5MW BIOMASS BASED COGENERATION PROJECT AT SAINSONS

Document Prepared By (PA Research & Consultants Pvt. Ltd)

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1 PROJECT DETAILS

1.1 Summary Description of the Project

Sainsons Paper Industries Limited (SPIL), a leading supplier and manufacturer of craft paper, and started its operation in 1993 in Bakhli village, Kurukshetra, Haryana. The present annual production capacity of plant is 225 tonnes per day.

Prior to porposed project activity, the SPIL was operating paper production plant at 150 MT per day. At 150 TPD, the total process steam requirement was 2717 GJ/Day and total electricity requirement was 114 MWh/day (64 MWh/day from captive turbines and 50 MWh/day from grid). Total installed capacity of boiler was 45 TPH and turbine was 3 MW.

The SPIL is planning to increase the paper production capacity to 225 MT per day, due which process steam requirement will increase to 4017 GJ/day and total electricity requirement would increase to 170 MWh per day. To fulfill the additional requirement SPIL has proposed new cogeneration plant with 50 TPH boiler and 5 MW turbine. 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 SPIL.

Parameter	Unit	Pre-project	Due to increased production	Total
Production	MT/day	150	75	225
Process steam required	GJ/day	2717	1300	4017
Process electricity required	MWh	114	56	170
Boiler capacity	TPH	45	50	95
Process steam required	TPH	35	15	50

Project Description:

SPIL has implemented a 5 MW cogeneration power project based on rice husk. The power will be produced by 5MW extraction-cum-condensing steam turbine with alternator. Major equipment of the power project comprises of 50 tonne per hour (TPH) capacity single drum travel grate type boiler. The average inflow of extraction steam is 30 tonne per hour, which is used for process steam requirement in the paper machine section. In pre project scenario the heat and power requirement was met using low-pressure boiler with 3 MW turbine, wherein the remaining power is imported from grid.

The fuel being used for project activity is rice husk, which is available in plenty in the nearby region. The rice husk required for project activity is being procured from the Rice Mills and other vendors available in the near by region, which is then transported to the project site using motor vehicle (trucks). The project proponent has developed an infrastructure in terms of manpower and financial resources, in order to ensure continuous fuel availability. The project proponent also intended to use small quantity of coal during heavy rain, when moisture content of rice husk increases.

Before project activity the total electricity requirement was 114 MWh/day or 37,620 MWh/year (68*330). Out of which 68 MWh/day or 22,440 MWh/year was supplied from in-house turbine generators and another 46 MWh/day or 15,180 MWh/year was supplied by grid. Before project activity, the total installed capacity of turbine was 3 MW and turbines were running at 90% load.

After project activity the total electricity requirement would be 170 MWh/day or 56,100 MWh/year. Out of which 22,440 MWh/year (2.7 MW) would be supplied from old turbines and 33,660

MWh/year (4.5 MW) would be supplied from project activity. Therefore 33,660 MWh/year represents the project activity electricity and removal of grid electricity.

The GHG emission reductions are from electricity generation. It would substitute electricity generation of NEWNE grid of India dominated by coal based power plants, and thus would reduce coal consumption. The estimated annual average GHG emission reductions from this project are **28,442 tCO_2e** and total GHG emission reductions over the ten year period are **284,420 tCO_2e**.

Scenario existing prior to the implementation of the project

Prior to the implementation of project, the capacity of plant production was 150 TPD. Process Steam requirement was 2.71 TJ/day and electricity requirement was 114 MWh/day. To meet this requirement, SPIL had 2 boilers with combined capacity of 45 TPH and 1 Turbine with rated capacity of 3 MW. The rest of electricity was met from NEWNE grid.

1.2 Sectoral Scope and Project Type

Sectoral scope-01, Energy Industries (Renewable -/non renewable sources)

Project Type- Renewable energy

Grouped Project: The proposed project activity is not a grouped project.

1.3 Project Proponent

Organization name	Sainsons Paper Industries Limited
Contact person	Mr H K Saini
Title	Director
Address	Plot no. 5, Vill-Bakhli (pehowa), Kurukshetra, Haryana
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1.4 Other Entities Involved in the Project

NA

1.5 Project Start Date

The start date of the project activity will be 01-October-2016, which corresponds to the expected date of commissioning of 5MW turbine.

1.6 Project Crediting Period

Crediting Period Start Date: 01/10/2016

VCS Project Crediting Period: Ten years, this may be renewed at most twice.

1st Crediting Period: 01/10/2016 – 30/09/2026

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)
2016-17	28442
2017-18	28442
2018-19	28442
2019-20	28442
2020-21	28442
2021-22	28442
2022-23	28442
2023-24	28442
2024-25	28442
2025-26	28442
Total estimated ERs	284420
Total number of crediting years	10
Average annual ERs	28442

Since the emission reductions from the project activity are below 300,000 tCO_2e per year, it falls under the category of "Project", however as per applied approved methodology, based on installed capacity of boiler and turbine project activity is a large scale project activity.

1.8 Description of the Project Activity

The need of project activity was because of increased production of paper mill from 150 TPD to 225 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 1300 GJ/day and additional electricity requirement was of 56 MWh/day. To meet up the complete demand after capacity expansion and to remove dependency from grid, SPIL decided to install a new co-generation unit.

The project is a cogeneration unit with one 50 TPH biomass based boiler and a 5 MW turbine generator (TG). The generated steam and electricity is used to meet the captive demand of increased capacity of paper plant.

The detailed specifications of Boiler and TG are as below:

Boiler:

Type:	Air Fluidized bed combustion (AFBC) Boiler
Pressure:	65 kg/cm^2(g)
Temperature:	490+/-5^{o}C
Capacity:	50 tonnes per hour (tph)
Fuel:	Fuel firing option: Rice Husk and Coal
Efficiency:	The efficiency for Rice husk 80%
Operational Lifetime:	20 years

Turbine:

Type:	Multistage, extraction-cum-condensing, Horizontal, Impulse type
Capacity:	5 MW
Inlet steam pressure:	63 Kg./Cm^{2}g
Temperature:	485+/- 5^{o}C
Gear Box Output speed:	1500 RPM

Alternator:

Rating:	5 MW
Speed:	1500 RPM
Frequency:	50 Hz

The plant installed one condensing cum extraction turbine along with 50 TPH high-pressure boiler with steam parameters of 63 kg/cm^2 and 485 ^{0}C. This boiler is of modern design with fluidized bed combustion suitable for indoor installation with water scrubber for dust collection. For generating maximum of 100% steaming capacity of the boiler at rated parameters, about 600 TPD of rice husk (100%rice husk firing) is required. The plant has Supervisory Control and data acquisition for operation and generates a gross output of 5000 KW at the generator terminals. The power generation in the cogeneration plant is at 440V level.

The plant is designed with all other auxiliary plant systems like:

1. Rice husk handling system.
2. Ash handling system
3. Air pollution control devices
4. Water system consists of following sub-systems:
5. Raw water system
   5.1 Condensate system
   5.2 Fire protection system

The rice husk is supplied by vendors on continuous basis hence the storage of rice husk is less than 30 days hence there is no significant GHG emission from storage of rice husk. Also the ash resulting from the firing of rice husk is dumped to a specified site. The operation of the rice husk based power plant will lead to mitigation of emission of carbon di-oxide, as husk is a carbon neutral fuel. The project apart from mitigating the emission of GHG will reduce the local emissions of sulfur and other pollutants associated with the burning of fossil fuels. Hence technology employed in project activity is environmentally safe and sound.

No technology transfer is involved in the project activity, as the technology used and know how required for the project activity is available in India.

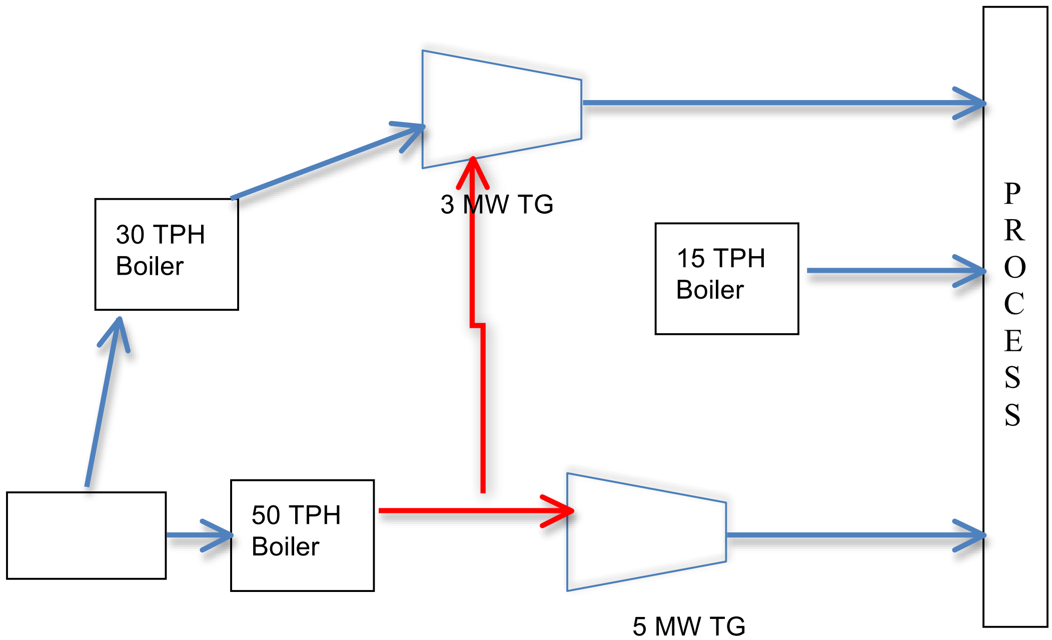


Fig: Project scenario

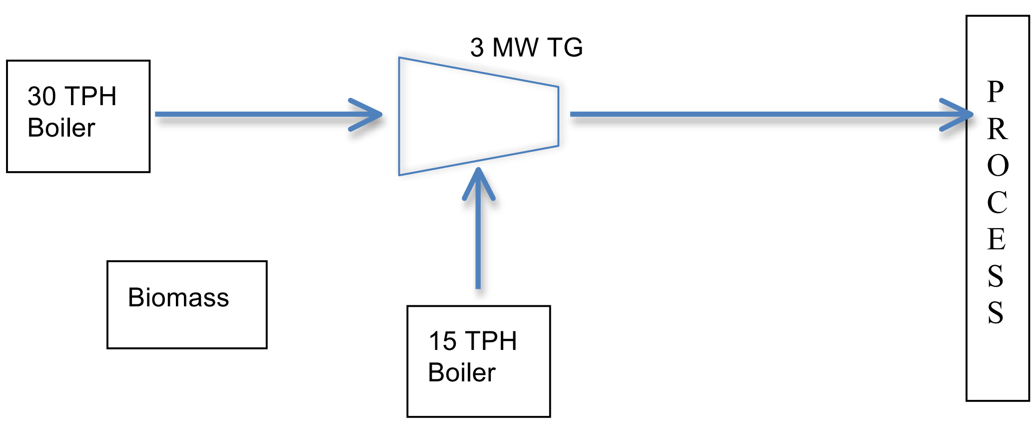
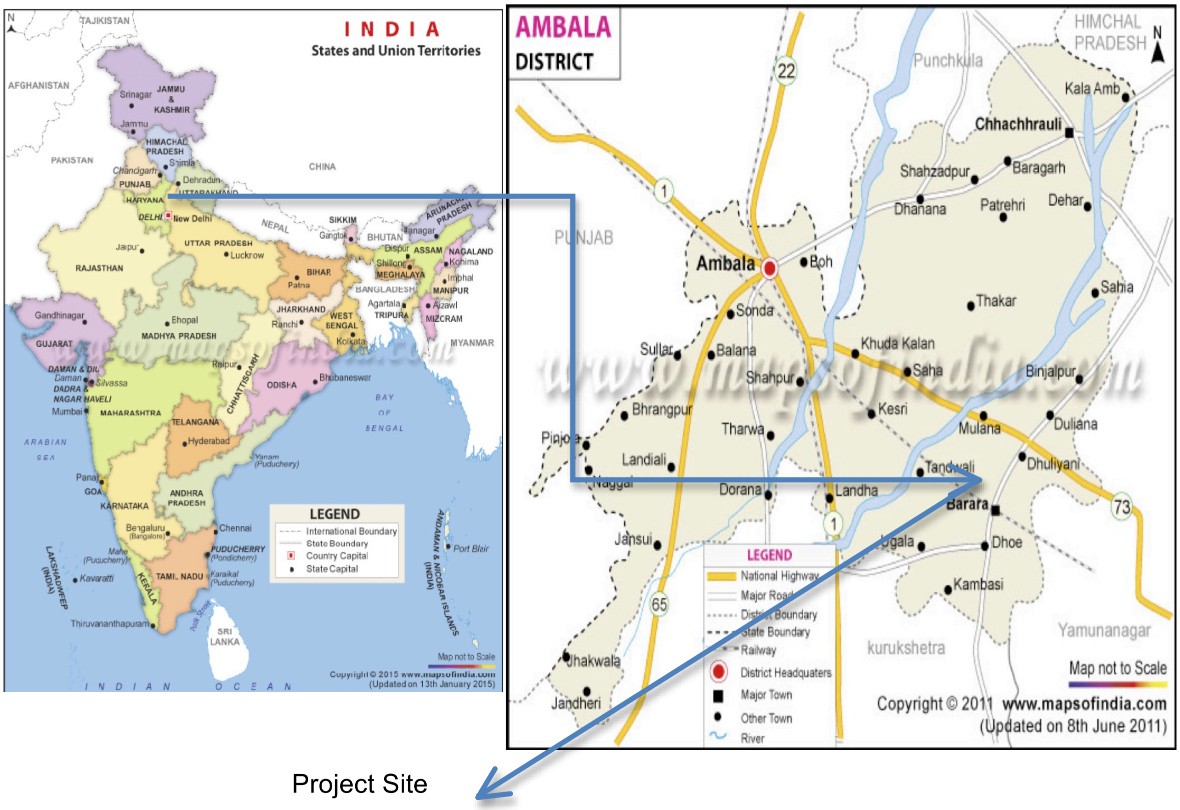


Fig: Baseline Scenario

1.9 Project Location

The proposed project activity is located in Bakhli village, Pehowa Tehshil, Kurukshetra district of Haryana state of India. The Project site is well connected by district and village roads to the nearest town. The nearest railway station is Kurukshetra Junction is 30 Km away. The geographic co-ordinate of project site is provided below.
Latitude: 30^0 00' 09"
Longitude: 76^0 31' 51.44"



Project Site

1.10 Conditions Prior to Project Initiation

Prior to the implementation of project, the capacity of plant production was 120 TPD. Process Steam requirement was 2.71 TJ/day and electricity requirement was 114 MWh/day. To meet this requirement, SPIL had 2 boilers with combined capacity of 45 TPH and 1 Turbine with rated capacity of 3 MW. The rest of electricity was met from NEWNE grid.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The relevant national laws and regulation pertaining to generation of energy are:

- Electricity Act 2003
- Energy conservation Act 2003
- National Electricity Policy 2005

Heat/Power generation using biomass is not a legal requirement or a mandatory option. There are state and sectoral policies, framed primarily to encourage biomass power projects. These policies have also been drafted realizing the extent of risks involved in the projects and to attract private investments. As per environmental act the proposed project activity does not require to carry out environmental impact assessment. The PP has secured all necessary regulatory and statutory clearances to establish and operate the project under discussion.

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 have been submitted to DOE.

1.12 Ownership and Other Programs

1.12.1 Right of Use

The following evidences can verify the ownership of the Project and its right to use:

1. Commissioning certificates
2. Purchase orders

1.12.2 Emissions Trading Programs and Other Binding Limits

This project activity is voluntary initiative and it is not to meet any local laws or regulatory compliances. An undertaking has been submitted that PP shall not claim for GHG emission reduction credits for the given crediting period under any other emission-trading program or GHG binding limits.

1.12.3 Other Forms of Environmental Credit

PP declares that emission reductions generated from the project activity will not be double counted (i.e. issuance of other form of environmental credit like under CDM) for the particular crediting period, which is being claimed under VCS mechanism. PP has submitted an undertaking to the VVB that they shall not claim for GHG emission reduction credits for the given period under any other emission-trading program.

1.12.4 Participation under Other GHG Programs

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

1.12.5 Projects Rejected by Other GHG Programs

PP hereby declares that any other GHG program has not rejected the project activity; an undertaking for the same has been submitted by the PP.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

The project activity is not a grouped project.

Leakage Management

As per the applied methodology, there are no leakage emissions envisaged. Hence, leakage emissions are not applicable.

Commercially Sensitive Information

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

Further Information

Government of India has stipulated following indicators for sustainable development in the interim approval guidelines[1] for CDM projects.

1. Social well-being
2. Economic well-being
3. Environmental well-being
4. Technological well-being

1. Social well-being:

The main source for this cogeneration plant will be locally available agriculture waste i.e. renewable biomass. The economy of the local people will be improved by selling biomass to the power plant. Since the project is located in a village it will assist in alleviation of poverty to certain extent by generating both direct and indirect employment in the area of skilled/unskilled jobs for regular operation and maintenance of the power plant.

2. Economic well-being:

The biomass-based cogeneration is an alternative to fossil fuel based cogeneration plants and the decentralized power generation will reduce the transmission and distribution losses. The project shall create new rural income resulting from the sales of biomass fuel like agriculture waste. Increased income levels shall contribute to the economic safety and empowerment of the most vulnerable sections of local society.

3. Environmental well-being:

The project is using biomass for heat/power generation. There is no net GHG emission from this project activity. Combustion of biomass in the proposed project does not result in net increase in GHG emissions of CO_2. In the absence of the project activity the biomass would have been decayed in the land and would emit CH_4. Hence, the project activity is also reducing CH_4 emission in the atmosphere.

Thus, the project causes no negative impact on the surrounding environment contributing to environmental well-being.

4. Technological well-being:

The project makes use of efficient environmentally safe technology for heat/power generation with no Green House Gas (GHG) emission.

In view of the above, the PP has considered that the project activity profoundly contributes to the sustainable development.

[1] Ministry of Environment and Forest web site: http://envfor.nic.in:80/divisions/ccd/cdm_iac.html

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Title: "Consolidated methodology for electricity and heat generation from biomass residues", ACM 0006, Version: 12.1.1, EB 69

The following tool have been used for the project activity under consideration –

Title: "Tool for demonstration and assessment of additionality", Version 7.0.0

Title: "Tool to calculate the emission factor for an electricity system", Version 5.0

Title: "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", Version 02

Title: "Project and leakage emissions from transportation of freight"; Version 1.1

2.2 Applicability of Methodology

This methodology is applicable to project activities that operate biomass (co-) fired power-and-heat plants**.** The following table provides the justification for the applicability of the considered methodology for the proposed project activity:

Criteria	Applicability
This methodology is applicable to project activities that operate biomass-residue (co-) fired power-and-heat plants.	The project activity proposes to utilise 100% rice husk for the generation of steam and electricity. However, in exigency e.g. during heavy rain small quantity of coal may be used, which will be monitored ex-post. In the absence of the project activity, the steam would be generated from biomass based boilers and electricity would be purchased from grid. The main intention of use of biomass in the aforesaid project activity is to displace the requirement on grid electricity from biomass based electricity generation system.
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 the existing plant;	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 150 TPD to 225 TPD of paper production was planned by SPIL to meet the growing demand of product in the market.

• 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.	
No biomass types other than biomass residues are used in the project activity	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.
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.	There is no fossil fuel co-fired in the Project.
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;	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 is not applicable for the proposed project activity; Hence criterion in not applicable.
The biomass residues used in the project facility are not stored for more than one year.	The project activity would require 108,000 tonnes of rice husk per year. The storage capacity designed for the project can only hold 60 days quantity of rice husk supply.
The biomass residues used by the project facility are not obtained from chemically processed biomass (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemical –degradation, etc.) prior to combustion. Moreover, the preparation of biomass-derived fuel does not involve significant energy quantities, except from transportation or mechanical treatment so as not to cause significant GHG emissions.	The biomass residues used by the project proponent is rice husk, which does not require any chemical pre-processing before combustion as fuel.
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	This project is not a fuel switch project activity. Hence criterion in not applicable.

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 residues	
In the case that biogas is used in power and/or heat generation, this methodology is applicable under the following conditions: • The biogas is generated by anaerobic digestion of wastewater (to be) registered as a VCS project activity and the details of the registered VCS project activity must be included in the PDD. Any CERs from biogas energy generation should be claimed under the proposed project activity registered under this methodology; • The biogas is generated by anaerobic digestion of wastewater that is not (and will not) be registered as a VCS project activity. The amount of biogas does not exceed 50% of the total fuel fired on an energy basis.	No biogas is used in power and/or heat generation. Hence criterion in not applicable.
In the case the project from dedicated plantations: (a) The cultivated land can be clearly identified and used only for dedicated energy biomass plantations; (b) The VCS project activity does not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed project activity can continue to provide at least the same amount of goods and services as in the absence of the project; (c) Theplantationsareestablished: (i) On land which was, at the start of the project implementation, classified as degraded or degrading; or (ii) On a land area that is included in the project boundary of one or several registered A/R VCS project activities; (d) The plantations are not established on organic soil (notably peatlands); (e) The land area of the dedicated plantations will be planted by direct	The rice husk is agrowaste and procured from vendors. Hence criterion in not applicable.

planting and/or seeding; (f) After harvest, regeneration will occur either by direct planting, seeding or natural sprouting; (g) Grazing will not occur within the plantation; (h) No irrigation is undertaken for the biomass plantations; (i) The land area where the dedicated plantation will be established is, prior to project implementation, severely degraded and in absence of the VCS project activity would have not been used for any other agricultural or forestry activity; (j) Only perennial plantations are eligible.	
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: • For power generation: Scenarios P2 to P7, or a combination of any of those scenarios; • For heat generation: Scenarios H2: to H7:, or a combination of any of those scenarios; • 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: o 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; o 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 Power: P7 Heat: H5 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.

Hence the proposed project activity satisfies the necessary/relevant applicability criteria of ACM0006, version 12.1.1.

2.3 Project Boundary

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

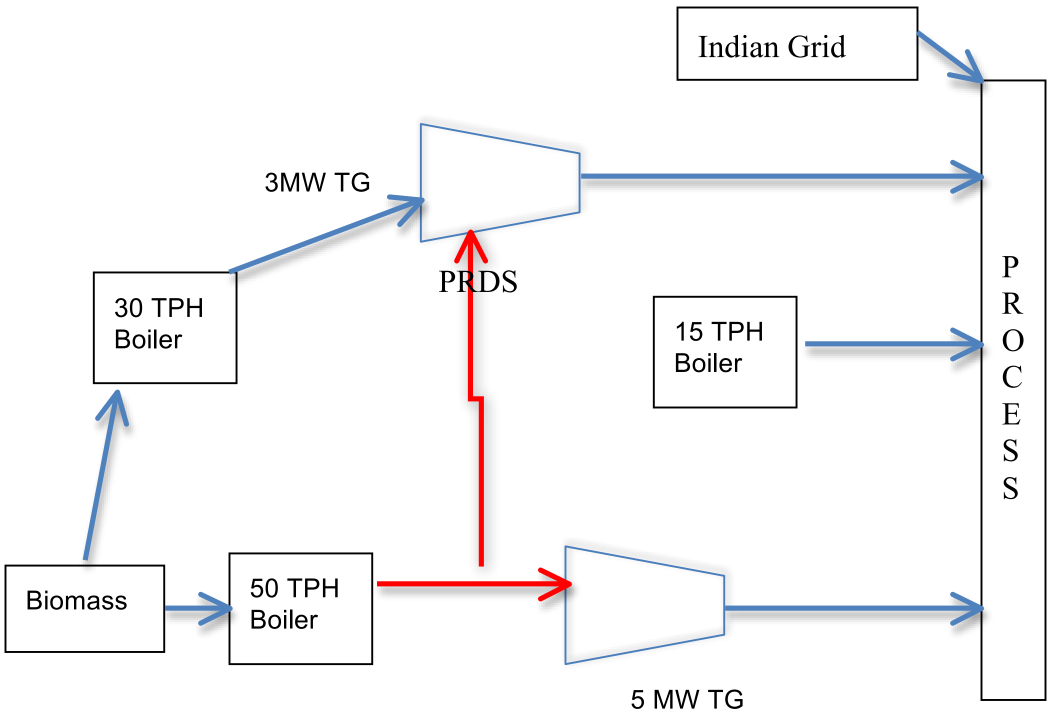


Fig: Project boundary

The project boundary includes existing boiler, turbine and new boiler and turbine, it also includes NEWNE grid from which power is imported. The main GHG gases targeted under proposed project activity is explained below

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity and heat generation	CO_2	Yes	Main 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	CO_2	No	Rice husk used in the project activity comes

Source		Gas	Included?	Justification/Explanation
	burning or decay of surplus biomass residues			from renewable sources. It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector. 2
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
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.
		N_2O	No	Excluded for simplification.
	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.
		N_2O	No	Excluded for simplification.
	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.
	Storage of biomass residues	CO_2	No	Excluded for simplification.
		CH_4	No	Biomass will not be stored for more than 2 months, hence excluded for simplification.
		N_2O	No	Excluded for simplification.
	Wastewater from the treatment of biomass residues	CO_2	No	No wastewater treatment in project case.
		CH_4	No	No wastewater treatment in project case.
		N_2O	No	No wastewater treatment in project case.
	Cultivation of land to produce biomass feedstock	CO_2	No	Biomass (rice husk) is agrowatse and is not cultivated for the biomass generation.
		CH_4	No	Biomass (rice husk) is agrowatse and is not cultivated for the biomass generation.
		N_2O	No	Biomass (rice husk) is agrowatse and is not cultivated for the biomass generation.

2.4 Baseline Scenario

As prescribed by ACM 0006 version 12.1.1, 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 5 MW capacity and supplies electricity to SPIL. The project will also generate 30 TPH steam at 4kg/cm^2 and supply it to SPIL 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 identifying relevant alternative scenarios, provide an overview of other technologies or practices the version 12.1.1 of the applied methodology (Pg. 9, Step 1a), “For the purpose of *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: SPIL paper production plant)

b) Supply of Heat Energy (Process Steam) for paper production operations (Application Area: SPIL 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 are 5 MW electricity and 30 TPH steam.

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 CO_2 Baseline Database for Indian Power Sector User Guide, Version 10, 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:

P1: The proposed project activity not undertaken as a carbon benefits project activity.

Despite the fact that this alternative is economically unattractive, as analyzed 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.

As mentioned above in section 1.10, SPIL had decided to increase the production capacity from 150 TPD to 225 TPD to meet the demand. The existing plant at the same conditions was generating only 2.7 MW. After increase in production the total electricity requirement would be 7.1 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, The existing plant at the same conditions was generating only 2.7 MW. After increase in production the total electricity requirement would be 7.1 MW. The total Turbine Generator capacity at full load was 2.7 MW in the existing plant. For project case the total electricity requirement would be 7.1 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, SPIL had decided to expand the production capacity from 150 TPD to 225 TPD to meet the demand. 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.

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 SPIL 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 4.7 MW, out of which 2 MW was sourced from Grid. Last three year data clearly shows this. 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.

Alternative scenarios for Heat Generation:

H1: The proposed project activity not undertaken as a carbon benefits project activity.

Yes, the proposed project activity not undertaken as a carbon benefits project activity is a possible alternative scenario for Heat generation in the project activity.

H2: 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 the most recent three years prior to the project activity

No, As mentioned above in section 1.10, SPIL had decided to increase the production capacity from 150 TPD to 225 TPD to meet the demand. The heat generation capacity of the existing plant was 45 TPH. After expansion, the additional heat requirement would be 15 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.

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, SPIL had decided to increase the production capacity from 150 TPD to 225 TPD to meet the demand. The heat generation capacity of the existing plant was 45 TPH. After expansion, the additional heat requirement would be 15 TPH. Even if the existing plant at the project site would operated with different conditions, let say if heat generation would happen at 100% load then even it can"t meet the requirement post expansion.

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, SPIL had decided to increase the production capacity from 150 TPD to 225 TPD to meet the demand. 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.

H5: The installation of new plants at the project site different from those installed under the project activity;

Yes, The project activity is an increase in production cpapcity 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 have 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 (Capacity of 50 TPH steam) based on: H5.1 Coal and 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 SPIL 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

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 and 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 Haryana. 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 and B4

The biomass i.e. rice husk would have been left or dumped to decay in aerobic condition. The total quantity required for the project activity is around 108,000 MT per annum.

According to the ACM0006 (Version 12.1.1), 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 has demonstrated 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 30% larger than the quantity of rice husk, which is utilized in the region including demand after SPIL‟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
Technical assumptions: 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 TPH, 65 kg/cm^2, 490°C. Boiler efficiency: 80%. Condensing – extracting turbine: 5 MW nominal capacity. Cogeneration plant load factor: 100%. Fuel mixes: Biomass: 108,000 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 SPIL 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.
Installed capacities: High-pressure steam boiler: 50 TPH, 65 kg/cm2, 490°C. Boiler efficiency: 82%. Condensing – extracting turbine: 5 MW nominal capacity. Cogeneration plant load factor: 100%. Fuel mixes: Coal: 72,011 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 SPIL for additional capacity would be generated in from the coal based cogeneration plant. The applicable baseline scenario for the heat would be: H5.1 (coal) 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. Installed capacities: Saturated steam boiler: 30 TPH, 12 kg/cm2 Boiler efficiency: 78%. plant load factor: 100%. Fuel mixes: Biomass: 40,091 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 SPIL 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) 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.
Installed capacities: Saturated steam boiler: 30 TPH, 12 kg/cm2 Boiler efficiency: 82%. Plant load factor: 100%. Fuel mixes: Coal: 25000 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 SPIL 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 SPIL 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.

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

- The proposed project activity without considering carbon benefits
- A New coal based cogeneration power plant at the project site different from those installed under project activity
- A New biomass based heat only generation plant at the project site and electricity would be sourced from grid.
- 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. The relevant laws and regulation pertaining to generation of energy from renewable sources are: Electricity Act 2003, National Electricity Policy 2005, Tariff Policy 2006. 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.

Step2: Barrier analysis

This step serves to identify barriers and to assess which alternatives these barriers prevent. 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 "Guidelines on the assessment of 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 Tool "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. SPIL 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.

The date of decision-making is 25-09-2012. This is the date of board resolution. For further analysis, all the values available as on 25-09-2012 have been chosen.

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

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

Parameter	Unit	Alter-1	Alter-2	Alter-3	Alter-4	Source
Installed capacity TG	MW	5	5	--	--	Plant requirement
Net Electricity Production capacity	MW	4.5	4.5	--	--	Design basis
Operational days/year	Days	330	330	330	330	Industry standard
PLF	%	100%	100%	100%	100%	Conservative
Electricity generated and used in project activity	MWh	32340	32340	--	--	Calculated
Electricity imported from grid	MWh	--	--	32340	32340	Calculated
Boiler capacity	TPH	50	50	30	30	Plant requirement
Fuel	--	Rice husk	Coal	Rice husk	Coal	Design basis
Feed water	^{0}C	130	130	105	105	Design basis
Efficiency	%	80	82	78	82	Design basis
NCV	Kcal/Kg	3200	4600	3200	4600	Lab test report
Fuel Price	INR/MT	3300	3250	3300	3250	Quotation from supplier
Escalation in biomass price	%	10	--	10	--	Historical data analysis
Electricity tariff	INR/kWh	5	5	5	5	Tariff applicable at time of decision
Escalation on ET	%	1.7	1.7	1.7	1.7	Historical analysis
Boiler cost	INR million	70	70	30	30	Supplier quotation
Turbine cost	INR million	60	60	--	--	Supplier quotation
Interest rate	%	13	13	13	13	As per existing rate by five major banks
O&M Cost	%	3	3	3	3	Industry specific
Escalation on O&M	%	5	5	5	5	Industry specific

Parameter	Unit	Value	Alternative
Levelised cost of energy generation	**INR/MJ**	0.293	1
		0.131	2
		0.283	3
		0.155	4

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 Tool "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. Price of Biomass

2. Rate of Electricity

3. Investment Cost

4. Operation and Maintenance cost (O&M)

5. Biomass NCV

Inline with methodological tool, Investment Analysis, '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".

Parameter	Levelise cost energy generation (INR/MJ)			Breaching Value
	-10%	0%	10%	
Change in biomass price	0.699	0.772	0.846	-41.3%
Change in project cost	0.769	0.772	0.776	Hypothetical
Change in O&M cost	0.771	0.772	0.774	Hypothetical
Change in NCV	0.854	0.772	0.706	71%

Biomass Price:

Project participant sources biomass price i.e. INR 3300 per tone considered for levelised cost calculation of energy generation from recent bills for biomass purchases, the purchase bills has been submitted to DOE, furthermore biomass price is subjected to escalation as per market trend. Hence the decrease in price by 41.3% to breach benchmark value is highly unlikely.

Project cost:

The project cost considered for levelised cost calculation i.e. INR 130 million is sourced from offer letter from technology supplier, the same has been also crosscheck with purchase orders and same is already incurred, hence any decrease in cost is not a possibility, moreover even considering cost as lower levelised cost per unit energy generation does not have significant impact.

O&M Cost:

Even considering O&M cost as 0, it does not breach the benchmark value and below zero is hypothetical case, hence this is not possible.

NCV Value:

The NCV value i.e. 2900 Kcal/kg used for levelised cost calculation is sourced from lab test report, moreover the rice husk NCV ranges between 2900-3000 Kcal/kg[2],[3],[4], hence an increase in NCV by 71% to breach benchmark value is not a likely scenario.

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 “Guidelines on common practice” Version 02.0 has been applied. According to the Guidelines, it requires the following definitions as follows:

1) **Applicable geographical area**: Haryana State. It is chosen because there are 28 States and 7 Union Territories in India (Host Country) and 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

2 http://www.ces.iisc.ernet.in/energy/paper/alternative/calorific.html
3 http://www.bioenergyconsult.com/tag/rice-husk/
4 http://briquette.ronakbriquetting.com/dawnloads/pdfs/RONAK%20AGROTECH%20CALORIFIC%20VALUE%20CHART.pdf

interference has adversely affected the quality of regulation. For e.g. Rate of Electricity in India for Large Industry in 2011 varies from 3.17 INR/KWh to 8.80 INR/KWh.

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 Haryana.

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 5 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 5 MW, the applicable output range for common practice analysis will be 2.5 MW to 7.5 MW (± 50% of 5 MW).

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

1.	*The projects are located in the applicable geographical area;*	*Projects located in the Haryana State.*
2.	*The projects apply the same measure as the proposed project activity;*	*Projects which has co-generation plants based on renewable energy*
3.	*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.*
4.	*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 and electricity for processes with comparable quality and properties as mentioned in section 1.8 above.*
5.	*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 2.5 MW- 7.5 MW have been considered as set in Step 1.*
6.	*The projects started commercial operation before VCS the start date of proposed project activity.*	*The decision making was done in the September 2012. Hence all the projects, which started commercial operation prior to September 2012 have been considered.*

As per the list from Haryana Energy Development Agency (HAREDA)[5]. Following table represents the projects, which are in the range of 2.5 MW to 7.5 MW and commissioned before September 2012.

S.No.	Company and Location	Capacity	Date of commissioning	CDM/VCS?	Further Analysis
1.	M/s Sainsons Paper Industries, Village-Bakhli, Pehowa, Distt, Kurukshetra	3MW	2009-10	Yes[6]	No
2	M/s REI Agro Ltd, (Unit-II) Bawal Growth Centre, Jaliawas, Rewari	2.50MW	2010-11	No	Yes
3	M/s Best Food International (P) Ltd, Village Norata, Tehsil Indri, Karnal	4MW	2010-11	Yes[7]	No
4	M/s Satyam Industries	3MW	2011-12	No	Yes

5 *http://hareda.gov.in//writereaddata/document/hareda051632647.pdf*

6 http://www.sgsqualitynetwork.com/tradeassurance/ccp/projects/291/SAINSONS%20PDD.pdf

7 https://cdm.unfccc.int/Projects/Validation/DB/EQ03X1N7X1OS8690JS0LKJPDPM8YSY/view.html

	Pvt. Ltd, Village Pardhana, Tehsil Israna, Panipat				
5	M/s Goel International Pvt. Ltd. Taraori, Karnal	3MW	2011-12	Yes (CDM Ref: 9484)	No
6	M/s REI Agro Ltd, (Unit-I) Bawal Growth Centre, Jaliawas, Rewari	3MW	2011-12	No	Yes
7	M/s Best Food International (P) Ltd, Village Norata, Tehsil Indri, Karnal	6MW	2012-13	Yes[8]	No
8	M/s NV International, Badhouli, Naraingarh, Ambala	4MW	2014-15	No	Yes
9	M/s Haryana Liquors, Jundla, Karnal	2.5MW	2014-15	No	Yes
10	M/s Shaktibhog Foods Ltd, Karnal	3.50MW	2014-15	Yes (CDM Ref: 9802)	No
11	M/s AB Grains Spirits Pvt. Ltd., Village Jatwar, Tehsil Narayangarh, district Ambala	8.9MW	2014-15	Yes (CDM Ref:7921)	No

This step gives a total of 5 biomass (non-bagasse) based co-generation projects in Haryana, which are eligible for further analysis.

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

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

N_{all} = 5

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.

All 5 projects eligible for further analysis are small scale project activity with installed capacity of boiler and turbine is much lower than proposed project activity, hence considering output of proposed project activity these are not comparable.

Hence,

N_{diff} =5

[8] http://www.cdmindia.gov.in/project_details_view_report.php?id=1319

Step 5: Calculate factor F=1-N_{diff}/N_{all} 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-(5/5) = 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 and N_{all}-N_{diff} = 0**As N_{all}-N_{diff} is not greater than 3, the project is not a common practice.**

2.6 Methodology Deviations

No deviation

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Baseline emissions are calculated based on the most plausible scenario identified in the above Section 2.4.

As per methodology the 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 (tCO2e)
y	=	Year of the crediting period
f	=	Fossil fuel type

Since the project baseline scenario is the generation of power in the grid; the generation of heat in biomass fired heat generators, the biomass residues partially (as power would be imported from the grid) are dumped or left to decay under mainly aerobic conditions. CH_4 emission from biomass residues in the baseline is not claimed conservatively, thus, the Emission calculation of the project is as follows:

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

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.

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.

Parameter	Value	Unit	Reference
Boiler: 1			
Steam boiler pressure	32	Kg/cm^2	Plant data
Steam boiler temperature	400	^0C	Plant data
Flow	30	TPH	Plant data
Steam enthalpy	3.226	GJ/Tonne	Calculated
Enthalpy of feedwater	0.439	GJ/Tonne	Calculated
Efficiency of boiler	77.7%	--	Plant data
Working hours	7920	Hours	Plant data
Steam used for process per year	605	TJ	Calculated
Boiler: 2			
Steam boiler pressure	32	Kg/cm^2	Plant data
Steam boiler temperature	330	^0C	Plant data
Flow	15	TPH	Plant data
Steam enthalpy	2.81	GJ/Tonne	Calculated
Enthalpy of feedwater	0.439	GJ/Tonne	Calculated
Efficiency of boiler	77.7%	--	Plant data
Working hours	7920	Hours	Plant data
Steam used for process per year	300	TJ	Calculated
$HC_{BL,y}$ total baseline heat generation	905	TJ	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

Parameter	**Value**	**Source**
Number of working hours	7920 hours	Plant data
Installed capacity of turbine	3 MW	Plant data
Total gross energy per year $EL_{PJ,gross,y}$	23760 MWh/year	Calculated
Ausxiliary consumption $EL_{PJ,aux,y}$	2376 MWh/year	Plant data
$EL_{PJ,import,y}$	33660 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. Minimum electricity would be procured from the grid; The electricity imported will be monitored, however it has been considered to be 0.
Baseline electricity generation $EL_{BL,y}$	56100 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).

$CAP_{EG,total,y} = LOC_y * \Sigma\ CAP_{EG,CG,i} * LFC_{EG,CG,i}$

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)

$LFC_{EG,CG,i}$ = Baseline load factor of heat engine *i* (ratio)

LOC_y = Length of the operational campaign in year *y* (hour)

i = Cogeneration-type heat engine in the baseline scenario

y= Year of the crediting period

Hence

$CAP_{EG,total,y}$ = 7920 * 3 *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

$EL_{BR,CG,x,i}$ = 23760 MWh

$CAP_{EG,total,y}$ = 23760 MWh

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:),

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 VCS PD for validation of the project activity for which data is already available (2012-13, 2013-14, 2014-15);

$BR_{B4n,y}$ = 102000 Tonne/year

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), GGLdefault 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.

Since in baseline scenario both boiler and turbine were operational and have a historical data for 3 years, same has been used to determine efficiency as heat to power ratio $HPR_{BL,CG}$ =12.1.

Step 1.6: Determine the emission factor of on-site electricity generation with fossil fuels

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 baseline emissions are the product of electrical energy baseline $EG_{BL,\ y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

The Emission Factor can be calculated in a transparent and conservative manner as follows:

(a) Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology "Tool to calculate the emission factor for an electricity system". OR

(b) The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option (a) has been considered to calculate the grid emission factor as per the 'Tool to calculate the emission factor for an electricity system' since data is available from an official source. CO_2 Baseline Database for the Indian Power Sector, Version 11, April 2016, published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per the "Tool to calculate the emission factor for an electricity system" Version 05.0, EB 75, Annex 15, the following steps have been followed.

STEP 1: Identify the relevant electricity systems;

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional);

STEP 3: Select a method to determine the operating margin (OM);
STEP 4: Calculate the operating margin emission factor according to the selected method;
STEP 5: Calculate the build margin (BM) emission factor;
STEP 6: Calculate the combined margin (CM) emission factor.

STEP 1: Identify the relevant electricity power systems
The tool defines that "for determining the electricity emission factors, identify the relevant electricity system. Similarly, identify any connected electricity systems". It also states that, "If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used". Keeping this into consideration, the Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into five regional grids viz. Northern, Eastern, Western, North-eastern and Southern.

However since Since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this CO2 Baseline Database. As of 31 December 2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

Indian Grid				
Northern	Eastern	Western	North-Eastern	Southern
Chandigarh Delhi Haryana Himachal Pradesh Jammu & Kashmir Punjab Rajasthan Uttar Pradesh Uttarakhand	Bihar Jharkhand Orissa West Bengal Sikkim Andaman-Nicobar	Chhattisgarh Gujarat Daman & Diu Dadar & Nagar Haveli Madhya Pradesh Maharashtra Goa	Arunachal Pradesh Assam Manipur Meghalaya Mizoram Nagaland Tripura	Andhra Pradesh Karnataka Kerala Tamil Nadu Pondicherry Lakshadweep

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants have the option of choosing between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

The Project Participant has chosen only grid power plants in the calculation.

STEP 3: Select a method to determine the operating margin (OM) method
The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

PP has chosen Option (a) i.e. simple OM, to determine the operating margin. Other available options in the tool were ruled out considering the fact that data required to calculate simple adjusted OM or dispatch data analysis is not available publically. As per the tool, low cost/must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. Data for the same, as published by Central Electricity Authority, has been presented below which illustrates that low cost/must run resources constitute less than 50% of total Indian grid generation, hence, the average OM method could not have been used.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2010-11	2011-12	2012-13	2013-14	2014-15
India	18.4%	19.6%	16.9%	18.6%	16.8%

Data Source: Central Electricity Authority (CEA) database Version-11

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of three most recent years) for the INDIAN grid is less than 50 % of the total generation. Thus the average emission rate method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.

The "Simple operating margin" has been calculated as per the weighted average emissions (in tCO_2/MWh) of all generating sources serving the system, excluding hydro, geo-thermal, wind, low-cost biomass, nuclear and solar generation;

As per tool to calculate emission factor for an electricity system (Version 05.0.0), The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Since the low cost/must run resources constitute less than 50% of total grid generation as seen from the average of five most recent years, the Simple OM method can be used to calculate the Operating Margin Emission factor.

PP has chosen ex ante option, thus, no monitoring and recalculation of the emissions factor during the crediting period is required. PP has considered a data vintage of 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

STEP 4: Calculate the operating margin emission factor according to the selected method
The simple OM emission factor is calculated as 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 may be calculated:

Option A: Based on the net electricity generation and a CO2 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.

The Central Electricity Authority, Ministry of Power, Government of India has published a database of Carbon Dioxide Emission from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO_2 Baseline Database provides information about the Combined Margin Emission Factors of all the regional electricity grids in India. The Combined Margin in the CEA database is calculated ex ante using the guidelines provided by the UNFCCC in the "Tool to calculate the emission factor for an electricity system, Version 05.0.0". We have, therefore, used the Combined Margin data published in the CEA database, for calculating the Baseline Emission Factor.

As per „Tool to calculate the emission factor for an electricity system", Option A ("Based on the net electricity generation and a CO_2 emission factor of each power unit") is used to calculate simple OM emission factor. Where Option A is used, the simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \Sigma (EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}$$

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

The CO_2 emission factor ($EF_{EL,m,y}$) data for simple OM, available under the CEA database (Version 11.0) for the last three years is as follows.

Net generation in operating margin GWh including import			
	2012-13	2013-14	2014-15
Indian Grid	697187	721632	808417

Simple operating margin(tCO_2/MWh) (Incl Import)			
	2012-13	2013-14	2014-15
Indian Grid	0.99	1.0	0.99

Weighted Avg. Operating Margin Indian Grid is

= (697187*0.99+721632*1.0+808417*0.99)/ (697187+721632+808417)
= 0.9941 tCO_2/MWh

Step 5: Calculate the build margin (BM) emission factor, $EF'_{grid',BM,y}$

The project participants have chosen Option I, i.e. fixing build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM PDD submission to the DOE for validation.

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

$$EFgrid_{BM,y} = \Sigma(EG_{m,y} \times EF_{EL,m,y}) / \Sigma EG_{m,y}$$

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (t CO_2 e/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* (t CO_2 e/MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) is determined as per the procedures given in step 4 (a) for the simple OM, using options A1B1 using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

The build margin emission factor ($EF_{grid,BM,y}$) for the year 2014-15 (most recent year) for Indian grid is 0.9285 tCO_2/MWh.

CEA's "CO2 Baseline Database for the Indian Power Sector" Version 11.0,.

Build Margin (tCO2/MWh) (not adjusted for imports)	
	2014-2015
Indian Grid	0.9285

Step 6: Calculate the combined margin (CM) emissions factor
The combined margin is the weighted average of the simple operating Margin and the build margin. As per the 'Tool to calculate the emission factor for an electricity system (Version 05.0.0)', allows to weigh the operating margin and Build margin at 50% and 50%, respectively

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

$$= (EF_{Southern,OM,y} \times 50\%) + (EF_{Southern,BM,y} \times 50\%)$$

Electronic spreadsheet showing calculation of all these parameters is being submitted separately and the final values are presented below:

Parameter	Value	Units
Operating Margin : $EF_{OM,y}$	0.9941	tCO2e/MWh
Build Margin : $EF_{BM,y}$	0.9285	
Combined Margin : $EF_{grid,CM,y}$	=0.9941*50%+0.9285*50%	
Combined Margin : $EF_{grid,CM,y}$	0.9613	

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:

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

Where:

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

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

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

y = Year of the crediting period

EL_{BLy} is estimated to be 56,100 MWh according to Step 1.2 and $CAP_{EG,total\ y}$ is estimated is 23,760 MWh according to step 1.3 then

$EG_{BL,GR,y}$ = 56100 -23760 = 32340 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.

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.12.1.1), "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 BEy = ELBL,GR,y * EFEG,GR,y

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

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

Where

$EL_{BL,GR,y}$ = 32340 MWh

$EF_{EG,GR,y}$ =0.9613 tCO_2e/MWh

$EL_{BL,FF/GR,y} = 0$

Hence,
BE_y = 32340 * 0.9613 = 31,088 tCO_2e/year (rounded down)

3.2 Project Emissions

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

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

Where:

PE_y = Project emissions in year *y* (t CO2)

$PE_{FF,y}$ = 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 CO2 emission coefficient $COEF_{i,y}$ has been opted.
$PE_{GR1,y}$	CO2 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 wastewater 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 CO2 emissions from fossil fuel combustion"; Version 02

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 $PE_{TR,y}$

Inline with ACM0006, the latest version of the tool "Project and leakage emissions from road transportation of freight" has been used 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 30km 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 108000 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 (Df,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 108000 (see BL step 1.4) tons rice husk which is from a radius of 50 km around the project site according to biomass assessment report, 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	108000
Return Trip Distance (2*$D_{f,m}$), KM	100
(EFCO2,f), gCO2/t km (From Tool)	245
$PE_{TR,y}$	2646
Total Project Emissions (tCO2)	2646

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. As the proposed project activity utilises rice husk i.e. an agro waste generated due husking of paddy grain, hence the only source may result in leakage emission due to diversion of biomass residue from other application.

As per para 26 of Annex 8, EB 83 "Project and leakage emission from biomass, since the biomass quantity is sufficiently available within 200 Km, hence as per applied methodology it can be neglected.

Further, in line with para 40 e) of Annex 8, EB 83 “The project participant shall evaluate ex ante if there is a surplus of the biomass in the region of the project activity, which is not utilised. If it is demonstrated (e.g., using published literature, official reports, surveys etc.) at the beginning of each crediting period that the quantity of available biomass in the region, is at least 25% larger than the quantity of biomass that is utilised including the project activity, then this source of leakage can be neglected otherwise this leakage shall be estimated and deducted from the emission reductions"

As per biomass assessment report, the biomass (rice husk) available within 100km from the project activity location is 35% larger than quantity of rice husk, which is utilised in the region including proposed projects demand. Furthermore, in line with para 23 of Annex-15, EB83, as the biomass quantity available within 50Km radius is more 25% surplus after project requirement. Thus, this source of leakage has been neglected.

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 sections 3.1 to 3.3.

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)
2016-17	31088	2646	0	28442
2017-18	31088	2646	0	28442
2018-19	31088	2646	0	28442
2019-20	31088	2646	0	28442
2020-21	31088	2646	0	28442
2021-22	31088	2646	0	28442
2022-23	31088	2646	0	28442
2023-24	31088	2646	0	28442
2024-25	31088	2646	0	28442
2025-26	31088	2646	0	28442
Total	**310,880**	**26,460**	**0**	**284,420**

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:	Rice husk 108000 Tonne
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.
Purpose of Data	Calculation of baseline emissions
Comments	--

Data / Parameter	$HC_{BR,CG/PO,x,i/j}$ ($HC_{BR,CG,x,1}$, $HC_{BR,CG,x,2}$)
Data unit	GJ
Description	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:	$HC_{BR,CG,x,1}$= 605 (3 years average) $HC_{BR,CG,x,2}$= 300 (3 years average)
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 12.1.1: For heat engines with a minimum three-year operational history prior to the start date of crediting period, the heat-to-power ratio should be determined as per the design conditions of the plant, for the configuration identified as baseline scenario.
Purpose of Data	--
Comments	--

Data / Parameter	$EL_{BR,CG/PO,x,i/j}$
Data unit	MWh
Description	Quantity of electricity generated in heat engine i/j in year x (MWh)

Source of data	Design parameter of turbine
Value applied:	23760
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 12.1.1: For heat engines with a minimum three-year operational history prior to the start date of crediting period, the heat-to-power ratio should be determined as per the design conditions of the plant, for the configuration identified as baseline scenario.
Purpose of Data	--
Comments	--

Data / Parameter	$CAP_{HG,h}$
Data unit	GJ/hour
Description	Baseline capacity of heat generator h (GJ/h)
Source of data	Baseline plant design parameters
Value applied:	271.7
Justification of choice of data or description of measurement methods and procedures applied	This parameter reflects the design maximum heat generation capacity (in GJ/h) of the baseline heat generation h.
Purpose of Data	--
Comments	--

Data / Parameter	$CAP_{EG,CG,i}$
Data unit	MW
Description	Baseline electricity generation capacity of heat engine i (MW) (Cogeneration Mode)
Source of data	Plant record
Value applied:	3
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). This is based on the installed capacity of the heat engine.
Purpose of Data	Calculation of project emissions

Comments	--

Data / Parameter	$LFC_{HG,h}$
Data unit	Ratio
Description	Baseline load factor of heat generator h (ratio)
Source of data	On-site measurements
Value applied:	1
Justification of choice of data or description of measurement methods and procedures applied	As per methodology, this parameter should reflect the maximum load factor. PP has chosen the maximum value possible i.e. 1. Hence conservative.
Purpose of Data	Calculation of project emissions
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:	12.1
Justification of choice of data or description of measurement methods and procedures applied	The values have been calculated according to Step 1.5 of baseline emission calculation of the methodology ACM0006 based in reference plant parameters.
Purpose of Data	Calculation of project emissions
Comments	--

Data / Parameter	$LFC_{EG,CG,i}$
Data unit	Ratio
Description	Baseline load factor of heat engine i (ratio) (cogeneration Mode)
Source of data	Based on 3 years historical data
Value applied:	0.8
Justification of choice of data or description of measurement methods	This parameter reflects the maximum load factor (i.e. the ratio between the „actual electricity generation“ of the heat engine and its „design maximum electricity generation“) of the baseline heat

and procedures applied	engine. Last 3 years data has been used.
Purpose of Data	--
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
Source of data	Baseline CO2 Emission Database, Version 11.0,
Value applied:	0.9613
Justification of choice of data or description of measurement methods and procedures applied	The emission factors in the CO2 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 5.0)
Purpose of Data	Calculation of baseline emissions
Comments	Fixed ex-ante for entire crediting period

4.2 Data and Parameters Monitored

Data / Parameter	$BR_{PJ,n,y}$
Data unit	Tonnes
Description	Quantity of biomass residues of category n used in the project activity in year y (tonnes on dry-basis)
Source of data	Onsite measurement
Description of measurement methods and procedures to be applied	The quantity of Rice Husk will be measured at the entrance-using weighbridge. Dry weight of all biomass residues will be subsequently determined using the biomass moisture content of the corresponding biomass type in internal laboratory and will be cross checked with test in third party laboratory.
Frequency of monitoring/recording	On each delivery and monthly aggregation
Value applied:	108000
Monitoring equipment	Weighbridge
QA/QC procedures to be applied	The weighbridge will be calibrated annually.
Purpose of data	Calculation of project emissions
Calculation method	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.
Comments	--

Data / Parameter	$BR_{B4,n,y}$
Data unit	Tonne
Description	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	Plant record
Description of measurement methods and procedures to be applied	Calculated ex ante as per the step 1.4 of baseline emission calculation
Frequency of monitoring/recording	--
Value applied:	101000
Monitoring equipment	--
QA/QC procedures to be applied	--
Purpose of data	--
Calculation method	--
Comments	--

Data / Parameter	$EF_{ff,y}$
Data unit	tCO_2/GJ
Description	CO2 emission factor for fossil fuel type f in year y (t CO2/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	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 (Diesel)
Monitoring equipment	--
QA/QC procedures to be applied	--
Purpose of data	Calculation of project emissions
Calculation method	--
Comments	--

Data / Parameter	$HC_{BL,y}$
Data unit	GJ
Description	Baseline process heat generation in year y (GJ)
Source of data	Plant record
Description of measurement methods and procedures to be applied	The value is calculated based on steam generated, temperature and pressure.
Frequency of monitoring/recording	Determined ex-ante according to project configuration.
Value applied:	27171
Monitoring equipment	Calculated
QA/QC procedures to be applied	NA
Purpose of data	To check energy balance
Calculation method	This parameter determined as the difference of the enthalpy of the generated in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators. The respective enthalpies determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables has been used to calculate the enthalpy as a function of temperature and pressure.
Comments	--

Data / Parameter	$EL_{Gross,y}$
Data unit	MWh

Description	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	Plant record
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 the manufacturer specifications.
Frequency of monitoring/recording	Continuous monitoring, monthly recording
Value applied:	56100
Monitoring equipment	Energy meter of accuracy class 0.5s
QA/QC procedures to be applied	The energy meter will be calibrated annually or as per industry standard/manufacturer specification.
Purpose of data	Calculation of baseline emissions
Calculation method	--
Comments	--

Data / Parameter	$EL_{PJ,aux}$
Data unit	MWh
Description	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh)
Source of data	Plant record
Description of measurement methods and procedures to be applied	The auxiliary consumption will be monitored using trivector energy meter of accuracy class 0.5s.
Frequency of monitoring/recording	Continuous, monthly recording
Value applied:	5610
Monitoring equipment	Energy meter of accuracy class 0.5s
QA/QC procedures to be applied	The energy meter will be calibrated annually or as per industry standard/manufacturer specification.

Purpose of data	Calculation of baseline emissions
Calculation method	--
Comments	--

Data / Parameter	$NCV_{BR,n,y}$
Data unit	GJ/Tonne
Description	Net calorific value of biomass residue of category n in year y (GJ/tonne on dry-basis)
Source of data	Onsite measurement
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 every six months, taking at least three samples for each measurement.
Value applied:	14.9 (Rice husk)
Monitoring equipment	Not applicable.
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.
Purpose of data	To check energy balance
Calculation method	--
Comments	--

Data / Parameter	$h_{LOW,y}$ $h_{HIGH,y}$
Data unit	GJ/Tonne
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	Plant record
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:	$h_{LOW,y}$ = 2.51 (GJ/Year) $h_{HIGH,y}$ = 2.71 (GJ/Year)
Monitoring equipment	Calculated
QA/QC procedures to be applied	--
Purpose of data	--
Calculation method	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
Comments	--

Data / Parameter	Moisture content of the biomass residues
Data unit	%
Description	Moisture content of each biomass residues type k
Source of data	Onsite measurement
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 for each batch of biomass of homogeneous quality. The weighted average should be calculated for each monitoring period and used in the calculations
Value applied:	--
Monitoring equipment	Not applicable. Moisture content will be measured locally, in

	reputed laboratories.
QA/QC procedures to be applied	--
Purpose of data	To calculate dry basis weight of biomass
Calculation method	--
Comments	--

Data / Parameter	LOC_y
Data unit	Hour
Description	Length of the operational campaign in year y (hour)
Source of data	Plant record
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	Contnuous, monthly recording
Value applied:	7920
Monitoring equipment	--
QA/QC procedures to be applied	
Purpose of data	Calculation of baseline emissions and project emissions
Calculation method	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.
Comments	--

Data / Parameter	$FC_{i,j,y}$
Data unit	Mass or volume unit per year (e.g. ton/yr or m3/yr)
Description	Quantity of fuel type i combusted in process j during the year y.
Source of data	Plant record/logbook
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, monthly aggregation
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	Volume measurement
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.
Purpose of data	Calculation of project emissions
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/m3 , GJ/ton)
Description	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	option d) (IPCC default values) in this case.
Frequency of	Any future revision of the IPCC Guidelines should be taken into

monitoring/recording	account.
Value applied:	Diesel: 43.3 GJ/ton
Monitoring equipment	--
QA/QC procedures to be applied	--
Purpose of data	Calculation of project emissions
Calculation method	--
Comments	--

Data / Parameter	$\rho_{i,y}$
Data unit	Weighted average density of fuel type i in year y (Diesel)
Description	Weighted average net calorific value of fuel type i in year y.
Source of data	Bureau of Energy Efficiency, India Standard Value - http://emt-india.com/BEE-Exam/GuideBooks/2Ch1.pdf
Description of measurement methods and procedures to be applied	Not applicable, since the Project Proponent 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	--
QA/QC procedures to be applied	--
Purpose of data	Calculation of project emissions
Calculation method	--
Comments	--

Data / Parameter	$EF_{CO2,i}$
Data unit	tCO_2/TJ
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	option d) IPCC default values chosen
Frequency of monitoring/recording	Any future revision of the IPCC Guidelines should be taken into account.
Value applied:	Diesel: 0.0748 (tCO2/GJ)
Monitoring equipment	--
QA/QC procedures to be applied	--
Purpose of data	Calculation of project emissions
Calculation method	--
Comments	--

Data / Parameter	$D_{f,m}$
Data unit	Kilometer
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
Monitoring equipment	--
QA/QC procedures to be applied	All the suppliers are within the range of 50 KMs.
Purpose of data	Calculation of project emissions
Calculation method	NA
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	Plant logbook
Description of measurement methods and procedures to be applied	The quantity of biomass trasnported will be measured using weighbridge installed at site on each delivery and record will be maintained in log-book.
Frequency of monitoring/recording	On each delivery
Value applied:	108000
Monitoring equipment	--
QA/QC procedures to be applied	The weighbridge will be calibrated on annual basis.
Purpose of data	To Calculation of project emissions
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

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

This monitoring plan is developed in accordance with the modalities and procedures for small-scale CDM project activities and in line with the guidance provided in the applied methodology. The monitoring plan, which will be implemented by the project proponents, describes about overall monitoring organization, Internal reporting procedure for data collection and archiving, Calibration of measurement equipments, Training procedures and internal audit procedures.

Data and parameters, which will be monitored under this monitoring plan as sited in 4.2 will be measured and strictly monitored at the project site by means of accurately calibrated instruments.

The monitoring plan structure and the roles of the different member in the monitoring plan are explained below.

Internal reporting procedure: Technicians and operators are responsible for recording of the relevant data on plant logbooks. Shift in-charges are also responsible of QA/QC of data recorded and maintenance of logbooks and other records.

These daily records in plant logbooks will consolidate in the form of monthly GHG report by plant supervisor and will be submitted to plant manager for review. The Management, who represents the overall responsibility on the project activity, will be able, with this operational structure, to monitor the development of the project activity and make the relevant amendments to the process.

Director <-----Plant Manager <------ Shift Incharge <------Operator

Data Collection and Archiving:

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

5 ENVIRONMENTAL IMPACT

As per the EIA notification 2009[9], given by the Ministry of Environment and Forests under the under the Environmental (Protection) Act 1986, the project activity will not fall under the requirement of conducting EIA. The project will not involve any negative environmental impacts, as the heat and electricity is being generated using renewable biomass, which is a clean source of energy, thus no EIA study was conducted.

6 STAKEHOLDER COMMENTS

The local stakeholder consultation meeting for the proposed project activity has been conducted at project site on 18th Feb 2016. The PP has identified the stakeholders e.g. nearby villager, nodal agencies and NGO and sent invitation letters dated 08/02/2016. The stakeholder meeting process is followed in the following sequence

- Welcome Speech by the organizers.
- Introduction to 'GHG' programme
- Interactive Sessions with the stakeholders.
- Vote of Thanks

There were no negative comments raised by stakeholders in the local stakeholder consultation meetings and due to the associated benefits stakeholders have appreciated the proposed project activity. In summing up, the project has not received any negative or discouraging feedback from the stakeholders concerned. All the stakeholders have appreciated the measures taken by the Sainsons Paper Industries. People participated in the meeting with great enthusiasm and raised a few questions, which were answered to in an appropriate manner by the project proponent. People were also in favour of the project activity. As this has lead to various direct and indirect benefits socially and economically. All the stakeholders have entrusted their support for this project activity.

[9] http://moef.nic.in/downloads/rules-and-regulations/3067.pdf