24.45 MW BIOMASS BASED PROJECT IN PUNJAB

Document Prepared By Infinite Solutions

Project Title	24.45 MW Biomass based project in Punjab
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The project activity is located in Satia Industries Limited (SIL), one of the leading paper mill in India. It is situated in District - Muktsar, State – Punjab. The project is a biomass utilization project that is to use rice husk for simultaneous generation of thermal and electrical energy in a cogeneration unit. The project is a cogeneration unit in two phases with 125 TPH (50 TPH +75 TPH) biomass-based boilers 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 project activity involves installation of new cogeneration units consisting of a 125 TPH (50 TPH +75 TPH) boiler and a 24.45 MW (10.45+14) steam turbine in existing facility to generate both steam and power.

In the pre-project scenario, the SIL had paper production installed capacity of the plant would be 300 MT per day and total process steam and electricity requirement would be around 11.75TJ/day and 488 MWh/day. To fulfil the additional requirement the project activity, which is a co-generation plant with 125 TPH (50 TPH +75 TPH) AFBC rice husk combustion boiler and 24.45 (10.45+14) MW) steam turbine was proposed. The project activity would consume 326,557 tonnes of rice husk per year and is expected to generate around 1,180 TJ/annum of process steam and 371844 MWh/annum of electricity. The primary objective of the Project Proponent (PP) is to generate process steam and electricity for the increase capacity of the paper production plant and to reduce dependency on grid electricity. Below is the comparison of pre-project and post project scenario at SIL.

Parameter	Unit	Pre Project	Due to Capacity Expansion Project Activity	Total (Post Project)
Capacity of Plant	TPD	300	385	685
Process Heat Requirement	TJ/Day	11.75	8.01	19.76
Electricity Requirement	MWh/day	488	530	1018
Combined Boiler Production Capacity	TPH	190	125 (50+75)	315

Before project activity the total electricity requirement was 488 MWh/day or 178,200 MWh/year. Before project activity, the total installed capacity of turbine was 22.5 MW.

After project activity the total electricity requirement would be 1018 MWh/day or 371,844 MWh/year. Out of which 178,200 MWh/year (22.5 MW) would be supplied from old turbines and 193,644 MWh/year (24.45 MW) would be supplied from project activity.

The project activity is commissioned on 15/09/2017 (10.45 MW) and started to generate steam and power while the remaining 14 MW is proposed to commissioned in 2020. In the project activity, rice husk is used as fuel in the biomass-based cogeneration plant for simultaneous production of steam and electricity generation. Even though SIL has cheaper and reliable options such as fossil fuel-based cogeneration plant to produce steam and power, SIL decided to take up the project activity only after considering carbon credit benefits extended for such green energy projects under Kyoto Protocol. They also have a project of 12.5 MW capacity registered in VCS.

Baseline Scenario:

Prior to the implementation of project, the capacity of plant was 300 TPD. 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.

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
Methodology : ACM0006: Electricity and heat generation from biomass --- Version 14.0, Sectoral Scope: 01, EB 101, Annex 9[1]

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	Vill.Rupana,Muktsar-Malout road, Muktsar, Punjab – 152206, India
Telephone	+91-163-3262215,262001,263585
Email	satiapaper@gmail.com

1.4 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the project	Project Consultant
Contact person	Ms. Richa Thakur
Title	Project Manager
Address	611, Chetak Centre Main, 12/2 RNT Marg, Indore- 452001
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[1] https://cdm.unfccc.int/UserManagement/FileStorage/58IAGB7SZUDEO2VN6LYM30K41HFPRQ

1.5 Project Start Date

Project Start Date: 15-Sept-2017;
The project start date is the earliest commissioning date of the turbine for 10.45 MW.

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 Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	
Large project	√

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	208,613
Year 2	208,613
Year 3	208,613
Year 4	208,613
Year 5	208,613
Year 6	208,613
Year 7	208,613
Year 8	208,613
Year 9	208,613
Year 10	208,613
Total estimated ERs	2,086,130
Total number of crediting years	10
Average annual ERs	208,613

1.8 Description of the Project Activity

Description of project activity

The need of project activity was because of capacity expansion of paper mill from 300 TPD to 685 TPD. The Boilers and TG sets before project activity were not enough to meet the demand after capacity expansion. Hence, there was a need of a new cogeneration plant to meet the process steam and electricity requirement because of expansion of project.

Due to capacity expansion, the additional process heat requirement was of 8 TJ/day and additional electricity requirement was of 530 MWh/day.

To meet up the complete demand after capacity expansion and to remove dependency from grid, SIL decided to install a new co-generation units in phases.

Description of technology/measure employed:

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.

The detailed specifications of Boiler and TG are as below:

Specification of Boiler

S. No.	Specification	Phase 1	Phase 2	Unit	Source
1	Type - Natural circulation, Single drum, Water tube, AFBC boiler.	-		-	As per offer from Cheema Boilers Limited
2	Design steam generation capacity at MCR	50	75	TPH	As per offer from Cheema Boilers Limited
3	Steam Pressure	67	67	Kg/cm^2	As per offer from Cheema Boilers Limited
4	Steam Temperature	495 ± 5	495 ± 5	°C	As per offer from Cheema Boilers Limited
5	Make– Cheema Boiler Limited Design Code - IBR 1950	-	-	-	As per offer from Cheema Boilers Limited
6	Fuel - 100 % Rice husk. - 80% Rice Husk with 20% coal	-	-	-	As per offer from Cheema Boilers Limited
7	Economiser water inlet temp	105	105	°C	As per offer from Cheema Boilers Limited
8	Efficiency	78 ± 2	78 ± 2	%	As per offer from Cheema Boilers Limited
9	Operational Life Time	30	30	Years	As per offer from Cheema Boilers Limited

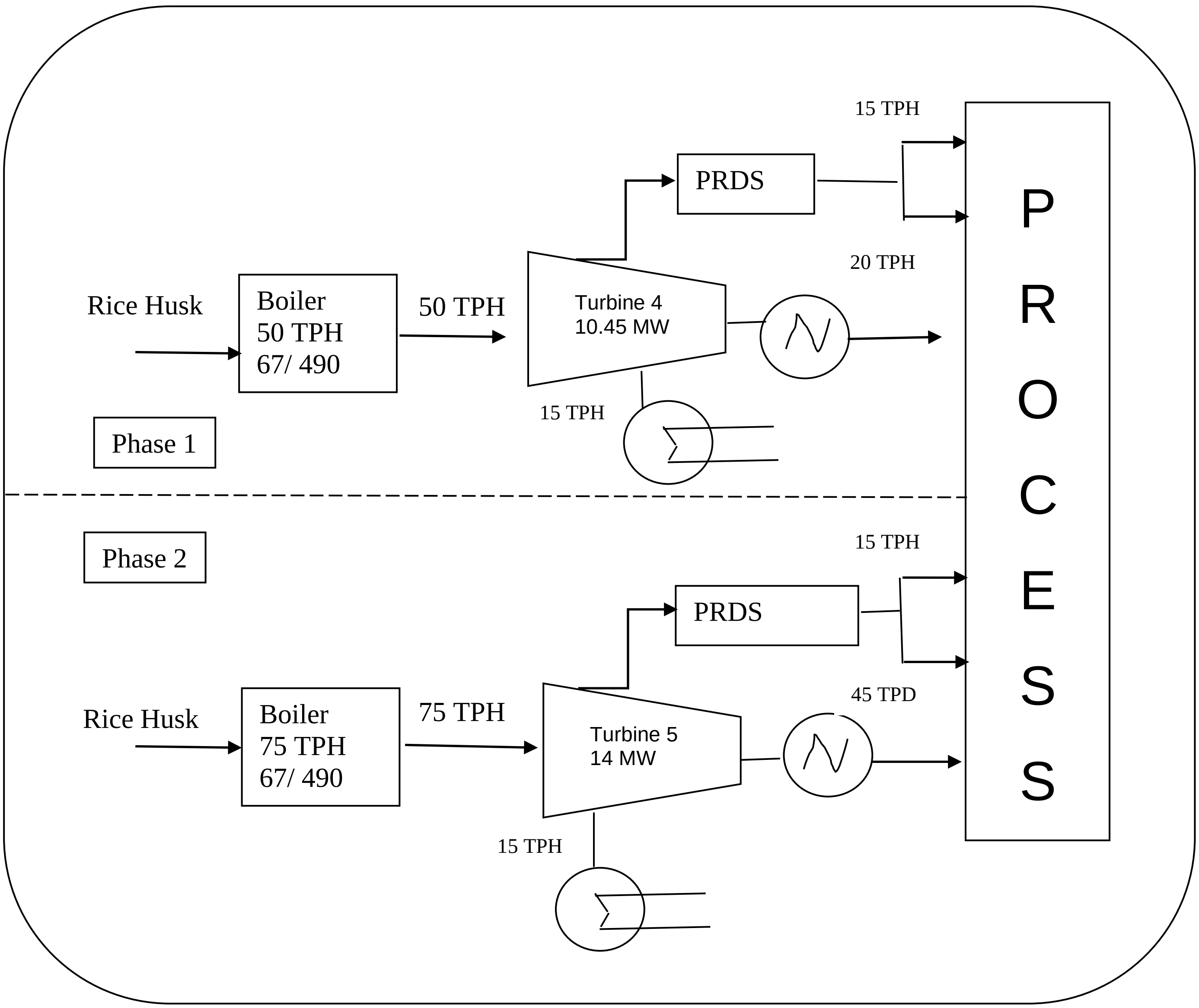
10	Load Factor	80	80	%	Conservative

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[2]	20[3]	Years

[2]Default Factor used as per “Tool to determine the remaining lifetime of equipment” version 1.0, EB 50, annex 15

[3]Default Factor used as per “Tool to determine the remaining lifetime of equipment” version 1.0, EB 50, annex 15



<u>Line diagram of project activity:</u>

How the same types and levels of services provided by the project would have been provided in the baseline scenario:

The same type of levels of services (1. heat/steam and 2. electricity) provided by the project would have been provided in the baseline scenario from two different sources. The heat/steam demand would be fulfilled from biomass based boilers and electricity would be purchased from grid. The detailed description is given below in section 2.4 and 2.5.

List of facilities, systems and equipment in operation under the existing scenario prior to the implementation of the project:

Boilers:

1. Boiler No. 1: 45 TPH - 42 kg/cm^2
2. Recovery Boiler No. 2: 20 TPH - 42 kg/cm^2
3. Recovery Boiler No. 3: 50 TPH - 67 kg/cm^2

Turbines: Installed turbines to meet power generation

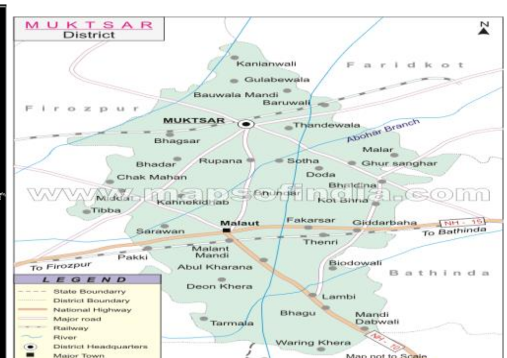
1. TG 1: Condensing Turbine – 5 MW
2. TG 2: Back Pressure Turbine – 5 MW
3. TG 3: Bleed Condensing Turbine – 12.5 MW

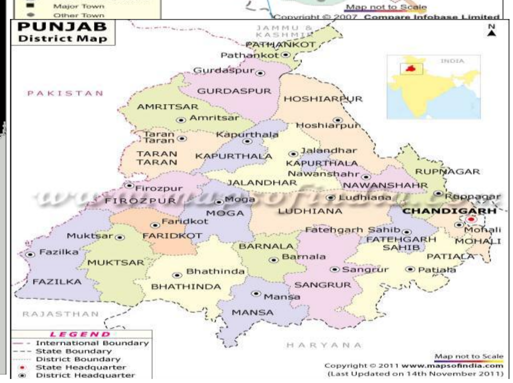
How project will achieve net GHG emission reductions or removals:

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. 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.

1.9 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:





1.10 Conditions Prior to Project Initiation

Prior to the project initiation are as follow:

1. Capacity of paper production of plant – 385 TPD
2. Process steam requirement – 11.75 TJ/day;
3. Electricity requirement – 488 MWh/day.
4. Boilers:
   4.1 Boiler No. 1: 45 TPH - 42 kg/cm2

   4.2 Recovery Boiler No. 2: 20 TPH - 42 kg/cm2

   4.3 Recovery Boiler No. 3: 50 TPH - 67 kg/cm2

   4.4 Boiler No 4 : 75 TPH - 67 kg/cm2

The total production of capacity from Boiler was 190 TPH/day.

5. Turbines:
   a. TG 1: Condensing Turbine – 5 MW
   b. TG 2: Back Pressure Turbine – 5 MW
   c. TG 3: Bleed Condensing Turbine – 12.5 MW

Requirement of expansion:

SIL had decided to expand the production capacity from 300 TPD to 685TPD in view the constant pressure of market forces, technological changes and environmental issues. The expansion from 385 TPD was not small, it was a major expansion. Due to capacity expansion, the additional demand for steam would be approx. 125 TPH and the additional demand for electricity would be 530 MWh/day which is more than double the present capacity. Turbine of 10.45 MW capacity is installed under phase 1 while 14 MW Turbine shall be installed in phase 2 of the project to meet the expansion requirements.

With the boilers and turbines available with the company prior to project initiation, the company could not meet the additional demand of steam of electricity due to design constraints. As mentioned above that prior to project the company was hardly meeting its steam requirement from existing system. The rest of electricity was purchased from grid.

So, to meet the additional requirement of heat and electricity and also to reduce dependency on grid the company had decided to install a new co-generation plant in phases.

The project has not been implemented to generate GHG emission for the purpose of their subsequent reduction, removal or destruction, but it was the strong need of the company to meet the steam and power requirement of the plant to achieve the production goal.

Baseline Scenario

In this project, the baseline scenario is different from pre project scenario. The baseline scenario for the project activity is:

- Steam would be generated from Biomass based boilers and;
- Electricity would be purchased from grid.

The detailed description of identifying the Baseline project activity is described below in section 2.4 and 2.5.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

In India, the Central Pollution Control Board (CPCB) provides the regulations for paper plants in the form of "Corporate Responsibility for Environmental Protection" (CREP) for agro-based industries including Pulp & Paper Mills.
(http://www.cpcb.nic.in/divisionsofheadoffice/pci3/pciiiidivrivision.pdf)

The project activity is consistent with the CREP and other applicable laws and regulations.

The project activity meets all local laws and regulation of India. All necessary NOCs, commissioning certificates, loan approval documents have been submitted to DOE.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

The ownership of the Project and its right to use is completely entrusted to SIL which can be verified by the Purchase orders for the project equipment along with necessary approvals.

1.12.2 Emissions Trading Programs and Other Binding Limits

The project proponent is not part of any emission trading program. SIL 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.

1.12.3 Other Forms of Environmental Credit

The project proponent hereby confirms that the credits from VCS/IREC mechanism would be claimed in either of the mechanism for a given monitoring period, the phase 1 of the project is registered in IREC mechanism.

1.12.4 Participation under Other GHG Programs

The Project has not participated in any other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

The Project is not rejected by other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

This is not a grouped project activity. Thus, this section is not applicable for this project

Leakage Management

Project does not involve any leakage emissions other than methodology requirement for Biomass power project. Hence there are no any extra Leakage Management Plan and risk mitigation measures are required.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description

Sustainable Development

Legislative:

The project participants obtained all clearances from stakeholders hence no legal risks are anticipated.

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. By building and operating the Hydro power project, much pollution is avoided. In the absence of the project activity, equivalent power 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 will be transmitted at high voltage to ensure low losses. Moreover, the technology being used is well established, most updated and environmentally safe.

Further Information

There are no information or incidents that will have bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

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, Annex8
https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v4.pdf

2.2 Applicability of Methodology

The following steps will show the applicability of the project under this methodology

Applicability Criterion (with Para number reference)		Project Case
1.	This methodology is applicable to project activities that operate biomass-residue (co-)fired power-and-heat plants.	Applicable. The project activity uses rice husk for the generation of steam and electricity. In the absence of the project activity, the steam and electricity would be generated from biomass-based boilers. The main intention of use of biomass in the aforesaid project activity is to displace the requirement on grid electricity by electricity generation from biomass-based system.
2.	The project activity may include the following activities or, where applicable, combinations of these activities: • The installation of new plants at a site where currently no power and heat generation occurs (Greenfield projects); • The installation of new plants at a site where currently power or heat generation occurs. The new plant replaces or is operated next to existing plants (capacity expansion projects); • The improvement of energy efficiency of existing plants (energy efficiency improvement projects), which can also lead to a capacity expansion, e.g. by retrofitting	Applicable. The project activity involves the installation of a new plant at a site where power or heat generation was occurring. The new plant is operated next to existing plants (capacity expansion project). The expansion from 300 TPD to 685 TPD of paper production was planned by SIL to meet the growing demand of product in the market.

	the existing plant; • The total or partial replacement of fossil fuels by biomass residues in existing plants or in new plants that would have been built in the absence of the project (fuel switch projects), e.g. by increasing the share of biomass residues use as compared to the baseline, by retrofitting an existing plant to use biomass residues, etc.	
3.	Biomass used by the project facility is limited to biomass residues, biogas, RDF and/or biomass from dedicated plantations;	**Applicable**. The project will only use rice husk as the fuel for power and heat generation. No other biomass types than biomass residues are used in the project plant.
4.	Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired does not exceed 80% of the total fuel fired on an energy basis.	**Applicable.** There is no fossil fuel co-fired in the Project
5.	For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;	**Not Applicable.** The biomass residues used by the Project are by-products from local agriculture activities. No biomass residue from production process is involved in the Project, so the condition presented above is not applicable for the proposed project activity;
6.	The biomass used by the project facility is not stored for more than one year.	**Applicable.** The project activity would require 246,767 tonnes of rice husk per year. The storage capacity designed for the project can only hold 30 - 45 days of quantity of rice husk supply.
7.	The biomass used by the project facility is not processed chemically or biologically (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemical degradation, etc.) prior to combustion. Thermal degradation, drying and mechanical processing, such as shredding and palletisation, are allowed.	**Applicable.** The biomass residues used by the project proponent is rice husk which does not require any chemical pre-processing before combustion as fuel.
8	In the case of fuel switch project activities, the use of biomass residues or the increase in the use of biomass residues as compared to the baseline scenario is technically not possible at the project site without a capital investment in: • The retrofit or replacement of existing heat generators/boilers; or • The installation of new heat generators/boilers; or • A new dedicated biomass residues supply chain established for the purpose of the project (e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes); or • Equipment for preparation and feeding of biomass	**Not Applicable**. This project is not a fuel switch project activity.

	residues	
9	If biogas is used for power and/or heat generation, the biogas must be generated by anaerobic digestion of wastewater, and: • If the wastewater generation source is registered as a CDM project activity, the details of the wastewater project shall be included in the PDD, and emission reductions from biogas energy generation are claimed using this methodology • If the wastewater source is not a CDM project, the amount of biogas does not exceed 50% of the total fuel fired on energy basis.	**Not Applicable.** No biogas is used in power and/or heat generation.
10	In the case biomass from dedicated plantations are used, the applicability conditions of the methodological tool "Project and leakage emissions from biomass" apply.	**Not Applicable**. The rice husk, project activity uses is not from dedicated plantations
11	Finally, the methodology is only applicable if the most plausible baseline scenario, as identified per the "Selection of the baseline scenario and demonstration of additionality" section hereunder, is: a. For power generation: Scenarios P2 to P7, or a combination of any of those scenarios; b. For heat generation: Scenarios H2: to H7: or a combination of any of those scenarios; c. If some of the heat generated by the CDM project activity is converted to mechanical power through steam turbines, for mechanical power generation: Scenarios M2 to M5: • In the case of M2 and M3, if the steam turbine(s) are used for mechanical power in the project, the turbine(s) used in the baseline shall be at least as efficient as the steam turbine(s) used for mechanical power in the project; • In the case of M4 and M5, steam turbine(s) for mechanical power are not allowed for the same purpose in the project. For biomass residue use: Scenarios B1: to B8:, or any combination of those scenarios. For scenarios B5: to B8:, leakage emissions should be accounted for as per the procedures of the methodology. For the land use of the plantation area: Scenario L1 is the baseline.	The baseline scenario identified for the project is: a. Power: P7 b. Heat: H5 c. Mechanical Power - The heat generated by the project activity is not converted into mechanical power. Hence not applicable. Biomass: B1 and B4. The project does not involve biomass sourced from dedicated plantation hence not applicable. Biomass is not used from dedicated plantation area. Hence L1 is not required As the identified baseline scenarios for Power, Heat and Biomass is permitted, the application of the methodology is justified.

2.3 Project Boundary

According to the methodology, the project boundary is shown in as below:

According to the ACM0006 (Version 12.1.1), the Project Proponent must provide an explanation in the project document of the specific situation of the project activity. This information is provided in the tables below:

For each plant generating power and/or heat that has been operated at the project site within the most recent three years prior to the start of the project activity:	
Type and capacity of the heat generators:	Heat Generators (Boilers) Baseline 1. Boiler No. 1: 45 TPH - 42 kg/cm2 2. Recovery Boiler No. 2: 20 TPH - 42 kg/cm2 3. Recovery Boiler No. 3: 50 TPH - 67 kg/cm2 4. Boiler No 4 : 75 TPH - 67 kg/cm2 Project 5. Boiler No 5: 50 TPH - 67 kg/cm2 6. Boiler No 6 : 75 TPH - 67 kg/cm2
The types and quantities of fuels which have been used in the heat generators:	Type of Fuels – Rice Husk Quantity of Fuels – 161,764 Tonnes/year (Maximum in Baseline) and Quantity of Fuels in Project – 246,767 tonnes/year
The type and capacity of heat engines	Heat Engines (Turbines) Baseline: 1. TG 1: Condensing Turbine – 5 MW 2. TG 2: Back Pressure Turbine – 5 MW 3. TG 3: Bleed Condensing Turbine – 12.5 MW5. Project: 4. TG 4 – Bleed Condensing – 10.45 MW 5. TG 5 –Condensing Turbine – 14 MW
Whether the equipment continues operation after the start of the VCS project activity;	Yes

For each plant generating power and/or heat installed under the project activity:	
Type and capacity of the heat generators:	Heat Generators (Boilers) Project 1. Boiler No 5: 50 TPH - 67 kg/cm2 2. Boiler No 6 : 75 TPH - 67 kg/cm2
The types and quantities of fuels which have been used in the heat generators:	Type of Fuels – Rice Husk Quantity of Fuels – 246,767 tonnes/year
The type and capacity of heat engines	Heat Engines (Turbines) Project: 1. TG 4 – Bleed Condensing – 10.45 MW 2. TG 5 –Condensing Turbine – 14 MW
Direct heat extractions	Not applicable

For each plant generating power and/or heat that would be installed in the absence of the project activity:	
The type and capacity of the plant, including the type and capacity of the heat generators	Heat Generators (Boilers) Project 1. Boiler No 5: 40 TPH - 67 kg/cm2 2. Boiler No 6: 65 TPH - 67 kg/cm2

Heat engines and electric power generators used:	There would be not heat engines (turbine) in this case. Electricity would be procured from grid.
The types and quantities of fuels which would be used in each heat generator	Type: Rice Husk Quantity: 187,543 tonnes/year

The average amounts of electricity and heat import from off-site sources that would happen in the absence of the project activity on a yearly basis and the forecast for the project scenario:	
Average amount of electricity and heat import from off-site sources in the absence of the project activity:	Electricity imports: 193,644 MWh/year from the grid. Heat imports: 0 (GJ/yr). The baseline plant would be self sufficient in heat generation. The baseline plant would not receive heat from off-site sources in the absence of the project activity.
Average amount of electricity and heat import from off-site sources under the project activity:	Electricity imports: 193,644 MWh/year from the grid. The SIL would have a grid connection of load 15000 KVA. This would be required under certain circumstances (e.g. turbine stops and start-up operations). This power amount is highly variable, therefore, though it will be monitored and duly accounted for, it will not be considered in the emission reduction calculation in this document. Heat imports: 0 GJ/yr. The project plant would be self-sufficient in heat generation. The project plant would not receive heat from off-site sources.

Table: The sources and gases included in the project boundary

Source		Gas	Included	Justification/Explanation
Baseline	Electricity and heat generation	CO_2	Yes	Major emission source It must be noted, that the proposed project activity does not claim emission reductions due to heat displacement. Heat generation is not influenced by the proposed project activity. Furthermore, heat generation in the new cogeneration facility is accomplished using renewable, carbon neutral biomass residues.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO_2	No	All rice husk used in the project activity comes from renewable sources. It is assumed that CO emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources

Source		Gas	Included	Justification/Explanation
Project	On-site fossil fuel consumption	CO_2	Yes	This emission source is not expected to be relevant (< 0.2% of baseline emissions), however it will be considered.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Off-site transportation of biomass residues	CO_2	Yes	This emission source is not expected to be relevant (< 0.2% of baseline emissions), however it will be considered.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Combustion of biomass residues for electricity and heat	CO_2	No	It is assumed that CO2 emissions from surplus biomass do not lead to changes in the carbon pool in the LULUCF sector.
		CH_4	No	No CH4 emissions are expected in the project activity due to combustion of biomass residues for electricity and heat
		N_2O	No	Excluded for simplification. This emission source is assumed to be small
	Storage of biomass residues	CO_2	No	It is assumed that CO2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	Excluded for simplification. Since biomass are stored not longer than one year, this emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emissions source is assumed to be very small
	Wastewater from the treatment of biomass residues	CO_2	No	It is assumed that CO2 emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector
		CH_4	No	This emission source shall be included in cases where the waste water is treated (partly) under anaerobic conditions. Since the proposed project activity does not originate wastewater from biomass treatment, this emission source is excluded in this case.
		N_2O	No	Excluded for simplification. This emission source is assumed to be small.
	Cultivation of land to produce biomass feedstock	CO_2	No	This emission source is excluded in this case, since the proposed project activity does not use biomass from dedicated plantations.
		CH_4	No	This emission source is excluded in this case, since the proposed project activity does not use biomass from

Source		Gas	Included	Justification/Explanation
				dedicated plantations.
		N_2O	No	This emission source is excluded in this case, since the proposed project activity does not use biomass from dedicated plantations.

2.4 Baseline Scenario

As prescribed by ACM 0006 version 14, project participant has determined the baseline scenario and demonstrated additionality using the “Tool for demonstration and assessment of additionality” (version 7.0)

The project activity is cogeneration plant of 24.45 MW capacity and supplies electricity to SIL. The project will also generate 80 TPH steam at 4.5 kg/cm2 and 30 TPH steam at 9 kg/cm2 and supply it to SIL for process use.

Step 1: Identification of alternative scenarios

The selection of the baseline scenarios: The proposed steps involve identification of alternative scenarios to the proposed project activity

Step 1a: Define alternative scenarios to the proposed project activity

This step includes the identification of the realistic alternative scenarios that are available to the project participant and that provide outputs or services with comparable quality, properties and application areas as the proposed project activity.

- How electric power would be generated in the absence of the project activity; and
- How heat would be generated in the absence of the project activity;
- If the project activity generates mechanical power through steam turbine, how the mechanical power would be generated in the absence of the project activity; and
- What would happen to the biomass residues in the absence of the project activity.

As per the version 14.0 of the applied methodology (Pg. 9, Step 1a), “For the purpose of identifying relevant alternative scenarios, provide an overview of other technologies or practices that provide outputs or services with comparable quality, properties and application areas as the proposed project activity…”

In case of this project activity, the following outputs are supplied:

a. Supply of Power for paper production operations (Application Area: SIL paper production plant)
b. Supply of Heat Energy (Process Steam) for paper production operations (Application Area: SIL paper production plant)

Application Area: A part of the power and process steam generated is utilized for paper production operations and hence the application area for this portion would be considered as paper production plant.

Overview of other technologies that provide outputs with comparable quality, properties and application areas as the proposed project activity:

Outputs from project activity
1. Power – 24.45 (10.45 + 14) MW
2. Steam – 152 (50+75) TPH

The following technologies for Power are discarded:

1. **Wind Power Plant**: This technology provides a lower plant load factor and also the power supplied is intermittent in nature. Hence this technology would not be able to provide outputs comparable to the project activity. Thus this technology option can be excluded from further evaluation.

2. **Hydel Power Plant:** This technology has a lower plant load factor and is site specific. There is no potential to install a hydel power plant at the project site. Hence this technology would not be able to provide outputs comparable to the project activity. Thus this technology option can be excluded from further evaluation.

3. **Solar Power Plant:** This technology provides a lower plant load factor and also the power supplied is intermittent in nature. Hence this technology would not be able to provide outputs comparable to the project activity. Thus this technology option can be excluded from further evaluation.

4. **Natural Gas Based Power Plant:** This technology requires availability of Natural Gas in the region. As there is no availability if Natural Gas in the nearby region. The creation of a pipeline/transportation for the supply of natural gas would prove financially unfeasible for the project proponent. Thus this technology option can be excluded from further evaluation.

5. **Liquid Fuel (Diesel/Furnace Oil) Based Power Plant:** As per the CEA CO2 Baseline Database for Indian Power Sector User Guide, Version 14.0, there is no diesel/furnace oil based power plant operational in the applicable geographical area. Thus this technology option can be excluded from further evaluation.

The project proponent has considered alternatives for power generation, heat generation and biomass residues use in the absence of project activity. The overview of applicable, realistic and credible alternatives for co-generation projects is given in table below:

<u>Alternative scenarios for Electric Power</u>

Alternative	Description	Applicability

P1	The proposed project activity not undertaken as a carbon benefits project activity.	**Yes** Despite the fact that this alternative is economically unattractive, as analysed in section B.5, this alternative is a plausible scenario for further analysis.
P2	If applicable, the continuation of power generation in the existing power plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the starting date of the project activity.	**No** As mentioned above in section 1.10, SIL had decided to expand the production capacity from 300 TPD to 685 TPD to meet the demand. The existing plant at the same conditions was generating only 22.5 MW[12]. After expansion the total electricity requirement would be 46.95 MW. Hence it is not possible the continuation of power generation in the existing power plants at project site at same conditions.
P3	If applicable, the continuation of power generation in existing power plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the starting date of the project activity	No As mentioned above in section 1.10, SIL had decided to expand the production capacity from from 300 TPD to 685 TPD to meet the demand. The expansion from 300 TPD was not small, it was a major expansion. The existing plant at the same conditions was generating only 22.5 MW. After expansion the total electricity requirement would be 46.95 MW. The total Turbine Generator capacity at full load was 22.5 MW in the existing plant. After expansion the total electricity requirement would be 46.95 MW. So even if power generation from existing plant has been done at full load (which is conservative), it would not be sufficient for power requirement after capacity expansion. Hence it is not possible.
P4	If applicable, the retrofitting of existing power plants at the project site. The retrofitting may or may not include a change in fuel mix.	No As mentioned above in section 1.10, SIL had decided to expand the production capacity from from 300 TPD to 685 TPD to meet the demand. The expansion from 300 TPD was not small, it was a major expansion. The retrofitting of the existing power plants at the project site is not possible as it was a major expansion and retrofitting would result in the complete shutdown of the plant as it would need retrofitting of boilers also; which would result in heavy financial losses. Also the retrofitting is not possible due to design constraints. Third party evidences for the same has been submitted to DOE. Hence it is not possible.
P5	The installation of new power plants at the project site different from those installed under the project activity.	**Yes** The project activity is a capacity expansion. A similar output in terms of power could have been

		produced using new power plants at the project site different from those installed under the project activity. These may include Wind, Hydel, Solar and Fossil Fuel (Coal, Natural Ga, Liquid Fuel) based power plants at the project site. As per the detailed discussions presented in the step 1 above, it can be concluded that except coal based power plants none of these options are realistic and credible baseline alternatives.
P6	The generation of power in specific off-site plants, excluding the power grid	**No** In this project context, there are no off-site power plants available from where SIL can source electric power.
P7	The generation of power in the power grid.	Yes This is a possible alternative scenario for power generation in the project activity. Even, prior to the project activity, the total power requirement was approximate 22.5 MW, while grid electricity is used in shut downs or in case of sudden demands. Therefore, it is possible that in the absence of the project activity the electricity demand could have been met from grid electricity

Possible Scenario: P1, P5, P7.

<u>Alternative scenarios for Heat Generation:</u>

Alternative	Description	Applicability
<u>H1</u>	The proposed project activity not undertaken as a carbon benefits project activity.	The proposed project activity not undertaken as a carbon benefits project activity is a possible alternative scenario for Heat generation in the project activity.
<u>H2</u>	If applicable, the continuation of heat generation in existing plants at the project site. The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in	**No** As mentioned above in section 1.10, SIL had decided to expand the production capacity from from 300 TPD to 685 TPD to meet the demand. *The heat generation capacity of the existing plant was 190 TPH. After expansion, the additional heat requirement would be 125 TPH. Hence it is not possible the continuation of heat generation in the existing plants at project site where existing plants would operated at same conditions.*

	the most recent three years prior to the project activity	
H3	If applicable, the continuation of heat generation in existing plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the project activity	**No** As mentioned above in section 1.10, SIL had decided to expand the production capacity from from 300 TPD to 685 TPD to meet the demand. It is a major expansion. The heat generation capacity of the existing plant was 190 TPH. After expansion, the additional heat requirement would be 125 TPH. Even if the existing plant at the project site would operate with different conditions, let say if heat generation would happen at 100% load then even it can't meet the requirement post expansion due to massive expansion as the demand will be of 125 TPH more.
H4	If applicable, the retrofitting of existing plants at the project site. The retrofitting may or may not include a change in fuel mix;	**No** As mentioned above in section 1.10, SIL had decided to expand the production capacity from 300 TPD to 685 TPD to meet the demand. It was a major expansion. *The retrofitting of the existing power plants at the project site is not possible as it was a major expansion and retrofitting would result in the complete shutdown of the plant; which would result in heavy financial losses. Also the retrofitting is not possible due to design constraints. Third party evidences for the same has been submitted to DOE. Hence it is not possible.*
H5	The installation of new plants at the project site different from those installed under the project activity;	**Yes** The project activity is a capacity expansion project which includes installation of a rice husk based cogeneration plant. A similar output in terms of heat energy (process steam) could have been produced using new heat only or co-generation plant at the project site different from those installed under the project activity. These would largely include Fossil Fuel based or biomass based heat only plants. *The primary objective of the Project Proponent* (PP) is to generate process steam for the increased capacity of the paper production plant. In absence of the project activity , the PP would installed a fossil fuel based or biomass based heat only plants to supply steam for paper production operation. Hence, In the absence of the project activity, the demand for steam at the paper plant would most likely be met via a new standalone boiler: **H5.1 Coal** ***H5.2 Biomass***
H6	The generation of heat in specific off-site plants.	**No** *In this project context, there are no off-site heat plants available from where SIL can source heat.*

H7	The production of heat from district heating.	**No** *There is no district heat or any other form of heat available in the region and hence the alternative scenario is not realistic and is excluded from further consideration.*

Possible Scenario: H1, H5.1. H5.2.

Alternatives scenarios for Mechanical Power

There is no mechanical power generated in the project. Hence there is no need to find alternative scenarios for mechanical power.

Alternatives scenarios for Biomass

Alternative	***Description***	***Applicability***
B1	The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.	**Yes** *As per the biomass assessment study, there are surplus biomass residues available in the region. Hence it can be assumed that the biomass residues may be dumped or left to decay without being utilised in any other activity. Thus this alternative can be a plausible baseline scenario.*
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields,	**No** As per the biomass assessment study, there are surplus biomass residues available in the region. Hence it can be safely assumed that the biomass residues will be dumped or left to decay under aerobic conditions (in open fields) in the absence of the project activity. Hence this is not a realistic baseline scenario.
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.	**No** *The biomass residues are burnt in an uncontrolled manner without utilizing it for energy As per the discussion for baseline scenario B1, the surplus biomass residues may be dumped or left to decay under aerobic conditions. Hence this scenario cannot be considered as plausible scenario.*
B4	The biomass residues are used for power or heat generation at the project site in new and/or existing plants.	**Yes** *There are other heat or electricity generation project using biomass residues at the project site. The biomass residues are used for power or heat generation at the project site in new plants is realistic.*

		Therefore, B4 is a realistic and credible alternative for baseline selection.
B5	The biomass residues are used for power or heat generation at other sites in new and/or existing plants.	**No** *There is no other power plant or cogeneration plant using biomass residues around the project site, and power plants at other sites are unlikely to use these surplus biomass residues considering the transportation cost. Therefore, B5 is not a realistic and credible alternative for baseline alternative. .*
B6	The biomass residues are used for other energy purposes, such as the generation of biofuels.	**No** *The generation of biofuels using forestry biomass residues (rice husk) is not developed at an industrial scale in Punjab. Also the surplus biomass available in the region which has been calculated after considering consumption by households and industries. Hence use of biomass residues for other energy purposes, such as the generation of bio fuels is not a realistic baseline alternative.*
B7	The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry).	No, there is surplus rice husk available in the region which has been calculated after considering the consumption for non-energy purposes. However, rice husk is not used for non-energy purpose. Hence this is not a realistic baseline alternative.
B8	Biomass residues are purchased from a market, or biomass residues retailers, or the primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.	**No** As per the biomass assessment study, there are abundant biomass residues available in the region. Hence as described in B1, the biomass residues will be dumped or left to decay under aerobic conditions (in open fields) in the absence of the project activity. Thus the fate of biomass residues in the absence of the project activity can be clearly identified and hence this scenario is not considered as a realistic baseline alternative.

Possible Scenario: B1, B4.

Table for biomass residues categories

Biomass residues category (k)	***Biomass residues type***	***Biomass residues source***	***Biomass residues fate in the absence of the project***	***Biomass residues use in the project***	***Biomass residues quantity***

			activity	scenario	(tonnes)
1	*Rice Husks*	From Retailers	Dumped or left to decay mainly under aerobic conditions (B1:)	*Electricity and heat generation on-site (biomass-only boiler)*	*246,767 tonnes/year*

According to the ACM0006 (Version 14), for biomass residues categories for which scenarios B1:, B2: or B3: are deemed plausible baseline alternatives, project participants must demonstrate that these are realistic and credible alternative scenarios. To do this, the Project Proponent will demonstrate that for the biomass residues used in the project activity that:

- There is an abundant surplus of the type of biomass residue in the region of the project activity which is not utilized. For this purpose, the Project Proponent will demonstrate that the quantity of that type of biomass residue available in the region is at least 25% larger than the quantity of biomass residue of that type which is utilized in the region (e.g. for energy generation or as feedstock), including the project plant demand.

  This study has been done in the Biomass Assessment Report. It is clear that rice husk available in the region is 26.9% larger than the quantity of rice husk which is utilized in the region including demand after SIL"s capacity expansion project.
  The project activity does not involve the generation of biogas or dedicated plantation. Hence those conditions from the methodology are not discussed for the project activity.
  In the following tables below, the Project Proponent presents the different project alternatives that consider the baseline scenarios for power, heat and biomass use identified above. In each case it is addressed the feasibility of the project option of becoming the baseline scenario for the proposed project as well as the situation of power and heat generation, the biomass consumption and how this situation compares to the one observed under the project scenario. Finally, it also addressed what would happen to any differences in power and heat generation and biomass consumption between each alternative and the project plant, in the absence of the proposed project activity.

Alternative 1. The proposed project activity without considering carbon benefits
<u>Technical assumptions:</u> Under this scenario, installed capacities, load factors, energy efficiencies, fuel mixes and equipment configuration correspond to the ones considered under the proposed project activity and are fully described in this document and LCOE &ER Sheet. These are: High-pressure steam boiler: 50+75 TPH, 67 kg/cm2, 490°C. Boiler efficiency: 80%. Bleed Condensing: 10.45+14 MW nominal capacity. Cogeneration plant load factor: 100%. Fuel mixes: *Biomass: 246,767 tonnes/year*
Power generation: Power would be generated in the new cogeneration power plant. All the power would for self-consumption at the paper plant. • The applicable baseline for all the power generation in the power plant would be: P1.
Heat generation: All the heat required by the SIL for additional capacity would be generated in the cogeneration plant, using biomass residues. • The applicable baseline scenario for the heat would be: H1.
Biomass residues: As in the proposed project activity, the same biomass types and amounts would be used as fuel for heat and power cogeneration in the power plant. • The applicable baseline scenarios for the biomass types would be: B4.

Alternative 2. A New coal based cogeneration power plant at the project site different from those installed under project activity.
Technical assumptions:
Installed capacities: High-pressure steam boiler: 50+75 TPH, 67 kg/cm2, 490°C. Boiler efficiency: 80%. Bleed Condensing: 10.45+14 MW nominal capacity. Cogeneration plant load factor: 100%. Fuel mixes: *Coal: 166,272 tonnes/year*
Power generation: Power would be generated from new coal based cogeneration power plant. All the power would for self-consumption at the paper plant. • The applicable baseline for all the power generation in the power plant would be: P5.
Heat generation: All the heat required by the SIL for additional capacity would be generated in from the coal based cogeneration plant. • The applicable baseline scenario for the heat would be: H5.1
Biomass residues: As in the proposed project activity, the same biomass types and amounts would be used as fuel for heat and power cogeneration in the power plant. • The applicable baseline scenarios for the biomass types would be: B1.

Alternative 3. A New biomass based heat only generation plant at the project site and electricity would be sourced from grid.
Technical assumptions: High-pressure steam boiler: 40+60 TPH, 67 kg/cm2, 490°C. Boiler efficiency: 80%. Cogeneration plant load factor: 100%. Fuel mixes: Biomass: 165,496 tonnes/year
Power generation: Since there would be no power generation at the site in this alternative. All the power contemplated under the project activity scenario would be sourced from grid. • The applicable baseline for all the power generation in the power plant would be: P7.
Heat generation: All the heat required by the SIL for additional capacity would be generated in the new boiler, using biomass residues. • The applicable baseline scenario for the heat would be: H5.2.
Biomass residues: Since there would be no biomass consumption in the alternative. • The applicable baseline scenarios for the biomass types would be: B4 – For the fraction would be used for heat generation *B1 – For the remaining fraction that would be required for power generation in the project activity.*

Alternative 4. A New coal based heat only generation plant at the project site and electricity would be sourced from grid.
Technical assumptions:

Installed capacities: High-pressure steam boiler: 40+60 TPH, 67 kg/cm2, 490°C. Boiler efficiency: 80%. Cogeneration plant load factor: 100%. Fuel mixes: *Coal: 115,683 tonnes/year*
Power generation: Since there would be no power generation at the site in this alternative. All the power contemplated under the project activity scenario would be sourced from grid. • The applicable baseline for all the power generation in the power plant would be: P7.
Heat generation: All the heat required by the SIL for additional capacity would be generated in the new boiler, using coal. • The applicable baseline scenario for the heat would be: H5.1
Biomass residues: in this case, the consumption of biomass residues in the SIL for additional expanded capacity would be used only for the generation of process steam purposes. For that reason, the biomass consumption would be a fraction of the biomass residue that would be used in the project activity. The rest of the biomass residues contemplated under the project activity would be discarded and not used for energy purposes. • The applicable baseline scenarios for the biomass types would be: B1.

Outcome of Step 1a:

According to the above, the list of plausible and realistic alternative scenarios to the proposed VCS project activity would be:

1. The proposed project activity without considering carbon benefits

2. A New coal-based cogeneration power plant at the project site different from those installed under project activity

3. A New biomass-based heat only generation plant at the project site and electricity would be sourced from grid.

4. A New coal-based heat only generation plant at the project site and electricity would be sourced from grid.

Sub-step 1b: Consistency with mandatory applicable laws and regulations
All the alternative scenarios for the present case pertain to the generation of heat and electricity from the renewable energy source or coal and also sourcing electricity from grid. The above alternative scenarios are in compliance with all applicable legal and regulatory requirements as mentioned below:
The relevant laws and regulation pertaining to generation of energy from renewable sources are:

- Electricity Act 2003[13]
- National Electricity Policy 2005[14]
- Tariff Policy 2006[16]

The above mentioned laws and regulations do not restrict the alternatives in any way in terms of fuel and technology choice or otherwise.

Outcome of Step 1b: All the plausible alternative scenarios for the proposed project activity listed above are in compliance with mandatory legislation and regulations under existing practices.

Adherence to regulatory surplus requirements

As per clause 4.6.3 of VCS Standard v3.4[17], "The project shall not be mandated by any law, statute or other regulatory framework, or for UNFCCC non-Annex I countries, any systematically enforced law, statute or other regulatory framework." The project activity mentioned here is not mandated by any law. It is voluntary activity chosen by the project proponent. The declaration regarding this has been submitted to the DOE.

Step2: Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. As per the applied methodology, this step is optional and hence has been skipped.

2.5 Additionality

Additionality approach as per VCS Standard - As per VCS standards, the PP has chosen project method to determine additionality.

Step 3: Investment analysis

The objective of Step 3 is to compare the economic or financial attractiveness of the alternative scenarios by conducting an investment analysis. The analysis here includes all alternative scenarios as identified above.

This step has been implemented following the guidance in Step 2 of the latest version of the "Tool for the demonstration and assessment of additionality" i.e. Version 07.0.0 and the latest version of the "Tool investment analysis", has been taken into account during this step.

As per "Tool for the demonstration and assessment of additionality" Version 07.0.0."

Sub-step 2a: Determination appropriate analysis method:

As per the additionality tool, "If the project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than carbon benefits related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III)."

In case of project activity, it would generate economic benefits through the heat and electricity generation, i.e other than carbon benefits related income. Hence simple cost analysis (Option I) had been ruled out.

Further, in line with paragraph 19 of guidance on assessment of investment analysis, "If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used."

As identified above, the project proponent viz. SIL had other choices available to fulfil the need of additional demand of the heat and electricity; hence investment comparison analysis (option II) had been appropriately chosen.

Sub-step 2b: Option II. Investment comparison analysis

Identification of suitable financial indicator:
The suitable financial indicator needs to be selected considering the project type and decision-making context. For this project activity, the PP had two more other options available for the heat and electricity. So unit cost of service i.e. Levelized cost of energy (LCOE) delivered had been selected as the appropriate indicator.

Sub-step 2c: Calculation and comparison of financial indicators

The main key assumptions used for calculation are presented as below:

Phase I: 10.45 MW

S. No	Parameter	Units	Alternative-1	Alternative-2	Alternative-3	Alternative-4	Source
1	Turbine Capacity	MW	10.45	10.45	-	-	As per requirement of plant
2	Net Electricity Production capacity	MW	8.90	8.90	-	-	As per design parameters and requirement
3	Operational days/year	days	330	330	330	330	Industry Standard
4	PLF	%	80%	80%	80%	80%	Conservative
5	Electricity generated and used in the project activity	MWh/ year	56,390	56,390	-	-	Calculated
6	Electricity imported from Grid and used in the project activity	MWh/ year	-	-	56,390	56,390	Calculated
7	Boiler Capacity	TPH	50	50	35	35	Requirement Analysis
8	Steam	-	Superheated Steam	Superheated Steam	Saturated Steam	Saturated Steam	Requirement Analysis
9	Fuel	-	Rice Husk	Coal	Rice Husk	Coal	Manufacturer Specification
10	Feed Water Temperature	°C	130	130	105	105	Manufacturer Specification
11	Steam for processes at high pressure (11.5 kg/cm2)	TPH	15	15	15	15	Requirement Analysis
12	Steam for processes at medium pressure (4.5 kg/cm2)	TPH	20	20	20	20	Requirement Analysis
13	Efficiency	%	80%	80%	80%	80%	http://pserc.gov.in/pages/Final_Order_37_of_2013.pdf
14	NCV of Fuel	kcal/k	3,537	5,060	3,537	5,060	RH - Lab Report

		g					Coal – Coal Quotation
15	Fuel Price	INR/Tonne	4,522.81	4,000	4,522.81	4,000	RH - Data available with plant Coal – Coal Quotation
16	Escalation in Fuel Price	%	9.96%	6.62%	9.96%	6.62%	Data available with plant
17	Electricity Price	INR/KWh	6.14	6.14	6.14	6.14	Rate Analysis at the time of decision making
18	Escalation in Electricity Prices	%	0%	0%	0%	0%	Electricity Price are decreasing which shows a negative escalation, however we have considered 0% on Conservative Basis
21	Interest rate	%	10%	10%	10%	10%	As per past experience of Project Developer
22	Operation and Maintenance cost	%	3%	3%	3%	3%	http://pserc.gov.in/pages/background_paper_nrse.html (p.7.39)
23	% escalation in O&M Cost	%	5%	5%	5%	5%	http://pserc.gov.in/pages/background_paper_nrse.html (p.7.39)
24	Cost of Capital (WACC)	%	9.82%	9.82%	9.82%	9.82%	Calculated

Phase II: 14 MW

S. No	Parameter	Units	Alternative-1	Alternative-2	Alternative-3	Alternative-4	Source
1	Turbine Capacity	MW	14	14	-	-	As per requirement of plant
2	Net Electricity Production capacity	MW	11.80	11.80	-	-	As per design parameters and requirement
3	Operational days/year	days	330	330	330	330	Industry Standard
4	PLF	%	80%	80%	80%	80%	Conservative
5	Electricity generated and used in the project activity	MWh/year	74,765	74,765	-	-	Calculated
6	Electricity imported from Grid and used in the project activity	MWh/year	-	-	74,765	74,765	Calculated
7	Boiler Capacity	TPH	75	75	60	60	Requirement Analysis
8	Steam	-	Superheated Steam	Superheated Steam	Saturated Steam	Saturated Steam	Requirement Analysis
9	Fuel	-	Rice Husk	Coal	Rice Husk	Coal	Manufacturer Specification
10	Feed Water Temperature	°C	130	130	105	105	Manufacturer Specification
11	Steam for processes at high pressure (11.5 kg/cm2)	TPH	15	15	15	15	Requirement Analysis

12	Steam for processes at medium pressure (4.5 kg/cm2)	TPH	45	45	45	45	Requirement Analysis
13	Efficiency	%	80%	80%	80%	80%	http://pserc.gov.in/pages/Final_Order_37_of_2013.pdf
14	NCV of Fuel	kcal/kg	3,537	5,060	3,537	5,060	RH - Lab Report Coal – Coal Quotation
15	Fuel Price	INR/Tonne	4,973.49	4,320	4,973.49	4,320	RH - Data available with plant Coal – Coal Quotation
16	Escalation in Fuel Price	%	9.96%	6.62%	9.96%	6.62%	Data available with plant
17	Electricity Price	INR/KWh	6.03	6.03	6.03	6.03	Rate Analysis at the time of decision making
18	Escalation in Electricity Prices	%	0%	0%	0%	0%	Electricity Price are decreasing which shows a negative escalation, however we have considered 0% on Conservative Basis
21	Interest rate	%	10%	10%	10%	10%	As per past experience of Project Developer
22	Operation and Maintenance cost	%	3%	3%	3%	3%	http://pserc.gov.in/pages/background_paper_nrse.html (p.7.39)
23	% escalation in O&M Cost	%	5%	5%	5%	5%	http://pserc.gov.in/pages/background_paper_nrse.html (p.7.39)
24	Cost of Capital (WACC)	%	9.75%	9.75%	9.75%	9.75%	Calculated

	Capacity	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Levelized cost of energy generation in different alternatives (INR/MJ)	**10.45 MW**	1.331	0.660	1.261	0.844
	14 MW	1.365	0.657	1.320	0.818

The above analysis demonstrates that Alternative 1 (Project Activity) has the highest levelised cost of energy generation. Alternative-2 and alternative-4 are more attractive than alternative-3 but alternative-2 and alternative-4 are based on coal. PP was already using biomass based cogeneration plant, hence this has been ruled out. However it is consistent with the baseline scenario of chosen with least emission among alternatives. This is conservative.

Therefore, best suitable alternative for project activity is Alternative-3.

Sensitivity analysis:

To show the robustness of the financial analysis, a sensitivity analysis is carried out on key factors that may impact the performance of the project activity. As required by Annex 5 EB 62 “Guidance on the assessment of investment analysis” only those parameters that constitute more than 20% of either total project costs or total project revenues are subjected to reasonable variation. The critical parameters thus identified for determination of financial viability of a project are as follows:

1. Change in Biomass rate
2. Change in Coal rate
3. Change in Electricity rate
4. Change in NCV of Biomass
5. Change in NCV of Coal
6. Change in Project cost
7. Change in O&M cost

According to para 21 of Annex 05 EB 62, 'As a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and -10%, unless this is not deemed appropriate in the context of the specific project circumstances‟. The variation in the price unit electricity generation with variation in the parameters gave the following results:

Phase I : 10.45 MW

Parameters	Variation	Levelized cost of energy				
		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Remarks
Change in Biomass rate	10%	1.457	0.660	1.339	0.844	Levelized Cost of Energy for Alternative 1 should be Higher than other Alternatives (Additional)
	-10%	1.205	0.660	1.182	0.844	
Change in Coal rate	10%	1.331	0.719	1.261	0.881	
	-10%	1.331	0.601	1.261	0.808	
Change in Electricity rate	10%	1.331	0.660	1.306	0.890	
	-10%	1.331	0.660	1.215	0.798	
Change in NCV of Biomass	10%	1.216	0.660	1.189	0.844	
	-10%	1.471	0.660	1.347	0.844	
Change in NCV of Coal	10%	1.331	0.607	1.261	0.811	
	-10%	1.331	0.726	1.261	0.885	
Change in Project cost	10%	1.338	0.667	1.262	0.846	
	-10%	1.324	0.653	1.259	0.842	
Change in O&M cost	10%	1.333	0.662	1.261	0.845	
	-10%	1.329	0.659	1.260	0.844	

Phase II: 14 MW

Parameters	Variation	Levelized cost of energy				
		Alternative 1	Alternative 2	Alternative 3	Alternative 4	Remarks
Change in Biomass rate	10%	1.495	0.657	1.412	0.818	Levelized Cost of Energy for Alternative 1 should be Higher than other Alternatives (Additional)
	-10%	1.234	0.657	1.227	0.818	
Change in Coal rate	10%	1.365	0.717	1.320	0.861	
	-10%	1.365	0.596	1.320	0.776	
Change in Electricity rate	10%	1.365	0.657	1.357	0.856	
	-10%	1.365	0.657	1.282	0.781	
Change in NCV of Biomass	10%	1.246	0.657	1.235	0.818	
	-10%	1.510	0.657	1.422	0.818	
Change in NCV of Coal	10%	1.365	0.602	1.320	0.780	
	-10%	1.365	0.723	1.320	0.866	

Change in Project cost	10%	1.370	0.662	1.321	0.820	
	-10%	1.359	0.651	1.318	0.817	
Change in O&M cost	10%	1.366	0.658	1.320	0.819	
	-10%	1.363	0.655	1.319	0.818	

It can be seen that even in the best scenarios through decreasing the price of biomass the project is not able to overcome the investment barrier and would require carbon benefits for its successful operations.

Outcome of Step 3:

From the sensitivity, it is clear that in the LCOE of project activity without being considering carbon benefits is more than options available. Therefore, it can be concluded that the project activity without getting additional revenue from carbon benefits is financially not a viable activity.

Step 4: Common Practice Analysis
Identified and discussed the common practice through the following Sub-steps:

Since the project activity is a measure that involves use of renewable energy in the applicable geographical area, as per paragraph 57 of the methodological tool "Demonstration and assessment of additionality" version 07.0.0, we proceed to sub-step 4a.

Sub-step 4a: The proposed project activity(ies) applies measure(s) that are listed in the definitions section above.

As per paragraph 58 of the tool, the "*Methodological tool: Common Practice*" has been applied. According to the Guidelines, it requires the following definitions as follows:

1) Applicable geographical area: Punjab State. It is chosen because the regulatory environment varies from state to state in the country. For particular this project, the major parameter in the decision making were cost of electricity, technology as biomass based power generation, availability of biomass. Both the parameters are widely varied across states to states.

Rate of Electricity: In India, independent regulatory agencies -- Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERCs) -- were constituted at the central and state levels respectively. The major regulatory functions of these bodies are licensing, setting tariffs, ensuring maintenance of service standards and promoting competition in the sector. However, outcomes across states have not been very encouraging as political interference has adversely affected the quality of regulation.

Biomass Power: In India, the total estimated potential of Biomass Power is estimated to be 17538 MW. Out of this, Punjab state has the highest potential with 3172 MW of estimated potential. After Punjab, the next state with highest potential of Biomass Power is Maharashtra with 1887 MW of Capacity. As per analysis, it is clear that Biomass based power generation the PP has a very limited option as the availability of Biomass differs heavily from state to state.

Hence, the geographical area has been considered to Punjab State.

2) **Measure:** The project activity falls under the following measure:

"(b) Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy);"

3) **Output:** "Power generation" may be considered to be the output in the context of the project activity.

4) **Different technologies**: in the context of the common practice of the project activity:

a) Energy source/fuel: In this case, the fuel is rice husk.

b) Feed Stock: This criterion is irrelevant in the context of the project activity as no feed stock is involved

c) Size of installation: Since the installed capacity of the project activity is 24.45 MW, the installation size shall be considered as "Small"

d) Investment climate:

i. Access to technology: Access to the biomass residues based co-generation technology is fairly same across the host country

ii. Subsidies or other financial cash flows: Though not applicable in the case of project activity, subsidies are regulated by the Ministry of New & Renewable Energy, India for the entire host country

iii. Promotional policies: In India, as per the Electricity Act 2003, the preferential tariff policy for the sale of power generated from renewable energy is there and is to be decided by respective state regulatory commissions. But in this case the PP would use electricity for captive purpose and there is no provision to sell electricity. Hence this is not applicable

iv. Legal regulation: Not applicable

Step 1: Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity.

Since the proposed project activity has a proposed installed capacity of 24.45 MW, the applicable output range for common practice analysis will be 12.225 MW to 36.675 MW (± 50% of 24.45 MW).

Step 2: Identify similar projects (both with carbon benefits and not) which fulfil all of the following conditions:

(a)	*The projects are located in the applicable geographical area;*	Projects located in the Punjab State.
	The projects apply the same measure as the	Projects which has co-generation

(b)	*proposed project activity;*	plants based on renewable energy
(c)	*The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;*	Project use the energy fuel as Biomass.
(d)	*The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant*	Plants which produce pressure steam for paper industry and electricity for processes with comparable quality and properties as mentioned in section 1.8 above.
(e)	*The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;*	The capacity of the projects is within the applicable capacity of 12.225 MW to 36.675 MW have been considered as set in Step 1.
(f)	*The projects started commercial operation before VCS the start date of proposed project activity.*	The decision making was done in the Sep-2017. Hence all the projects which started commercial operation prior to Sep-2017 have been considered

As per the list from Punjab Energy Development Agency (PEDA)[4]. Following table represents the projects which are in the range of 12.225 MW to 36.675 MW and commissioned before 2017.

Step 3: Within the projects identified in Step 2, identify those that are neither registered as a carbon benefit project activity, project activities submitted to registration, nor project activities undergoing validation. Note their number N_{all}.

6 projects are neither registered as a carbon benefit project activity, project activities submitted to registration, nor project activities undergoing validation

Nall = 6

Step 4: Within the projects identified in Step 3 identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number Ndiff.

Ndiff = 6

Step 5: Calculate factor F=1-Ndiff/Nall representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity

F= 1-(6/6) = 0

The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff} is greater than 3.

F = 0

N_{all}-N_{diff} = 0

As F is not greater than 0.2 and N_{all}-N_{diff} is not greater than 3, the project is not a common practice.

[4] http://www.peda.gov.in/main/cogeneration.html

2.6 Methodology Deviations

No Methodology deviations.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

As per the various baseline scenarios identified in approved methodology ACM0006 version 14, the emission reductions have been identified using the following steps:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emissions reductions in year *y* (t CO_2)
BE_y	=	Baseline emissions in year *y* (t CO_2)
PE_y	=	Project emissions in year *y* (t CO_2)
LE_y	=	Leakage emissions in year *y* (t CO_2)

Baseline Emissions

Baseline emissions are calculated based on the most plausible baseline scenario identified in the section “Selection of the baseline scenario and demonstration of additionality”, above in this PD, taking into account how power and heat would be generated, and how the biomass residues would be used, in the absence of the project activity.

Baseline emissions are calculated as follows:

$$BE_y = EL_{BL,GR,y}.EF_{EG,GR,y} + \sum_f FF_{BL,HG,y,f}.EF_{FF,y,f} + EL_{BL,FF/GR,y}.\min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EL_{BL,GR,y}$	=	Baseline minimum electricity generation in the grid in year *y* (MWh)
$EF_{EG,GR,y}$	=	Grid emission factor in year *y* (tCO_2/MWh)
$FF_{BL,HG,y,f}$	=	Baseline fossil fuel demand for process heat in year *y* (GJ)
$EF_{FF,y,f}$	=	CO_2 emission factor for fossil fuel type f in year *y* (tCO_2/GJ)
$EL_{BL,FF/GR,y}$	=	Baseline uncertain electricity generation in the grid or on-site in year *y* (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* (tCO_2/MWh)
$BE_{BR,y}$	=	Baseline emissions due to disposal of biomass residues in year

		y (tCO_2e)
y	=	Year of the crediting period
f	=	Fossil fuel type

In this case, there is no baseline fossil fuel demand for process heat hence $FF_{BL,HG,y,f} = 0$ and $EF_{EG,FF,y} = 0$.

So the above equation can be revised to:

$$BE_y = EL_{BL,GR,y} * EF_{EG,GR,y} + BE_{BR,y}$$

The algorithm used to determine the data above can be summarized as follows:

- Step 1: Determine biomass availability, generation and capacity constraints, efficiencies and power emission factors;
- Step 2: Determine the minimum baseline electricity generation in the grid;
- Step 3: Determine the baseline biomass-based heat and power generation;
- Step 4: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation;
- Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues;
- Step 6: Calculate baseline emissions.

A flow chart is presented on the next page for ease of reference.

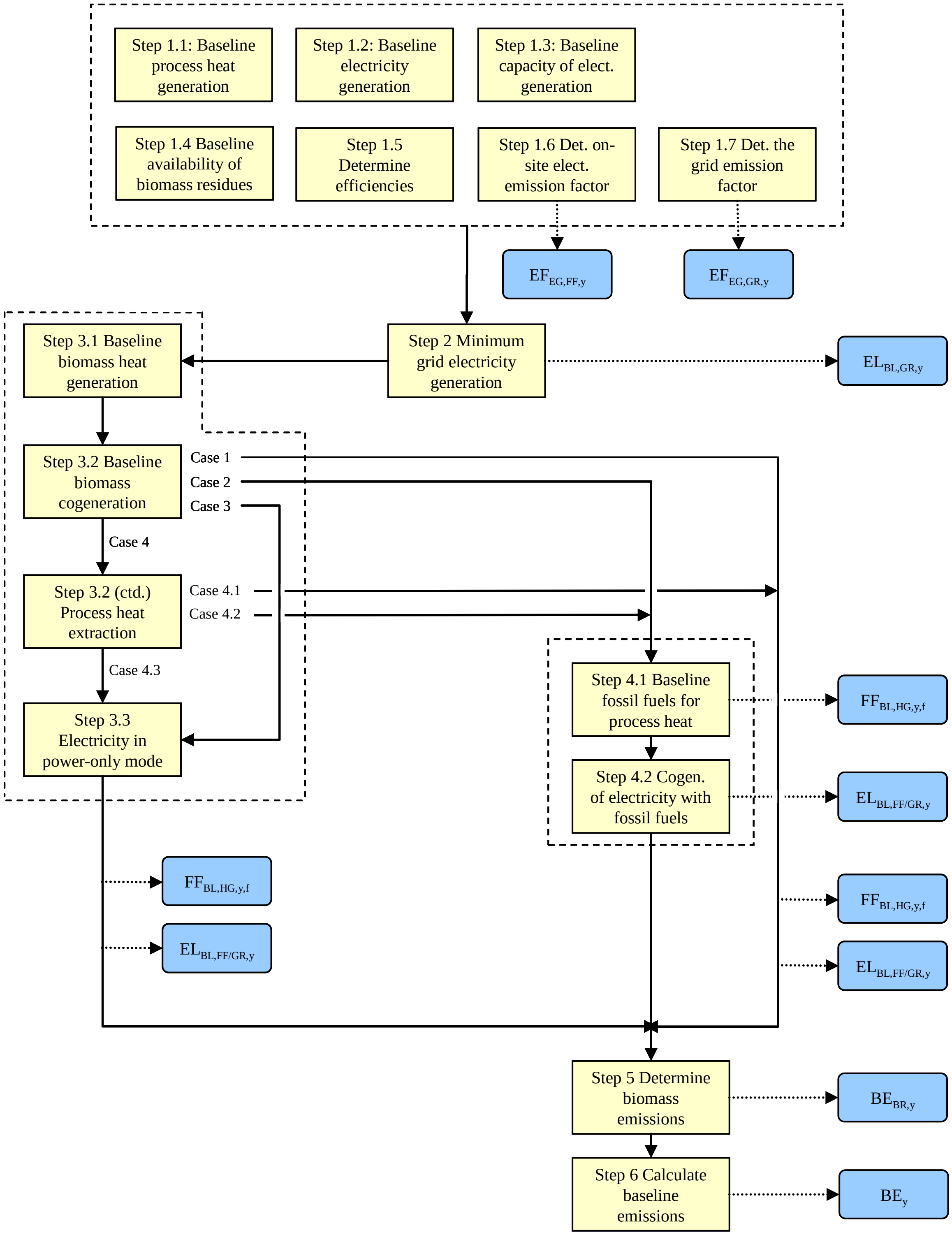


Figure: Flow chart for the calculation of baseline emissions

Step 1: Determine biomass availability, generation and capacity constraints, efficiencies and power emission factors in the baseline

Step 1.1: Determine total baseline process heat generation

The amount of process heat that would be generated in the baseline in year *y* ($HC_{BL,y}$) is determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads 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 should be determined based on the mass (or volume) flows, 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.

The process heat should be calculated net of any parasitic heat used for drying of biomass.

Data:	**Value**	**Unit**	**Source**
Boiler 1			
Steam Boiler Pressure for process:	42.0	Kg/cm^2	Plant Requirement
Steam Boiler Temperature for process:	405	Cº	Plant Requirement
Flow	45	TPH	Plant Requirement
Steam enthalpy $h_{Medium,y}$	3.22	GJ/tonnes	Steam Superheated steam, https://beta.spiraxsarco.com/resources-and-design-tools/steam-tables/superheated-steam-region#article-top
Enthalpy of the feed-water(at 105ºC)	0.439	GJ/tonnes	Steam table (values @feed water temp - 105 degree celsius at economizer outlet)
Amount of heat needed to be added per tonne of steam	2.785	GJ/tonnes	Calculated
No. of working Hours	7,920	Hours	Assumption
Steam used for process per year	993	TJ	Calculated
Boiler 2			
Steam Boiler Pressure for process:	42.0	Kg/cm^2	Plant Requirement
Steam Boiler Temperature for process:	405	Cº	Plant Requirement
Flow	20	TPH	Plant Requirement, CRP
Steam enthalpy $h_{LOW,y}$	3.22	GJ/tonnes	Steam table
Enthalpy of the feed-water(at 90ºC)	0.439	GJ/tonnes	Steam table (values @feed water temp - 105 degree celsius at economizer outlet)
Amount of heat needed to be added per tonne of steam	2.785	GJ/tonnes	Calculated
No. of working Hours	7,920	Hours	Assumption

Steam used for process per year	441	TJ	Calculated
Boiler 3			
Steam Boiler Pressure for process:	67.0	Kg/cm^2	Plant Requirement
Steam Boiler Temperature for process:	490	C^o	Plant Requirement
Flow	50	TPH	Plant Requirement, New CRP
Steam enthalpy $h_{LOW,y}$	3.39	GJ/tonnes	Steam table
Enthalpy of the feed-water(at 90ºC)	0.439	GJ/tonnes	Steam table (values @feed water temp - 105 degree celsius at economizer outlet)
Amount of heat needed to be added per tonne of steam	2.951	GJ/tonnes	Calculated
No. of working Hours	7,920	Hours	Assumption
Steam used for process per year	1,169	TJ	Calculated
Boiler 4			
Steam Boiler Pressure for process:	67.0	Kg/cm^2	Plant Requirement
Steam Boiler Temperature for process:	490	C^o	Plant Requirement
Flow	75	TPH	Plant Requirement
Steam enthalpy $h_{LOW,y}$	3.39	GJ/tonnes	Steam table
Enthalpy of the feed-water(at 90ºC)	0.439	GJ/tonnes	Steam table (values @feed water temp - 105 degree celsius at economizer outlet)
Amount of heat needed to be added per tonne of steam	2.951	GJ/tonnes	Calculated
No. of working Hours	7,920	Hours	Assumption
Steam used for process per year	1,753	TJ	Calculated
Boiler 5			
Steam Boiler Pressure for process:	67.0	Kg/cm^2	Plant Requirement
Steam Boiler Temperature for process:	490	C^o	Plant Requirement
Flow	50	TPH	Plant Requirement
Steam enthalpy $h_{LOW,y}$	3.39	GJ/tonnes	Steam table
Enthalpy of the feed-water(at 90ºC)	0.439	GJ/tonnes	Steam table (values @feed water temp - 105 degree celsius at economizer outlet)
Amount of heat needed to be added per tonne of steam	2.951	GJ/tonnes	Calculated
No. of working Hours	7,920	Hours	Assumption
Steam used for process per year	1,169	TJ	Calculated
Boiler 6			
Steam Boiler Pressure for process:	67.0	Kg/cm^2	Plant Requirement
Steam Boiler Temperature for process:	490	C^o	Plant Requirement
Flow	75	TPH	Plant Requirement

Steam enthalpy $h_{LOW,y}$	3.39	GJ/tonnes	Steam table
Enthalpy of the feed-water (at 90ºC)	0.439	GJ/tonnes	Steam table (values @feed water temp - 105 degree celsius at economizer outlet)
Amount of heat needed to be added per tonne of steam	2.951	GJ/tonnes	Calculated
No. of working Hours	7,920	Hours	Assumption
Steam used for process per year	1,753	TJ	Calculated
$HC_{BL,y}$ Total baseline process heat generation	6,108.15	TJ/Year	Calculated

Step 1.2: 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

Data:	**Value**	**Units**	**Source**
No. of Days	330	Days	Assumption
Working Hours	24	Hour	Assumption
Totl no. of Working Hours	7,920	Hours/Year	Calculated
Power Plants which are located at the project site and included in the project boundary in year y	5.0	MW	Rated Capacity, Biomass Condensing type, TG1
	5.0	MW	Rated Capacity, CRP, TG 2
	12.5	MW	Rated Capacity, Biomass, TG 3
	10.5	MW	Rated Capacity, Biomass, TG 4
	14.0	MW	Designed Capacity, TG 5
$EL_{PJ,gross,y}$: Total gross energy per year	371,844	MWh/year	Calculated
Auxiliary electricity consumption	10%		Plant Data
$EL_{PJ,aux,y}$ = Auxiliary electricity consumption per year	37,184	MWh/year	Calculates

$EL_{PJ,imp,y}$: Electricity Imports	0	MWh	In the project activity, there is no provision to import electricity from grid. But a connection would be required to in case of complete blow down of all the heat engines. A minimum electricity would be procured from the grid, however considering this to be 0 is conservative in this case. There is a seperate meter and it would be properly measured and in future actual value will be used.
$EL_{BL,y}$ Baseline electricity generation in year y (MWh)	334,660	MWh/year	Calculated

Step 1.3: 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)
$LFC_{EG,CG,i}$	=	Baseline load factor of heat engine *i* (ratio)
$LFC_{EG,PO,j}$	=	Baseline load factor of heat engine *j* (ratio)
LOC_y	=	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

Data:	**Value**	**Units**	**Source**
LOC_y: Length of the operational campaign in year y (hour)	7,920	hours	Assumption
$CAP_{EG,CG,1}$ Baseline electricity generation capacity of heat engine 1 (Turbine 1)	5.0	MW	Plant Data
$CAP_{EG,CG,2}$ Baseline electricity generation capacity of heat	5.0	MW	Plant Data

engine 2 (Turbine 2)			
$CAP_{EG,CG,3}$ Baseline electricity generation capacity of heat engine 4 (Turbine 4)	12.5	MW	Plant Data
$CAP_{EG,CG,1,2,3}$	22.5	MW	Calculated
$LFC_{EG,CG,1}$ = Baseline load factor of heat engine 1 (Turbine 1)	0.46		Maximum of 3 years
$LFC_{EG,CG,2}$ = Baseline load factor of heat engine 2 (Turbine 2)	0.44		Maximum of 3 years
$LFC_{EG,CG,3}$ = Baseline load factor of heat engine 3 (Turbine 3)	0.64		Maximum of 3 years
$CAP_{EG,PO,1,2,3}$	0.0	MW	No Power-only-type heat engine in the baseline scenario
$LFC_{EG,PO,j}$ = 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	99,468	MWh	Calculated
$EL_{BR,PO,x,j}$ = Quantity of electricity generated in heat engine j in year x (MWh) in Power only mode according to Base line configuration	0	MWh	Calculated
$CAP_{EG,totay,y}$	99,468	MWh	Calculated

Step 1.4: 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 shall be based on the monitored amounts of biomass residues used for power and/or heat generation in the project boundary for which B4 has been identified as the most plausible baseline scenario above.

Where the whole amount of biomass residues of one particular type and from one particular source would be used in the baseline in clearly identifiable baseline heat generators, the monitored quantities of biomass residues used in the project can be directly allocated to those heat generators in the baseline scenario. However, the following situations require particular attention:

- One biomass residue type from one particular source could be used in the baseline in two or more heat generators. In this case, the use of this biomass residue type from this source has to be allocated to the different heat generators should they have different efficiencies; (Not applicable here)

- One biomass residue type from one particular source could have two different fates in the baseline scenario. The biomass categories 1 and 2 in Table 2 illustrate this situation: the rice husks are obtained from one source but would in the baseline partly be dumped (B1:) and partly be used for power generation (B4:). This can apply, for example, if parts of one biomass residue type were already collected prior to the implementation of the CDM project activity while another part was not needed and thus dumped, left to decay or burnt. In this case, it is necessary to allocate the biomass residue quantity used under the project to the following fates in the baseline scenario: (Applicable here)

a) Power or heat generation (B4:), or

b) Dumping, leaving to decay or burning (B1:, B2: and/or B3:), or

The approaches used should be consistent with the identified baseline scenario and reflect the particular situation of the underlying project activity. In doing so, the following allocation rules should be adhere to:

(a) In the case a biomass residues type from one particular source has been used prior to the implementation of the project activity partly in heat generators operated at the project site (scenario B4:) and partly has been dumped, left to decay or burnt (scenarios B1:, B2:, B3:) and if this situation would continue in the baseline scenario, then use, as a conservative approach to address the uncertainty associated with such an allocation, the maximum value among the following two approaches for the quantity of rice husk allocated to scenario B4:;

(b) The quantity of rice husk is the highest annual historical use of that rice husk for power and/or heat generation at the project site observed in the most recent three years prior the date of submission of the PDD for validation of the project activity for which data is already available (2014, 2015, 2016);

$BR_{B4,n,y}$	161,764 tonnes/year	Pant 3 year data Annual Audited Report

Step 1.5: Determine the efficiencies of heat generators, and efficiencies and heat-to-power ratio of heat engines

The efficiencies of heat generators and heat engines should be calculated using one of the following options:

Option 1: Default values. Use Option F in the latest approved version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems". The default value for the losses linked to the electricity generator group (i.e. turbine/engine, couplings and electricity generator), $GGL_{default}$ is 5%.

Option 2: Manufacturer's data. This option is only applicable to heat engines and heat generators that were operated at the project site prior to the implementation of the project activity. The efficiency of the heat generator or heat engine is determined based on manufacturer's data of the efficiency under optimal operating conditions and take into account the actual conditions of the fuel used.

Option 3: This option is only applicable to heat generators and heat engines that were operated at the project site for at least three calendar years prior the date of submission of the PD for validation of the project activity.

Data:	**Value**	**Source**
Efficiency of Heat Generator		
$\eta_{BL,HG1,BR,h}$ = Baseline biomass-based heat generation efficiency of heat generator	80%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4
$\eta_{BL,HG2,BR,h}$ = Baseline biomass-based heat generation efficiency of heat generator	78%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 2
$\eta_{BL,HG3,BR,h}$ = Baseline biomass-based heat generation efficiency of heat generator	78%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 3
$\eta_{BL,HG4,BR,h}$ = Baseline biomass-based heat generation efficiency of heat generator	80%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4
$\eta_{BL,HG4,BR,h}$ = Baseline biomass-based heat generation efficiency of heat generator	80%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4
$\eta_{BL,HG4,BR,h}$ = Baseline biomass-based heat generation efficiency of heat generator	80%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4
Efficiency of Heat Engine		
$\eta_{BL,EG4,CG,T1}$ = Baseline biomass-based heat generation efficiency of heat generator - Turbine 1	73%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4
$\eta_{BL,EG4,CG,T2}$ = Baseline biomass-based heat generation efficiency of heat generator - Turbine 2	73%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4
$\eta_{BL,EG4,CG,T3}$ = Baseline biomass-based heat generation efficiency of heat generator - Turbine 3	73%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4
$\eta_{BL,EG4,CG,T4}$ = Baseline biomass-based heat generation efficiency of heat generator - Turbine 4	73%	Manufacturer Data (As per Option 2 of Step 1.5). This is for Boiler 4

Heat-to-power ratio

The heat-to-power ratio of cogeneration-type heat engines (e.g. backpressure and heat-extraction steam turbines) has been calculated according to Case 1 of the Step 1.5: For existing heat engines with a minimum three-year operational history prior to the project activity:

$$HPR_{BL,EG,CG/PO,i/j} = \frac{1}{3.6} \cdot MAX\left\{\frac{HC_{BR,CG/PO,x,i/j}}{EL_{BR,CG/PO,x,i/j}}; \frac{HC_{BR,CG/PO,x-1,i/j}}{EL_{BR,CG/PO,x-1,i/j}}; \frac{HC_{BR,CG/PO,x-2,i/j}}{EL_{BR,CG/PO,x-2,i/j}}\right\}$$

Where:

$HPR_{BL,i}$	Baseline heat-to-power ratio of the heat engine *i* (ratio)

$HC_{BR,CG/PO,x,i/j}$	Quantity of process heat extracted from the heat engine *i/j* in year *x* (GJ)
$EL_{BR,CG/PO,x,i/j}$	Quantity of electricity generated in heat engine *i/j* in year *x* (MWh)
x	Last calendar year prior to the start of the crediting period
i	Cogeneration-type heat engine in the baseline scenario
j	Power-only-type heat engine in the baseline scenario

$HC_{BR,CG,1}$ = Quantity of process heat extracted from the heat engine 1 (GJ) (Cogeneration) - Year 2015	606,322	GJ
$HC_{BR,CG,1}$ = Quantity of process heat extracted from the heat engine 1 (GJ) (Cogeneration) - Year 2014	257,900	GJ
$HC_{BR,CG,1}$ = Quantity of process heat extracted from the heat engine 1 (GJ) (Cogeneration) - Year 2013	219,906	GJ
$HC_{BR,CG,2}$ = Quantity of process heat extracted from the heat engine 2 (GJ) (Cogeneration) - Year 2015	489,102	GJ
$HC_{BR,CG,2}$ = Quantity of process heat extracted from the heat engine 2 (GJ) (Cogeneration) - Year 2015	424,397	GJ
$HC_{BR,CG,2}$ = Quantity of process heat extracted from the heat engine 2 (GJ) (Cogeneration) - Year 2015	339,517	GJ
$HC_{BR,CG,3}$ = Quantity of process heat extracted from the heat engine 3 (GJ) (Cogeneration) - Year 2015	1,314,589	GJ
$HC_{BR,CG,3}$ = Quantity of process heat extracted from the heat engine 3 (GJ) (Cogeneration) - Year 2014	1,343,237	GJ
$HC_{BR,CG,3}$ = Quantity of process heat extracted from the heat engine 3 (GJ) (Cogeneration) - Year 2013	1,296,388	GJ
$EL_{BR,CG,1}$ = Quantity of electricity generated in heat engine 1 (MWh) (Cogeneration) - Year 2015	4,904	MWh
$EL_{BR,CG,1}$ = Quantity of electricity generated in heat engine 1 (MWh) (Cogeneration) - Year 2014	19,910	MWh
$EL_{BR,CG,1}$ = Quantity of electricity generated in heat engine 1 (MWh) (Cogeneration) - Year 2013	12,563	MWh
$EL_{BR,CG,2}$ = Quantity of electricity generated in heat engine 2(MWh) (Cogeneration) - Year 2015	17,553	MWh
$EL_{BR,CG,2}$ = Quantity of electricity generated in heat engine 2(MWh) (Cogeneration) - Year 2014	18,991	MWh
$EL_{BR,CG,2}$ = Quantity of electricity generated in heat engine 2(MWh) (Cogeneration) - Year 2013	12,245	MWh

$EL_{BR,CG,3}$ = Quantity of electricity generated in heat engine 3(MWh) (Cogeneration) - Year 2015	68,602	MWh
$EL_{BR,CG,3}$ = Quantity of electricity generated in heat engine 3(MWh) (Cogeneration) - Year 2015	68,702	MWh
$EL_{BR,CG,3}$ = Quantity of electricity generated in heat engine 3(MWh) (Cogeneration) - Year 2015	63,932	MWh
$HPR_{BL,CG,1}$ = Baseline heat-to-power ratio of in Cogeneration-mode heat engine - Turbine 1	34.34	
$HPR_{BL,CG,2}$= Baseline heat-to-power ratio of in Cogeneration-mode heat engine - Turbine 2	7.74	
$HPR_{BL,CG,3}$= Baseline heat-to-power ratio of in Cogeneration-mode heat engine - Turbine 3	5.63	

Step 1.6: 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, $EF_{EG,FF,y} = EF_{EG,GR,y}$.

Step 1.7: Determination of the emission factor of grid electricity generation

The parameter $EF_{EG,GR,y}$ should be determined as the combined margin CO_2 emission factor for grid to which the project activity is connected in year y, calculated using the latest approved version of the “Tool to calculate the emission factor for an electricity system” at the time of submission of the project to the DOE for validation. The latest approved tool at the time project submission to DOE is

- “Tool to calculate the emission factor for an electricity system Version 04.0.0”[5]
- Baseline Carbon Dioxide Emissions Database, Version 9[6]

As per version 04.0.0 of Tool to calculate emission factor for an electricity system, following steps are included in baseline methodology.

STEP 1.7.1. Identify the relevant electricity systems.
STEP 1.7.2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 1.7.3.Select a method to determine the operating margin (OM).
STEP 1.7.4 Calculate the operating margin emission factor according to the selected method.
STEP 1.7.5. Calculate the build margin (BM) emission factor.
STEP 1.7.6. Calculate the combined margin (CM) emission factor.

The project participant has applied these six steps.

[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf
[6] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

Step 1.7.1. Identify the relevant electricity systems:

A project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints. The Central Electricity Authority (CEA), Government of India has considered the entire country as one singe grid.

Step 1.7.2. Choose whether to include off-grid power plants in the project electricity system (optional):

For calculating the grid emission factor for the project activity, "*Option I (only grid power plants are included in the calculation)*" of this step has been chosen. PP has chosen not to include off-grid power plants in the project electricity system.

Step 1.7.3. Select a method to determine the Operating Margin (OM):

The calculation of the operating margin emission factor ($EF_{OM,y}$) can be based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

Out of the above options, the simple OM method (option a) is used in India.

As per emission factor tool, simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50 per cent of total grid generation (excluding electricity generated by off-grid power plants) in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

In India as per available data (most recent five years) with CEA, the low-cost/must-run resources constitute 17.50% which is less than 50 per cent of total grid generation (excluding electricity generated by off-grid power plants).

NEWNE Grid: Share of low cost / Must- run (% of net generation)					
Years	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Share of low cost / Must- run (% of net generation)	18.6%	16.8%	15.1%	14.6%	14.3%
Average of five most recent year	**15.9%**				
Table reference- CO_2 Baseline Database (Version - 14)					

The above table clearly shows that the percentage of total grid generation by low-cost/must-run plants (on the basis of average of five most recent years) for the Indian grid is much less than 50% of the total generation. Thus, Simple OM method can be used for calculating the emission factor.

Ex-ante option - For, the simple OM emissions factor is calculated using the ex ante option. As per this option, the emission factor has been determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

Step 1.7.4. Calculate the operating margin emission factor according to the selected method,($EF_{OM,grid}$)

The generation weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The Simple OM must be calculated as:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the proposed project activity, the values of OM have been taken from the data published by CEA (reference is provided above) for calculating CO_2 emissions. The database uses the following formulae (corresponding to **option A** of the current version of the Tool as per the "Tool to Calculate the Emission Factor for an Electricity System". Simple operating margin for all the last three years have been provided in the database.

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y

(MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m = All power units serving the grid in year y except low-cost / must-run power units

y = The relevant year as per the data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$

The emission factor of each power unit m has been determined as follows (corresponding to the option A1 of calculating the $EF_{EL,m,y}$:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/MWh)

$FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)

Based on the above mentioned formulae, the simple OM values are calculated and a database is created by the Central Electricity Authority. The latest database available at the time of submission of the PDD to the DOE has been considered. Generation weighted average of simple OM values of last 3 years has been taken for the project activity.

Parameters	**Latest three years from CEA CO_2 Baseline Database (Version 9)**		
	2015-16	2016-17	2017-18
Simple Operating Margin (tCO_2/MWh) (incl. Imports)	0.9655	0.9636	0.9543
Weighted average OM for latest three years, tCO_2/MWh	**0.9610**		

OM calculation has been done *ex-ante* and hence OM value will remain fixed and need not be monitored during the crediting period.

STEP 1.7.5. Calculate the build margin emission factor ($EF_{grid,BM,y}$)

The value of BM has been referred from CEA CO_2 Baseline Database (Version 14) which has been calculated by "*Tool to calculate the emission factor for an electricity system*" (Version- 06).

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{EG_{m,y}}$$

Where

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m = Power units included in the build margin
y = Most recent historical year for which electricity generation data is available

The value of the BM has been refereed from CEA for the year 2017-18 as 0.8644 tCO_2/MWh. BM calculations has been done ex-ante and hence BM value will remain fixed and need not be monitored during the crediting period.

STEP 1.7.6. Calculate the combined margin (CM) emission factor ($EF_{grid, CM, y}$)

The combined margin emission factor is calculated as follows:

$EF_{CM,grid} = EF_{OM,grid} \times w_{OM} + EF_{BM,grid} \times w_{BM}$

Where
$EF_{grid,BM,y}$ = Build Margin CO2 emission factor in the year *y* (tCO2/GWh)
$EF_{grid,OM,y}$ = Operating Margin CO2 emission factor in the year *y* (tCO2/GWh)
W_{BM} = Weighting of build margin emission factor (%)
W_{OM} = Weighting of operating margin emission factor (%)

The following default values should be used for W_{BM} & W_{OM}

- Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;
- All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period , and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

For the proposed project: W_{OM} = 0.5 and W_{BM} = 0.5

$EF_{CM,grid} = EF_{OM,grid} \times 0.50 + EF_{BM,grid} \times 0.50$

$EF_{CM,grid}$ = 0.9610 × 0.50 + 0.8644 × 0.50 = **0.9127** tCO_2/MWh

The value of $EF_{grid,CM,y}$ is calculated ex ante & is fixed.

Step 2: 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 is based on the assumption 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:

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

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

EL_{BLy} is estimated to be 334,660 MWh according to Step 1.2 and $CAP_{EG,total\ y}$ is estimated is 99,468 MWh according to step 1.3 then

$$\mathbf{EL_{BL,GR,y} = 334{,}660 - 99{,}468 = 235{,}192\ MWh}$$

Step 3: Determine the baseline biomass-based heat and power generation

Step 3.1: Determine the baseline biomass-based heat generation

It is assumed that the use of biomass residues for which scenario B4 has been identified as the baseline scenario ($BR_{B4,n,y}$) would be prioritized over the use of any fossil fuels in the baseline. From that assumption, the equivalent amount of heat that would be generated with biomass residues ($HG_{BL,BR,y}$) should be determined.

In order to do that, follow the procedure below:

- Prepare a list of all heat generators that would use biomass residues in the baseline scenario The list should include both biomass-based and co-fired heat generators;

Data:	Value		Source
$BR_{B4,n,y}$ = Quantity of biomass residues of category n used in the project activity in year y for which the baseline scenario is B4	161,764		see step 1.4
NCV	14.8	GJ/Tonnes	Lab reports
Prepare a list of all heat generators that would use biomass residues in the baseline scenario The list should include both biomass-based and co-fired heat generators;			
Boiler 1			
Efficiency	80%		Plant Data
Rice Huck Consumption	83,842	Tonnes/year	See ER Sheet
Boiler 4			
Efficiency	80%		Plant Data
Rice Huck Consumption	148,060	Tonnes/year	See ER Sheet
Boiler 5 (40 TPH)			
Efficiency	80%		Plant Data
Rice Huck Consumption	69,095	Tonnes/year	See ER Sheet
Boiler 6 (60 TPH)			
Efficiency	80%		Plant Data
Rice Huck Consumption	118,448	Tonnes/year	See ER Sheet

- Allocate the biomass types and quantities for which B4 has been identified as the baseline scenario ($BR_{B4,n,y}$) to the different heat generators ($BR_{B4,n,h,y}$). In doing so, the following principles should be adhered to:

- Where a biomass residue type can technically be used in more than one heat generator, it should be assumed that it is allocated from the most efficient to the less efficient heat generators to the maximum extent possible, taking into account any technical and operational constraints;

The amount of heat generated with biomass residues has been calculated based on the allocation rules established in the PD using the following equations:

$$HG_{BL,BR,y} = \sum_{h}\sum_{n}\left(BR_{B4,n,h,y} \cdot NCV_{BR,n,y} \cdot \eta_{BL,HG,BR,h}\right)$$

Subject to,

$$\sum_{h}\sum_{n} BR_{B4,n,h,y} = \sum_{n} BR_{B4,n,y}$$

, i.e. the biomass residues used in each heat generator should not exceed the total amount of biomass residues available.

$$\sum_{n}\left(BR_{B4,n,h,y} \cdot NCV_{BR,n,y} \cdot \eta_{BL,HG,BR,h}\right) \le LOC_{y} \cdot CAP_{HG,h} \cdot LFC_{HG,h}$$

, i.e. the heat generation in each heat generator should not exceed the total capacity of the heat generator;

Where:

$HG_{BL,BR,y}$	=	Baseline biomass-based heat generation in year *y* (GJ)
$BR_{B4,n,h,y}$	=	Quantity of biomass residues of category n used in heat generator h in year *y* with baseline scenario B4 (tonne on dry-basis)
$NCV_{BR,n,y}$	=	Net calorific value of biomass residue of category n in year *y* (GJ/tonne on dry-basis)
$\eta_{BL,HG,BR,h}$	=	Baseline biomass-based heat generation efficiency of heat generator *h* (ratio)
$BR_{B4,n,y}$	=	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)
LOC_{y}	=	Length of the operational campaign in year *y* (hour)
$CAP_{HG,h}$	=	Baseline capacity of heat generator *h* (GJ/h)
$LFC_{HG,h}$	=	Baseline load factor of heat generator *h* (ratio)
y	=	Year of the crediting period
h	=	Heat generator in the baseline scenario

Boiler 1	83,842	Tonnes	Allocated
Boiler 4	148,060	Tonnes	Allocated
Boiler 5	69,095	Tonnes	Allocated
Boiler 6	118,448	Tonnes	Allocated
Total	419,446	Tonnes	Calculated
Heat generation in year in Boiler 1 (GJ)	992,610	Heat generation in year	Calculated

		in Boiler 1 (GJ)	
Heat generation in year in Boiler 4 (GJ)	1,752,894	Heat generation in year in Boiler 4 (GJ)	Calculated
Heat generation in year in Boiler 5 (GJ)	818,017	Heat generation in year in Boiler 5 (GJ)	Calculated
Heat generation in year in Boiler 6 (GJ)	1,402,315	Heat generation in year in Boiler 6 (GJ)	Calculated
$HG_{BL,BR,y}$ = Baseline biomass-based heat generation in year y (GJ)	4,965,836	(GJ)	
LOC_y = Length of the operational campaign in year y (hour)	7,920	hours	See Step 1.3
$CAP_{HG,h}$ = Baseline capacity of heat generator h (GJ/h)	821.96	GJ/h	Calculated
$LFC_{HG,h}$ = Baseline load factor of heat generator h (ratio)	1		
LOC_y *$CAP_{HG,h}$ *$LFC_{HG,h}$ = total capacity of the heat generator	6,509,895	GJ	Calculated

As 4,965,836 is less than 6.509,895 ; the heat generation of the heat generator not exceed the total capacity of the heat generator. (refer to eq.15 of methodology)

Step 3.2: Determine the baseline biomass-based cogeneration of process heat and electricity and heat extraction

It is assumed that cogeneration of process heat and power using biomass-based heat ($HG_{BL,BR,y}$) would be prioritized over the use of fossil fuels for the generation of process heat and power on-site. From that assumption the equivalent amount of electricity ($EL_{BL,BR,CG,y}$) and process heat ($HC_{BL,BR,CG,y}$) that would be generated are determined.

Considering that the several heat engines of different types might be identified as part of the baseline scenario, the prioritization of heat engines use may be challenging and much dependent on specific site conditions. For that reason, the methodology proposes general principles that should be adhered to in order to determine the prioritization of use, which still leave room for technical constraints to be reflected given specific site conditions.
In order to do that follow the procedure below:

- Prepare a list containing the heat engines identified in the baseline scenario for which heat and power can be cogenerated. The list should contain, in case of steam cycles, only back-pressure and heat-extraction steam turbines. Condensing steam turbines should not be considered at this stage;

Data:	**Value**	
Turbine 1 (back-pressure)	5.0	MW
Turbine 3 (bleed condensing)	12.5	MW

- Allocate the total biomass-based heat ($HG_{BL,BR,y}$) to the different heat engines ($HG_{BL,BR,CG,y,i}$).

In doing so, the following principles should be adhered to:

- Where heat can technically be used in more than one heat engine type, it should be assumed that it is allocated so as to maximize the cogeneration of process heat. For instance, in case of steam cycles, if both back-pressure and heat-extraction steam turbines are identified in the baseline, heat should be first allocated to back-pressure turbines and then to heat-extraction turbines to the maximum extent possible, taking into account any technical and operational constraints;
- Subject to the allocation rule above, it should be assumed that heat is allocated from the most efficient to the less efficient heat engines to the maximum extent possible, taking into account any technical and operational constraints; (turbine 3 is more efficient then turbine 1)

- Calculate the amount of electricity and process heat generation based on the allocation above using the following equations:

$$EL_{BL,BR,CG,y} = \frac{1}{3.6} \cdot \sum_i \left(\frac{1}{(HPR_{BL,i} + 1 + GGL_{default})} \cdot HG_{BL,BR,CG,y,i} \right)$$

$$HC_{BL,BR,CG,y} = \sum_i \left(\frac{HPR_{BL,i}}{(HPR_{BL,i} + 1 + GGL_{default})} \cdot HG_{BL,BR,CG,y,i} \right)$$

Subject to,

$\sum_i HG_{BL,BR,CG,y,i} \leq HG_{BL,BR,y}$, i.e. the biomass-based heat used in cogeneration mode should not exceed the total biomass-based heat generated;

$HC_{BL,BR,CG,y} \leq HC_{BL,y}$, i.e. the process heat cogenerated should not exceed the total process heat demand; **(1)**

$(\eta_{BL,EG,CG,i} \cdot HG_{BL,BR,CG,y,i}) \leq LOC_y \cdot CAP_{EG,CG,i} \cdot LFC_{EG,CG,i}$, i.e. the electricity generation in each heat engine should not exceed the total capacity of the heat engine.

Where:

$EL_{BL,BR,CG,y}$	=	Baseline biomass-based cogenerated electricity in year *y* (MWh)
$\eta_{BL,EG,CG,i}$	=	Baseline electricity generation efficiency of heat engine *i* (MWh/GJ)
$HG_{BL,BR,CG,y,i}$	=	Baseline biomass-based heat used in heat engine *i* in year *y* (GJ)
$HC_{BL,BR,CG,y}$	=	Baseline biomass-based process heat cogenerated in year *y* (GJ)
$HPR_{BL,i}$	=	Baseline heat-to-power ratio of the heat engine *i* (ratio)
$GGL_{default}$	=	The default value for the losses linked to the electricity generator group (turbine, couplings and electricity generator. Set at 0.05) (ratio)
$HG_{BL,BR,y}$	=	Baseline biomass-based heat generation in year *y* (GJ)
$HC_{BL,y}$	=	Baseline process heat generation in year *y* (GJ)
LOC_y	=	Length of the operational campaign in year *y* (hour)
$CAP_{EG,CG,i}$	=	Baseline electricity generation capacity of heat engine *i*

		(MW)
$LFC_{EG,CG,i}$	=	Baseline load factor of heat engine *i* (ratio)
i	=	Cogeneration-type heat engine in the baseline scenario
y	=	Year of the crediting period

$HG_{BL,BR,CG,y,turbine1}$	992,609.64 GJ	As Turbine 1 is attached with Boiler 1
$HG_{BL,BR,CG,y,turbine3}$	1,752,894.00 GJ	As Turbine 3 is attached with Boiler 4
$GGL_{default}$ = The default value for the losses linked to the electricity generator group (turbine, couplings and electricity generator. Set at 0.05) (ratio)	0.05	According to Step 1.5 of the methodology ACM0006. The default value for the losses linked to the electricity generator group (i.e. turbine/engine, couplings and electricity generator), GGLdefault , is 5%.
$HPR_{BL,turbin\ 2}$	34.34	See Step 1.5
$HPR_{BL,turbin\ 3}$	7.74	See Step 1.5
Electricity generation based on cogen on turbine 1	7,789.94 MWh	
Electricity generation based on cogen on turbine 3	55,392.51 MWh	
$EL_{BL,BR,CG,y}$ = Baseline biomass-based cogenerated electricity in year y (MWh)	63,182 MWh	Calculated
Process Heat generation based on cogen on turbine 1	963,164 GJ	Calculated
Process Heat generation based on cogen on turbine 3	1,543,510 GJ	Calculated
$HC_{BL,BR,CG,y}$ = Baseline biomass-based process heat cogenerated in year y (GJ)	2,506,674 GJ	Calculated

The next step to be followed depends on the outcomes of the calculations above. Four cases are possible. Only case 3.2.4 applies to the project baseline:

Case 3.2.4: If $HG_{BL,BR,y} > \sum_i HG_{BL,BR,CG,y,i}$ and $HC_{BL,y} > HC_{BL,BR,CG,y}$, then there would be biomass-based heat in the baseline that could still be used and process heat demand to be met. It is assumed then that this balance of biomass-based heat would be extracted from the heat header and used to meet the process heat demand without cogeneration of power. Three cases should thus be considered (refer to the monitoring tables for a definitions of $h_{LOW,y}$ and $h_{HIGH,y}$ used in the equations below):

Data:	Value	Source
$HG_{BL,BR,y}$ = Baseline biomass-based heat generation in year y (GJ)	4,965,836.04 GJ	See Step 3.1

$HG_{BL,BR,CG,y,i}$ = Baseline biomass-based heat used in heat engine i in year y (GJ)	2,745,503.64 GJ	See Step 3.2
$HC_{BL,y}$ =Baseline process heat generation in year y (GJ)	6,108,153.48 GJ	See Step 1.1
$HC_{BL,BR,CG,y}$ = Baseline biomass-based process heat cogenerated in year y (GJ)	2,506,673.96 GJ	See Step 3.2
$h_{HIGH,y}$ = Specific enthalpy of the heat carrier at the heat generator side (GJ/tonnes).	3.22 GJ/tonnes	
$h_{LOW,y}$ = Specific enthalpy of the heat carrier at the process heat demand side (GJ/tonnes)	2.94 GJ/tonnes	
$HC_{BL,y}$ - $HC_{BL,BR,CG,y}$	3,601,480 GJ	Calculated
h_{LOW}/h_{HIGH}*($HG_{BL,BR,y}$ -∑ $HG_{BL,BR,CG,y,i}$)	2,027,260 GJ	Calculated

Then this fit to case 3.2.4.2

Case 3.2.4.2: If $HC_{BL,y} - HC_{BL,BR,CG,y} > \frac{h_{LOW,y}}{h_{HIGH,y}} \cdot \left(HG_{BL,BR,y} - \sum_i HG_{BL,BR,CG,y,i} \right)$, i.e. the balance of biomass-based heat (right-hand side of the equation) is less than the remaining demand for process heat (left-hand side of the equation). Then all biomass-based heat was used and there still remains process heat demand to be met. It is assumed then that this process heat demand would be met by using fossil fuels in the baseline. In order to estimate the baseline parameters that result project participants should:

- Define $HC_{balance,FF,y} = \left(HC_{BL,y} - HC_{BL,BR,CG,y} \right) - \frac{h_{LOW}}{h_{HIGH}} \cdot \left(HG_{BL,BR,y} - \sum_i HG_{BL,BR,CG,y,i} \right)$, $EL_{balance,FF,y} = EL_{BL,y} - EL_{BL,GR,y} - EL_{BL,BR,CG,y}$, and,
- Proceed to Step 1: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation.

As per this step all biomass based heat was used and there still remains process heat demand to met. This process heat demand would be met by using recovery boiler there would be no provision that heat demand would be met by using fossil fuels in the baseline. Therefore step 4 is not applicable and this is conservative from emission reduction point of view.

Step 1: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation

There is no fossil fuel based plant to meet the process heat and the corresponding electricity generation. Hence this step has been skipped.

Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues

According to ACM0006 (ver.14), “The calculation of baseline emissions due to uncontrolled burning or decay of biomass residues is optional and project participants can decide whether to include these emission sources or not. If project participants wish to include these emission sources, the procedure below should be followed, and emissions from combustion of biomass residues under the project activity should be also be determined. Otherwise, this section does not need to be applied and project emissions do not need to include emissions from the combustion of biomass residues under the project activity.”

PP has decided not to apply this section.

Step 6: Calculate baseline emissions

$\boldsymbol{BE_y = EL_{BL,GR,y} * EF_{EG,GR,y}}$

Based on these assumptions, baseline emissions are calculated as follows:

$$\mathrm{BE}_{\mathrm{y}} = EL_{\mathrm{BL,GR,y}} \cdot \mathrm{EF}_{\mathrm{EG,GR,y}} + EL_{BL,FF/GR,y} \cdot \min(EF_{\mathrm{EG,GR,y}}, EF_{\mathrm{EG,FF,y}})$$

$EL_{BL,GR,y}$ = Baseline minimum electricity generation in the grid in year y (MWh)	235,191.39	MWh	Step 2
$EF_{EG,GR,y}$ = Emission factor of grid electricity generation - for first year	0.91270	tCO_2/MWh	Step 1.7
$EL_{BL,FF/GR,y}$ = Baseline uncertain electricity generation in the grid or on-site in year y (MWh)	0	MWh	Step 3.3.1
$EF_{EG,FF,y}$ = 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	Step 1.6 :Since no fossil fuel based power generation was identified as part of the baseline scenario, then make $EF_{EG,FF,y} = EF_{EG,GR,y}$
Then $Min(EF_{EG,GR,y},EF_{EG,FF,y})$ =	0.00000	tCO_2/MWh	Calculated

BE_y = 214,659 tCO_2

3.2 Project Emissions

For the purpose of determining GHG emissions of the project activity, project participant shall include the following emissions sources:

$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG2,y} + PE_{BC,y}$

Where:

PE_y	=	Project emissions in year *y* (t CO_2)
$PE_{FF,y}$	=	Emissions during the year y due to fossil fuel consumption at the project site (t CO_2)
$PE_{GR1,y}$	=	Emissions during the year y due to grid electricity imports to the project site (t CO_2)
$PE_{GR2,y}$	=	Emissions due to a reduction in electricity generation at the project site as compared to the baseline scenario in year *y* (t CO_2)
$PE_{TR,y}$	=	Emissions during the year y due to transport of biomass to the project plant (t CO_2)
$PE_{BR,y}$	=	Emissions from the combustion of biomass during the year *y* (t CO_2e)
$PE_{WW,y}$	=	Emissions from wastewater generated from the treatment of biomass in year *y* (t CO_2e)
$PE_{BG2,y}$	=	Emissions from the production of biogas in year *y* (t CO_2e)
$PE_{BC,y}$	=	Project emissions associated with the cultivation of land to produce biomass in year *y* (t CO_2)

$PE_{FF,y}$	Emission due to on-site fossil fuel consumption. There will consumption of Diesel due to operational reasons (starting of boiler) and to be consumed in front loader in rise husk yard. This will be very small. This will be monitored. However it has been considered to 0 for now. The following tool will be used for calculation. "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"; Version 02 Option B of the tool to calculate CO_2 emission coefficient $COEF_{i,y}$ has been opted.
$PE_{GR1,y}$	CO_2 emissions from grid-connected fossil fuel power plants in the electricity system for any electricity that is imported from the grid to the project site; It is not expected any electricity import from the grid therefore $PE_{GR1,y}$ = 0. If in the future there will any consumption, it will be measured and taking in account as project emissions.
$PE_{GR2,y}$	If (Case 3.3.2) or (Case 4.2.2), the amount of electricity generated on-site in the baseline exceeds the amount of electricity generated in the project scenario. In such cases it is assumed that an equivalent amount of electricity is generated during year y in order to offset this reduction in electricity generation at the project site. As the project has no case 3.3.2 and 4.2.2; $PE_{GR\ 2,y}$ = 0
$PE_{TR,y}$	Explained below
$PE_{BR,y}$	If project proponents chose to include emissions due to uncontrolled burning or decay of biomass residues ($BE_{BR,y}$) in the calculation of baseline emissions. No Baseline emissions included therefore it is 0.
$PE_{WW,y}$	This emission source should be estimated in cases where wastewater originating from the treatment of the biomass is (partly) treated under anaerobic conditions and where methane from the waste water is not captured and flared or combusted. No such case therefore it is zero.

$PE_{BG2,y}$	In case the project includes biogas the consideration of project emissions associated with the production of biogas depends. No such case therefore it is zero.
$PE_{BC,y}$	This step calculates emissions associated with the cultivation of lands to produce biomass and is applicable if heat/electricity is produced from biomass cultivated in dedicated plantations. No such case therefore it is zero.

Determination of $PE_{FF,y}$

The following tool will be used for calculation.

"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"; Version 03

This is applicable as fossil fuels are being proposed to be used in this project activity. The fossil fuel (Diesel) would be used during the boiler start up activity and would be monitored. For ex-ante purposes the quantity diesel has been considered and will be monitored. Therefore,

$PE_{FF,y} = FC_{diesel,y} \times \rho \times PE \times COEF_{diesel,y}$

Where:

ρ = Average density of diesel (kg/l)
$FC_{diesel,y}$ = Diesel consumption (l)
$COEF_{diesel,y}$ = Emission Factor of Diesel (kgCO_2/TJ)

$COEF_{diesel,y} = NCV_{diesel} \times EF_{diesel,y}$

Where:

NCV_{diesel} = Net Calorific Value of diesel (KJ/kg))
$EF_{diesel,y}$ = Emission Factor of Diesel (kgCO_2//TJ)

Determination of $PE_{TR,y}$

According to the ACM0006 using the latest version of the tool "Project and leakage emissions from road transportation of freight" to determine the CO2 emission from transportation of the biomass. $PE_{TR,m}$ in the tool corresponds to the parameter $PE_{TR,y}$ in this methodology and the monitoring period m is one year.

Two options are provided to determine these emissions:

(a) Option A: Monitoring fuel consumption; or

(b) Option B: Using conservative default values.

According to the Tool, transportation activity information on below sectors is listed as below:

(a) *The origin and destination of the freight (to the extent that this is known at validation*); The origin of the freight is the place within a radius of 50 km around the project site. The destination of the freight is the project site.

(b) *The type(s) of freight that are planned to be transported*; The rice husk are planned to be transported;

(c) *The planned number of trips made and/or the planned quantity of freight that should be transported;* and Planned quantity of the freight that should be transported is 246,767 tonnes.

(d) The option selected (A or B) to determine emissions.

To the purpose of this project, Option B is chosen to calculate $PE_{TR,y}$ in the project activity. Under this option, the following data shall be monitored separately for each freight transportation activity f to estimate the emissions:

(a) The quantity of freight transported ($FR_{f,m}$);

(b) The origin and destination of the freight transported and the road (or rail line) distance between the origin and the destination ($D_{f,m}$); and

(c) The vehicle class used, if the freight is transported by road.

In this case, the quantity of freight transported assumed to be 148,571 (see BL step 1.4) tons rice husk which is from a radius of 50 km around the project site according to BAR, therefore the average distance from collection to project site will be less than 50 Km, and the $D_{f,m}$ is adopted as 50 km in the PD for project emissions calculation is conservative.

Amount of biomass procured from Other Suppliers, ($FR_{F,m}$), MT	246.767
Return Trip Distance ($2^*D_{f,m}$), KM	100
(EFCO2,f), gCO2/t km (From Tool)	245
$PE_{TR,y}$	6,045.8
Total Project Emissions (tCO_2) per annum	**6,046**

3.3 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

3.4 Net GHG Emission Reductions and Removals

The procedure for quantification of net GHG emission reductions and removals including all relevant equations has mentioned in the above section 3.3.

Provide the ex-ante calculation (estimate) of baseline emissions/removals, project emissions/removals, leakage emissions and net GHG emission reductions and removals in the table below.

For data and parameters monitored, use estimates. Document how each equation is applied, in a manner that enables the reader to reproduce the calculation. Provide example calculations for all key equations, to allow the reader to reproduce the calculation of estimated net GHG emission reductions or removals.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1	214,659	6,046	0	208,613
Year 2	214,659	6,046	0	208,613
Year 3	214,659	6,046	0	208,613
Year 4	214,659	6,046	0	208,613
Year 5	214,659	6,046	0	208,613
Year 6	214,659	6,046	0	208,613
Year 7	214,659	6,046	0	208,613
Year 8	214,659	6,046	0	208,613
Year 9	214,659	6,046	0	208,613
Year 10	214,659	6,046	0	208,613
Total	2,146,590	60,460	0	2,086,130

4 MONITORING

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 will be 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.
Measurement procedures (if any):	---
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:	For detailed calculation, please refer to BL Step 3.2.4
Measurement procedures (if any):	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 feed-water, the boiler blow-down and any condensate return.
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.
Measurement procedures (if any):	---
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:	see table below
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.
Measurement procedures (if any):	---
Comments:	---

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

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.
Measurement procedures (if any):	---
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 measurement methods and procedures applied:	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 procedures (if any):	---
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.
Measurement procedures (if any):	---
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.
Measurement procedures (if any):	---
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 reflect 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.
Measurement procedures (if any):	Refer to ‘BL Step1.3’.
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 a reputed lab. It has a in-house lab also. It was calculated at 3537 kcal/kg.
Measurement procedures (if any):	Measurements carried out at reputed laboratories according to relevant international standards
Comments:	---

Data / Parameter	**$EF_{EG,GR,y}$**
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emisison 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)
Measurement procedures (if any):	Calculated using latest tool and latest data.
Comments	Fixed ex-ante for entire crediting period

4.2 Data and Parameters Monitored

Complete the table below for all data and parameters that will be monitored during the project crediting period (copy the table as necessary for each data/parameter). Data and parameters determined or available at validation are included in Section 4.1 (Data and Parameters Available at Validation) above.

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	The biomass quantities provided in the table below were determined ex-ante. All these amounts will be 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 will be measured at the entrance using dedicated weight bridges. The external biomass residues will be all measured using dedicated weight-bridges. Dry weight of all biomass residues will be 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 applied:	See table below:

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

	<table><tr><td></td><td></td><td></td><td>boiler)</td><td></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>246,767</td></tr></table>
Monitoring equipment	Weighbridge All the Rice Husk used in the new boiler will identified at the weighbridge. The moisture content in order to determine the quantity of dry biomass will be 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 will be electronic with accuracy between 0.25% - 1.0%. The calibration period will be according to the manufacturer but in any case it will be 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.
Calculation method	-
Comments	-

Data / Parameter	For biomass residues categories for which scenarios B1:, B2: or B3: is deemed a plausible baseline alternative, project participants shall 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 applied:	Not applicable in this case. The Project Proponent will use the first approach to support the selection of the baseline scenario B1/B3 for the additional biomass residues used under the project activity. Refer tool “Project and leakage emissions from biomass”
Monitoring	Not applicable in this case.

equipment	
QA/QC procedures to be applied	Not applicable in this case.
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 will be measured at the entrance using dedicated weight bridges. The external biomass residues will be all measured using dedicated weight-bridges. Dry weight of all biomass residues will be 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 applied:	It is expected to be 246,767 tonnes of dry rice husk.
Monitoring equipment	Weighbridge All the Rice Husk used in the new boiler will identified at the weighbridge. The moisture content in order to determine the quantity of dry biomass will be 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 will be electronic with accuracy between 0.25% - 1.0%. The calibration period will be according to the manufacturer but in any case it will be 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.
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	Calculated ex ante as per the step 1.4 of baseline emission calculation

methods and procedures to be applied	
Frequency of monitoring/recording	Not applicable in this case.
Value applied:	148,571
Monitoring equipment	---
QA/QC procedures to be applied	---
Calculation method	Refer to step 1.4 of baseline emission calculation
Comments	---

Data / Parameter	$EF_{FF,y,f}$
Data unit	T CO_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 will use the values at the upper limit of the uncertainty at a 95% confidence interval.
Description of measurement methods and procedures to be applied	Not applicable. The Project Proponent will use IPCC default values.
Frequency of monitoring/recording	The Project Proponent will review the appropriateness of the data annually.
Value applied:	0.0748 (tCO_2 /GJ) for Diesel.
Monitoring equipment	---
QA/QC procedures to be applied	Not applicable. The Project Proponent will use IPCC default values.
Purpose of 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	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)

applied	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 applied:	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 will be claimed only on electricity generation.
Calculation method	N.A.
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 will be monitored continuously and aggregated as appropriate, to calculate emissions reductions. The proportion of data to be monitored is 100% and the data will be archived electronically. The metering system will be 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 applied:	371,844 (MWh/year)
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.
Calculation method	N.A.
Comments	Data will be kept electronically.

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 applied:	It is expected an auxiliary electricity consumption of 10%. The value has been estimated to 37,184 MWh/year.
Monitoring equipment	The consistency of metered electricity generation should be cross-checked with the quantity of fuels fired.
QA/QC procedures to be applied	The metering system will be calibrated according to CEA regulations which specifies Electricity meters to be calibrated once in 5 years.
Calculation method	N.A.
Comments	$EG_{PJ,aux,y}$ shall include 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 will be kept electronically.

Data / Parameter	$NCV_{BR,n,y}$
Data unit	GJ/tonnes of dry matter
Description	$NCV_{BR,n,y}$ = Net calorific value of biomass residue of category n in year y (GJ/tonne on dry-basis)
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Measure the NCV on dry-basis.
Frequency of monitoring/recording	At least once in an year.
Value applied:	<table><tr><td>Biomass residues category (k)</td><td>Biomass residues type</td><td>Biomass residues source</td><td>NCV (GJ/ton-dry matter)</td></tr><tr><td>1</td><td>Rice Husks</td><td>From Retailers</td><td>14.80</td></tr></table>
Monitoring equipment	Not applicable. Net calorific values will be measured locally, in reputed laboratories.
QA/QC procedures to be applied	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.
Calculation method	N.A.
Comments	Data will be kept electronically.

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 applied:	$h_{LOW,y}$ = 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.
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 will be monitored and registered by taking periodic samples from each biomass type flow to the power boiler. Humidity content will be calculated by evaporating the water of the samples and measuring the weight before and after the water has been evaporated. This process will be 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 applied:	-
Monitoring equipment	Not applicable. Moisture content will be measured locally, in reputed laboratories.
QA/QC procedures to be applied	---
Calculation method	N.A.
Comments	Data will be 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 applied:	7920 Hours
Monitoring equipment	---
QA/QC procedures to be applied	---
Calculation method	N.A.
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 will be calculated in this case.
Frequency of monitoring/recording	Continuously.
Value applied:	• Diesel consumption in the power boiler due to operational reasons: 0 ton/yr. • Diesel consumption of the front-loaders: 0 lt/yr.
Monitoring equipment	N.A
QA/QC procedures to be applied	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the emission reduction project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.

Calculation method	Diesel consumption in the power boiler: The consumption will be 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 will use the diesel performance index expressed in litres of diesel consumption per hour of operation of the front loader. The Project Proponent will choose a conservative diesel performance index for the emission reduction calculation for the period. The total diesel consumption will be determined by multiplying the diesel consumption index of the front loader by the total amount of hours of operation of the front loader.
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 will use option d) (IPCC default values) in this case.
Frequency of monitoring/recording	Any future revision of the IPCC Guidelines should be taken into account.
Value applied:	Diesel: 43.3 GJ/ton
Monitoring equipment	Not applicable, since the Project Proponent will use option d) (IPCC default values) in this case.
QA/QC procedures to be applied	Not applicable, since the Project Proponent will use option d) (IPCC default values) in this case.
Calculation method	N.A.
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 will use data in line with national standard.
Frequency of monitoring/recording	Any future revision of the IPCC Guidelines should be taken into account.
Value applied:	Diesel: 0.87 kg/l
Monitoring equipment	Not applicable, since the Project Proponent will use data in line

	with national standard.
QA/QC procedures to be applied	Not applicable, since the Project Proponent will use data in line with national standard.
Calculation method	N.A.
Comments	---

Data / Parameter	$EF_{CO2,i}$
Data unit	(tCO^2/GJ).
Description	Weighted average CO^2 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 will use option d) (IPCC default values) in this case.
Frequency of monitoring/recording	Any future revision of the IPCC Guidelines should be taken into account.
Value applied:	Diesel: 0.0748 (tCO^2/GJ).
Monitoring equipment	Not applicable, since the Project Proponent will use option d) (IPCC default values) in this case.
QA/QC procedures to be applied	Not applicable, since the Project Proponent will use option d) (IPCC default values) in this case.
Calculation method	N.A.
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	To be updated whenever the road distance changes.
Value applied:	100 km
Monitoring equipment	---
QA/QC procedures to be applied	All the suppliers are within the range of 30 KMs. If rice husk is transported by more than 30 KM then it will be not economically viable. So the value considered 50 KM is conservative.
Calculation method	N.A.
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 applied:	246,767 (ton/yr)
Monitoring equipment	---
QA/QC procedures to be applied	---
Calculation method	Biomass residues from third parties will be measured (weighted) using dedicated weighbridges at the entrance of the biomass power plant.
Comments	---

4.3 Monitoring Plan

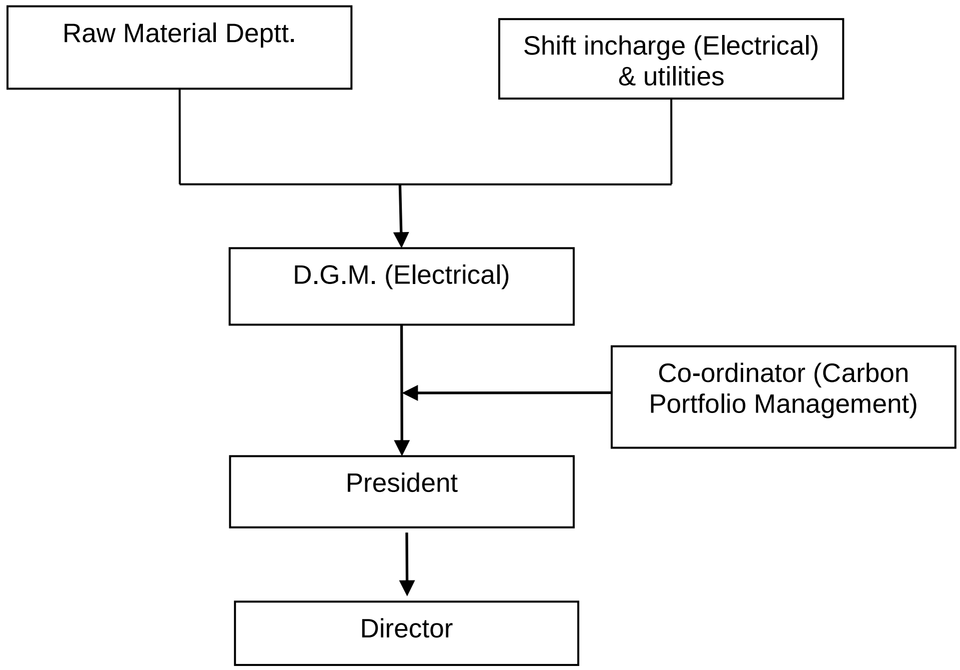
Describe the process and schedule for obtaining, recording, compiling and analyzing the monitored data and parameters set out in Section 4.2 (Data and Parameters Monitored) above. Include details on the following:

- *The methods for measuring, recording, storing, aggregating, collating and reporting data and parameters. Where relevant, include the procedures for calibrating monitoring equipment.*
- *The organizational structure, responsibilities and competencies of the personnel that will be carrying out monitoring activities.*
- *The policies for oversight and accountability of monitoring activities.*
- *The procedures for internal auditing and QA/QC.*
- *The procedures for handling non-conformances with the validated monitoring plan.*
- *Any sampling approaches used, including target precision levels, sample sizes, sample site locations, stratification, frequency of measurement and QA/QC procedures.*

Where appropriate, include line diagrams to display the GHG data collection and management system.

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 reports 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 will be 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 Manger 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 will 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 log book and electronic form. However, the data in electronic form is archived throughout the life time 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 will prepare a monitoring report showing all emission reduction calculations as per monitoring plan**.**

The monitoring report will be compiled annually. This report will contain:

- 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 will be submitted at the end of each monitoring period.

5 SAFEGUARDS

5.1 No Net Harm

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

5.2 Environmental Impact

The proposed project activity is a biomass based cogeneration project. As per the Schedule 1 of the EIA notification 2006, given by the Ministry of Environment and Forests under the Environment (Protection) Act 1986, Biomass based cogeneration project activity doesn't fall under the list of activities requiring EIA The Ministry of Environment and Forests (MoEF), Government of India notification, dated September 14, 2006 regarding the requirement of Environment Impact Assessment (EIA) studies states that any project developer in India needs to file an application to the Ministry of Environment and Forests (including a public hearing and an EIA) in case the proposed industry or project is listed in a predefined list. Thirty-eight categories of activity with a certain investment criteria are required to undertake an Environment Impact Assessment (EIA). However, the proposed project activity doesn't fall under the list of activities requiring EIA. Thus, no EIA study is required for this project activity.

5.3 Local Stakeholder Consultation

A stakeholder meeting for the project was scheduled as below;

Date: 06-Sep-2017; Time: 9:30am; at Plant Admin office.

Agenda of the meeting:

1. Welcome speech
2. Description of the project details
3. Interactive session with the stakeholders
4. Vote of thanks

Mr. R. K. Bhandari, Satia Industries Limited, welcomed the gathering and introduced the company and its initiative to the attendees. He briefed the attendees purpose of the stakeholder meeting with reference to the installation of new project activity and further briefed the gathering that this meeting has been convened for discussing opinions, concerns and benefits for 2% sharing of the Carbon Credit revenues from the Biomass Co-generation Project as per the requirement from Ministry of Environment, Forest and Climate Change (MoEF&CC) being established in this region by the aforementioned company.

Mr. Ajay Jindal, Satia Industries Limited, then briefed the villagers about the company and the plan for sharing of 2% Carbon Credit revenue. He explained that the project with respect to environment and socio-economic considerations 2% revenue will be shared for the purposes like for eye camp, donation to schools, free books to student's, donation to Thelassaemic Children Welfare Association and advertisement for social welfare activities.

Subsequently all the stakeholders were asked for their queries and suggestions. Following are the questions and responses to their queries:

(Q) Mr. Manoj Kumar enquired about the plan for sharing of 2% Carbon Credit revenues?

(A) It was assured to all the villagers by Mr. Jindal that the 2% of the total revenue generated by the sale of Carbon Credits depending upon the market price, will be shared with the local villagers and the plan for above was distributed among the villagers.

(Q) Ms. Kiran Devi asked: Will Satia Industries monitor the sharing of 2% Carbon Credit revenues?

(A) Satia Industries Limited will monitor the sharing of 2% Carbon Credit revenues, Mr. J.R. Sharma, Director (Legal) and S. Avtar Singh, Assistant manager will be responsible for the monitoring of the Carbon Credit revenues.

Vote of thanks

After ensuring that all the queries of the stakeholders were satisfactorily answered and there weren't any further queries, the meeting was concluded by Mr. R.K. Bhandari. He thanked all the people for rendering their valuable time and requested them to continue their support and co-operation toward the project.

Around 15-20 stakeholders attended the meeting including the representatives from the PP. The attendance was duly recorded.

5.4 Public Comments

The project has been listed for 30 days period from 25th July – 24th August 219 2019[7]. No comments were received during this period.

[7] https://www.vcsprojectdatabase.org/#/pipeline_details/PL1920

APPENDIX X: <TITLE OF APPENDIX>

Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.