



**Project design document form
(Version 12.0)**

BASIC INFORMATION	
Title of the project activity	2.5 MW Rice husk-based cogeneration plant at Hanuman Agro Industries Limited ¹
Scale of the project activity	<input type="checkbox"/> Large-scale <input checked="" type="checkbox"/> Small-scale
Version number of the PDD	08
Completion date of the PDD	08/06/2022
Project participants	M/s Hanuman Agro Industries Limited
Host Party	India
Applied methodologies and standardized baselines	AMS-I.C. ver. 22 - Thermal energy production with or without electricity Standardized baseline - Not applicable
Sectoral scopes	1 : Energy industries (renewable - / non-renewable sources)
Estimated amount of annual average GHG emission reductions	34,308 tCO ₂ e

¹ <https://cdm.unfccc.int/Projects/DB/SGS-UKL1204641540.4/view>
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SECTION A. Description of project activity

A.1. Purpose and general description of project activity

Project Proponent

Hanuman Agro Industries Limited (HAIL) is a public limited company, incorporated on 7th January 1994 with the main objectives of carrying out business activities in the field of Paper & Power Generation using conventional or non-conventional fuel.

The purpose of the project is to collect and utilize available and un-utilized waste biomass resource effectively for effective generation of electricity for in-house consumption. The project activity is the 2.50 MW rice husk based cogeneration power plant generating electricity and steam for captive consumption.

Salient features of the project

Hanuman Agro Industries Limited (HAIL), manufacturer of paper is the promoter of the project activity. The major equipments of the project activity comprise of a new 2.50 MW condensing cum extraction turbine and one 22 TPH boiler. The company was using a 12 TPH boiler (coal fired) for meeting the process steam requirement. The new cogeneration system has replaced the existing coal-fired boiler and the electricity supplied by state utility.

Present (Pre-Project) scenario

The total power requirement of the paper mill was being met by the power supplied by the Chhattisgarh State Electricity Board (Unified Indian Grid)) and total process steam requirement of around 9 TPH at 10 Kg/cm² was being met by coal fired boiler.

Project Scenario

The project activity, which is a 'carbon neutral fuel' based cogeneration plant, generates electricity in addition to steam to meet HAIL's captive electricity requirement thereby displacing power supplied from the State Grid. A part from the electricity, project activity is saving the equivalent coal otherwise would have been used for steam generation in process plant. The new boiler is a high- pressure boiler with 22 TPH steam production. Envisaged generation MCR of 2,500 KW comfortably meets the peak power demand, including the co- generation auxiliaries. 9 TPH of extraction steam of 10 Kg/cm² from the turbine adequately meet the process steam requirement at the mill. A part of the steam is fed to pulp section at 10 Kg/cm² and rest goes to paper section at 4 Kg/cm² through the existing pressure reducer. The generation is synchronized with utility supply at 11 KV and step down to usage level of 400 V by the existing 11 KV/400 V transformer.

Since the project envisages the procurement & utilization of local biomasses for power generation and steam production, it not only supplement the current & planned electricity generation from traditional fossil fuels but also conserve the fossil fuel (coal in this present scenario) and avoid harmful gas emissions that would arise from using the coal.

The project activity was completed as planned in the registered project design document (PDD). The Biomass based cogeneration power has been successfully commissioned on 31/08/2006. The project was completed with major equipment supplied as follows:

S. No.	Equipment	Supplier
01	Boiler	Cheema Boiler Ltd.
02	Turbine	Pentagon Turbine (P) Ltd.
03	Alternator	Kirloskar Electric

S. No.	Equipment	Supplier
04	E.S.P.	Adhor and Cheema
05	Fuel Handling Plant	Bevcon (P) Ltd.
06	Ash Handling Plant	O.S.M. Engineering (P) Ltd.
07	Mist Cooling tower	Mist
08	Balance of Plant	Various suppliers like Siemens for breaker and panel. AVR, Kirlosar, Ion Exchange, R.O. D.M. Plant Ultra filtration etc.

The project activity is located in a rural belt and contributes positively to the 'Sustainable Development of India' by further strengthening four pillars of sustainable development:

Social well-being:

The Project activity is contributing to a small increase in the local employment by employing skilled and unskilled personnel for operation and maintenance of the equipment. The productive use of an agro waste brings in associated economic and social benefits. The project also helps to bridge the gap of electricity demand and supply at local and national level.

Economic well-being:

The increase in demand of rice husk exerted by the project have local effect on its price and generates additional revenue for the rice millers, which in turn benefits the local farmers, as this is paddy-growing area. The project activity results in saving the coal and HSD and allowing it to be diverted to other needy section of the economy.

Environmental well-being:

The project activity is a renewable energy power project, which collects & use waste biomass generated in the local region as a fuel for power generation and export clean power to the CSEB grid. This electricity generation either substitutes or supplements the power generation by CSEB using conventional sources of energy (which also includes high carbon emissive fuel). Thus it reduces the CO₂ emissions which otherwise would have been emitted due to the generation of power by CSEB grid generation mix. Conserving coal by avoiding the process steam generation from coal fired boiler and mitigating the emission of GHG (CO₂) as a rice husk is a carbon neutral fuel. This project results in annual estimated emission of 34,308 tCO₂e. The project will achieve total 240,156 tCO₂e emission reductions during the third crediting period of 7 years.

Technology well-being:

The project activity is adopting an advanced and sustainable technology for long-term benefits.

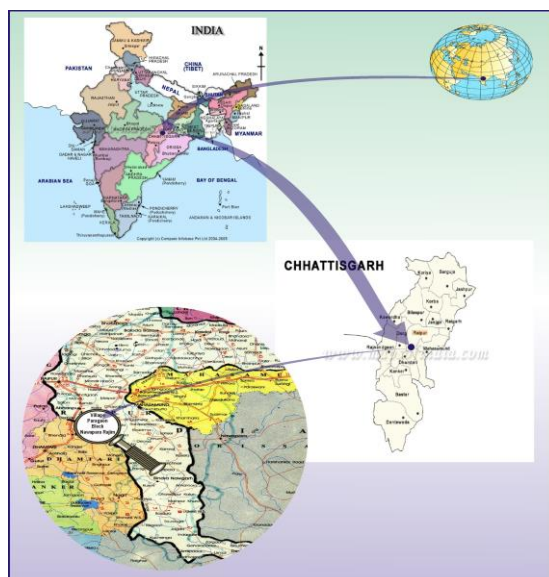
A.2. Location of project activity

The project is located in Village Paragoan, Nawapara-Rajim, Chhattisgarh State, India

The project is readily identifiable as it is the only paper & pulp plant at Paragoan village which is situated near to Rajim, Tehsil Head Quarter (between 20°57'46 N Latitudes to 81°53'05 E Longitude) but may be further identified as under.

Approach	
From Capital	Raipur – 40 kms
From Tehsil Office	Rajim - 3 km
From National Highway	NH -200 – 20 km
Nearest Airport	Mana, Raipur – 32 kms
Nearest Railway Station	Raipur – 43 kms

The map indicating the project location is given here under.



A.3. Technologies/measures

HAIL has set up a biomass based captive cogeneration plant with a capacity of 2.5 MW power generation at their industrial complex located at Village Paragoan, Raipur district of Chhattisgarh State in Central part of India. The project involves installation of 22 TPH FBC Boiler with the outlet steam parameters of 44 Kg/cm² & 450+/-5°C Steam temperature and Multistage, impulse, nozzle governed bleed & extraction cum condensing type 2.5 MW capacity Turbo-Generator Set. The project consumes around 10% of the generation for auxiliary consumption and the rest is primarily used to meet the in-house power requirement, which is 2.25 MW at present. The extraction steam from turbine outlet is used for meeting the steam requirement of the paper mill.

The operational lifetime of the implemented project activity is 20 years.

There is substantial surplus of Biomass (rice husk), which may be combusted in the boiler. Please refer section B.6.3 for surplus biomass availability.

The project helps to reduce the ever-increasing demand and supply gap of electricity and conserve coal besides contributing towards economic growth and development of the area. The project activity is commissioned in August 2006.

Technology employed for the project activity.

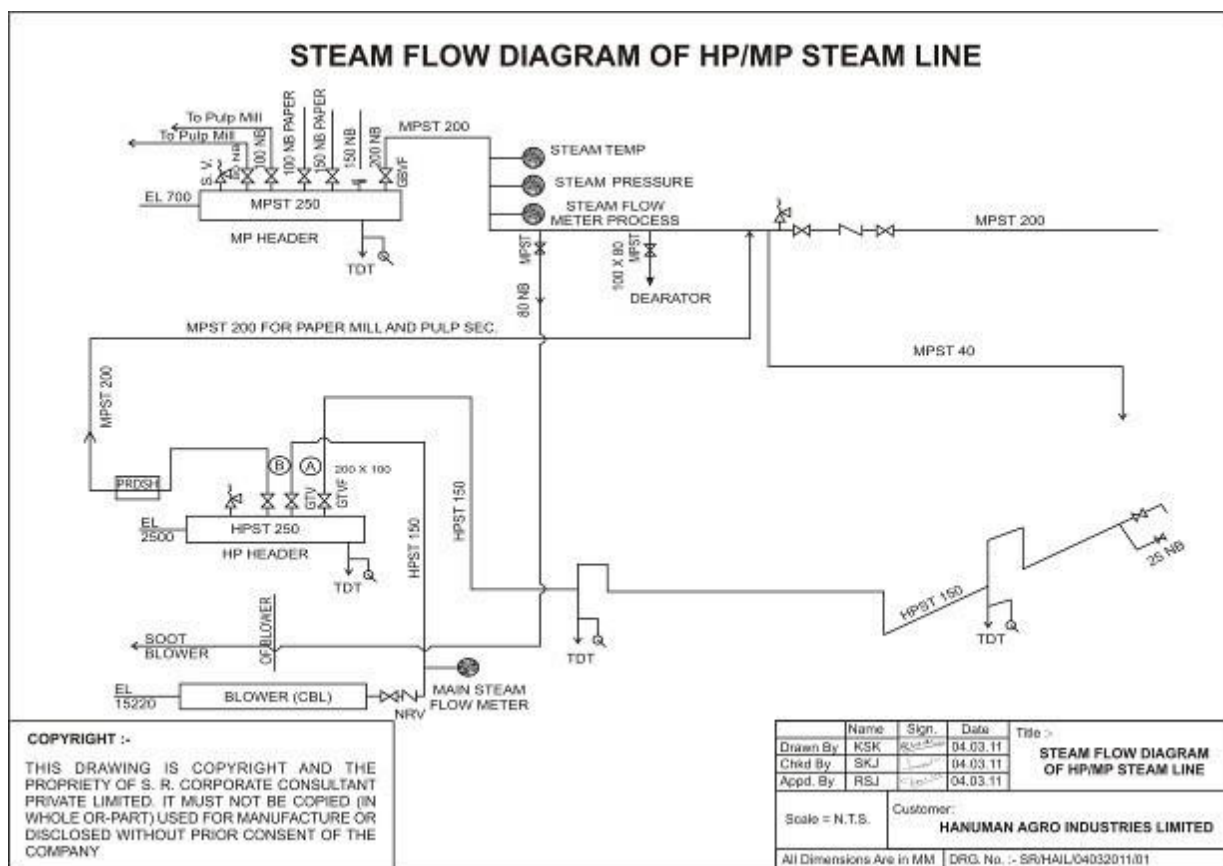
The plant installed one condensing cum extraction turbine along with 22 TPH high-pressure boiler with steam parameters of 44 kg/cm² and 450+/-5°C. This boiler is of modern design with fluidised bed furnace suitable for outdoor installation with water scrubber for dust collection. Uninterrupted flow of rice husk to the boiler enabled by a twin bunker system located in front of the boiler. In case of exigencies of biomass fuel scarcity, HAIL purposes to use coal as fuel to the extent of 15%. The plant has seven days storage capacity for husk.

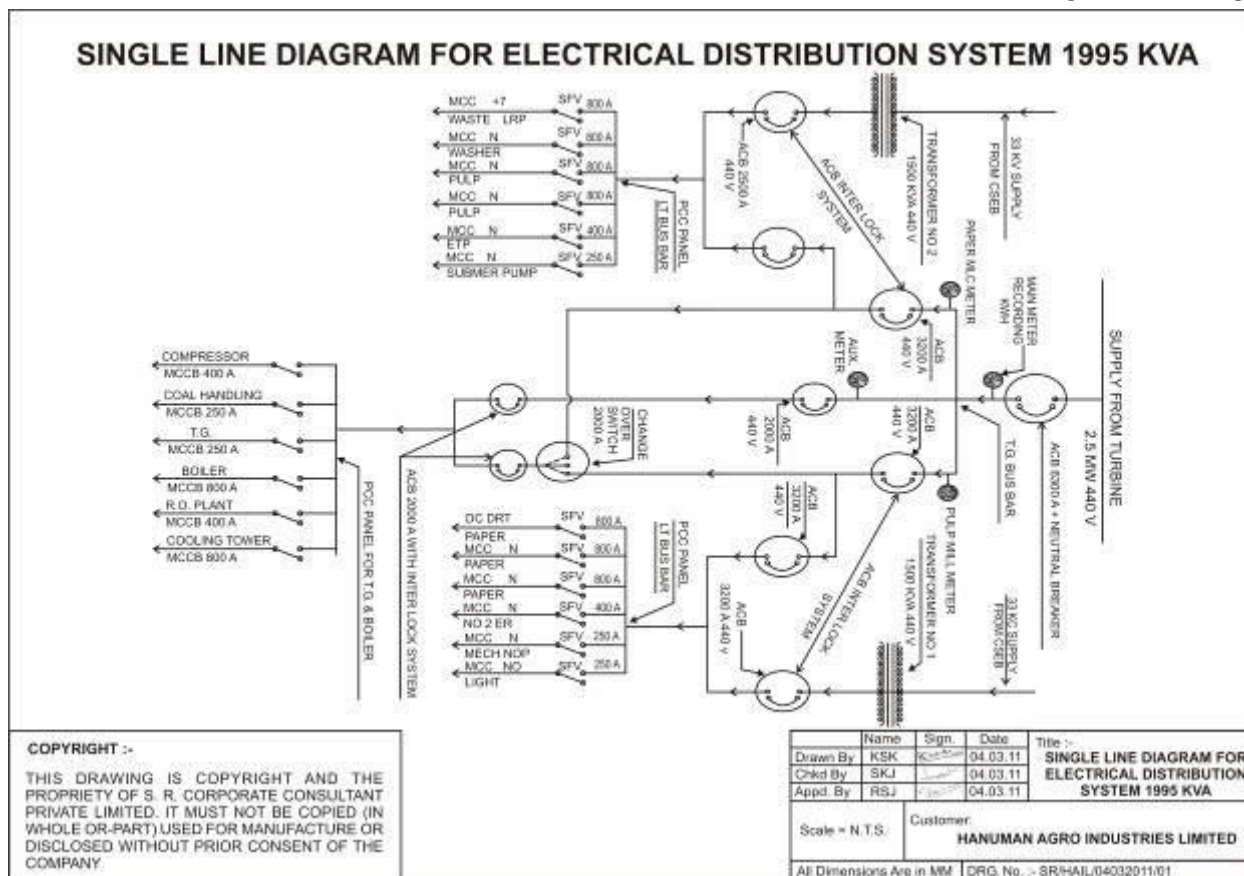
For generating maximum of 100% steaming capacity of the boiler at rated parameters, about 6.6

TPH of rice husk (100%rice husk firing) is required. The plant also has coal-handling facilities with necessary crushers and conveyors to meet the requirement in case of exigencies of biomass fuel scarcity. The project generates a gross power output of 2500 KW at the generator terminals. The power generation in the cogeneration plant is at 440V level. No transfer of technology is involved to host country because technology is available within India from reputed manufactures.

- The plant is designed with all other auxiliary plant system like:
 - Rice husk and coal handling system.
 - Pneumatic Ash handling system
 - Air pollution control devices
 - Water system consist of following sub-systems:
 - Raw water system
 - Condensate system
 - RO system
 - Service and potable water system
 - Compressed air system
 - Fire protection system
 - Complete electrical system for power plant including, instrumentation and control system

The details of technology as implemented has been described in section A.1. of this PDD, the Schematic showing electrical power & steam output metering arrangements is as below: -





A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host Party)	M/s Hanuman Agro Industries Limited	No

A.5. Public funding of project activity

The project has not received any public funding.

A.6. History of project activity

The project activity was successfully commissioned on 31/08/2006. The Project Activity was granted the Host Country Approval and Authorization by the Nation CDM Authority of India vide Letter No. 4/2/2007-CCC dated 02/04/2007².

CDM registration date: 07/11/2008

First crediting period: 07/11/2008 to 06/11/2015

Second crediting period: 07/11/2015 to 06/11/2022

Currently, the project proponent is applying for third Renewal of crediting period from 07/11/2022 to 06/11/2029.

A.7. Debundling

In reference to Para 9 of TOOL20, Methodological tool: Assessment of debundling for small-scale project activities (Version 04.0)³: -

² <https://cdm.unfccc.int/Projects/DB/SGS-UKL1204641540.4/view>

³ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-20-v1.pdf>

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- a) With the same project participants;
- b) In the same project category and technology/measure; and
- c) Registered within the previous 2 years; and
- d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The project participant hereby confirms that they have not registered any small scale CDM activity or applied to register another small scale CDM project activity within 1 km of the project boundary, in the same project category and technology/measure in previous 2 years.

This means that the project activity does not fall under the de-bundled category and qualifies for small scale CDM Project.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

The approved CDM small-scale baseline and monitoring methodology AMS I.C. “Thermal energy production with or without electricity” (Version 22)⁴

Methodological tools used:

- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion- Version 03⁵
- Tool to calculate the emission factor for an electricity system- Version 07⁶

B.2. Applicability of methodologies and standardized baselines

The project activity is a ‘Renewable energy project’ which has an output capacity less than 15 megawatts equivalent and falls under Type I project activities category in accordance with the CDM rules and requirements.

The selected category for the implemented project activity is as follows: Type I: Renewable energy Methodology AMS I.C “Thermal energy production with or without electricity”, Version 22

Para No.	Criteria	Justification
3 & 4	As per Para 3, Biomass-based cogeneration and trigeneration systems are included in this category. As per Para 4, Emission reductions from a biomass cogeneration or tri-generation system can accrue from one of the following activities: (a) Electricity supply to a grid; (b) Electricity and/or thermal energy production for on-site consumption or for consumption by other facilities; (c) Combination of (a) and (b).	The project involves a cogeneration system for producing heat and electricity. Electricity is utilized onsite for auxiliary consumption (0.25 MW) for co-generation purposes (i.e. the boiler its accessories). The remaining electricity (2.25 MW) displaces the fossil fuel dominated grid electricity from INDIAN grid. The steam is utilized for operation of their paper mill. Thus, the project falls under option (b) of para 3 & 4, i.e. Electricity and/or thermal energy production for on-site consumption or for consumption by other facilities

⁴ <https://cdm.unfccc.int/UserManagement/FileStorage/6GZLF8KSJVXAT3WPR05D71EMO9HUNB>

⁵ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf>

⁶ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

5	Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category	The project activity is a green field project activity and does not involve any retrofit or modification in an existing facility. Hence, this criteria is not applicable.
6	In the case of new facilities (Greenfield projects) and project activities involving capacity additions the relevant requirements related to determination of baseline scenario provided in the "General guidelines for SSC CDM methodologies" for Type-II and Type-III Greenfield/capacity expansion project activities also apply.	The project activity is a Type-I green field project activity and does not involve any capacity addition to the existing facility. Hence, this criteria is not applicable.
7	The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal ⁷ (see paragraph 9 for the applicable limits for cogeneration and trigeneration project activities).	<p>The project involves a cogeneration system for producing heat and electricity. Electricity is utilized onsite for auxiliary consumption (0.25 MW) for co-generation purposes (i.e. the boiler its accessories). The remaining electricity (2.25 MW) displaces the fossil fuel dominated grid electricity from INDIAN grid.</p> <p>The net thermal energy output from the project activity is approximately 20 MW_{th} which is below 45 MW_{thermal} as specified in the methodology. Hence, the capacity of the project equipment is less than 45 MW thermal.</p> <p>Therefore this applicability criterion has been met.</p>
8	For co-fired systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel, shall not exceed 45 MW thermal (see paragraph 9 for the applicable limits for cogeneration project activities).	The net thermal energy output from the project activity is approximately 20 MW _{th} which is below 45 MW _{thermal} as specified in the methodology. Hence, the capacity of the project equipment is less than 45 MW thermal. Therefore this applicability criterion has been met.

⁷ Thermal energy generation capacity shall be manufacturer's rated thermal energy output, or if that rating is not available the capacity shall be determined by taking the difference between enthalpy of total output (for example steam or hot air or chilled water in kcal/kg or kcal/m³) leaving the project equipment and the total enthalpy of input (for example feed water or air in kcal/kg or kcal/m³) entering the project equipment. For boilers, condensate return (if any) must be incorporated into enthalpy of the feed.

9	<p>The following capacity limits apply for biomass cogeneration and trigeneration units:</p> <p>(a) If the emission reductions of the project activity are on account of thermal and electrical energy production, the total installed thermal and electrical energy generation capacity of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating the capacity limit the conversion factor of 1:3 shall be used for converting electrical energy to thermal energy (i.e. for renewable energy project activities, the installed capacity of 15 MW(e) is equivalent to 45 MW thermal output of the equipment or the plant); (b) If the emission reductions of the project activity are solely on account of thermal energy production (i.e. no emission reductions accrue from the electricity component), the total installed thermal energy production capacity of the project equipment shall not exceed 45 MW thermal; (c) If the emission reductions of the project activity are solely on account of electrical energy production (i.e. no emission reductions accrue from the thermal energy component), the total installed electrical energy generation capacity of the project equipment shall not exceed 15 MW.</p>	<p>The project involves a cogeneration system for producing heat and electricity. Electricity is utilized onsite for auxiliary consumption (0.25 MW) for co-generation purposes (i.e. the boiler its accessories). The remaining electricity (2.25 MW) displaces the fossil fuel dominated grid electricity from INDIAN grid.</p> <p>The net thermal energy output from the project activity is approximately 20 MW_{th} which is below 45 MW_{thermal} as specified in the methodology. Hence, the capacity of the project equipment is less than 45 MW thermal. Therefore this applicability criterion has been met.</p>
10	<p>The capacity limits specified in paragraphs 7 to 9 above apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project shall comply with capacity limits specified in the paragraphs 7 to 9, and shall be physically distinct⁸ from the existing units.</p>	<p>It may be noted that the project activity meets the capacity limits specified in paragraphs 7 to 9 above. The project activity is a green field project activity and does not involve any retrofit or modification in an existing facility. Hence, this criteria is not applicable.</p>
11	<p>If solid biomass fuel (e.g. briquette) is used, it shall be demonstrated that it has been produced using solely renewable biomass and all project or leakage emissions associated with its production shall be taken into account in the emissions reduction calculation.</p>	<p>Project involves usage of rice husk and coal for generation of electricity. No solid biomass fuel is involved in the project activity; hence, this criteria is not applicable.</p>

⁸ Physically distinct units are those that are capable of producing thermal/electrical energy without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct"

12	Where the project participant is not the producer of the processed solid biomass fuel, the project participant and the producer are bound by a contract that shall enable the project participant to monitor the source of the renewable biomass to account for any emissions associated with solid biomass fuel production. Such a contract shall also ensure that there is no double-counting of emission reductions.	Project involves usage of rice husk and coal for generation of electricity. No solid biomass fuel is involved in the project activity; hence, this criteria is not applicable.
13	If electricity and/or thermal energy produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into that ensures there is no double-counting of emission reductions	The electricity generated at the project site is not supplied to any other facility or facilities within the project boundary. Hence the above mentioned condition is not applicable.
14	If the project activity recovers and utilizes biogas for producing electricity and/or thermal energy and applies this methodology on a standalone basis i.e. without using a Type III component of a SSC methodology, any incremental emissions occurring due to the implementation of the project activity (e.g. physical leakage of the anaerobic digester, emissions due to inefficiency of the flaring), shall be taken into account either as project or leakage emissions as per relevant procedures in the tool "Emissions from solid waste disposal sites" and/or "Project emissions from flaring". In the event that the biomass fuel (solid/liquid/gas) is sourced from an existing CDM project, then the emissions associated with the production of the fuel shall be accounted with that project.	The project activity does not involves usage of biogas hence this criterion is not applicable.
15	If project equipment contains refrigerants, then the refrigerant used in the project case shall have no ozone depleting potential (ODP).	Not applicable, as the project equipment do not contain refrigerants.

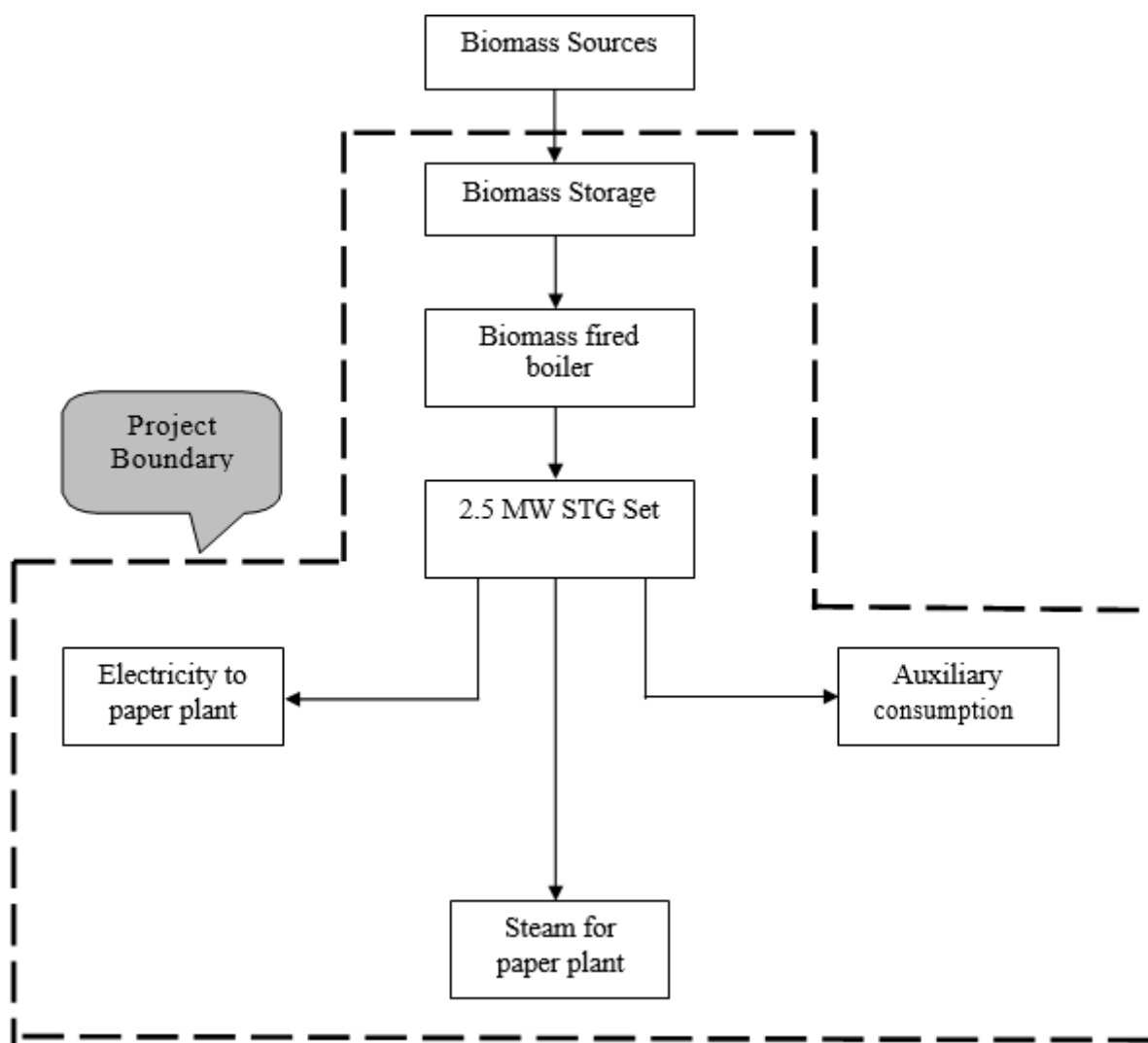
16	Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources, provided: (a) Charcoal is produced in kilns equipped with methane recovery and destruction facility; or (b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered. These emissions shall be calculated as per the procedures defined in the approved methodology "AMS-III.K: Avoidance of methane release from charcoal production by shifting from traditional open-ended methods to mechanized charcoaling process". Alternatively, conservative emission factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable e.g. source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.	Project involves usage of rice husk and coal for generation of electricity. No charcoal based biomass energy generation is involved in the project activity; hence, this condition is not applicable
17	In cases where the project activity utilizes biomass the "Tool 16: Project and leakage emissions from biomass" shall be applied to determine the relevant project emissions from the cultivation of biomass and utilization of biomass or biomass residues.	The project activity does not utilizes biomass sourced from dedicated plantations (cultivation of biomass), hence this criterion is not applicable.

B.3. Project boundary, sources and greenhouse gases (GHGs)

As mentioned under para 24 of AMS I.C (version 22) applied baseline and monitoring methodologies for selected small scale CDM project activity categories, Project boundary encompasses the physical and geographical site of the renewable generation sources. For the implemented project activity the project boundary is from the point of fuel storage to the point of electricity and steam supply to the paper mill (Paper and Pulp section) where the project proponent has a full control. Thus, project boundary covers fuel storage, boiler, steam turbine generator and all other accessory equipment's.

The project boundary does not include the biomass transportation from biomass sources to the plant site because the implemented project activity is switching the use of coal which is being transported from around 220 km away from the plant site whereas the biomass would be procured from the nearby rice mills situated within a range of 15 kms from the plant site. The emission resulting from transportation of coal is much higher than that would have result from transportation of biomass. The implemented activity is having a net positive impact on the environment by way of reduced emission due to transportation.

Flow chart and project boundary is illustrated in the following diagram:



Source		GHG	Included?	Justification/Explanation
Baseline	Baseline emissions from combustion of Coal in the Coal based steam generation	CO ₂	Included	Main emission source due to coal combustion.
		CH ₄	Excluded	Minor Emissions. Neglected for simplicity.
		N ₂ O	Excluded	Minor Emissions. Neglected for simplicity
Project activity	Project Emissions from combustion of fossil fuel in the project activity	CO ₂	Included	The usage of fossil fuel in the new biomass based boiler have been considered under project emissions.
		CH ₄	Excluded	Minor Emissions. Neglected for simplicity
		N ₂ O	Excluded	Minor Emissions. Neglected for simplicity

B.4. Establishment and description of baseline scenario

Updated baseline for the third crediting period in line with the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.” Version 03.0.1.⁹

This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 279 to 292 of Project Standard version 03.0.

⁹ <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf>

The tool stipulates the following steps to be carried out.

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The baseline scenario for (Thermal Energy Generation and Electricity generation) remains unchanged and is in compliance with all the relevant mandatory national and/or sectoral policies.

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project activity was thermal energy (steam) generation from fossil fuels like coal and the electricity (which is going to be displaced by the project activity) would have otherwise been generated by the operation of grid connected power plants and by the addition of new generation sources into the grid. Thus this project activity was a voluntary investment which intends to replace coal emissions of thermal energy and equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace coal emissions for equivalent amount of thermal energy and equivalent amount of electricity at grid. Hence, the same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewal of the project's crediting period under CDM.

Nevertheless, there is an impressive growth attained by the Indian Power Sector within the recent years, the installed capacity has grown from mere 1,713 MW in 1950 to 382,151.22 MW as on 31/03/2021, consisting of 234,728.22 MW Thermal, 94,433.79 MW Renew and 6,780 MW Nuclear. Sector-wise details of installed capacity are shown in Table 1. However, it is evident from Table 1 that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the CO₂ emissions in the country by increased use of renewable energy sources.

Furthermore, project participant has considered the latest available CO₂ Baseline Database (CEA database, version 17) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all the new circumstances. Hence, the new circumstances do not have an impact on the baseline emission. As per below table, the fossil fuel based thermal power generation is dominant over the renewable based power generation, thus baseline scenario remains same as original.

Table 1: Sector- wise installed capacity (MW) as on 31/03/2021 (CEA Database version 17)¹⁰

Sector	Thermal					Nuclear	Hydro	RES	Total
	Coal	Lignite	Gas	Diesel	Total				
State	65931.50	1150.00	7087.36	236.01	74404.86	0.00	27069.50	2395.27	103869.64
Central	62570.00	3640.00	7237.91	0.00	73447.91	6780.00	15646.72	1632.30	97506.93
Private	74173.00	1830.00	10598.74	273.70	86875.45	0.00	3493.00	90406.21	180774.66
All India	202674.50	6620.00	24924.01	509.71	234728.22	6780.00	46209.22	94433.79	382151.22

Thus, current baseline remain same and there is no impact if circumstances, existing at the time of requesting renewal of crediting period.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

As explained in step 1.2, the baseline scenario was thermal energy (steam) generation from fossil fuels like coal and the electricity generation from the power plants connected to the electricity grid.

¹⁰ https://cea.nic.in/wp-content/uploads/tpe_cc/2022/02/User_Guide_ver_17_2021.pdf
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The project activity in green field project and there is no any baseline equipment or investment involved in project activity. Therefore this condition is not applicable to the project activity.

Step 1.4: Assessment of the validity of the data and parameters

This step stipulates that “Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.”

In the context of the present project activity the grid emission factor for electricity has been updated along with the approach used to calculate the grid emission factor for electricity.

Step 2: Update the current baseline and the data and parameters

As per above table 1, the fossil fuel (predominantly coal) based thermal power generation is dominant over the renewable based power generation, thus baseline scenario remains same as original. The baseline scenario for project activity is thermal energy (steam) generation from fossil fuels like coal and the electricity import/generation from the power plants connected to the electricity grid.

As evident from the explanation provided above the baseline scenario remains unchanged. Only the approach used to calculate the baseline emission factor is updated as per the latest version of CEA database available at the time of PDD submission for renewal.

In line with the project standard version 03.0, the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period at the time of requesting renewal of crediting period; and the correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period

Impact of the national and/or sectoral policies and circumstances upon the baseline scenario of the project activity

The Government of India enacted the Electricity Act in the year 2003 to harmonize and rationalize the provisions in the existing laws. The Act consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. With the Enactment of the act, the then existing laws viz, The Indian Electricity Act 1910, The Electricity Supply Act, 1948 and The Electricity Regulatory Commissions Act, 1998 were repealed. The Electricity Act 2003 was in force at the time of the completion of the baseline study for the registered PDD.

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government¹¹ notified the National Electricity Policy¹¹ on 12th February 2005 which was in force at the time of completion of the baseline study as stated in the registered PDD of the project activity. This policy has not been revised since then and is currently in force as well.

In addition to the above policies, State Electricity Regulatory Commissions (SERCs) have announced preferential tariffs and Indian Renewable Energy Development Agency (IREDA) provides

¹¹ <http://www.cercind.gov.in/Act-with-amendment.pdf>
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term loan assistance towards establishing biomass power projects. All these fiscal and financial incentives were in force at the time of completion of the baseline study for the registered PDD of the project activity and still continue to exist.

The state electricity regulatory commission issues tariff order in respect of procurement of power generated wind generators and there is no mandatory national and/or sectoral policies have come into effect that would affect the compliance of the current baseline. Hence, it can be concluded the current baseline complies with all relevant mandatory national and/or sectoral policies that have come into effect after the submission of the project activity for validation and are applicable at the time of requesting renewal of the crediting period.

However, in spite of the financial incentives given by the government to renewable power projects in India the generation from the low cost must run resources connected to the Indian Grid has not increased to such an extent that this would lead to more than 50% contribution from the low cost must run resources towards the total generation from the Indian Grid.

The approved small scale methodology Thermal energy production with or without electricity, AMS-I.C (Version 22), has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period. As referred in the methodology "*Tool to calculate the emission factor for an electricity system*" (version 07.0) has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

As per CEA database version 17, the fossil fuel dominated thermal or electricity is more than renewable sector and is continuing with same pattern. In light of the above discussion it is to be concluded that in accordance with relevant guidelines stipulated in the Project Standard version 03.0, national and/or sectoral policies and circumstances had been considered towards formulating the OM & BM baseline scenario. Hence the baseline scenario as applied for the present project activity remains justified.

As per para 37 of the approved small scale methodology Thermal energy production with or without electricity, AMS-I.C (Version 22.0) "For project activities that do not displace captive electricity generated by an existing plant but displace grid electricity import and/or supply electricity to grid, the emission factor of the grid shall be calculated as per the procedures detailed in AMS-I.D. or AMS-I.F.

As per para 23 of AMS I.D, The emission factor shall be calculated in a transparent and conservative manner as follows:

- (a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system"; or
- (b) The weighted average emissions (in t CO₂/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

PP has followed option a) combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

The project activity involves setting up of biomass based co-generation project. In the absence of the project activity, coal emissions would have occurred for equivalent amount of thermal energy and the equivalent amount of power would have been supplied by the Indian grid, which is supplied mainly by fossil fuel fired plants. Hence coal for thermal energy and Indian grid for Electricity are baseline scenario.

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source (where available) and made publically available. The CEA database version 17 is the latest available data at the time of PDD submission to DOE for validation, hence same is considered for emission factor calculations.

The combined margin of the Indian grid used for the project activity is as follows:

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.8989 tCO ₂ /MWh	Combined margin CO ₂ emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.25) & build margin (0.75) ¹² values, sourced from Baseline CO ₂ Emission Database, Version 17.0, Oct.2021 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9522 tCO ₂ /MWh	Operating margin CO ₂ emission factor for the project electricity system in year y	Calculated as the last 3 year (2018- 19, 2019-20, 2020-21) generation-weighted average, sourced from Baseline CO ₂ Emission Database, Version 17.0, Oct.2021 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.8811 tCO ₂ /MWh	Build margin CO ₂ emission factor for the project electricity system in year y	Baseline CO ₂ Emission Database, Version 15.0, Dec.2019 published by Central Electricity Authority (CEA), Government of India (As per Methodological Tool " Tool to calculate the emission factor for an electricity system" Version 07.0 , Para 72 (b), for the third crediting period, the build margin emission factor calculated for the second crediting period has been used.)

B.5. Demonstration of additionality

As per para 281 of CDM Project Standard version 03. "For renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality." Hence the additionality has been kept same as given in PDD for first crediting period.

As per the decision 17/cp.7 Para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity, which is a 'carbon neutral fuel' based cogeneration plant, generates electricity in addition to steam to meet HAIL's captive electricity requirement thereby displacing power supplied from the State Grid. A part from the electricity, project activity is saving the equivalent coal otherwise would have been used for steam generation in process plant.

This project activity is a renewable energy projects with net zero CO₂ emission due to the carbon sequestration. Plants, which are sources of biomass, are re-grown at the same rate as it is being harvested, act as a sink for atmospheric carbon dioxide and the net flux of CO₂ to the atmosphere is zero. The power generated by the project activity replaces the grid power. The steam from the process is used to meet the steam requirement of the Paper Mill which is presently met by the coal fired 12 TPH Boiler. Therefore the project activity reduces the anthropogenic emissions of greenhouse gases by sources below those that would have occurred in absence of the registered CDM project activity.

¹² As per tool to evaluate the emission factor for an electricity system version 07.0 Para 86 point (b) "All other projects: wOM = 0.5 and wBM = 0.5 for the first crediting period, and wOM = 0.25 and wBM = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool" Since it's a biomass project, 0.25 of operating margin and 0.75 of build margin has been considered as project is undergoing validation for third crediting period.

In line with attachment A to appendix B of the simplified M&P for small-scale CDM project activities. Demonstration of additionality focuses on the barriers facing the Investment Barriers along with a brief analysis of operational barrier. In showing that the project is additional we demonstrate that it is not part of the baseline scenario, which in the case of the HAIL is that the plant continues to use steam generated from the coal fired boilers and the power continues to be supplied from the Grid based on predominantly fossil fuel generation and that the rice husk remains uncollected and decays naturally.

Investment Barrier

In Accordance of paragraph 3 of Indicative Simplified Baseline and Monitoring Methodologies for selected Small-Scale CDM Project Activity, the project participants need to demonstrate that that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in attachment A of this appendix.

Clause (a) of the attachments describes the Investment barrier which says a financially more viable alternative to the project activity would have led to higher emissions. In this case the project participants have two options viz. setting up of a coal based co-generation plant with less investment and high emissions or setting up of a biomass based co-generation plant with higher investments leading to negligible emissions.

Originally the idea conceived was to install a 2.5 MW coal based co-generation plant to meet the heat & electricity requirements of the company. The project was estimated at INR 108 Million with a project IRR of 14.07% during the expected operational lifetime of the project activity. The bankers also extended a term facility of INR 80 Million.

Incidentally the promoters have come across the environmental benefits of using renewable energy instead of fossil fuel; they immediately contacted the CREDA (Chhattisgarh Renewable Energy Development Agency). CREDA, the state nodal agency of MNRE (Ministry of New and Renewable Energy), is responsible for the development and promotion of renewable energy in the state. CREDA appraised the project participants about Kyoto Protocol and the modalities involved in clean development mechanism besides other environmental benefits associated with the renewable energy projects. It also informed them about the possible CDM benefits associated with setting up of a biomass based co-generation plant.

Keeping in view the possible CDM benefits, the project participants decided to set up a biomass based cogeneration plant instead of a coal based co-generation plant. The project cost was than estimated at INR 121.84 Millions. The additional fund required has been raised by the HAIL in form of equity and unsecured loans from the shareholders of the company. The project IRR also adversely effected and dropped down to 10.59%. But when the possible CDM revenue considered, it improves to 24.70% making this an attractive investment option.

Both the options are described hereunder:

Investment Analysis:-

S.No.	Description	Option I Coal Based Co-generation Plant	Option II Biomass Based Co-generation Plant
1.	Estimated Project Cost	Rs. 108.00 Million	Rs. 121.84 Million
2.	Project IRR	14.07%	10.59%
3.	Project IRR considering the possible CDM Revenues		24.70%

4.	Investment Decision considering the possible CDM Revenue	Option II
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So to perform the investment analysis for the project activity, Investment Comparison analysis has been applied.

While choosing the alternatives available for cogeneration plant, the most economical option is replacement of existing coal-fired boiler with bigger capacity of coal-fired boiler. The cost of steam produced using coal fired boiler is much lower than that of biomass fired boiler due to higher calorific value of coal as compared to biomass and the higher boiler efficiency described as under:

Calculation of Biomass and coal requirement for 22 TPH Boiler

Rice Husk		
Steam Requirement for the process	22	TPH
Net Calorific Value (NCV) Kcal/kg.	3250	Kcal/kg
Feed Water Temperature	105	0C
Boiler Efficiency*	82.0%	
Rice husk required for 1 TPH Steam Generation		
Theoretical Heat Requirement for steam generation at 44 kg/cm ² , 4500C	794000	Kcal
Theoretical Heat Requirement at 82% Boiler Efficiency	968293	Kcal
Rice Husk requirement per TPH steam Generation	298	kg per hour
Rice Husk requirement per 22 TPH steam Generation	6.55	TPH
No of working days in a year	330	days
No of working Hours per day	24	hours
Annual Rice Husk Requirement	51912	MT
(if 100% rice husk is used as raw-material)		
Rice Husk Price Per MT# Rs.	950	
Proposed %	85%	
Annual Rice Husk Requirement (85% uses)	44126	MT
Coal		
Steam Requirement for the process	22	TPH
Net Calorific Value (NCV) Kcal/kg.	3800	Kcal/kg
Feed Water Temperature	105	0C
Boiler Efficiency*	85.0%	
Coal required for 1 TPH Steam Generation		
Theoretical Heat Requirement for steam generation at 44 kg/cm ² , 4500C	794000	Kcal
Theoretical Heat Requirement at 85% Boiler Efficiency	934118	Kcal
Coal requirement per TPH steam Generation	246	kg per hour
Coal requirement per 22 TPH steam Generation	5.41	TPH
No of working days in a year	330	days
No of working Hours per day	24	hours
Annual Coal Requirement	42832	MT
(if 100% Coal is used as raw-material)		

Coal Price Per MT# Rs.	1100	
Proposed %	15%	
Annual Coal Requirement (15% uses)	6425	MT
* : Taken from technical Specification Provided by Boiler Supplier, # : Prevailing Market Rates		

The cost of raw material for power generation is also cheaper when the fuel is coal. It is estimated at Rs.1.25 per kWh as compared to Rs. 1.31 per unit when biomass is used as fuel. If we consider the CDM revenue flowing to such activity the cost would come down to Rs 0.11 per kWh in terms of the calculations given below:

Calculation of Cost per kWh using Biomass and coal as fuel

Cost of Power using Coal		
Installed Capacity of Plant	2.5	MW
Steam Requirement	12	TPH
Net Calorific Value (NCV) Kcal/kg.	3800	Kcal
Feed Water Temperature	105	OC
Boiler Efficiency	85.0%	
Coal for full TPH required for 2.5 MW	2.56	MT
Coal required for 1 kWh generation	1.024	Kg/kWh
No of working days in a year	335	days
No of working Hours per day	24	hours
Annual Coal Requirement	20580	MT
Average Coal Price	1100	Rs/MT
RM Cost per Unit	1.25	Rs./kWh
Cost of Power Using Biomass		
Installed Capacity	2.5	MW
Steam Required for 8 MW Power Production	12	TPH
Net Calorific Value (NCV) Kcal/kg.	3250	Kcal
Feed Water Temperature	105	OC
Boiler Efficiency	82.0%	
Rice Husk for full TPH required for 2.5 MW	3.10	MT
Rice husk required for 1 kWh generation	1.24	kg/kWh
No of working days in a year	335	days
No of working Hours per day	24	hours
Annual Biomass Requirement	24944	MT
Biomass Price Per MT Rs.	950	Rs/MT
RM Cost per Unit	1.31	Rs/kWh
Cost of Power considering CDM Revenue		
Qty of Coal to be consumed (MT)	2.56	MT/hr
Calorific Value of Sub-bituminous Coal (TJ/Kt)	18.90	TJ/kt
CO2 Emission Factor for Sub-bituminous Coal (t CO2/TJ)	96.10	t CO2/TJ
Project Emission in tonnes of CO2	4.65	t CO2/hr
Estimated revenue (@10 EUROS)	46.49	EURO
Estimated revenue	2697	INR

(assuming conversion factor 1 EURO = 58 INR)		
Estimated cost of Biomass Per hour	2947	INR
Less: Estimated CDM Revenue	2697	INR
Effective Cost of Biomass	251	INR
Average cost per unit	0.11	Rs/kWh

Operational barrier

Another major risk to the operation of the plant is the supply of rice husk. The majority of paddy in Chhattisgarh is grown under rain-fed rather than irrigated conditions. The yields of paddy are therefore weather related and there is a high production risk associated with the crop. For mitigating this risk, the promoters had decided to use other biomasses available in the region in case there is a crop failure or less productivity. Added risks on the availability of paddy and hence rice husk revolve around the policy of the state government-Paddy is a heavily regulated crop with about 75% being procured by the state, the remaining paddy is purchased through "Krishi Upaj Mandi" (local agricultural markets). The government policy has, till date, been to mill the paddy within the state and the "mandies" are not permitted to sell paddy outside the state. Any reversal in this policy would impact the milling of paddy and hence the availability of rice husk within the state. This is crucial, as the milling of paddy outside the state increases price of rice husk as this is primarily a function of the transport cost. Whilst these factors pose a risk to the project in relation to the likely plant load factor and hence returns.

Taking investment and operational barriers into consideration and looking for the support of CDM revenue to increase the viability of the project; project proponent has decided to go ahead with the project activity on 18th November 2004. The detailed CDM project activity milestone activities are listed below:

- Pre-feasibility study of 2.5 MW Biomass based Co-generation Plant including CDM revenue has been carried out during October 2004
- The Management Board of Hanuman Agro Industries Limited has been considered CDM revenue consideration for the project activity on 18/11/2004
- Hanuman Agro Industries Limited Management Board resolution towards involvement of additional funding on 16/03/2005
- Chhattisgarh Renewable Energy Development Authority (CREDA) appraised the project proponent regarding benefits including CDM benefits associated with biomass based cogeneration plant during March 2005
- Purchase Orders for 22 TPH boiler and 2.5 MW Steam Turbine to Cheema Boilers Ltd. and Pentagon Turbines
- (P) Ltd. respectively has been placed on 08/02/2005
- Receipt of term loan sanctioned from State Bank of India on 16/03/2005
- Invitation of local stakeholder comments for the project activity during 18/03/2005
- Consent to Established for the project activity has been obtained from Chhattisgarh Environment Conservation Board on 15/09/2005.
- No Objection Certificate obtained from local village authority on 23/05/2005
- No Objection Certificate for the project has been obtained from Chhattisgarh Renewable Energy Development Authority (CREDA) on 28/09/2006.
- Consent to Operate for the project activity has been obtained from Chhattisgarh Environment Conservation Board on 01/11/2006
- Application for Host Country Approval has been submitted to Ministry of Environment ,Forests and Climate Change) Government of India on 22/01/2007
- Project activity has started its commercial operation on 26/03/2007
- The Host Country Approval for the project activity has got issued on 02/04/2007
- Project proponent has engaged DOE for project validation on 04/04/2007
- Initial PDD has been web hosted for International Stakeholder Consultation procedure during 23/05/2007 to 21/06/2007.

During project inception stage, project proponent were of the impression that the CDM validation procedure can only be started once the Host Country Approval (HCA) from Ministry of Environment Forest and Climate Change, Government of India as the procedural approach. Along with that project proponent was also aware that prior to apply for HCA, the PDD for the project activity needs to be completed. Although the PDD can be completed only after obtaining all the necessary statutory clearances from the concerned Government Authorities, thus delay in obtaining NOCs/ Clearances from Chhattisgarh Environment Conservation Board, Chhattisgarh Renewable Energy Development Authority also delayed the PDD preparation. After completion of the PDD, the application of HCA has been submitted to Indian DNA and after obtaining of the HCA on 02/04/2007 immediately project proponent has contracted DOE for CDM validation procedure.

It is evident from the above mentioned detail project chronology, that the project proponent has decisively considered the CDM revenue support to increase the financial viability of the project activity before the start of the project.

Based on the above discussion it can be concluded that the project meets additionality criteria stipulated from UNFCCC.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

In the case of this project activity, the emission reductions have been arrived at considering the thermal and electrical energy generated by the captive cogeneration plant.

For thermal energy generation using renewable technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient of the fossil fuel displaced (Sub-bituminous coal in this case). Emission factor for Coal is 96.1 tonnes of carbon dioxide per TJ of energy consumed. The pre-project scenario is considered as the base line scenario. The base line scenario is shown in the table given below:

Daily Steam Requirement	9	TPH
Operating Hours per day	24	Hours
Steam pressure required for process	10.5	Kg/cm2
Steam Temperature	180	0C
Enthalpy	2784	kJ/Kg
Daily thermal energy consumption	601344000	kJ/day
Operating days	330	days
Annual thermal energy consumption	198	TJ

As per Section 5.2 of the methodology, For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced. Also, as per Section 5.2.2. Baseline scenario for electrical and/or thermal energy production, Project activities producing both electricity and thermal energy shall use one of the following baseline scenarios:

- (a) Electricity is imported from a grid and thermal energy is produced using fossil fuel;
- (b) Electricity is produced in an on-site captive power plant using fossil fuel (with a possibility of export to the grid) and thermal energy is produced using fossil fuel;
- (c) A combination of (a) and (b);

(d) Electricity and thermal energy are produced in a cogeneration or trigeneration unit using fossil fuel (with a possibility of export of electricity to a grid/other facilities and/or thermal energy to other facilities);

(e) Electricity is imported from a grid and/or produced in an on-site captive power plant using fossil fuels (with a possibility of export to the grid); thermal energy is produced using biomass;

(f) Electricity is produced in an on-site captive power plant using biomass (with a possibility of export to a grid) and/or imported from a grid; thermal energy is produced using fossil fuel;

(g) Electricity and thermal energy are produced in a biomass fired cogeneration or trigeneration unit (without a possibility of export of electricity either to a grid or to other facilities and without a possibility of export of thermal energy to other facilities);

(h) Electricity and/or thermal energy produced in a co-fired system;

(i) Electricity is imported from a grid and/or produced in a biomass fired cogeneration or trigeneration unit (without a possibility of export of electricity either to the grid or to other facilities); thermal energy is produced in a biomass fired cogeneration or trigeneration unit and/or a biomass fired boiler (without a possibility of export of thermal energy to other facilities);

(j) Electricity is imported from a grid and/or produced in an on-site captive power plant using fossil fuel and thermal energy is produced using electricity.

Out of the above, the project activity falls under (a). Hence, as per para 33, Baseline emissions for supply of electricity to and/or displacement of electricity from a grid shall be calculated as follows:

Baseline emissions for electricity production:

$$BE_{grid,y} = EG_{grid,y} \times EF_{grid,y}$$

Where:

$BE_{grid,y}$ = Baseline emissions for the grid electricity displaced by the project in year y (t CO₂e)

$EG_{grid,y}$ = Amount of grid electricity displaced by project in year y (MWh)

$EF_{grid,y}$ = Emission factor of the grid (t CO₂e/MWh)

BE_{grid,y} is also mentioned as BE_e in PDD.

As per para 37 of the approved small scale methodology Thermal energy production with or without electricity, AMS-I.C (Version 22.0) "For project activities that do not displace captive electricity generated by an existing plant but displace grid electricity import and/or supply electricity to grid, the emission factor of the grid shall be calculated as per the procedures detailed in AMS-I.D. or AMS-I.F.

As per para 23 of AMS I.D, The emission factor shall be calculated in a transparent and conservative manner as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system"; or

(b) The weighted average emissions (in t CO₂/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option a has been followed by PP to determine Grid Emission Factor.

As per methodology, combined grid emission factor as per the “Tool to calculate the emission factor for an electricity system” version 07 is calculated as below.

CO₂ Baseline Database for the Indian Power Sector, Version 17, Oct.2021¹³ published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per Methodological tool: Tool to calculate the emission factor for an electricity system (Version 07.0, EB 100, Annex 4), following six steps have been followed:

- (a) **Step 1:** Identify the relevant electricity systems;
- (b) **Step 2:** Choose whether to include off-grid power plants in the project electricity system (optional);
- (c) **Step 3:** Select a method to determine the operating margin (OM);
- (d) **Step 4:** Calculate the operating margin emission factor according to the selected method;
- (e) **Step 5:** Calculate the build margin (BM) emission factor;
- (f) **Step 6:** Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems

As described in tool “For determining the electricity emission factors, identify the relevant project 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 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 serves as the baseline for this project.

Table: Geographical Scope of Indian Electricity Grid

Northern	Eastern	Western	North-Eastern	Southern
Chandigarh	Bihar	Chhattisgarh	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	Karnataka
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadar & Nagar Haveli	Meghalaya	Tamil Nadu
Jammu & Kashmir	Sikkim	Madhya Pradesh	Mizoram	Telangana
Punjab	Andaman & Nicobar	Maharashtra	Nagaland	Puducherry

¹³ https://cea.nic.in/wp-content/uploads/tpe_cc/2022/02/User_Guide_ver_17_2021.pdf

Rajasthan		Goa	Tripura	Lakshadweep
Uttar Pradesh				
Uttarakhand				

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

Project participants may choose 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)

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.

The data required to calculate Simple adjusted OM and Dispatch data analysis OM is not possible due to lack of availability of data to project developers. The choice of other two options for calculating operating margin emission factor depends on generation of electricity from low-cost/ must-run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

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

	2016-17	2017-18	2018-19	2019-20	2020-21
India	14.6%	14.3%	14.5%	17.0%	16.5%

Data Source: Central Electricity Authority (CEA) database Version 17, Oct.21¹⁴

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

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- (a) **Ex-ante option:** if the ex-ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required.

OR

¹⁴ https://cea.nic.in/wp-content/uploads/tpe_cc/2022/02/User_Guide_ver_17_2021.pdf

(b) **Ex-post option:** if the ex-post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

PP has chosen ex-ante option for calculation of Simple OM emission factor using a 3-year generation-weighted average, based on the most recent data available at the time of submission of the PDD to the DOE for validation.

OM determined at validation stage will be the same throughout the crediting period. There will be no requirement to monitor & recalculate the emission factor during the crediting period.

Step 4: Calculate the operating margin emission factor ($EF_{grid,OMSimple,y}$) according to the selected method

The operating margin emission factor has been calculated using a 3 year data vintage:

Net Generation in Operating Margin (GWh) (incl. Imports)			
	2018-19	2019-20	2020-21
INDIAN Grid	995,957	965,009	958,218

Simple Operating Margin (tCO₂/MWh) (incl. Imports)			
	2018-19	2019-20	2020-21
INDIAN Grid	0.9603	0.9555	0.9405

Weighted Generation Operating Margin	
INDIAN Grid	0.9522

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

As per Methodological tool: “Tool to calculate the emission factor for an electricity system” (Version 07.0, EB 100, Annex 4) para 72:

In terms of vintage of data, project participants can choose between one of the following two options:

(a) **Option 1** - for the first crediting period, calculate the 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 PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

(b) **Option 2** - For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Option 2 as described above for the third crediting period, the build margin emission factor calculated for the second crediting period has been used.

Build Margin (tCO₂/MWh) (not adjusted for imports)	
	2018-19
INDIAN Grid	0.8811

Step 6: Calculate the combined margin (CM) emission factor ($EF_{grid,CM,y}$)

As per Methodological tool: "Tool to calculate the emission factor for an electricity system" (Version 07.0, EB 100, Annex 4) para 81:

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

PP has chosen option (a) i.e weighted average CM to calculate the combined margin emission factor for the project activity.

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$$

Where:

$EF_{grid,BM,y}$	= Build margin CO ₂ emission factor in year y (t CO ₂ /MWh)
$EF_{grid,OM,y}$	= Operating margin CO ₂ emission factor in year y (t CO ₂ /MWh)
W_{OM}	= Weighting of operating margin emissions factor (per cent)
W_{BM}	= Weighting of build margin emissions factor (per cent)

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

For Biomass projects: $W_{OM} = 0.25$ and $W_{BM} = 0.75$ for the second crediting period and for subsequent crediting periods. Since project activity is of power generation by using biomass, the above weightage has been considered for OM and BM.

$$\begin{aligned} \text{Therefore, } EF_{grid,CM,y} &= 0.9522 * 0.25 + 0.8811 * 0.75 \\ &= 0.8989 \text{ tCO}_2/\text{MWh} \end{aligned}$$

Baseline emission factor (EF_y):

The baseline emission factor is calculated using the combined margin approach as described in Step 6 above:

$$\text{Therefore, } EF_y = EF_{grid,CM,y} = 0.8989 \text{ tCO}_2/\text{MWh}.$$

Baseline emissions for heat production:

Base line Emission Reductions resulting from Steam/heat produced using fossil fuel:

$$BE_{th} = HG_y * CO_2EF_{coal} / \eta_{th}$$

Where:

BE_{th} : The baseline emissions from steam/heat displaced by the project activity during the year y in tCO₂e. ($BE_{thermal\ CO_2,y}$)

HG_y : The net quantity of steam/heat supplied by the project activity during the year y in TJ. ($EG_{thermal,y}$)

CO_2EF_{coal} : the CO₂ emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO₂ / TJ), obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used. Here Coal is considered as baseline fuel (EF_{FF,CO_2})

η_{th} : the efficiency of the plant using fossil fuel that would have been used in the absence of the project activity. This is same as $\eta_{BLthermal}$ of methodology.

3. Total Baseline Emission reduction per annum by project activity (BE_y)

$$BE_y = BE_{th} + BE_e$$

$$BE_y = 24863 + 14416$$

$$BE_y = 39,279 \text{ tCO}_2e$$

(round down value)

Project emissions calculation

The project may use coal as auxiliary fuel to the extent of 15% in case of exigency. The MNES also allows use of fossil fuel to the extent of 25% in case of exigencies.

Accordingly the project emissions in the form of tonnes CO₂ from combustion of coal is calculated using CO₂ emission factor refereeing the IPCC 2006 Guidelines for National Green House Gas Inventories. Formula used for calculation:

$$PE_y = NCV_{coal} \times Q_{fc} \times CO_2EF_{coal}$$

Where

PE_y : Carbon-dioxide emission due to coal burning at project site in tCO₂

NCV_{coal} : Calorific value of sub-bituminous coal in TJ/Kt

Q_{fc} : Quantity of coal burned in MT

CO₂EF_{coal} : Baseline Emission Factor for sub-bituminous coal

$$PE_y = 4,971 \text{ tCO}_2e \text{ (round up value)}$$

Leakage:

As per para 79, If the energy generating equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered

The project activity green field biomass based renewable project. Also, there is no transfer of equipment's observed. Hence leakage is considered as zero.

As per the "TOOL22: Leakage in biomass small-scale project activities"¹⁵ (Version 04.1), para 23 "The project participant shall evaluate ex ante id there is surplus of biomass in the region of the project activity, which is not utilized. 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 (e.g., 50 km radius), 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 Tool 22, PP conducted biomass assessment study for project activity. The surplus availability of rice husk in the 5 Km radius from the plant site is assessed at 218,980 M.tonnes per annum and 10 KM radius from the plant site is assessed at 286,572 M.tonnes per annum and 25 KM radius from the plant site is assessed at 379,252 M. tonnes per annum whereas the plant consumes 44,126 tonnes of rice husk at 100% capacity utilization assuming a fuel mix ratio of 85:15. Hence the availability of biomass is about 58.38% higher than the required quantity of biomass for the project.

¹⁵ <https://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-22-v1.pdf>
Version 12.0

PP checked the biomass survey report prepared by 3rd party and confirms that surplus biomass is available in the region for the 3rd renewal sought.

B.6.2. Data and parameters fixed ex ante

Data/Parameter	NCV_{coal}
Data unit	TJ/kt
Description	Net Calorific Value of fossil fuel (coal)
Source of data	Used IPCC 2006 guidelines for National Greenhouse gas Inventories, volume 2, Table 1.2, p.1.1
Value(s) applied	18.9
Choice of data or measurement methods and procedures	In the absence of project specific data and region specific data, IPCC values shall be taken.
Purpose of data	To determine Project Emissions
Additional comment	The fossil fuel consumption has been considered as 0 for the ex-ante calculations. However, the same is monitored ex-post once the project is operational.

Data/Parameter	EF_{CO₂,coal}
Data unit	tCO ₂ e/TJ
Description	CO ₂ emission factor of fossil fuel used onsite (coal)
Source of data	Used IPCC 2006 guidelines for National Greenhouse gas Inventories, volume 2, Table 1.4, p.1.23
Value(s) applied	96.1
Choice of data or measurement methods and procedures	In the absence of project specific data and region specific data, IPCC values shall be taken.
Purpose of data	To determine Project Emissions
Additional comment	IPCC values have been found conservative to the local values provided by CEA, hence used for calculation.

Data/Parameter	EF_{grid,OM,y}
Data unit	tCO ₂ /MWh
Description	Operating Margin CO ₂ emission factor in year y
Source of data	Calculated from CEA database, Version 17, Oct. 2021 ¹⁶
Value(s) applied	0.9522
Choice of data or measurement methods and procedures	Calculated as the last 3 year (2018-19, 2019-20, 2020-21) generation-weighted average, sourced from Baseline CO ₂ Emission Database, Version 17.0, Oct.2021 published by Central Electricity Authority (CEA), Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period

¹⁶ https://cea.nic.in/wp-content/uploads/tpe_cc/2022/02/User_Guide_ver_17_2021.pdf
Version 12.0

Data/Parameter	EF_{grid,BM,y}
Data unit	tCO ₂ /MWh
Description	Build Margin CO ₂ emission factor in year y
Source of data	Calculated from CEA database, Version 15, Dec.2019 ¹⁷
Value(s) applied	0.8811
Choice of data or measurement methods and procedures	Calculated as per "Tool to calculate the emission factor for an electricity system, version 07" as per the latest data available for most recent year 2018-19. ¹⁸ The data is obtained from "CO ₂ Baseline Database for Indian Power Sector" version 17, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period

Data/Parameter	EF_{grid,CM,y}
Data unit	tCO ₂ /MWh
Description	Combined Margin CO ₂ emission factor in year y
Source of data	Calculated from CEA database, Version 17, Oct.2021 & CEA data base , Version 15, Dec.2019
Value(s) applied	0.8989
Choice of data or measurement methods and procedures	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$ = Build margin CO ₂ emission factor in year y (tCO ₂ /MWh) $EF_{grid,OM,y}$ = Operating margin CO ₂ emission factor in year y (tCO ₂ /MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 25% W_{BM} = Weighting of build margin emissions factor (%) = 75%
Purpose of data	For the calculation of the Baseline Emission
Additional comment	This parameter is fixed ex-ante for the entire crediting period-

Data/Parameter	η_{th}
Data unit	%
Description	Boiler Efficiency
Source of data	Calculated on the basis of actual measured data during last 6 years prior to validation of project activity.
Value(s) applied	76.7%
Choice of data or measurement methods and procedures	As per AMS-I.C. version 22 highest baseline boiler efficiency measured during last six years has been considered.
Purpose of data	To determine Baseline Emissions
Additional comment	Nil

¹⁷ https://cea.nic.in/wp-content/uploads/baseline/2020/07/user_guide_ver15.pdf

¹⁸ For the third crediting period, the build margin emission factor calculated for the second crediting period has been used.

Data/Parameter	Q_biomass
Data unit	MT/ Year
Description	Evaluation of Surplus Biomass within a range of 25 Km from plant site
Source of data	Secondary as well as primary data to be collected by the third party working in this field
Value(s) applied	379,252
Choice of data or measurement methods and procedures	As the data are critical in calculating emission reductions by project activity, the assessment shall be carried out by the professional assistance Once prior to crediting period. The availability of biomass is about 58.38% larger than the required quantity of biomass for the project. Hence leakage due to competing uses for the biomass is neglected
Purpose of data	To determine Leakage Emissions if applicable
Additional comment	Nil

B.6.3. Ex ante calculation of emission reductions

The following Formulas have been used for estimating the Net Emission Reductions arising out of the project activity:

A. Baseline Emission Reductions:

I. Baseline Emission Reductions resulting from Steam/heat produced using fossil fuel:

$$BE_{th} = HG_y * CO_2EF_{coal} / \eta_{th}$$

Where:

BE_{th} : The baseline emissions from steam/heat displaced by the project activity during the year y in tCO₂e.

HG_y : The net quantity of steam/heat supplied by the project activity during the year y in TJ.

CO_2EF_{coal} : the CO₂ emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO₂/TJ), obtained from reliable local or national data if available, otherwise, IPCC default emission factors are used.

η_{th} : the efficiency of the plant using fossil fuel that would have been used in the absence of the project activity.

II. Carbon Emission reduction per annum by project activity due to displacement of electricity from Grid:

$$BE_{el} = EG_y \times BE_{Fe}$$

Where,

BE_{el} : Carbon Emission reduction per annum by project activity due to displacement of electricity from Grid in t CO₂.

EG_y : Net power supplied by the project activity i.e. Clean Power to be consumed by the entity replacing the Grid Power in GWh.

BE_{Fe} : Baseline Emission Factor for Indian Grid of India in Kg CO₂ per kWh.

III. Total Baseline Emission reduction per annum by project activity (BE_y)

$$BE_y = BE_{th} + BE_{el}$$

B. Onsite Project Emission expected from the Project Activity (PE_y):

The project may use coal as auxiliary fuel to the extent of 15% in case of exigency. The MNES also allows use of fossil fuel to the extent of 25% in case of exigencies. Accordingly the project emissions in the form of tonnes CO₂ from combustion of coal is calculated using CO₂ emission factor refereeing the IPCC 2006 Guidelines for National Green House Gas Inventories. Formula used for calculation:

$$PE_y = NCV_{\text{coal}} \times Q_{\text{fC}} \times CO_2EF_{\text{coal}}$$

Where

PE_y : Carbon-dioxide emission due to coal burning at project site in tCO₂
 NCV_{coal} : Calorific value of sub-bituminous coal in TJ/Kt
 Q_{fC} : Quantity of coal burned in MT
 CO₂EF_{coal} : Baseline Emission Factor for sub-bituminous coal (CO₂ Emission Coefficient) in tCO₂ per TJ

C. Leakage (Ly)

There is no energy generating equipment being transferred from or to another activity.

Para 17 & 18 of Attachment C to Appendix B of Indicative Simplified Baseline and Monitoring Methodologies for selected small-scale CDM project activity categories - General guidance on leakage in biomass project activities, version 02, EB 28 states that if the quantity of available biomass in the region (e.g. 50 km radius), is at least 25% larger than the quantity of biomass that is utilized including the project activity, then this source of leakage can be neglected.

The plant consumes 6555 Kgs of biomass per hour. According to the Biomass Assessment Study in Paragaon with adjoining area of 25 KM radius for 2.5 MW Rice husk based cogeneration power plant by Hanuman Agro Industries Limited, the surplus availability of rice husk in the 5 Km radius from the plant site is assessed at 218,980 M.tonnes per annum , 10 KM radius from the plant site is assessed at 286,572 M,tonnes per annum and 25 KM radius from the plant site is assessed at 379,252 M.tonnes per annum whereas the plant consumes 44,126 tonnes of rice husk at 100% capacity utilization assuming a fuel mix ratio of 85:15. Hence the availability of biomass is about 58.38% larger than the required quantity of biomass for the project. Hence leakage due to competing uses for the biomass is neglected.

Therefore, leakage emissions are not considered.

D. Net Carbon Emission Reduction by project activity $ER_y = BE_y - PE_y - LE_y$

Where

ER_y : Net Carbon Emission Reduction by project activity
 PE_y : Carbon-dioxide emission due to coal burning at project site
 LE_y : Project Leakage

Using the formula the estimated emission reductions from the project activity is provided under Section B.6.4.

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
2022-2023	39,279	4,971	0	34,308
2023-2024	39, 279	4,971	0	34,308
2024-2025	39, 279	4,971	0	34,308
2025-2026	39, 279	4,971	0	34,308
2026-2027	39, 279	4,971	0	34,308
2027-2028	39, 279	4,971	0	34,308
2028-2029	39, 279	4,971	0	34,308
Total	274,953	34,797	0	240,156
Total number of crediting years	07			
Annual average over the crediting period	39, 279	4,971	0	34,308

B.7. Monitoring plan**B.7.1. Data and parameters to be monitored**

Data/Parameter	EG _{Gross}
Data unit	GWh
Description	Total electricity generated from the project Activity.
Source of data	Measured data at Plant Site
Value(s) applied	17.82
Measurement methods and procedures	Gross electricity generation is measured through energy meter installed within the project boundary on continuous basis and Data is recorded electronically through online PLC system and spot readings of the meter is made hourly and recorded on logbook. The energy meter was installed within the project boundary by HAIL and is checked & sealed by CSEB.
Monitoring frequency	Gross electricity generation had been measured through energy meter installed within the project boundary on continuous basis and Data had been recorded electronically through online PLC system and spot readings of the meter made on hourly basis is noted on the logbook . This is updated and reported on the excel sheet on daily basis and further on monthly and yearly basis in the excel sheet. The parameter is measured using energy meters which measure the electricity in kWh and further updated to GWh on monthly basis while achieving on the excel sheet. Gross Energy Meter Accuracy Class: 0.2s Calibration Frequency: Annually
QA/QC procedures	Measurement through accurately calibrated Gross Energy Meter. check of the data logging by department head on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis
Purpose of data	This parameter is not directly used for Emission Reduction calculations
Additional comment	Nil

Data/Parameter	EG _{aux}
Data unit	GWh
Description	Auxilliary Consumption by Power Plant
Source of data	Measured data at Plant Site
Value(s) applied	1.78
Measurement methods and procedures	Auxiliary electricity consumption is measured through energy meter installed within the project boundary on continuous basis and Data is recorded electronically through online PLC system and spot readings of the meter is made hourly and recorded on logbook. The energy meter was installed within the project boundary by HAIL and is checked & sealed by CSEB.
Monitoring frequency	Auxiliary electricity consumption had been measured through energy meter installed within the project boundary on continuous basis and Data had been recorded electronically through online PLC system and spot readings of the meter made on hourly basis is noted on the logbook . This is updated and reported on the excel sheet on daily basis and further on monthly and yearly basis in the excel sheet. The parameter is measured using energy meters which measure the electricity in kWh and further updated to GWh on monthly basis while achieving on the excel sheet. Auxiliary Energy Meter Accuracy Class: 0.2s Calibration Frequency: Annually
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose. Measurement through accurately calibrated Auxiliary Energy Meter. check of the data logging by department head on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis
Purpose of data	This parameter is not directly used for Emission Reduction calculations
Additional comment	Nil

Data/Parameter	EG _y
Data unit	GWh
Description	The electricity consumed by the Paper Mill and pulp section from the project activity.
Source of data	Measured data at Plant Site
Value(s) applied	16.04
Measurement methods and procedures	Net electricity supplied to the paper and pulp mill is measured through energy meter installed within the project boundary on continuous basis and Data is recorded electronically through online PLC system and spot readings of the meter is made hourly and recorded on logbook. The energy meter was installed within the project boundary by HAIL and is checked & sealed by CSEB. Calculated as $EG_y = EG_{paper} + EG_{pulp}$ Paper Machine Energy Meter Accuracy Class: 0.2s Calibration Frequency: Annually Pulp Mill Energy Meter Accuracy Class: 0.2s Calibration Frequency: Annually

Monitoring frequency	Electricity supplied to Paper Mill and pulp section had been measured through energy meter installed within the project boundary on continuous basis and Data had been recorded electronically through online PLC system and spot readings of the meter made on hourly basis is noted on the logbook. This is updated and reported on the excel sheet on daily basis and further on monthly and yearly basis in the excel sheet. The parameter is measured using energy meters which measure the electricity in kWh and further updated to GWh on monthly basis while achieving on the excel sheet. Net electricity supplied to the paper & Pulp mill had been measured through energy meter installed with the project boundary on continuous basis and The Net Energy Consumption had been Calculated from EGpaper and EGpulp on daily basis and compiled on daily basis in Daily register then monthly and annual basis
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose
Purpose of data	For calculation of baseline emission
Additional comment	Nil

Data/Parameter	$Q_{fcbiomass}$
Data unit	MT
Description	Total quantity of biomass used for generation of power & steam shall be maintained at Plant site in form of Daily logbooks at stores department
Source of data	Measured at Plant Site
Value(s) applied	44,126
Measurement methods and procedures	The Biomass quantity is continuously measured at fuel receiving station & storage station through weighbridges. The supply of fuel to the steam generation set shall be monitored on daily basis. Data is recorded electronically as well as manually. Weigh Bridge Accuracy Class: 0.5% Calibration frequency: Annual
Monitoring frequency	The Biomass quantity had been continuously measured at fuel receiving station & storage station through weighbridges. The supply of fuel to the steam generation set had been monitored on daily basis. Data had been recorded electronically as well as manually.
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose and the monthly biomass consumption can be cross checked through biomass stock balance with reference to the Store receipts and biomass invoices. Measurement through accurately calibrated Weigh Bridge. check of the data logging by Storekeeper on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis Monthly biomass consumption is cross checked with the stock balance and further with the store receipts and biomass invoices.
Purpose of data	This parameter is not directly used for Emission Reduction calculations
Additional comment	Nil

Data/Parameter	$Q_{fccolal}$
Data unit	MT
Description	Total quantity of coal used for generation of power & steam shall be maintained at Plant site in form of Daily logbooks at supply department

Source of data	Plant Site
Value(s) applied	2,737
Measurement methods and procedures	The coal quantity is continuously measured at fuel receiving station & storage station through weighbridges. The supply of fuel to the steam generation set shall be monitored on daily basis. Data is recorded electronically as well as manually. Weigh Bridge : Accuracy Class: 0.5% Calibration frequency : Annually
Monitoring frequency	The coal quantity is continuously measured at fuel receiving station & storage station through weighbridges. The supply of fuel to the steam generation set is monitored on daily basis. Data is recorded electronically as well as manually.
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose and the monthly biomass consumption can be cross checked through coal stock balance with reference to the Store receipts and biomass invoices. Measurement through accurately calibrated Weigh Bridge. check of the data logging by Storekeeper on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis Monthly coal consumption is cross checked with the stock balance and further with the store receipts and coal invoices
Purpose of data	This parameter is used for Project emission calculations
Additional comment	Nil

Data/Parameter	$Q_{totalsteam}$
Data unit	Tonns
Description	Total quantity of steam generated per hour shall be maintained at Plant site in form of Shift Engineer's report
Source of data	Measured data at Plant Site
Value(s) applied	22 TPH
Measurement methods and procedures	Steam generation is measured through steam flow meter installed within the project boundary on continuous basis and Data is recorded electronically through online PLC system and spot readings of the steam generation is made hourly and recorded on logbook. Total Steam Flow Meter Accuracy Class : 0.2% Calibration Frequency: Annually.
Monitoring frequency	Total Steam generation had been measured through steam flow meter installed within the project boundary on continuous basis and Data had been recorded electronically through online PLC system and spot readings of the steam generation was made on daily basis and recorded on logbook.
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose Measurement through accurately calibrated Steam Flow Meter check of the data logging by Department Head on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis
Purpose of data	This parameter is not directly used for Emission Reduction calculations
Additional comment	Nil

Data/Parameter	$Q_{processsteam}$
Data unit	Tonns

Description	Total quantity of steam supplied per hour to the paper and pulp section shall be maintained at Plant site in form of Shift Engineer's report
Source of data	Measured data at Plant Site
Value(s) applied	12 TPH
Measurement methods and procedures	Steam supplied to the paper and pulp section is measured through steam flow meter installed within the project boundary on continuous basis and Data is recorded electronically through online PLC system and spot readings of the steam generation is made hourly and recorded on logbook. Total Steam Flow Meter Accuracy Class : 0.2% Calibration Frequency: Annually.
Monitoring frequency	Total steam supplied to the paper and pulp section had been measured through steam flow meter installed within the project boundary on continuous basis and Data had been recorded electronically through online PLC system and spot readings of the steam generation was made on daily basis and recorded on logbook.
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose Measurement through accurately calibrated Steam Flow Meter check of the data logging by Department Head on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis
Purpose of data	This parameter is used for Baseline Emission calculations
Additional comment	Nil

Data/Parameter	$P_{\text{processsteam}}$
Data unit	Kg/cm ²
Description	Pressure of process steam supplied per hour shall be maintained at Plant site in form of Shift Engineer's report
Source of data	Measured data at Plant Site
Value(s) applied	10.5
Measurement methods and procedures	Online measurement and manual logging Spot reading through PLC system and manual logging on daily basis as per standard industrial norms which shall be averaged on monthly basis; monthly average value shall be used to calculate Steam Enthalpy Pressure Gauge with 0.5 S accuracy installed within the project boundary Accuracy Class : 0.5% Calibration Frequency: Annually.
Monitoring frequency	Pressure of total steam supplied to Paper & Pulp section had been measured through steam pressure gauge installed within the project boundary on continuous basis and data has been recorded electronically through online PLC system and spot readings of the steam generation was made on daily basis and recorded log book and further on excel sheet and used for calculation of emission reductions. Monthly average is calculated which is used to calculate enthalpy.
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose. Measurement through accurately calibrated Pressure Gauge check of the data logging by Department Head on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis
Purpose of data	This parameter is used for Baseline Emission calculations
Additional comment	Nil

Data/Parameter	t _{processsteam}
Data unit	°C
Description	Temperature of process steam supplied per hour shall be maintained at Plant site in form of Shift Engineer's report
Source of data	Measured data at Plant Site
Value(s) applied	185
Measurement methods and procedures	Online measurement and manual logging Spot reading through PLC system and manual logging on daily basis as per standard industrial norms which shall be averaged on monthly basis; monthly average value shall be used to calculate Steam Enthalpy Temperature Gauge with 0.5 S accuracy installed within the project boundary Accuracy Class : 0.5% Calibration Frequency: Annually.
Monitoring frequency	Temperature of total steam supplied to Paper & Pulp section had been measured through steam temperature gauge installed within the project boundary on continuous basis and data has been recorded electronically through online PLC system and spot readings of the steam generation was made on daily basis and recorded log book and further on excel sheet and used for calculation of emission reductions. Monthly average is calculated which is used to calculate enthalpy.
QA/QC procedures	As the data are critical in calculating emission reductions by project activity, these variables are strictly monitored at the site by means of accurately calibrated instruments dedicated for the intended purpose. Measurement through accurately calibrated Temperature Gauge check of the data logging by Department Head on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis
Purpose of data	This parameter is used for Baseline Emission calculations
Additional comment	Nil

Data/Parameter	Steam Enthalpy
Data unit	KJ/Kg
Description	Heat value of process steam supplied to paper & pulp section
Source of data	Calculated based on temp and pressure of process steam
Value(s) applied	2784
Measurement methods and procedures	Calculated on monthly average value of steam pressure and temperature through steam table or below link or equivalent source https://www.spiraxsarco.com/resources-and-design-tools/steam-tables/dry-saturated-steam-line
Monitoring frequency	Pressure and Temperature of steam supplied to Paper & Pulp section had been measured through pressure and steam temperature gauge installed within the project boundary on continuous basis and data has been recorded electronically through online PLC system and spot readings of the Pressure and Temperature of steam supplied to Paper & Pulp section was made on daily basis and recorded log book and further on excel sheet and used for calculation of emission reductions. Monthly average is calculated which is used to calculate enthalpy.
QA/QC procedures	As there is no condensate return, the enthalpy of process steam is the net enthalpy/heat supplied by the project activity Measurement through accurately calibrated Pressure and Temperature Gauge check of the data logging by Department Head on daily basis check of the data logging by Commercial Manager on weekly basis check of the data logging by General Manager on monthly basis
Purpose of data	This parameter is used for Baseline Emission calculations
Additional comment	Nil

B.7.2. Sampling plan

Not Applicable

B.7.3. Other elements of monitoring plan

The project activity results in GHG emission reductions from generation of thermal and electrical energy using renewable biomass and helps in displacing an equivalent amount of energy from fossil fuel based sources. This requires proper monitoring of all the relevant GHG performance parameters. Therefore the project proponent has developed a robust monitoring protocol which is followed throughout the proposed crediting period in order to ensure proper operation of the project activity resulting in generation of quality carbon credits.

- The monitoring plan covers:
- Overall project management
- Recording of results
- Calibration of measurement equipments
- Maintenance procedures
- Procedures for training of project personnel
- Internal audit procedure
- Corrective actions

The data and parameters (as outlined below) under monitoring plan, shall strictly be monitored at the site by means of accurately calibrated instruments and authentic procedure dedicated for the intended purposes.

- Electricity Generation (EG_{gross}) and Auxiliary Consumption (EG_{aux})
- Net Energy supply (EG_y) ($EG_y = EG_{paper} + EG_{pulp}$)
- Fuel Consumption ($Q_{fc_biomass}$ – Quantity of Biomass)
- Fuel Consumption (Q_{fc} – Quantity of Coal)
- Total Steam Generation ($Q_{totalsteam}$)
- Total Process Steam consumption ($Q_{processsteam}$)
- Pressure of Process Steam ($P_{processsteam}$)
- Temperature of Process Steam ($t_{processsteam}$)
- Steam Enthalpy

Parameters to be measured	Monitoring system	Data recording system
Electricity Generation (EG_{gross}) and Auxiliary Consumption (EG_{aux})	Direct measurement through duly calibrated energy meters	Data is captured on continuous basis through online PLC system and manually on hourly basis in logbooks. Daily measurement and monthly recording in excel sheet
Net Energy supply (EG_y)	Direct measurement through duly calibrated energy meters	Data is captured on continuous basis through online PLC system and manually on hourly basis in logbooks. Daily measurement and monthly recording in excel sheet

Fuel Consumption (Q _{fc_biomass} – Quantity of Biomass)	Measurement through duly calibrated weighbridges.	Data is captured on daily basis through both the electronic and manual method. Logbooks towards Goods received at site (GRN), Store records for receipt & issue to the boiler section. Daily measurement and monthly recording in excel sheet
Fuel Consumption (Q _{fc} – Quantity of Coal)	Measurement through duly calibrated weighbridges.	Data is captured on daily basis through both the electronic and manual method. Logbooks towards Goods received at site (GRN), Store records for receipt & issue to the boiler section. Daily measurement and monthly recording in excel sheet
Total Steam Generation (Q _{totalsteam}) and Total Process Steam consumption (Q _{processsteam})	Direct measurement through duly calibrated steam flow meters	Data is captured on continuous basis through online PLC system and manually on hourly basis in logbooks. Daily measurement and monthly recording in excel sheet
Pressure of Process Steam (P _{processsteam}), Temperature of Process Steam (t _{processsteam}) and Steam Enthalpy	Direct measurement through duly calibrated pressure and temperature gauges	Data is captured on continuous basis through online PLC system and manually on hourly basis in logbooks. Daily measurement and monthly recording in excel sheet

HAIL has an operational and management structure in place, which has set procedures and systems to monitor emission reductions generated by the project activity. The details of the set procedures are being followed and have been described in detail in the “HAIL CDM Manual”. This manual describes the best practices in industry and established procedures for monitoring emission reductions. A CDM team comprising of persons from relevant departments has been constituted, who are responsible for carrying out the procedures set by the manual.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

08/02/2005 (Based on boiler and TG purchase order placement date)

C.2. Expected operational lifetime of project activity

20 Years

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable Crediting Period

C.3.2. Start date of crediting period

07/11/2022

C.3.3. Duration of crediting period

7 years (07/11/2022 to 06/11/2029 – Inclusive of both the dates)

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

Host Country's legislation does not require any documentation on the analysis of environmental impacts of the project activity as the capital cost of the project is less Rs 100 Crores. The factory meets all environmental legislations as set out by the Chhattisgarh Environment Conservation Board (the State Pollution Control Board) and there is on-going monitoring of the plant by this state body. "Consent to Establish" was issued to the plant on 15th September 2005 and "Consent to operate" on 17th April 2006.

The Environmental Impacts of the project activity on the environment are very minimal and the project proponent has taken all precautionary and remedial measures to mitigate the impacts in both the construction and operational stages. The project activity comprises of a state-of-art Electro Static Precipitators, wherein the air pollution is brought under the limits. Ash handling system conveyors are covered and the collected ash is wetted before disposal from the boiler. Oxygen analyzer and online monitoring of suspended particulate matter are provided for control of boiler flue gases.

Water usage is minimized and recycling and reuse of water (of good quality at prescribed standards) are affected with the help of Reverse Osmosis and De Mineralization Plant. Fuel storage yard is fully covered and fuel-handling systems are maintained in a safe and secure position. Fire extinguishers are provided in fuel storage as well as at all critical locations in the project site. Safety training program is imparted to all employees with the guidance of fire service department personnel. All employees are educated on safety; health and environment related issues and personal safety equipments are provided, keeping in mind the well-being of the employees. First Aid boxes are supplied to all departments and two vehicles are employed by the project promoter to commute the injured employees, in case of any emergencies. The project promoter has tied up with a nearby hospital (well equipped) to ensure safety and health of the employees, at all times.

In relation to the base line scenario negligible negative environmental impacts arise as a result of the project activity that is noise pollution due to transportation activities and operation of the plant.

The positive environmental impacts arising from the project activity are:

- A reduction in carbon dioxide emissions from the replacement of fossil fuels, which would be generated under the baseline scenario.
- A reduction in the emissions of other harmful gases (NO_x and SO_x) that arise from the combustion of coal in power generation.
- A reduction in ash in comparison to the baseline scenario due the lower ash content of rice husk relative to coal (18% versus 46% respectively)
- A reduction in methane emissions through the controlled combustion rice husks & other biomasses

D.2. Environmental impact assessment

Since Host Country's legislation does not require any documentation on the analysis of environmental impacts of the project activity as the capital cost of the project is less than Rs 100 Crores and the project is not covered under the specified list of industries which requires the EIA, no such EIA has been documented.

Further no negative environmental impact except negligible noise pollution due to transportation of raw material arises as a result of the project activity.

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

The project activity has been implemented by HAIL at their Industrial complex located in Paragoan, Raipur district of Chhattisgarh State. The project uses biomass available in nearby region of Plant site in Village Paragoan, Raipur District as the fuel. The plantation, representing a cyclic process, sequesters the GHG emissions of the combustion process, mainly CO₂. So the project leads to zero net GHG on-site emissions. Stakeholders list includes the government and non-government parties, which are involved in the project at various stages. The stakeholders identified for the project are as under:

- Local Authority i.e. Gram Panchyat
- Chhattisgarh State Electricity Board (CSEB)
- Chhattisgarh Renewable Energy Development Agency (CREDA)
- Chhattisgarh Environment Conservation Board (CECB)
- Project Consultants & Contractor

HAIL has not only communicated with the relevant stakeholders under statutory obligations but also has engaged the other stakeholders in a proactive manner in expressing and accounting

E.2. Summary of comments received

The Local elected body of representatives administrating the local area is a true representative of the local population in a democracy like India. Hence, their comment / permission to set up and operate the project is necessary. HAIL has received the full support and clearance for its project from all the villagers including the village head & panchs in the meeting, which was conducted and chaired by The Village Head in Village Paragoan. The "Gram panchayat" (a locally elected representative) had issued a no objection certificate on 25th May 2005.

The local community mainly comprises of the local people in and around the project area. The roles of the local people are of beneficiary of the project. The project provides direct and indirect employment opportunities to local populace thus encouraging the project. The project does not require any displacement of the local population. The project is located in fallow land of the village Paragoan in District Raipur. Thus, it implies that the project does not cause any adverse social impacts on the local population but helps in improving the quality of life for them.

CECB under Environment Department, Government of Chhattisgarh have prescribed standards of environmental compliance and monitor the adherence to the standards. Chhattisgarh Renewable Energy Development Agency (CREDA) is one who implements policies in respect of non-conventional renewable power projects in the state of Chhattisgarh. CREDA has accorded its support for the project. Further, State's apex body of power is CSEB and they have already issued consent.

The Government of India, through Ministry of Non-conventional energy Sources (MNES), has been promoting energy conservation, demand side management and viable renewable energy projects including wind, small hydro, solar and biomass power generation projects. Projects consultants have been involved in the project to take care of the various pre-contract and post-contract issues / activities like preparation of Detailed Project Report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project operation, implementation until the successful commissioning and trial run of the project.

E.3. Consideration of comments received

No adverse comment has been raised by any of stakeholder

SECTION F. Approval and authorization

The project activity was successfully commissioned on 31/08/2006. The Project Activity was granted the Host Country Approval and Authorization by the Nation CDM Authority of India vide Letter No. 4/2/2007-CCC dated 02 April 2007¹⁶. Currently, the project proponent is applying for Renewal of Crediting Period from 07/11/2022 to 06/11/2029.

¹⁶ <https://cdm.unfccc.int/Projects/DB/SGS-UKL1204641540.4/view>

Appendix 1. Contact information of project participants

Organization name	Hanuman Agro Industries Limited
Country	India
Address	Modhaupara, Apartment No 8, 2nd Floor, Lalganga Apartments, Raipur, Chhattisgarh - 492 001
Telephone	+91-0771-2223510
Fax	+91-0771-2223520
E-mail	hail@cal.vsnl.net.in
Website	NA
Contact person	Anjan Kanoria

Appendix 2. Affirmation regarding public funding

Kindly refer section A.5 of the Project Design Document.

Appendix 3. Applicability of methodologies and standardized baselines

Kindly refer section B.2 of the Project Design Document.

Appendix 4. Further background information on ex ante calculation of emission reductions

Kindly refer section B.6.3 of the Project Design Document.

Appendix 5. Further background information on monitoring plan

Kindly refer section B.7.3 of the Project Design Document.

Appendix 6. Summary report of comments received from local stakeholders

Kindly refer section E of the Project Design Document.

Appendix 7. Summary of post-registration changes

Not Applicable.

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
12.0	8 October 2021	Revision to: Improve consistency with version 03.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN).
11.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Improve consistency with the “CDM project standard for project activities” and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with the “CDM project standard for project activities” (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the “Project design document form for small-scale CDM project activities” (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: <ul style="list-style-type: none"> • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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