import (MWh)X (1+TDL) X GEF (tCO2/MWh)

= 1815.135596 X (1+22%) X 0.9593

= 2125 tCO_{2e}

Total Project Emission:

$PEy = PE_{fossil\ fuel,y} + PE_{diesel,y} + PE_{grid,import,y}$

= 0 + 52 + 2125

= *2177 tCO_{2e}*

5.3 Leakage

Since the biomass is sourced from the plant itself, thus leakage is zero.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
2016	38,656	327.00	0	38,329
2017	42,132	634.00	0	41,498
2018	40,818	1,011.00	0	39,807
2019	1,654	205.00	0	1,449
Total	123,260.00	2,177.00	0	121,083

It is to be noted here that as per the estimated emission reduction from the project activity for the current monitoring period is 210,942 tCO2e, whereas actual emission reductions achieved are 121,083 tCO2e, which is approximately - 42.60% lower than the estimated emission reductions. The co-generation generation plant operation depends upon various factors, one of them is process requirement and solely operates on process plant need basis. Hence during the current monitoring period requirement of process steam was less. Also, plant operation was stopped for 5 months for shutdown. This difference in the generation during the current verification period is hence due to certain process requirement conditions and hence acceptable.

APPENDIX 1: < APPENDIXMETER CALIBRATION DETAILS >

Steam Flow Meter

Equipment Name	Flow Transmitter	Flow Transmitter	Flow Transmitter
S.No	FT-PRS-11	91M218339	3K721703064136
Make	Rosemount	Yokogawa	ABB
Accuaracy	+/- 0.1 of Range	+/- 0.1 of Range	+/- 0.1 of Range
Type	Smart with HART Protocol	Smart with HART Protocol	Smart with HART Protocol
Date of Calibration	30-Jan-15	10-Mar-17	26-Jan-18
Due Date	29-Jan-18	09-Mar-20	25-Jan-21

Frequency
Once in 3 year

Exhaust Steam Pressure

Equipment Name	Pressure Transmitter	Pressure Transmitter	Pressure Transmitter	Pressure Gauge
S.No/Tag No	TB 21	91L846964	91L846964	0033PG0067
Make	Yokogawa	Yokogawa	Yokogawa	WAARRE
Accuaracy	+/- 0.1 of Range	+/- 0.1 of Range	+/- 0.1 of Range	0 TO 6 KG/CM2
Type	Smart with HART Protocol	Smart with HART Protocol	Smart with HART Protocol	GAUGE
Date of Calibration	21-Jan-16	14-Feb-17	27-Jan-18	14-Feb-19
Due Date	20-Jan-17	13-Feb-18	26-Jan-19	13-Feb-20
Delay in Exhaust Steam Pressure Calibration has been found in Feb 17 & Feb 19. Hence, maximum permissible error factor has been applied for the whole month of Jan 17 (as Feb 17, Jan-19 & Feb 19 plant was shut down) to the exhaust pressure meter reading.				

Frequency
Once in a year

(Gross Gen) kWh Meter

Equipment Name	kWh Meter	kWh Meter	kWh Meter	kWh Meter
S.No	MSB0001253	DBC344233	PE-210/210	ME-120/1802
Make	Elmeasure	Elmeasure	SLICONICXS	SLICONICXS
Accuracy Class	0.2s	0.2s	0.2s	0.2s
Date of Calibration	25-Jan-14	21-Feb-17	02-Aug-17	04-Mar-18
Due Date	24-Jan-17	20-Feb-20	01-Aug-20	03-Mar-21
Delay in Gross Gen Meter Calibration has been found. Hence, maximum permissible error factor has been applied for the whole month of Jan 17 & Feb 17 of the Gross Gen meter reading.				

Frequency
Once in 3 year

Import Meter

Equipment Name	Import Meter	Import Meter	Import Meter	
S.No	MSB0001254	11319333	17266672	
Make	Elmeasure	L&T	L&T	
Accuracy Class	0.2s	0.2s	0.2s	
Date of Calibration	25-Jan-14	25-Nov-17	01-Feb-18	
Due Date	24-Jan-17	24-Nov-20	31-Jan-21	
Delay in Import Meter Calibration has been found in Nov 17. Hence, maximum permissible error factor has been applied for the whole month of Jan 17 to Nov 17 of the import meter reading.				

Frequency
Once in 3 year

Weigh Bridge

Equipment Name	2016	2017	2018	2019

	Make	METLER	METLER	METLER	METLER
	Accuracy Class	5 kg	5 kg	5 kg	5 kg
Frequency	Date of Calibration	28-Apr-16	29-Apr-17	23-Jun-18	29-Apr-19
Once in a year	Due Date	27-Apr-17	28-Apr-18	22-Jun-19	28-Apr-20
	Delay	1 Month		3 Month	
	Delay in Weigh bridge calibration has been identified in Apr 2017 for 2 day and in June 2018 for 3 months. Therefore, maximum permissible error due to delay in calibration has been applied for the whole month of April 17, Apr18, May 18 & June 18 on the biomass quantity.				