24.45 MW Biomass based project in Punjab

Document Prepared by Infinite Solutions

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Project Title	24.45 MW Biomass based project in Punjab
Version	03
Report ID	1st Monitoring Report
Date of Issue	19-May-2022
Project ID	1920
Monitoring Period	15-Sept-2017 to 31-Dec-2020 (Inclusive of both the dates)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project activity is located in Satia Industries Limited (SIL), one of the mills in India. It is situated in Village Rupana, District - Muktsar, State – Punjab. The project is a biomass utilization project that is to use rice husk for electricity generation. The project was a cogeneration unit with one 125 TPH (50 TPH + 75 TPH) biomass-based boiler and a 24.45 (10.45 + 14) MW turbine generator (TG). The generated steam and electricity are being used to meet the captive demand of paper plant.

The purpose of the project activity was to generate power by installing a bleed condensing 24.45 MW turbine. Prior to the project activity, the process steam requirement was 11.75 TJ/day and electricity requirement were 433 MWh/day. To meet this requirement, SIL had 4 boilers with combined capacity of 190 TPH and 3 Turbines with rated capacity of 22.5 MW. The total electricity requirement was 488 MWh/day or 178,200 MWh/year.

The Project activity commissioning dates: -

Sr. No	Capacity	Phase	Commissioning date
1	10.45 MW	Phase - 1	15-Sept-2017
2	14 MW	Phase - 2	22-Dec-2020

After installation of turbine, 125 TPH (50 TPH + 75 TPH) boilers run on full capacity and generates and 24.45 MW turbine generates electricity on full load. The electricity produced from project turbine displaces equivalent amount of electricity that would have otherwise supplied by the grid. The estimated annual GHG emission reductions registered in the project activity are 208,613 tCO_2e.

The total GHG emission reductions or removals generated in this monitoring period, i.e., 15-Sept-2017 to 31-Dec-2020 (inclusive both days) is 157,174 tCO_2e.

1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:

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

Project Type : I - Renewable Energy Projects

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	Satia Industries Limited
Contact person	R. K. Bhandari
Title	Director
Address	Village Rupana, Muktsar – Malout road, Muktsar, Punjab – 152206, India
Telephone	+91-163-3262215,262001,263585
Email	infosatia@gmail.com

1.4 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the Project	Carbon Consultant
Contact person	Jimmy Sah
Title	Head - Sustainability
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Telephone	+91-731-4050174
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1.5 Project Start Date

Project Start Date: 15-Sept-2017[1];

The Project Start Date is the earliest commissioning date of the turbine for 10.45 MW.

[1] Date of Commercial operation

1.6 Project Crediting Period

Crediting Period Start date: 15-Sept-2017

Crediting Period End date: 14-Sept-2027

Project crediting period: 10 years (Renewable Twice)

The project activity adopts renewable crediting period with the first crediting period of 10 years and with an option to renew twice, considering the lifetime of the project activity to be more than 30 years.

1.7 Project Location

The project activity is located in District Muktsar of Punjab state, India. The geographical co-ordinates of the project are Latitude: 30° 25'43'' N and longitude as 74° 31' 22'' E. The geographical location of the project site is shown below through maps

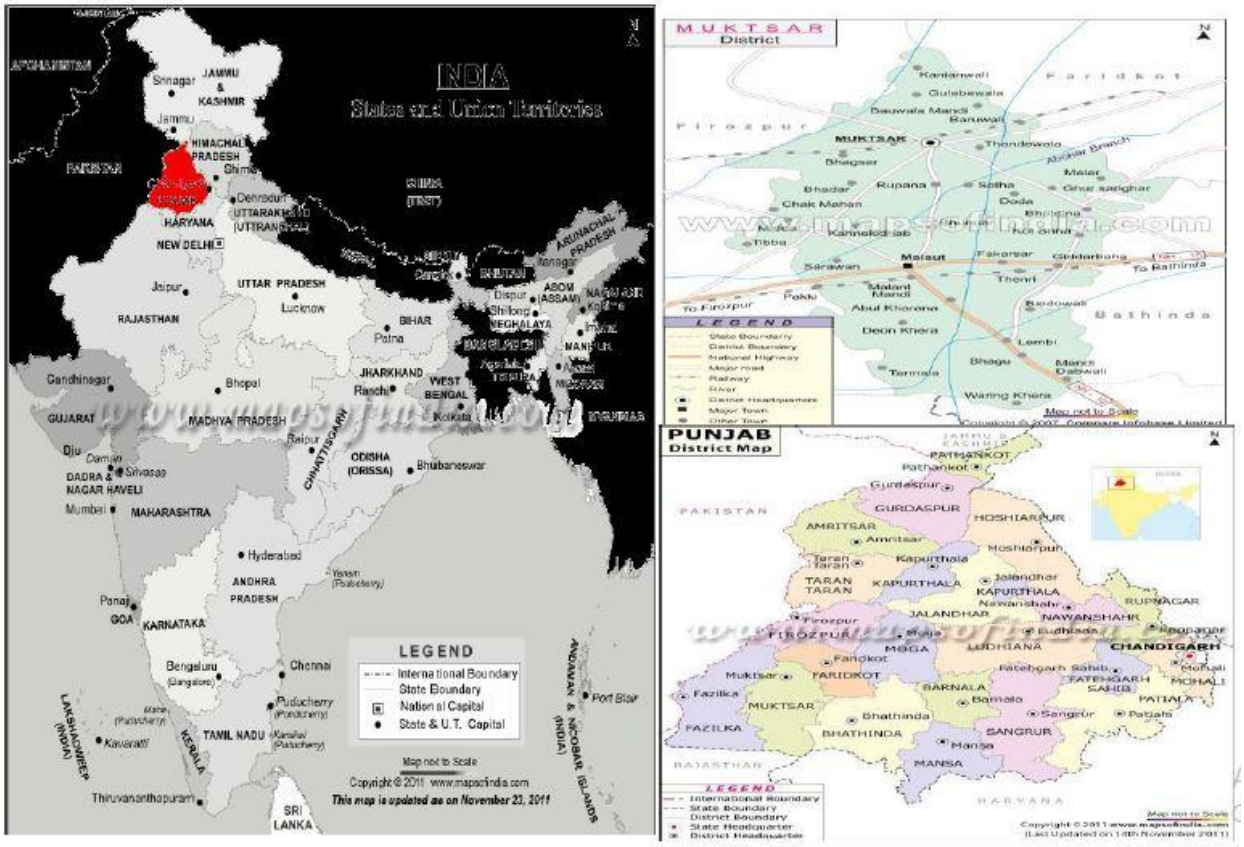


Figure 1: Location of the project activity

1.8 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied.

Methodology:

ACM0006: Electricity and heat generation from biomass --- Version 14.0, Sectoral Scope: 01, EB 101, Annex 9

https://cdm.unfccc.int/methodologies/DB/QFLMQ6JJHL625H0XR2N6WUSE6BEA7E

The project activity also takes reference from following Tools from the tools prescribed by applied methodology:

1. Tool for the demonstration and assessment of additionality --- Version 07.0.0, EB 96, Annex 3

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

2. Tool to calculate the emission factor for an electricity system --- Version 07.0, EB 100, Annex 4

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

3. Project and leakage emissions from biomass, version 4, EB 96, Annex 8

https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v4.pdf

1.9 Participation under other GHG Programs

The project activity has not been registered, or currently seeking registration under any other GHG programs. The project has not participated under any other GHG programme.

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits: This project activity is voluntary initiative, and it is not to meet any local laws or regulatory compliances. Project has not participated in emission trading program and other binding limits. An undertaking has been submitted that PP shall not claim for GHG emission reduction credits for the given crediting period under any other emission-trading program or GHG binding limits

Other Forms of Environmental Credit : PP declares that emission reductions generated from the project activity not be double counted for the monitoring period, which is being claimed under VCS mechanism. PP has submitted an undertaking to the VVB that they shall not claim for GHG emission reduction credits for the given period under any other emission-trading program. Also, the project is not claiming any other form of environmental credit.

1.11 Sustainable Development

Contribution to Sustainable Development

Socio-economic well-being:

- Project activity has generated direct and indirect employment for skilled and unskilled manpower during construction phase as well as during operational stage and thus helped in controlling migration from the region and alleviation of poverty.
- The project activity's contribution of power supply towards the Indian grid is helping in the upliftment of the social life of the people by ensuring a sustainable and reliable source of power for the region.
- The Project activity has improved the infrastructural facilities like water availability, road, and medical facilities etc. in the region.

Environmental well-being:

- The project activity generates clean and green power thus causing negligible emissions of greenhouse gases. In the absence of the project activity, equivalent electricity and heat would have been generated based on the fossil fuels resulting in more Green House Gas emissions into the atmosphere.
- The project activity has reduced the dependence on fossil fuels for power generation thus conserving the natural reserves. The project has led to greenhouse gas emission reduction and hence contributed in mitigating climate change.

Technological well-being:

The project activity has increased awareness and interest among the private players to make investments in similar areas. The project activity envisages installation of high efficiency turbines and generators and the power is transmitted at high voltage to ensure low losses. Moreover, the technology being used is well established, most updated and environmentally safe.

2 SAFEGUARDS

2.1 No Net Harm

There were no harm identified form the project and hence no mitigations measures are applicable.

2.2 Local Stakeholder Consultation

The project has already been registered under VCS mechanism. The Local stakeholder consultation process was conducted during the validation stage. Hence it is not applicable.

There were no negative comments received during the meeting and stakeholders appreciated proactive efforts taken by project proponent towards reducing emissions.

For ongoing communication, the PP has also placed a grievance register onsite where in the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately.

However, there is no negative feedback has been reported within this monitoring period.

2.3 AFOLU-Specific Safeguards

Not applicable to this as this is not an AFOLU project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project is a cogeneration unit with two 125 (50+75) biomass-based boiler and a 24.45 (10.45 +14) MW turbine generator (TG). The generated steam and electricity are used to meet the captive demand of increased capacity of paper plant.

Current status for the project activity : -

Sr. No	Capacity	Phase	Commissioning date
1	10.45 MW	Phase – 1	15-Sept-2017
2	14 MW	Phase – 2	15-Sept-2017

The project activity utilizes rice husk for electricity generation and thus displaces the use of electricity that would be purchased from the northern grid of India (now integrated as Indian Grid). The electricity in the grid is dominated by coal-based power plants. Thus, use of this rice husk for electricity generation would reduce electricity demand from the grid which reduces equivalent amount of coal burning in the power plants and in turn achieve GHG emission reduction.

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 current monitoring period i.e., from 15-Sept-2017 to 31-Dec-2020 (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.

The Breakdown details/outage details during monitoring report has been submitted to assessment team along with this submission.

The detailed specifications of Boiler and TG are as below:

Specification of Boiler

Sr.no	Specification	Phase 1	Phase 2	Unit
1	Type - Natural circulation, Single drum, Water tube, AFBC boiler.	-		-
2	Design steam generation capacity at MCR	50	75	TPH
3	Steam Pressure	67	67	Kg/cm^2
4	Steam Temperature	495 ± 5	495 ± 5	°C
5	Make– Cheema Boiler Limited Design Code - IBR 1950	-	-	-
6	Fuel - 100 % Rice husk. - 80% Rice Husk with 20% coal	-	-	-
7	Economiser water inlet temp	105°	105°	°C

8	Efficiency	78 ± 2	78 ± 2	%
9	Operational Life Time	30	30	Years

Specification of Turbine Generator

Parameter	Value	Value	Unit
Make	Siemens	Siemens	-
Type	Bleed condensing	Bleed condensing	-
Rated capacity of turbine	10.45	14	MW
Capacity for steam extraction I	15	15	TPH
Steam extraction pressure I	11.5	11.5	kg/cm^2
Steam extraction temperature I	290^0	290^0	Celsius
Capacity for steam extraction II	20	45	TPH
Steam extraction pressure II	4.5	4.5	kg/cm^2
Steam extraction temperature II	200^0	200^0	Celsius
Efficiency of biomass-based boiler (%)	80%	80%	-
Lifetime of the equipment	20	20	Years

The project boundary of the project activity is presented below:

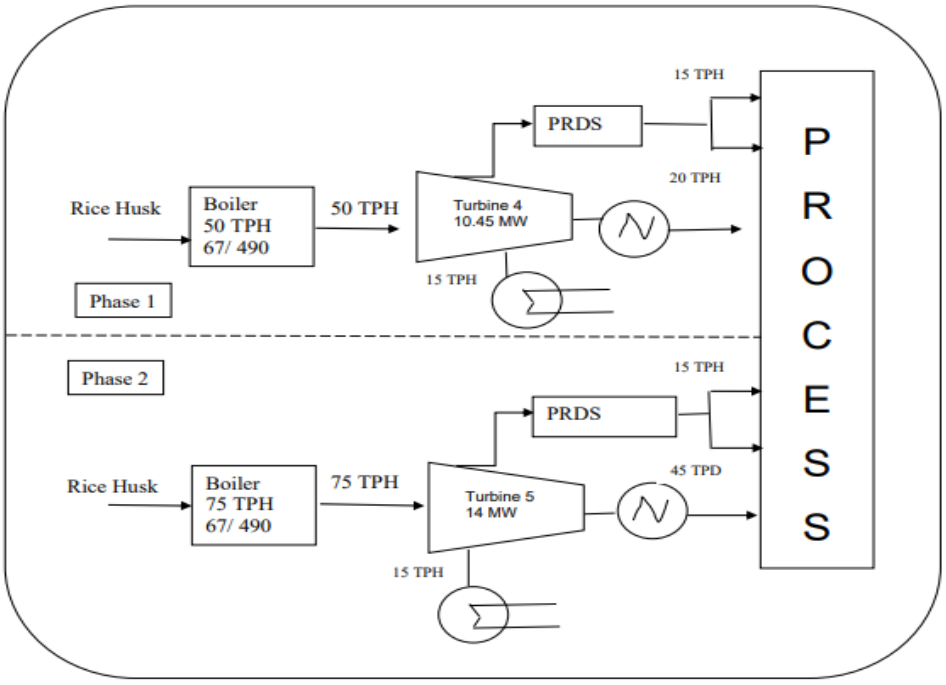


Figure 1 Project Boundary

3.2 Deviations

2.3.1 Methodology Deviations

There are no methodology deviations.

2.3.2 Project Description Deviations

There are no project Description deviations

3.3 Grouped Projects

The project is not a grouped thus this is not applicable.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	Biomass categories and quantities used for the selection of the baseline scenario selection and assessment of additionality
Data unit	- Type (i.e., bagasse, rice husks, empty fruit bunches, tree bark etc.). - Source (e.g., produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, dedicated plantations etc.). - Fate in the absence of the project activity (scenarios B). - Use in the project scenario (scenarios P and H). - Quantity (tonnes on dry-basis)
Description	The biomass quantities provided in the table below were determined ex-ante internally.
Source of data	On-site assessment of biomass residues categories and quantities according to project characteristics.
Value applied	See table below:

Type	Source	Fate in the absence of the project activity	Use in the project scenario	Quantity
Rice Husks	From Retailers	Dumped (B1)	Heat and power generation on-site (biomass only boiler)	0

	Rice Husks	From Retailers	Heat generation on-site (B4)	Heat and power generation on-site (biomass only boiler)	246,767
Justification of choice of data or description of measurement methods and procedures applied	This is the expected use of rice husk that are used in the project and that which fate in the absence of the project activity. The calculation is done on the basis of the new cogeneration plant and the estimation of ex-ante of the biomass types and quantities.				
Purpose of Data	Validated parameter in the registered VCS PD				
Comments	-				

Data / Parameter	$HG_{BR,CG/PO,x,i,j}$
Data unit	GJ
Description	$HG_{BR,CG/PO,x,i,j}$ = Quantity of heat used in heat engine *i/j* in year *x* (GJ)
Source of data	Calculated as per Design conditions of the plant for the configuration identified as baseline scenario in the "Selection of the baseline scenario and demonstration of additionality"
Value applied	$HG_{BR,CG,x,j}$ = Baseline biomass-based heat used in Cogeneration -mode heat engine = 2,745,503.64 GJ
Justification of choice of data or description of measurement methods and procedures applied	This parameter has been determined as the difference of the enthalpy of the process heat (steam or hot water) generated by the heat generators(s) minus the enthalpy of the feedwater, the boiler blow-down and any condensate return.
Purpose of Data	Validated parameter in the registered VCS PD
Comments	-

Data / Parameter	$HC_{BR,CG/PO,x,i/j}$ ($HC_{BR,CG,x,2}$, $HC_{BR,CG,x,2}$, $HC_{BR,CG,x,3}$)
Data unit	GJ
Description	$HC_{BR,CG/PO,x,i/j}$ = Quantity of process heat extracted from the heat engine *i/j* in year *x* (GJ)
Source of data	On-site measurements as per design conditions of plant

Value applied	$HC_{BR,CG,1}$ = 606,322 (2015) $HC_{BR,CG,1}$ = 257,900 (2014) $HC_{BR,CG,1}$ = 219,906 (2013) $HC_{BR,CG,2}$ = 489,102 (2015) $HC_{BR,CG,2}$ = 424,397 (2014) $HC_{BR,CG,2}$ = 339,517 (2013) $HC_{BR,CG,3}$ = 1,314,589 (2015) $HC_{BR,CG,3}$ = 1,343,237 (2014) $HC_{BR,CG,3}$ = 1,296,388 (2013)
Justification of choice of data or description of measurement methods and procedures applied	This parameter is calculated according to Case 1 of the Step 1.5 for the calculation of baseline emissions of the methodology ACM0006 Version 14: For heat engines with a minimum three-year operational history prior to the start date of crediting period, the heat-to-power ratio should be determined as per the design conditions of the plant, for the configuration identified as baseline scenario.
Purpose of Data	Validated parameter in the registered VCS PD
Comments	-

Data / Parameter	$EL_{BR,CG/PO,x,i/j}$ ($EL_{BR,CG,x2}$, $EL_{BR,CG,x,3}$)
Data unit	MWh
Description	$EL_{BR,CG/PO,x,i/j}$ = Quantity of electricity generated in heat engine i/j in year *x* (MWh)
Source of data	On-site measurements and design conditions of plant
Value applied	$EL_{BR,CG,1}$ 2015: 4,904 MWh $EL_{BR,CG,1}$ 2014: 19,910 MWh $EL_{BR,CG,1}$ 2013: 12,563 MWh $EL_{BR,CG,2}$ 2015: 17,553 MWh $EL_{BR,CG,2}$ 2014: 18,991 MWh $EL_{BR,CG,2}$ 2013: 12,245 MWh $EL_{BR,CG,3}$ 2015: 68,602 MWh $EL_{BR,CG,3}$ 2014: 68,702 MWh $EL_{BR,CG,3}$ 2013: 63,932 MWh
Justification of choice of data or description of measurement	This parameter is calculated according to Case 1 of the Step 1.5 for the calculation of baseline emissions of the methodology ACM0006 Version 14: For heat engines with a minimum three-year operational history prior to the start date of crediting period, the heat-to-power ratio should be determined

methods and procedures applied	as per the design conditions of the plant, for the configuration identified as baseline scenario.
Purpose of Data	Validated parameter in the registered VCS PD.
Comments	-

Data / Parameter	$CAP_{HG,h}$
Data unit	GJ/h
Description	$CAP_{HG,h}$ = Baseline capacity of heat generator h (GJ/h)
Source of data	On-site measurements or identified baseline plant design parameters
Value applied	821.96 GJ/h - (See step 3.1 of baseline emission calculation)
Justification of choice of data or description of measurement methods and procedures applied	This parameter reflects the design maximum heat generation capacity (in GJ/h) of the baseline heat generation h.
Purpose of Data	Validated parameter in the registered VCS PD.
Comments	-

Data / Parameter	$CAP_{EG,CG,i}$ ($CAP_{EG,CG,2}$, $CAP_{EG,CG,3}$, $CAP_{EG,CG,1}$)
Data unit	MW
Description	$CAP_{EG,CG,i}$ = Baseline electricity generation capacity of heat engine *i* (MW) (Cogeneration Mode)
Source of data	On site measurements
Value applied	$CAP_{EG,CG,1}$, = 5 $CAP_{EG,CG,2}$, = 5 $CAP_{EG,CG,3}$ = 12.5 (See step 1.3 of baseline emission calculation)
Justification of choice of data or description of	This parameter is the design maximum electricity generation capacity (in MW) of the baseline heat engines (Turbine 2,3,1). These are based on the installed capacity of the heat engines.

measurement methods and procedures applied	
Purpose of Data	Validated parameter in the registered VCS PD.
Comments	-

Data / Parameter	$LFC_{HG,h}$
Data unit	Ratio
Description	$LFC_{HG,h}$ = Baseline load factor of heat generator h (ratio)
Source of data	On-site measurements
Value applied	1
Justification of choice of data or description of measurement methods and procedures applied	As per methodology, this parameter should reflect the maximum load factor. PP has chosen the maximum value possible i.e., 1. Hence conservative.
Purpose of Data	Validated parameter in the registered VCS PD.
Comments	-

Data / Parameter	$HPR_{BL,i}$
Data unit	Ratio
Description	Baseline heat-to-power ratio of the heat engine i (ratio)
Source of data	On-site measurements or reference plant design parameters
Value applied	$HPR_{BL,CG,1}$ = 34.34 (Cogeneration Mode – Turbine 1) $HPR_{BL,CG,2}$ = 7.74 (Cogeneration Mode – Turbine 2) $HPR_{BL,CG,3}$ = 5.63 (Cogeneration Mode – Turbine 3)
Justification of choice of data or description of measurement methods and procedures applied	The values have been calculated according to Step 1.5 of baseline emission calculation of the methodology ACM0006 based in reference plant parameters

Purpose of Data	Validated parameter in the registered VCS PD.
Comments	-

Data / Parameter	$LFC_{EG,CG,i}$ ($LFC_{EG,CG,1}$, $LFC_{EG,CG,2}$, $LFC_{EG,CG,3}$)
Data unit	Ratio
Description	$LFC_{EG,CG,i}$ = Baseline load factor of heat engine *i* (ratio) (cogeneration Mode)
Source of data	Last 3-year data
Value applied	$LFC_{EG,CG,1}$ = 0.46 $LFC_{EG,CG,2}$ = 0.44 $LFC_{EG,CG,3}$ = 0.64 (See step 1.3 of baseline emission calculation) Calculate as ex ante
Justification of choice of data or description of measurement methods and procedures applied	This parameter reflects the maximum load factor (i.e. the ratio between the 'actual electricity generation' of the heat engine and its 'design maximum electricity generation') of the baseline heat engine 2,3 and 1. Last 3 years data has been used.
Purpose of Data	Validated parameter in the registered VCS PD.
Comments	-

Data / Parameter	$NCV_{BR,n,x}$
Data unit	GJ/tonnes on dry basis
Description	Net calorific value of biomass residues of category n in year *x*
Source of data	Lab reports
Value applied	14.80 GJ/tonnes on dry basis (Rice Husk)
Justification of choice of data or description of measurement methods and procedures applied	PP measures the NCV of the rice husk at regular interval from an authorized lab(Shriram institute for Industrial Research lab). It has an in-house lab also It was calculated NCV as 3537 kcal/kg.
Purpose of Data	Validated parameter in the registered VCS PD.
Comments	-

Data / Parameter	$EF_{EG,GR,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using version 7 of the "Tool to calculate the emission factor for an electricity system"
Source of data	Baseline CO_2 Emission Database, Version 14,
Value applied	0.9127 tCO_2/MWh
Justification of choice of data or description of measurement methods and procedures applied	The emission factors in the CO_2 database of CEA are compiled specifically for application by grid-connected projects. The emission factors are consistent with Tool to calculate emission factor for an electricity system (Version 7)
Purpose of Data	Calculation of baseline emissions Calculation of project emissions
Comments	Fixed ex-ante for entire crediting period

4.2 Data and Parameters Monitored

Data / Parameter	Biomass residues categories and quantities used in the project activity.
Data unit	- Type (i.e., bagasse, rice husks, empty fruit bunches, tree bark etc.). - Source (e.g., produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, dedicated plantations etc.). - Fate in the absence of the project activity (scenarios B). - Use in the project scenario (scenarios P and H). - Quantity (tonnes on dry-basis)
Description	All these amounts are continuously monitored in the project plant, according to proper industry standards.
Source of data	On-site measurements and Calculations
Description of measurement methods and procedures to be applied	The entire Rice Husk are measured at the entrance using dedicated weight bridges. The external biomass residues are measured using dedicated weight-bridges. Dry weight of all biomass residues are subsequently determined using the biomass moisture content of the corresponding biomass type in reputed laboratory.
Frequency of monitoring/recording	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
Value monitored	See table below:

	<table><tr><th>Type</th><th>Source</th><th>Fate in the absence of the VCS project activity</th><th>Use in the project scenario</th><th>Quantity(Tonnes)</th></tr><tr><td>Rice Husks</td><td>From Retailers</td><td>Dumped (B1)</td><td>Heat and power generation on-site (biomass only boiler)</td><td>0</td></tr><tr><td>Rice Husks</td><td>From Retailers</td><td>Heat generation on-site (B4)</td><td>Heat and power generation on-site (biomass only boiler)</td><td>619,257</td></tr></table>
Monitoring equipment	Weighbridge All the Rice Husk used in the new boiler are identified at the weighbridge. The moisture content to determine the quantity of dry biomass are determined by authorized laboratory(Shriram institute for Industrial Research lab).). Data monitored continuously and aggregated as appropriate, to calculate emissions reductions. The weight meters have been made in installations using international standards. The weight meter is electronic with accuracy between 0.25% - 1.0%. The calibration period is according to the manufacturer but in any case, it is performed at least annually.
QA/QC procedures to be applied	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Purpose of the data	To calculate dry biomass and then project emission calculation
Calculation method	-
Comments	-

Data / Parameter	For biomass residues categories for which scenarios B1:, B2: or B3: is deemed a plausible baseline alternative, project participants demonstrate that this is a realistic and credible alternative scenario
Data unit	Tonnes
Description	Quantity of available biomass residues of type n in the region

	- Quantity of biomass residues of type n that are utilized (e.g., for energy generation or as feedstock) in the defined geographical region - Availability of a surplus of biomass residues type n (which can not be sold or utilized) at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region
Source of data	Surveys and statistics
Description of measurement methods and procedures to be applied	Not applicable in this case.
Frequency of monitoring/recording	At the validation stage for biomass residues categories identified ex-ante, and always that new biomass residues categories are included during the crediting period.
Value monitored	Not applicable in this case. The Project Proponent uses the first approach to support the selection of the baseline scenario B1/B3 for biomass residues used under the project activity. Refer tool "Project and leakage emissions from biomass"
Monitoring equipment	Not applicable in this case.
QA/QC procedures to be applied	Not applicable in this case.
Purpose of the data	To calculate the Project emissions
Calculation method	Not applicable in this case.
Comments	-

Data / Parameter	$BR_{PJ,n,y}$
Data unit	tonnes on dry-basis
Description	$BR_{PJ,n,y}$ = Quantity of biomass residues of category n used in the project activity in year *y* (tonnes on dry basis)
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	The entire Rice Husk is measured at the entrance using dedicated weight bridges. The external biomass residues are measured using dedicated weight-bridges. Dry weight of all biomass residues is subsequently determined using the biomass moisture content of the corresponding biomass type in reputed laboratory.

Frequency of monitoring/recording	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
Value monitored	619,257 tonnes of dry rice husk.
Monitoring equipment	Weighbridge All the Rice Husk used in the new boiler are identified at the weighbridge. The moisture content to determine the quantity of dry biomass is determined by reputed laboratory. Data monitored continuously and aggregated as appropriate, to calculate emissions reductions. The weight meters have been made in installations using international standards. The weight meter are electronic with accuracy between 0.25% - 1.0%. The calibration period are at least annually.
QA/QC procedures to be applied	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Purpose of the data	Calculation of Project emissions
Calculation method	-
Comments	The biomass residue quantities used should be monitored separately for (a) each type of biomass residue (e.g.) and each source (e.g., produced on-site, obtained from biomass residues suppliers, obtained from a biomass residues market, obtained from an identified biomass residues producer, etc.).

Data / Parameter	$BR_{B4,n,y}$
Data unit	tonnes on dry-basis
Description	$BR_{B4,n,y}$ = Quantity of biomass residues of category n used in the project activity in year *y* for which the baseline scenario is B4 (tonne on dry-basis)
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	Calculated ex ante as per the step 1.4 of baseline emission calculation
Frequency of monitoring/recording	Not applicable in this case.
Value monitored	194,685

Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation for Baseline emissions
Calculation method	Refer to step 1.4 of baseline emission calculation
Comments	-

Data / Parameter	$EF_{FF,y,f}$
Data unit	tCO_2/GJ
Description	$EF_{FF,y,f}$ = CO_2 emission factor for fossil fuel type f in year y (t CO_2/GJ)
Source of data	For the proposed project activity, the selected source is Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. To ensure conservativeness, the Project Proponent has used the values of upper limit at the uncertainty of 95% confidence interval.
Description of measurement methods and procedures to be applied	Not applicable. The Project Proponent uses IPCC default values.
Frequency of monitoring/recording	The Project Proponent are review the appropriateness of the data annually.
Value monitored	0.0748 (tCO_2 /GJ) for Diesel.
Monitoring equipment	-
QA/QC procedures to be applied	Not applicable. The Project Proponent uses IPCC default values.
Purpose of the data	Calculation of Project Emission
Calculation method	Not Applicable.
Comments	-

Data / Parameter	$HC_{BL,y}$
Data unit	GJ

Description	$HC_{BL,y}$ = Baseline process heat generation in year y (GJ)
Source of data	On-site measurements and calculations.
Description of measurement methods and procedures to be applied	This parameter determined as the difference of the enthalpy of the generated in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators. The respective enthalpies determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables has been used to calculate the enthalpy as a function of temperature and pressure.
Frequency of monitoring/recording	Determined ex-ante according to project configuration.
Value monitored	6108.15 (TJ/year) - Determined ex-ante according to project configuration.
Monitoring equipment	-
QA/QC procedures to be applied	Determined ex-ante according to project configuration. This is not required to monitor in each crediting period as the emission reduction are claimed only on electricity generation.
Purpose of the data	Calculation of Baseline emissions
Calculation method	NA
Comments	-

Data / Parameter	$EL_{PJ,gross,y}$
Data unit	MWh
Description	$EL_{PJ,gross,y}$ = Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y* (MWh)
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	Calibrated electricity meters, Data are monitored continuously and aggregated as appropriate, to calculate emissions reductions. The proportion of data to be monitored is 100% and the data is archived electronically. The metering system are calibrated according to CEA regulations which specifies Electricity meters to be calibrated once in 5 years.
Frequency of monitoring/recording	Data monitored continuously and aggregated as appropriate, to calculate emission reductions.

Value monitored	512,107 MWh
Monitoring equipment	Calibrated Meters
QA/QC procedures to be applied	The consistency of metered electricity generation should be cross-checked with the quantity of fuels fired.
Purpose of the data	Calculation of Baseline emissions.
Calculation method	N.A.
Comments	-

Data / Parameter	$EL_{PJ,aux,y}$
Data unit	MWh
Description	$EL_{PJ,aux,y}$ = Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh)
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	Calibrated electricity meters
Frequency of monitoring/recording	Data monitored continuously and aggregated as appropriate, to calculate emission reductions.
Value monitored	51,211 MWh
Monitoring equipment	The consistency of metered electricity generation should be cross-checked with the quantity of fuels fired. For more detail, please refer calculation sheet.
QA/QC procedures to be applied	The metering system are calibrated according to CEA regulations which specifies Electricity meters to be calibrated once in 5 years.
Purpose of the data	Calculation of Baseline emissons.
Calculation method	NA
Comments	$EG_{PJ,aux,y}$ included all electricity required for the operation of equipment related to the preparation, storage and transport of biomass and electricity required for the operation of all power plants which are located at the project site and included in the project boundary. Data is kept electronically.

<table>
<tr><td>Data / Parameter</td><td>$NCV_{BR,n,y}$</td></tr>
<tr><td>Data unit</td><td>GJ/tonnes of dry matter</td></tr>
<tr><td>Description</td><td>$NCV_{BR,\ n,y}$ = Net calorific value of biomass residue of category n in year y (GJ/tonne on dry-basis)</td></tr>
<tr><td>Source of data</td><td>On-site measurements</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>The Measurements is carried out at reputed laboratories and according to relevant international standards. Measure the NCV on dry-basis.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>At least once in a year.</td></tr>
<tr><td>Value monitored</td><td>
<table>
<tr><th>Biomass residues category (k)</th><th>Biomass residues type</th><th>Biomass residues source</th><th>NCV
(GJ/ton-dry matter)</th></tr>
<tr><td>1</td><td>Rice Husks</td><td>From Retailers</td><td>2017 – 15.71
2018- 17.1
2019- 19.06
2020- 17.72</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>Not applicable. Net calorific values are measured locally, in reputed laboratories.</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g., values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Ensure that the NCV is determined on the basis of dry biomass.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of Baseline emissions</td></tr>
<tr><td>Calculation method</td><td>N.A.</td></tr>
<tr><td>Comments</td><td>Data is kept electronically.</td></tr>
</table>

Data / Parameter	$h_{LOW,y}$

	$h_{HIGH,y}$
Data unit	GJ/tonnes
Description	$h_{LOW,y}$ = Specific enthalpy of the heat carrier at the process heat demand side (GJ/tonnes) $h_{HIGH,y}$ = Specific enthalpy of the heat carrier at the heat generator side (GJ/tonnes)
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	The specific enthalpies should be determined based on the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.
Frequency of monitoring/recording	Determined ex-ante according to project configuration.
Value monitored	$h_{LOW,y}$ = 3.22 (GJ/Year) $h_{MEDIUM,y}$ = 3.39 (GJ/Year)
Monitoring equipment	Calculated
QA/QC procedures to be applied	Determined ex-ante according to project configuration.
Purpose of the data	Calculation of Baseline emissions
Calculation method	Based on Flow, Pressure, Temperature, and Enthalpy of Feed Water.
Comments	The process heat demand side refers to where heat is finally used for heating purposes by end-users and the heat generator side refers to where heat is generated

Data / Parameter	Moisture content of the biomass residues
Data unit	% Water content in mass basis in wet biomass residues
Description	Moisture content of each biomass residues type *k*
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	The biomass residue moisture content are monitored and registered by taking periodic samples from each biomass type flow to the power boiler. Humidity content are calculated by evaporating the water of the samples and measuring the weight before and after the water has been evaporated. This process are carried out in dedicated scales

Frequency of monitoring/recording	The moisture content should be monitored on a random sample basis to ensure homogeneous quality. The weighted average should be calculated for each monitoring period and used in the calculations. Sample to be taken once every month.
Value monitored	**2017 - 10.85 %** **2018 - 9.69 %** **2019 - 11.27 %** **2020 - 13.77 %**
Monitoring equipment	Not applicable. Moisture content are measured locally, in reputed laboratories.
QA/QC procedures to be applied	Not Applicable
Purpose of the data	Efficiency Measurement
Calculation method	-
Comments	Data are kept electronically.

Data / Parameter	LOC_y
Data unit	Hour
Description	LOC_y = Length of the operational campaign in year *y* (hour)
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	Record and sum the hours of operation of the project activity facilities during year y.
Frequency of monitoring/recording	-
Value monitored	80,814
Monitoring equipment	-
QA/QC procedures to be applied	Not Applicable

Purpose of the data	Calculation of Baseline emissions
Calculation method	-
Comments	This estimation is based on the total available hours per month in a year, considering maintenance outages both for internal and external reasons. As a result, the yearly operating plan considers 30 days of the power plant outage in a year.

Data and parameters monitored from the tool: "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02)

Data / Parameter	$FC_{i,j,y}$
Data unit	Mass or volume unit per year (e.g., ton/yr or m^3/yr)
Description	Quantity of fuel type i combusted in process j during the year y.
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	On-site fossil fuel consumption are calculated in this case.
Frequency of monitoring/recording	Continuously.
Value monitored	• Diesel consumption in the power boiler due to operational reasons: 0 ton/yr. • Diesel consumption of the front-loaders: 0 lt/yr.
Monitoring equipment	NA
QA/QC procedures to be applied	Diesel consumption in the power boiler: The consumption is determined by recording the purchases of diesel and the stock differences in the diesel tank level. Diesel consumption of the front loaders: The calculation is similar to the one described above. However, in this case, the Project Proponent has used the diesel performance index expressed in litres of diesel consumption per hour of operation of the front loader. The Project Proponent choose a conservative diesel performance index for the emission reduction calculation for the period. The total diesel consumption are determined by multiplying the diesel consumption index of the front loader by the total amount of hours of operation of the front loader.

Purpose of the data	Calculation of Project emissions
Calculation method	-
Comments	-

Data / Parameter	$NCV_{i,y}$
Data unit	GJ per mass or volume unit (e.g., GJ/m^3 , GJ/ton)
Description	Weighted average net calorific value of fuel type i in year y.
Source of data	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.
Description of measurement methods and procedures to be applied	Not applicable since the Project Proponent has used option d) (IPCC default values) in this case.
Frequency of monitoring/recording	Any future revision of the IPCC Guidelines should be considered.
Value monitored	Diesel: 43.3 GJ/ton
Monitoring equipment	Not applicable, since the Project Proponent has used option d) (IPCC default values) in this case.
QA/QC procedures to be applied	Not applicable, since the Project Proponent has used option d) (IPCC default values) in this case.
Purpose of the data	Calculation of Project emissions
Calculation method	-
Comments	-

Data / Parameter	$\rho_{i,y}$
Data unit	Weighted average density of fuel type i in year y (Diesel)
Description	Weighted average net calorific value of fuel type i in year y.
Source of data	Bureau of Energy Efficiency, India Standard Value - http://emt-india.com/BEE-Exam/GuideBooks/2Ch1.pdf

Description of measurement methods and procedures to be applied	Not applicable since the Project Proponent has used data in line with national standard.
Frequency of monitoring/recording	Any future revision of the IPCC Guidelines should be considered.
Value monitored	Diesel: 0.87 kg/l
Monitoring equipment	Not applicable since the Project Proponent has used data in line with national standard.
QA/QC procedures to be applied	Not applicable since the Project Proponent has used data in line with national standard.
Purpose of the data	Calculation of Project emissions
Calculation method	-
Comments	-

Data / Parameter	$EF_{CO2,i}$
Data unit	tCO2/GJ
Description	Weighted average CO2 emission factor of fuel type i in year y.
Source of data	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.
Description of measurement methods and procedures to be applied	Not applicable since the Project Proponent has used option d) (IPCC default values) in this case.
Frequency of monitoring/recording	Any future revision of the IPCC Guidelines should be considered.
Value monitored	Diesel: 0.0748 (tCO2/GJ).
Monitoring equipment	Not applicable since the Project Proponent has used option d) (IPCC default values) in this case.
QA/QC procedures to be applied	Not applicable since the Project Proponent has used option d) (IPCC default values) in this case.

Purpose of the data	Calculation of Project emissions
Calculation method	-
Comments	-

Data and parameters monitored from the tool: "Project and leakage emissions from road transportation of freight" (Version 01)

Data / Parameter	$D_{f,m}$
Data unit	Kilometre.
Description	Return Distance between the origin and destination of freight transportation activity f in monitoring period m.
Source of data	Records of vehicle operator and/or records by project participants.
Description of measurement methods and procedures to be applied	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g., on-line sources).
Frequency of monitoring/recording	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g., on-line sources).
Value monitored	480 Km
Monitoring equipment	-
QA/QC procedures to be applied	All the suppliers are within the range of 60 KMs. The declaration from biomass supplier for biomass procurement from the source located within the distance of 60 km from the project facility is submitting along with this submission to the assessment team.
Purpose of the data	Calculations of Project emissions
Calculation method	-
Comments	-

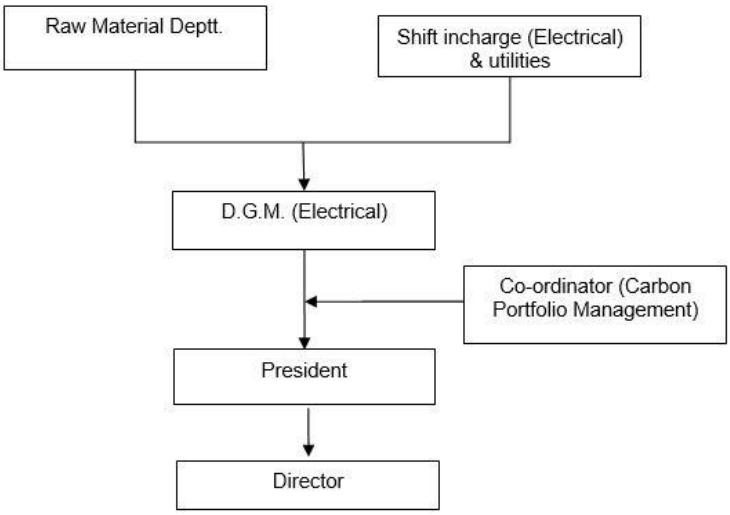
Data / Parameter	$FR_{f,m}$
Data unit	Tonnes

Description	Total mass of freight transported in freight transportation activity f in monitoring period m.
Source of data	Records by project participants.
Description of measurement methods and procedures to be applied	weighbridge
Frequency of monitoring/recording	Continuously
Value monitored	619,257 Tonnes
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculations of Project emissions
Calculation method	Biomass residues from third parties are measured (weighted) using dedicated weighbridges at the entrance of the biomass power plant.
Comments	-

4.3 Monitoring Plan

The purpose of the monitoring plan is to build an internal standard and guidance for using exact and conservative data in emission reduction calculation.

The project proponent has proposed the following operational and maintenance structure for the proposed VCS project activity.



The table below shows the roles and responsibilities and the information flow for the project activity data.

Personnel	Responsibility
Raw Material Dept.	• Continuous monitoring of biomass procurement for project activity. • Continuous supply of biomass to meet the daily requirement without any shortage.
Shift Incharge (Electrical Utility)	• Monitoring the plant parameters including the monitoring parameters as described in the VCS PD. • Collecting the data recorded in log sheets of respective sections
D.G.M (Electrical)	• Responsible for the overall plant performance and electricity generation of the power plant. • Cross check and sign the daily plant operation report regularly and report to Vice-President for any abnormality. • Should look after the periodical tests of the monitoring equipment's as per the monitoring plan. • Responsible for the storage and archiving of information in good condition. • Co-ordinate to obtain audit reports as per the monitoring plan from internal auditors.

VCS co-ordinator (Carbon Portfolio Management)	• Responsible for overall VCS activities and proper monitoring of data as mentioned in monitoring plan. • He is reporting to President & has to look after the VCS validation / verification process for the project activity.
President	• Responsible for the total monitoring plan. • Examining the reports generated by Plant Manager with reference to the monthly electricity generated; steam generated; electricity and steam consumption in process plant and annual emission reduction calculations as per the monitoring plan. • Examining the internal audit reports prepared by Plant Manager and take corrective actions in case of any deviations/errors.
Director	• Managing Director review the reports regularly and take necessary corrective action conforming to VCS.

Data Collection and Archiving:

The monthly data of electricity generation, steam generation, electricity and steam consumption in process plant, fuel consumption are collected in both logbook and electronic form. However, the data in electronic form is archived throughout the lifetime of the project. The electricity records are maintained regularly by the team at the site. Other data variables that are most directly related to the emission reductions are collected and archived electronically. The archived data will be kept for 2 years beyond the Crediting Period.

Monitoring Report:

Every year the project promoter is prepare a monitoring report showing all emission reduction calculations as per monitoring plan**.**

The monitoring report are compiled annually. This report contains:

- A summary of the emission reductions achieved.
- Data of the electricity generated and other data variables that are most directly related to the emission reductions in the Project activity.
- The required records of calibration and maintenance of measuring devices. It is submitted

at the end of each monitoring period.

- The consistency of metered electricity generation is cross-checked with the quantity of fuel fired. For more details, please refer calculation sheet.

Trainings

Prior to the commissioning of the Project, the manager of production department has organized the training to the monitoring staff in charge of executing the monitoring plan, with the training contents including routine operation, maintenance and safety issues; the carbon project manager of the project owner has provided training to the staff on basic concepts and operation modality of VCS, methods of data monitoring and archiving for VCS projects, quality control and quality assurance of monitoring, and preparation and improvement of key documents of monitoring and verification. Training records have been well kept.

QA/QC procedure

The project participant has established relevant QA/QC procedures to ensure project's implementation and monitoring in an accurate, transparent and conservative manner according to the registered monitoring plan. First, the PP has organized relevant trainings prior to the commissioning of the project (e.g., project operation and maintenance trainings, and trainings for data recording and management) for monitoring staff to ensure that every monitoring staff is capable of taking their responsibilities. Second, all of monitoring equipment have met the required accuracy standard and have been calibrated by qualified calibration entity to ensure that all monitoring data are accurate. All calibration certificates have been provided to DOE for the purpose of verification. Third, all collected data has been crosschecked and well documented, and all information can be tracked from the primary source to the end-data calculation in paper document.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Determine total baseline electricity generation

According to ACM0006, the amount of electricity that would be generated in the baseline in year y is calculated as follows:

$$EL_{BL,y} = EL_{PJ,gross,y} + EL_{PJ,imp\ y,} - EL_{PJ,aux,y}$$

Where:

$EL_{BL,y}$ = Baseline electricity generation in year y (MWh)

$EL_{PJ,gross,y}$ = Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year y (MWh)

$EL_{PJ,imp,y}$ = Project electricity imports from the grid in year y (MWh)

$EL_{PJ,aux,y}$ = Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh)

y = Year of the crediting period

Therefore, baseline emissions during monitoring period are calculated as below:

Data:	**Value**	
No. of Days	1204.00	Days
Total no. of Working Hours	80,814	Hours
Power Plants which are located at the project site and included in the project boundary in year y	5.0	MW
	5.0	MW
	12.5	MW
	10.5	MW
	14.0	MW
$EL_{PJ,gross,y}$: Total gross energy per year	512,107	MWh
Auxiliary electricity consumption	10%	
$EL_{PJ,aux,y}$ = Auxiliary electricity consumption per year	51,211	MWh/year
$EL_{PJ,imp,y}$: Electricity Imports	8,051	MWh

$EL_{BL,y}$ Baseline electricity generation in year y (MWh)	**468,947 MWh**

	$EL_{BL,y}$ Baseline electricity generation in year y (MWh)	
2017		**33,850**
2018		**139,864**
2019		**153,058**
2020		**142,175**
Total		**468,947**

Determine baseline capacity of electricity generation

The total capacity of electricity generation available in the baseline is to be calculated using the equation below. The heat engines i and j should be obtained from the baseline scenario identified using the "Selection of the baseline scenario and demonstration of additionality " and the load factors should take into account seasonal operational constrain as well as other technical constraints in the system (e.g., availability of heat to drive heat engines).

$$CAP_{EG,total,y} = LOC_y \cdot \left[\sum_i \left(CAP_{EG,CG,i} \cdot LFC_{EG,CG,i} \right) + \sum_j \left(CAP_{EG,PO,j} \cdot LFC_{EG,PO,j} \right) \right]$$

Where,

$CAP_{EG,total,y}$ - Baseline electricity generation capacity in year *y* (MWh)

$CAP_{EG,CG,I}$ - Baseline electricity generation capacity of heat engine *i* (MW)

$CAP_{EG,PO,j}$ - Baseline electricity generation capacity of heat engine *j* (MW)

$LF_{CEG,CG,I}$ - Baseline load factor of heat engine *i* (ratio)

$LF_{CEG,PO,j}$ - Baseline load factor of heat engine *j* (ratio)

LOCy - Length of the operational campaign in year *y* (hour)

I - Cogeneration-type heat engine in the baseline scenario

J - Power-only-type heat engine in the baseline scenario

Y - Year of the crediting period

Therefore, baseline emissions during monitoring period are calculated as below:

Data:	**Value**	
LOC_y: Length of the operational campaign in year y (hour)	80,814	hours
$CAP_{EG,CG,1}$ Baseline electricity generation capacity of heat engine 1 (Turbine 1)	5.0	MW
$CAP_{EG,CG,2}$ Baseline electricity generation capacity of heat engine 2 (Turbine 2)	5.0	MW
$CAP_{EG,CG,3}$ Baseline electricity generation capacity of heat engine 4 (Turbine 4)	12.5	MW
$CAP_{EG,CG,1,2,3}$	22.5	MW
$LFC_{EG,CG,1}$ = Baseline load factor of heat engine 1 (Turbine 1)	0.46	
$LFC_{EG,CG,2}$ = Baseline load factor of heat engine 2 (Turbine 2)	0.44	
$LFC_{EG,CG,3}$ = Baseline load factor of heat engine 3 (Turbine 3)	0.64	
$CAP_{EG,PO,1,2,3}$	0.0	MW
$LFC_{EG,PO,j}$ = Baseline load factor	1	
$EL_{BR,CG,x,i}$ = Quantity of electricity generated in heat engine i in year x (MWh) in Cogeneration-mode according to Base line configuration	276,792	MWh
$EL_{BR,PO,x,j}$ = Quantity of electricity generated in heat engine j in year x (MWh) in Power only mode according to Base line configuration	0	MWh
$CAP_{EG,total,y}$	276,792	MWh

	$CAP_{EG,total,y}$	
2017		**20,186**
2018		**85,764**
2019		**88,443**
2020		**82,399**
Total		**276,792**

Determine the baseline availability of biomass residues

Where the baseline scenario includes the use of rice husk for the generation of power and/or heat, the amount of rice husk that would be available in the baseline in year *y* ($BR_{B4,n,y}$) has to be determined.

The determination of this parameter is based on the monitored amounts of biomass residues used for power and/or heat generation in the project.

	$BR_{B4,n,y}$ (Tones)
15-Sep-17 : 31-Dec-17	44,406
01-Jan-18 : 31-Dec-18	187,039
01-Jan-19 : 31-Dec-19	194,685
01-Jan-20 : 31-Dec-20	193,127
Total	**619,257**

Determine the efficiencies of heat generators, and efficiencies and heat-to-power ratio of heat engines

The values under this step are ex-ante and hence the values are same as in the registered PD.

Determine the emission factor of on-site electricity generation with fossil fuels

As no fossil fuel-based power generation was identified as part of the baseline scenario, therefore, as per ACM0006, $EF_{EG,FF,y} = EF_{EG,GR,y}$.

Determination of the emission factor of grid electricity generation

The value is fixed ex-ante.

$EF_{EG,GR,y}$ = 0.9127 tCO_2/MWh
Kindly refer to registered PD for detailed calculation.

Determine the minimum baseline electricity generation in the grid

The calculation of the minimum amount of electricity that would be generated in the grid in the baseline assumes that the amount of electricity generated on-site in the baseline cannot be higher than the installed capacity of power generation available in the baseline scenario. Therefore, the following equation should be used:

$$\mathrm{EL}_{\mathrm{BL,GR,y}} = \max\left(0, EL_{BL,y} - CAP_{EG,total,y}\right)$$

Data:	Value	
$EL_{BL,y}$ = Baseline electricity generation in year y (MWh)	468,947	MWh
$CAP_{EG,total,y}$ = baseline electricity generation capacity in year y (MWh)	276,792	MWh
$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year y (MWh)	**192,155**	**MWh**

	$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year y (MWh)
2017	**13,665**
2018	**54,100**
2019	**64,615**
2020	**59,775**
Total	**192,155**

Baseline emissions during monitoring period

$$BE_y = EL_{BL,GR,y} \cdot EF_{EG,GR,y} + EL_{BL,FF/GR,y} \cdot \min(EF_{EG,GR,y}, EF_{EG,FF,y})$$

Where,

$EL_{BL,GR,y}$ - Baseline minimum electricity generation in the grid in year *y* (MWh)

$EL_{BL,y}$ - Baseline electricity generation in year *y* (MWh)

$CAP_{EG,total,y}$ - Baseline electricity generation capacity in year *y* (MWh)

Y - Year of the crediting period

Total Baseline Emissions (tCO_2)	175,380	(tCO2e)
$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year y (MWh)	192,155	MWh
$EF_{EG,GR,y}$ = Emission factor of grid electricity generation - for first year	0.91270	tCO_2/MWh
$EL_{BL,FF/GR,y}$ = Baseline uncertain electricity generation in the grid or on-site in year y (MWh)	0	MWh

$EF_{EG,FF,y}$ = CO_2 emission factor for electricity generation with fossil fuels at the project site in the baseline in year y (tCO2/MWh)	0.00000	tCO_2/MWh
Then Min($EF_{EG,GR,y}$, $E_{FEG,FF,y}$) =	0.00000	tCO_2/MWh

	Total Baseline Emissions (tCO_2)	
2017		**12,472**
2018		**49,377**
2019		**58,974**
2020		**54,557**
Total		**175,380**

5.2 Project Emissions

The following equation is used to calculate the total project emissions of the project for the purpose of determining GHG emissions of the project activity, project participant include the following emissions sources:

$$PE_y = PE_{FF,y} + PE_{GR\ 1,\ y} + PE_{\ GR2,\ y} + PE_{TR,y} + PE_{\ BR,y} + PE_{\ WW,y} + PE_{BG2\ ,\ y} + PE_{BC,\ y}$$

Where:

PE_y = Project emission in year y (tCO2e)

$PE_{FF,y}$ = Emissions during the year y due to fossil fuel consumption at the project site (tCO2e)

$PE_{GR1,y}$ = Emissions during the year y due to grid electricity imports to the project site (tCO2e)

$PE_{GR2,y}$ = Emissions due to a reduction in electricity generation at the project site as compared to the baseline scenario in year y (tCO2e)

$PE_{TR,y}$ = Emissions during the year y due to transport of biomass to the project plant (tCO2e)

$PE_{BR,y}$ = Emissions from the combustion of biomass during the year y (tCO2e)

$PE_{WW,y}$ = Emissions from wastewater generated from the treatment of biomass in year y (tCO2e)

$PE_{BG2,y}$ = Emissions from the production of biogas in year y (tCO2e)

$PE_{BC,y}$ = Project emissions associated with the cultivation of land to produce biomass year y (tCO2e)

Project Emissions during monitoring period: -

Project Emission Calculation	2017	2018	2019	2020
Amount of biomass procured from Other Suppliers, (FRF,m), MT	44,406	187,039	194,685	193,127
Return Trip Distance (Df,m), KM	120	120	120	120
(EFCO2,f), gCO2/t km (From Tool)	245	245	245	245
$PE_{TR,y}$	1,306	5,499	5,723	5,678
Total Project Emissions (tCO_2e)	**18,206**			

5.3 Leakage

As per methodology ACM0006, the most likely baseline scenario is that the biomass residues are dumped or left to decay without utilizing them for energy purposes, the leakage of the project activity 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)
2017(15/09/2017 to 31/12/2017)	12,472	1,306	0	11,166
2018(01/01/2018 to 31/12/2018)	49,377	5,499	0	43,878
2019(01/01/2019 to 31/12/2019)	58,974	5,723	0	53,251

2020(01/01/2020 to 31/12/2020)	54,557	5,678	0	48,879
Total	**175,380**	**18,206**	**0**	**157,174**

It is to be noted here that as per the estimated emission reduction from the project activity for the current monitoring period is 688,137 tCO_2e, whereas actual emission reductions achieved is 157,174 tCO_2e, which is approximately 77 % 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. Also, during the current monitoring period global pandemic COVID-19 come out as a major hurdle for stopping the operation. Also, the second phase of project activity was commissioned (22/12/2020) under current monitoring period which include very small-time frame i.e., 22/12/2020 to 31/12/2020. Furthermore, the estimated emission reduction was calculated on the total capacity (Phase 1 - 10.45 MW + Phase – 2 -14 MW) of the project activity. Thus, the difference in the generation during the current verification period is hence due to certain conditions which are beyond PP control.

APPENDIX 1: <CALIBRATION DETAILS>

Weighbridge Meter details :-

Weighbridge Meter Details		Calibration date	Calibration due date
	NAWI -Digital Scale		20/05/2021
Max Capacity	60000 kg	24/05/2017	
Make	Leotronic Scales(P) Ltd	24/05/2018	
Model No	FSD-501, Class III	20/05/2019	
Minimum Capacity	200 kg	20/05/2020	
Sr. No	610002		

Electricity Meter details:-

Gross Electricity generation

Turbine No	Sr. No	Make	Accuracy	Calibration date	Calibration due date
TG 1	**126221/25231**	Conzerv	+/-1.0 %	20/01/2016	19/01/2021
TG 2	**72074/8373**	Conzerv	+/-1.0 %	20/01/2016	19/01/2021
TG 4	**34121430685**	Schenider	+/-1.0 %	20/01/2016	19/01/2021
TG 5	**MC 7351/3/2/17**	Mehru	0.2 sec	22/12/2020	21/12/2025

Auxiliary consumption :-

Turbine No	Sr. No	Make	Accuracy	Calibration date	Calibration due date
TG 1	**110255/19607**	Conzerv	+/-1.0 %	20/01/2016	19/01/2021
TG 2	**156228/32602-3008**	Conzerv	+/-1.0 %	20/01/2016	19/01/2021
TG 4	**213447/18720-2311**	Schenider	+/-1.0 %	20/01/2016	19/01/2021
TG 5	**PBB50238**	Secure	0.2 sec	22/12/2020	21/12/2025