CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	➢ The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. ➢ As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	➢ The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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2.5 MW Rice husk based cogeneration plant at Hanuman Agro Industries Limited
Version 01, 10-05-2007

A.2. Description of the small-scale project activity:

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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. The project activity is helping in conservation of natural resources like coal and HSD.

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 scenario

The total power requirement of the paper mill was being met by the power supplied by the Chhattisgarh State Electricity Board (CSEB, a part of Indian Western Grid)) and total process steam requirement of around 9 TPH at 10 Kg/cm^2 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 would comfortably meet the peak power demand, including the co-generation auxiliaries. 9 TPH/Hr of extraction steam of 10 Kg/cm^2 from the turbine will adequately meet the process steam requirement at the mill. A part of the steam is fed to pulp section at 10 Kg/cm^2 and rest goes to paper section at 4 Kg/cm^2 through the existing pressure reducer. The generation will be synchronized with utility supply at 11 KV and step down to usage level of 400 V will be by the existing 11 KV/400 V transformer.

Since the project envisages the collection & utilisation of local biomasses for power generation and steam production, it will 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 is located in a rural belt and will contribute 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 will bring in associated economic and social benefits. The project will also help 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 will have local effect on its price and will generate additional revenue for the rice millers, which in turn will benefit the local farmers, as this is paddy-growing area. The project activity will result in saving the coal and HSD and allowing it to be diverted to other needy section of he economy.

- **Environmental well-being**:
  The project activity is a renewable energy power project, which will collect & 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 will either substitute or supplement the power generation by CSEB using conventional sources of energy (which also includes high carbon emissive fuel). Thus it will reduce the CO_2 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(CO_2) as a rice husk is a carbon neutral fuel.

- **Technology well-being**:
  The project activity is adopting an advanced and sustainable technology for long-term benefits.

A.3. Project participants:

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Name of Party	Private and / or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant
India (host)	Private entity: Hanuman Agro Industries Limited	No

A.4. Technical description of the small-scale project activity:

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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 BFBC Boiler with the outlet steam parameters of 44 Kg/cm^2 & 450$\pm$5^{o}C Steam temperature and Multistage, impulse, nozzle governed bleed & extraction cum condensing type 2.5 MW capacity Turbo-Generator Set. The project will consume around 10% of the generation for auxiliary consumption and the rest will be primarily used to meet the in-house power requirement, which is 2.25 MW at present. The extraction steam from turbine outlet will be used for meeting the steam requirement of the paper mill.

The plant will consume approximately 6555 kgs of biomass per hour. The annual requirement of biomass predominantly rice husk is estimated at 51.912 thousand MT at 100% capacity utilization (6.555 MT x 24 Hours x 330 Days) while the surplus availability of rice husk in the 15 Km range from the proposed plant site is assessed at 126.938 thousand MT. The project will help 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.

A study of the rice husk available within the local area arrived at rice husk surplus availability of 127 thousand MT per annum. The plant is expected to consume **44,126** tonnes of rice husk at 100% capacity utilisation assuming a fuel mix ratio of 85:15. Within the study area there are also a number of other types of biomass available – crop residues, fuel wood and bushes – that account for a further supply of 164,452 tonnes of biomass per annum as shown in the following table.

Table 1 - Biomass Generation, Consumption & Surplus

Sl. No.	Biomass From	Generation in Qty. in MTPA	Consumption in Qty. in MTPA	Surplus in Qty. in MTPA
1	Crop Residue	316015	234925	81090
2	Fuel Wood	107830	27703	80127
3	Bushes	6470	3235	3235
4	***Industries (Rice Husk)***	139346	12408	126938
Total		569661	278271	291390

Assuming that the annual requirement for 1 MW of power generation is 10,337 tonnes (1.18 MT x 24 Hours x 365 days) of rice husk this results in a potential power generation capacity of 12 MW in the study area comprising an area within 15 km range from the plant site. At present there is neither any plant exist nor did any plan for power plants in the study area that will draw on the surplus rice husk. It may therefore be concluded that there is substantial surplus of rice husk, which may be combusted in the boiler.

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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India

A.4.1.2. Region/State/Province etc.:

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Chhattisgarh State,

A.4.1.3. City/Town/Community etc:

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Village Paragoan, Nawapara-Rajim

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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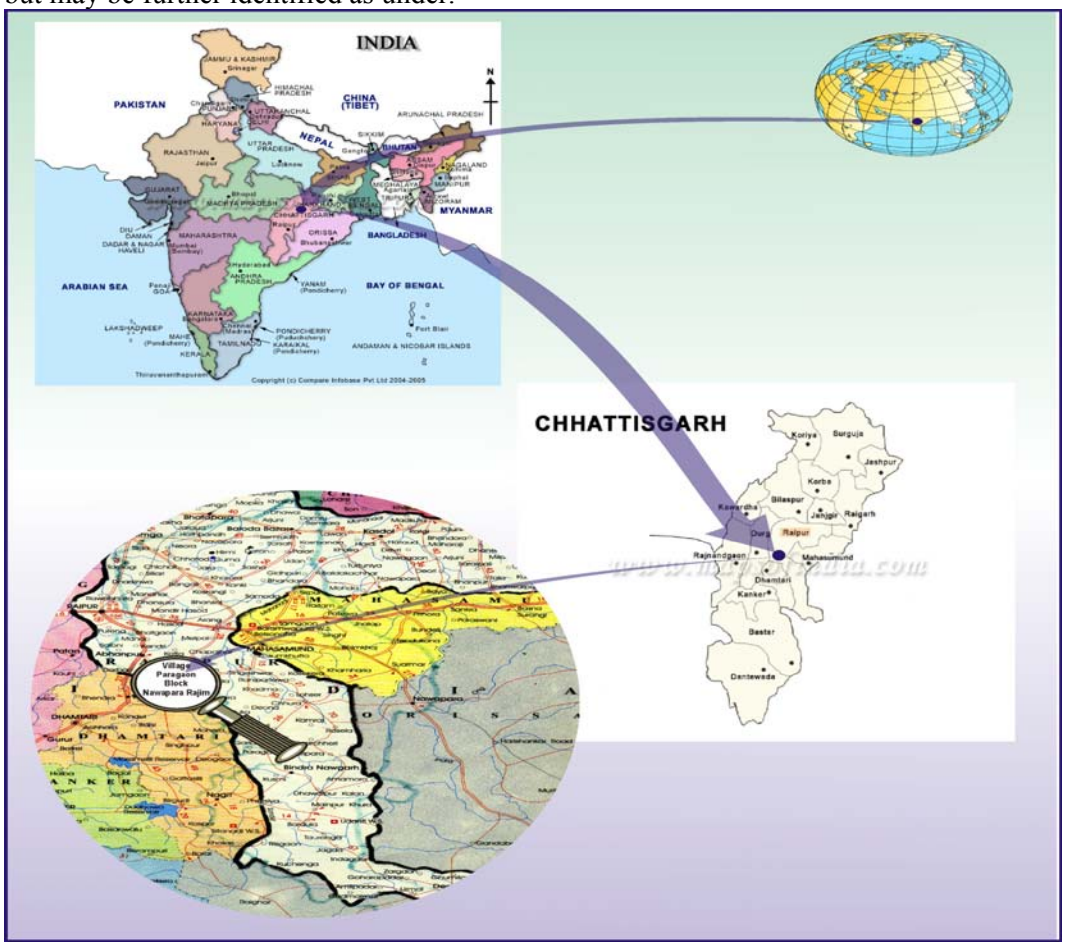
The project is readily identifiable as it is the only paper & pulp plant at Paragoan village but may be further identified as under.



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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Type and Category
Type I: Renewable Energy Projects
Category: AMS-1.C. Thermal Energy for the user with or without electricity, Version 10

As defined under Appendix D of the Indicative simplified modalities and procedures for small-scale CDM project activities (Version 10, 4th May 2007, this category includes **"Biomass-based co-generating systems that produce heat and electricity".** For Cogeneration projects that displace/ avoid fossil fuel consumption in the production of thermal energy (e.g. steam or process heat) and/or electricity shall use this methodology. The capacity of the project in this case shall be the thermal energy production capacity i.e. 45 $MW_{th.}$.

The project activity clearly qualifies in the above category since the net thermal energy output from the project activity is approximately 20 MW_{th} (< 45 MW_{th})

The power requirement for operating process plant at HAIL is about 2.25 MW. Previously the power requirement was met by supplies from State Utility. HAIL set up the rice husk based cogeneration plant to meet its steam and power requirement from captive sources. The electricity produced by the project activity replaced the electricity supplied from State Grid. The activity also replaced the steam being supplied from coal-fired boiler with this co generating system.

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/cm^2 and 450 ^{0}C.Tthis 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, SIPL 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 plant has Distributed Control System (DCS)/Supervisory Control and data acquisition (SCADA) for operation and generates a gross 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:

1. Rice husk and coal handling system.
2. Ash handling system
3. Air pollution control devices
4. Water system consist of following sub-systems:
5. Raw water system
6. Condensate system
7. Water treatment system
8. Service and potable water system
9. Compressed air system

10. Fire protection system
11. Complete electrical system for power plant including, instrumentation and control system etc.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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A seven years crediting period has been chosen as the project life is estimated at 25 years. It is estimated that the plant would operate at 90% PLF. The project activity is expected to reduce about 147,349 tCO_2equ as given in the following table:

Table 2 – Estimated Annual Emission Reductions

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2007 (7months)	11943
2008	20474
2009	20474
2010	20474
2011	20474
2012	20474
2013	20474
2014 (5 months)	12564
Total estimated reductions (tonnes of CO_2e)	**147349**
Total number of crediting years	**7**
Annual average of the estimated reductions over the crediting period (tCO_2 e)	**21050**

A.4.4. Public funding of the small-scale project activity:

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The project has not received any public funding.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to Appendix C of Simplified Modalities & Procedures for small-scale CDM project activities, *'Debundling'* is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities. In view of Para 2 of Appendix C, the 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:

- with the same project participants;
- in the same project category and technology/measure;
- Registered within the previous 2 years; and

- whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point.

In HAIL's case, it does not fall under the debundled category and qualifies as a small scale CDM project. It is the single such project of the promoters. The promoters have several other diverse businesses but not a power plant.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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Type I : Renewable Energy Projects
AMS-1.C. Thermal Energy for the user with or without electricity, Version 10

B.2 Justification of the choice of the project category:

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This project falls under the "Type I: Renewable energy projects" and "Category I.C. Thermal energy for the user". Accordingly cogeneration projects that displace/avoid fossil fuel consumption in the production of thermal energy (e.g. steam or process heat) and/or electricity shall use this methodology. The capacity of the project in this case shall be the thermal energy production capacity i.e. 45 $MW_{th.}$.

The project activity clearly qualifies in the above category since the net thermal energy output from the project activity is approximately 20 MW_{th} (< 45 MW_{th})

The power requirement for operating process plant at HAIL is about 2.25 MW. Previously the power requirement was met by supplies from State Utility. HAIL set up the rice husk based cogeneration plant to meet its steam and power requirement from captive sources. The electricity produced by the project activity replaced the electricity supplied from State Grid. The activity also replaced the steam being supplied from coal-fired boiler with this co generating system.

B.3. Description of the project boundary:

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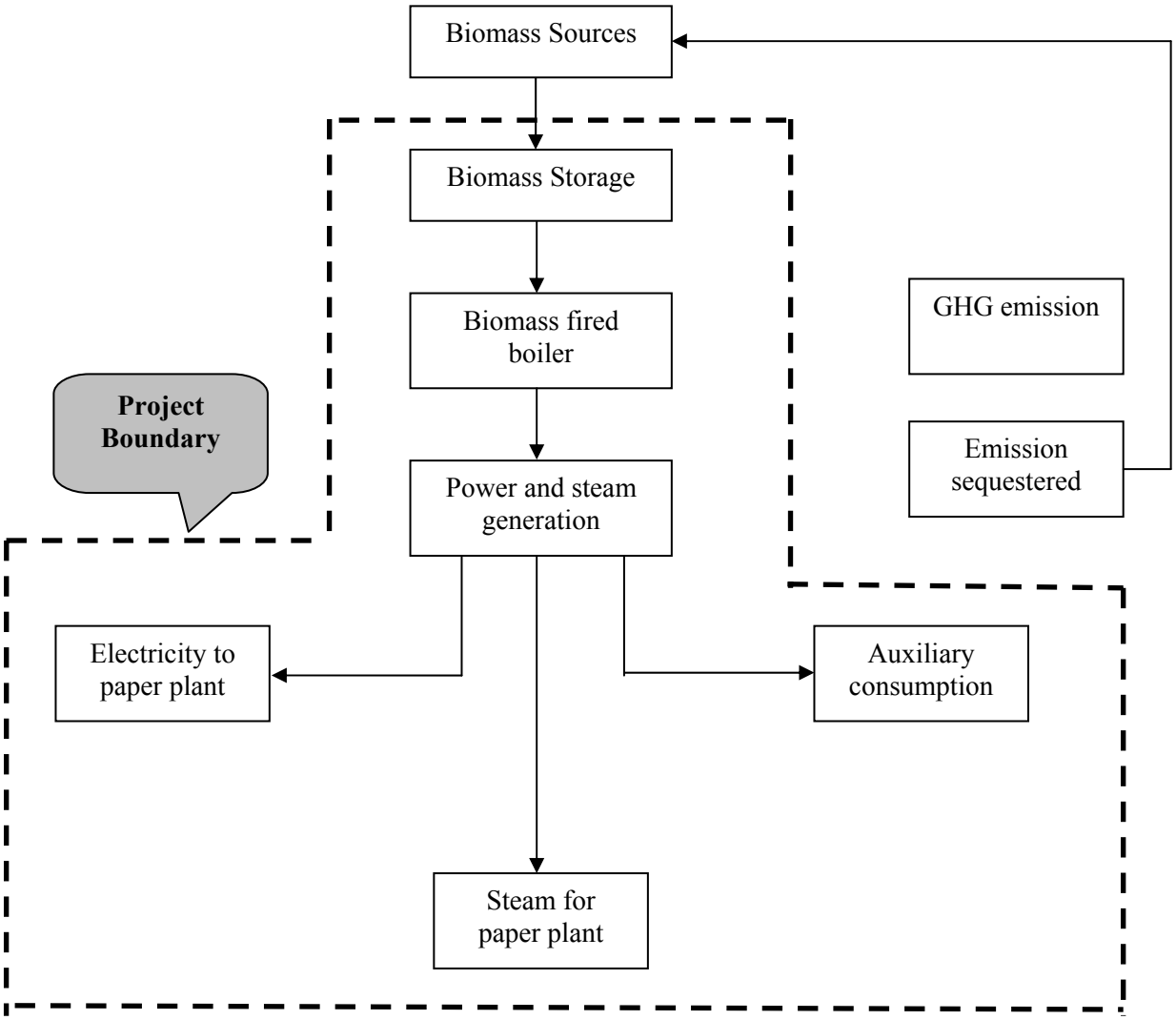
As mentioned under Type I.C. of *"Annex –B" of the Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories,* Project boundary encompasses the physical and geographical site of the renewable generation sources. For the proposed project activity the project boundary is from the point of fuel storage to the point of electricity and steam supply to the paper mill where the project proponent has a full control. Thus, project boundary covers fuel storage, boiler, steam turbine generator and all other accessory equipments.

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



The project boundary does not include the biomass transportation from biomass sources to the plant site because the proposed 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 proposed activity is having a net positive impact on the environment by way of reduced emission due to transportation.

B.4. Description of baseline and its development:

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The baseline methodology has followed the one specified in the Project Category I.C. in Para 6 & 7 of the *"Annex –B" of the Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories,*

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.

A. 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 (Non coking coal in this case).

B. For electricity generation, the base line scenario was determined as equivalent electricity generation from the grid as shown B2 earlier. Baseline methodology for projects such projects has been detailed in point no. 9 of the AMS 1.D of the referred document.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

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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 CO_2 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 CO_2 to the atmosphere is zero. The power generated by the project activity will replace the grid power and an analysis of the Western Regional grid generation mix gives the conservative baseline CO_2 emission factor of ***0.895 kgCO_2e/kWh*** for the credit period. The steam from the process will be 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 will reduce the anthropogenic emissions of greenhouse gases by sources below those that would have occurred in absence of the registered CDM project activity.

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 project-technological barriers, investment barriers and a brief analysis of prevailing practice in the state. 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 supplied from the Grid based on predominantly fossil fuel generation and that the rice husk remains uncollected and decays naturally.

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**
Gross Calorific Value (GCV) Kcal/kg.	**3250**	**Kcal/kg**
Feed Water Temperature	**105**	**^{0}C**
Boiler Efficiency	**82.0%**	
Rice husk required for 1 TPH Steam Generation		
Theoretical Heat Requirement for steam generation at 44 kg/cm^2, 480^{0}C	**794000**	**Kcal/tonne**
Theoretical Heat Requirement at 81% Boiler Efficiency	**968293**	**Kcal/tonne**
Rice Husk requirement per TPH steam Generation	**298**	**kg**
Rice Husk Price Per MT Rs.	950	**Rs./MT**
Cost of one MT Steam	**283**	**Rs./MT**
Coal		
Steam Requirement for the process	**22**	**TPH**
Gross Calorific Value (GCV) Kcal/kg.	**3800**	**Kcal/kg**
Feed Water Temperature	**105**	**^{0}C**
Boiler Efficiency	**85.0%**	
Coal required for 1 TPH Steam Generation		
Theoretical Heat Requirement for steam generation at 44 kg/cm^2, 480^{0}C	**794000**	**Kcal/tonne**
Theoretical Heat Requirement at 84% Boiler Efficiency	**934118**	**Kcal/tonne**
Coal requirement per TPH steam Generation	**246**	**kg**
Coal Price Per MT Rs.	1100	**Rs./MT**
Cost of one MT Steam	**270**	**Rs./MT**

The cost of raw material for power generation will also be 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 1.12 per kWh in terms of the calculations given below:

Cost of Power using Coal		
Installed Capacity of Plant	2.5	MW
Steam Requirement	12	TPH
Net Calorific Value (NCV)	3800	Kcal/kg
Feed Water Temperature	105	^{0}C

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		
Gross Calorific Value (GCV)	3250	Kcal/kg
Feed Water Temperature	105	^{0}C
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 Non Coking Coal (TJ/Kt)	9.69	TJ/kt
CO_2 Emission Factor for Coal (t CO_2/TJ)	28.95	t CO_2/TJ
Project Emission in tonnes of CO_2	0.72	t CO_2/hr
Estimated revenue (@ 10 EURO)	7.18	EURO
Estimated revenue (assuming conversion factor 1 EURO = 58 INR)	416	INR
Estimated cost of Biomass Per hour	2947	INR
Less: Estimated CDM Revenue	416	INR
Effective Cost of Biomass	2531	INR
Average cost per unit	**1.12**	**Rs/kWh**

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 will increase 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.

To provide an idea of prevailing practice in the region, no such type of cogeneration plant exists in the region.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The baseline methodology has followed the one specified in the Project Category I.C. in Para 6 & 7 of the *"Annex –B" of the Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories,*

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.

C. 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 (Non coking coal in this case). Emission factor for Coal is 26.13 tonnes of carbon dioxide per TJ of energy consumed. The pre-project scenario is considered as the base line scenario. The base lone scenario is shown in the table given below:

STEAM GENERATION

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

D. For electricity generation, the base line scenario was determined as the amount of electricity produced with the renewable technology (GWh) multiplied by the CO_2 emission factor of that grid. The emission factor for grid electricity is calculated as per the procedures detailed in AMS I.D. It states that the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen,

but the restrictions to use the Simple OM and the Average OM calculations must be considered

OR

(b) The weighted average emissions (in kg CO2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The baseline data have been taken from the Baseline Carbon Dioxide Emission Database with reference to the User Guide[3] Version 1.1 prepared by the Central Electricity Authority, New Delhi which is calculated using the Baseline Methodology ACM0002 - Version 6. The pre-project scenario is considered as the base line scenario. The base line scenario is shown in the table given below:

B.6.2. Data and parameters that are available at validation:

>> (Copy this table for each data and parameter)

(i) Data used for calculation of Onsite Carbon Emission Reduction due to avoidance of use of fossil fuel

Data / Parameter:	***CC***
Data unit:	TJ/kt
Description:	Calorific value of sub-bituminous coal
Source of data used:	India's Initial National Communication to UNFCCC Reference Table No. 2.3 Page No. 37
Value applied:	9.69
Justification of the choice of data or description of measurement methods and procedures actually applied:	Assessed & accepted data
Any comment:	Nil

Data / Parameter:	***EF CO_2***
Data unit:	Tonne CO_2 per TJ
Description:	Baseline Emission Factor for sub-bituminous coal
Source of data used:	India's Initial National Communication to UNFCCC Reference Table No. 2.3 Page No. 37
Value applied:	28.95
Justification of the choice of data or description of measurement methods and procedures actually applied:	Assessed & accepted data
Any comment:	Nil

(ii) Data used for calculation of Onsite Carbon Emission reduction by project activity due to displacement of electricity from Grid

Data / Parameter:	**BEF_e**
Data unit:	Kg CO_2 per kWh
Description:	Baseline Emission Factor for Western Grid of India
Source of data used:	Baseline Carbon Dioxide Emission Database & User Guide - Version 1 Prepared by Central Electricity Authority, Government of India Web Address: http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Value applied:	0.895 (Lower of Combined Margin Factor and Weighted Average Margin Factor)
Justification of the choice of data or description of measurement methods and procedures actually applied:	Approved methodology in terms of Project Category I.C. in Para 8 of the *"Annex –B" of the Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories* and Assessed & accepted data
Any comment:	Nil

B.6.3 Ex-ante calculation of emission reductions:

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

a. Onsite Emission Reductions resulting from the Project Activity:

$$BE_y = HG_y * EF\ CO_2 / \eta_{th}$$

Where:

BE_y: 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.

EF CO_2: the CO_2 emission factor per unit of energy of the fuel that would have been used in the baseline plant in (tCO_2 / 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.

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

$BER_E = P_{con} \times BEF_e$

Where

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

P_{con}: Clean Power to be consumed by the entity replacing the Grid Power

BEF_e: Baseline Emission Factor for Western Grid of India

c. Total On site Carbon Emission reduction per annum by project activity (CER)

$CER = BE_y + BER_E$

B . Onsite Project Emission expected from the Project Activity:

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 CO_2 from combustion of coal is calculated using India's Initial National Communication to UNFCCC Standard CO_2 emission factor using the following formula:

$PE = CC \times Q_{fC} \times CEF_f$

Where **PE** : Carbon-dioxide emission due to coal burning at project site
CC : Calorific value of non coking coal
Q_{fc} : Quantity of coal burned, MT
CEF_f : Baseline Emission Factor for Non Coking Coal (CO_2 Emission Coefficient)

C . Project Leakage (PL)

Para 17 & 18 of Attachment C to Appendix B of Indicative Simplified Baseline and Monitoring Methodologies for selected small-scale CDM project activity categories states that if the surplus availability of biomass is at least 25% larger than the quantity of biomass that is utilised including the project activity, then the leakage due to competing uses for the biomass may be neglected. According to the Biomass Assessment Study, the surplus availability is enough to support 12 MW of power generation i.e. 36 MW of Thermal Application. The installed capacity including the proposed project activity in the region is only 20 $MW_{thermal}$. That means surplus availability is approximately 44.4% larger than the quantity of biomass that is utilised including the project activity.

Further the proposed 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 proposed activity is having a net positive impact on the environment by way of reduced emission due to transportation. Hence the leakage due to competing use for biomass is not considered.

D . Net Carbon Emission Reduction by project activity

$CER_P = CER - PE - PL$

Where CER_P: Net Carbon Emission Reduction by project activity
PE : Carbon-dioxide emission due to coal burning at project site
PL : Project Leakage

Using the formula the estimated emission reductions from the project activity is calculated in Table 6.3.1 given overleaf.

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

The results of ex-ante estimations of emission reductions for all yeas of the crediting period is summarized in the following table

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakages (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2007	459	12402	0	11943
2008	787	21261	0	20474
2009	787	21261	0	20474
2010	787	21261	0	20474
2011	787	21261	0	20474
2012	787	21261	0	20474
2013	787	21261	0	20474
2014	328	12892	0	12564
Total (tonnes of CO_2 e)	**5511**	**152861**	**0**	**147349**

Table 6.3.1 Baseline Data	**Ref :Baseline Carbon Dioxide Emission Database & User Guide - Version 1.1, CEA**								
Net Operating Margin	1.01								
Built Margin Factor	0.78								
Combined Margin factor (Average of OM & BM)	**0.89**								
Weighted Average Margin factor	**0.92**								
Baseline Emission Factor ($kgCO_2/kWh$)	**0.89**								
Year		**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Operating Period		**7m**	**12m**	**12m**	**12m**	**12m**	**12m**	**12m**	**5m**
On site Carbon Emission Reduction due to avoidance of use of fossil fuel									
Capacity of Existing Boiler (TPH)	**$Boiler_{cap}$**	**12**	**12**	**12**	**12**	**12**	**12**	**12**	**12**
Boiler Efficiency	**η**	**75%**	**75%**	**75%**	**75%**	**75%**	**75%**	**75%**	**75%**
Annual quantity of steam/heat supplied (TJ)	**HG_y**	**198**	**198**	**198**	**198**	**198**	**198**	**198**	**198**
CO_2 Emission Factor for Non Coking Coal (t CO_2/TJ)	**EF CO_2**	26.13	26.13	26.13	26.13	26.13	26.13	26.13	26.13
Project Emission Reduction in tonnes of CO_2	**BE_y**	4033	6914	6914	6914	6914	6914	6914	6914
On Site Project Emission Reductions due to displacement of electricity from the Grid									
Installed Capacity		2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Auxiliary consumption @10%		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Exportable Capacity	**C_{net}**	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
No of Operating days per Annum	**O_{days}**	193	330	330	330	330	330	330	138
No of operating Hours per Day	**O_{hours}**	24	24	24	24	24	24	24	24
Average Plant Load Factor	**PLF**	90%	90%	90%	90%	90%	90%	90%	90%
Gross Power Generation per Annum (GWh)	**P_{gen}**	10.395	17.82	17.82	17.82	17.82	17.82	17.82	7.425
Net Power Consumed per Annum (GWh)	**P_{con}**	9.356	16.038	16.038	16.038	16.038	16.038	16.038	6.683
Emission Factor Considered	**BEF_e**	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895
Project Emission Reduction in tonnes of CO_2	**ER_E**	**8369**	**14347**	**14347**	**14347**	**14347**	**14347**	**14347**	**5978**

Total Project Carbon Emission Reductions (CER)	**BE_y+ER_C**	13109	22472	22472	22472	22472	22472	22472	14103
On Site Project Emissions									
Maximum Permissible Coal Usage		15%	15%	15%	15%	15%	15%	15%	15%
Qty of Coal to be consumed (MT)	**Q_{fc}**	1637	2807	2807	2807	2807	2807	2807	1169
Calorific Value of Non Coking Coal (TJ/Kt)	**CC**	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69
CO_2 Emission Factor for Non Coking Coal (t CO_2/TJ)	**Q_{fc}**	28.95	28.95	28.95	28.95	28.95	28.95	28.95	28.95
Project Emission in tonnes of CO_2	**PE**	**459**	**787**	**787**	**787**	**787**	**787**	**787**	**328**
Leakage	**PL**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Net Carbon Emission Reduction	**CER_P**	**11943**	**20474**	**20474**	**20474**	**20474**	**20474**	**20474**	**12564**
CER_P = CER-PE-PL									
Commitment period	**7 years**								
No. of years of delivery of CERs	**7 years**								
Total Number of CERS	**147349**								
	21050								

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	Electricity Generation, Auxiliary Consumption and Captive Consumption
Data unit:	kWh
Description:	Total electricity generated from the project Activity, the auxiliary consumption of the power plant and the net electricity consumed by the Paper Mill
Source of data to be used:	Plant Site
Value of data	High
Description of measurement methods and procedures to be applied:	Measured electronically continuously through out the year
QA/QC procedures to be applied:	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
Any comment:	Nil

Data / Parameter:	*Fuel Consumption*
Data unit:	*MT*
Description:	*Total quantity of rice husk, other biomass & coal used for generation of power & steam shall be maintained at Plant site in form of* Daily logbooks at supply department
Source of data to be used:	*Plant Site*
Value of data	High
Description of measurement methods and procedures to be applied:	Measured mechanically at monthly intervals through out the year
QA/QC procedures to be applied:	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
Any comment:	Nil

Data / Parameter:	Steam Generation
Data unit:	TPH
Description:	Total quantity of steam generated per hour shall be maintained at Plant site in form of Shift Engineer's report
Source of data to be used:	Plant Site - Shift Engineer's report

Value of data	High
Description of measurement methods and procedures to be applied:	Measured electronically continuously through out the year
QA/QC procedures to be applied:	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
Any comment:	Nil

Data / Parameter:	Emission Factor for Non Coking Coal
Data unit:	Tonne CO_2 per TJ
Description:	Standard Value
Source of data to be used:	IPCC/ IICUNFCC
Value of data	Low as standard values
Description of measurement methods and procedures to be applied:	Referred, Annually
QA/QC procedures to be applied:	Referred
Any comment:	Nil

Data / Parameter:	Calorific value of non coking coal
Data unit:	TJ/kt
Description:	Standard Value
Source of data to be used:	IPCC/ IICUNFCC
Value of data	Low as standard values
Description of measurement methods and procedures to be applied:	Referred, Annually
QA/QC procedures to be applied:	Referred
Any comment:	Nil

Data / Parameter:	Baseline Emission Factor for Western Grid of India
Data unit:	Kg CO_2 per kWh
Description:	Standard Value
Source of data to be used:	Central Electricity Authority (CEA), Government of India
Value of data	Low as standard values

Description of measurement methods and procedures to be applied:	Referred, Annually
QA/QC procedures to be applied:	Referred
Any comment:	Nil

Data / Parameter:	**Surplus Biomass Assessment**
Data unit:	**MT**
Description:	Total quantity of rice husk, other biomass available in surplus that can be used as fuel in the plant shall be carried out with the professional help.
Source of data to be used:	Secondary as well as primary data to be collected by the Experts in this field
Value of data	High
Description of measurement methods and procedures to be applied:	Estimated on the basis of critical analysis of data so collected on an annual basis
QA/QC procedures to be applied:	As the data are critical in calculating emission reductions by project activity, the assessment shall be carried out by the professional assistance annually & shall be verified by DOE at the time of verification
Any comment:	Nil

B.7.2 Description of the monitoring plan:

>>

Type I : Renewable Energy Projects
AMS-1.C : Thermal Energy for the user with or without electricity, Version 10

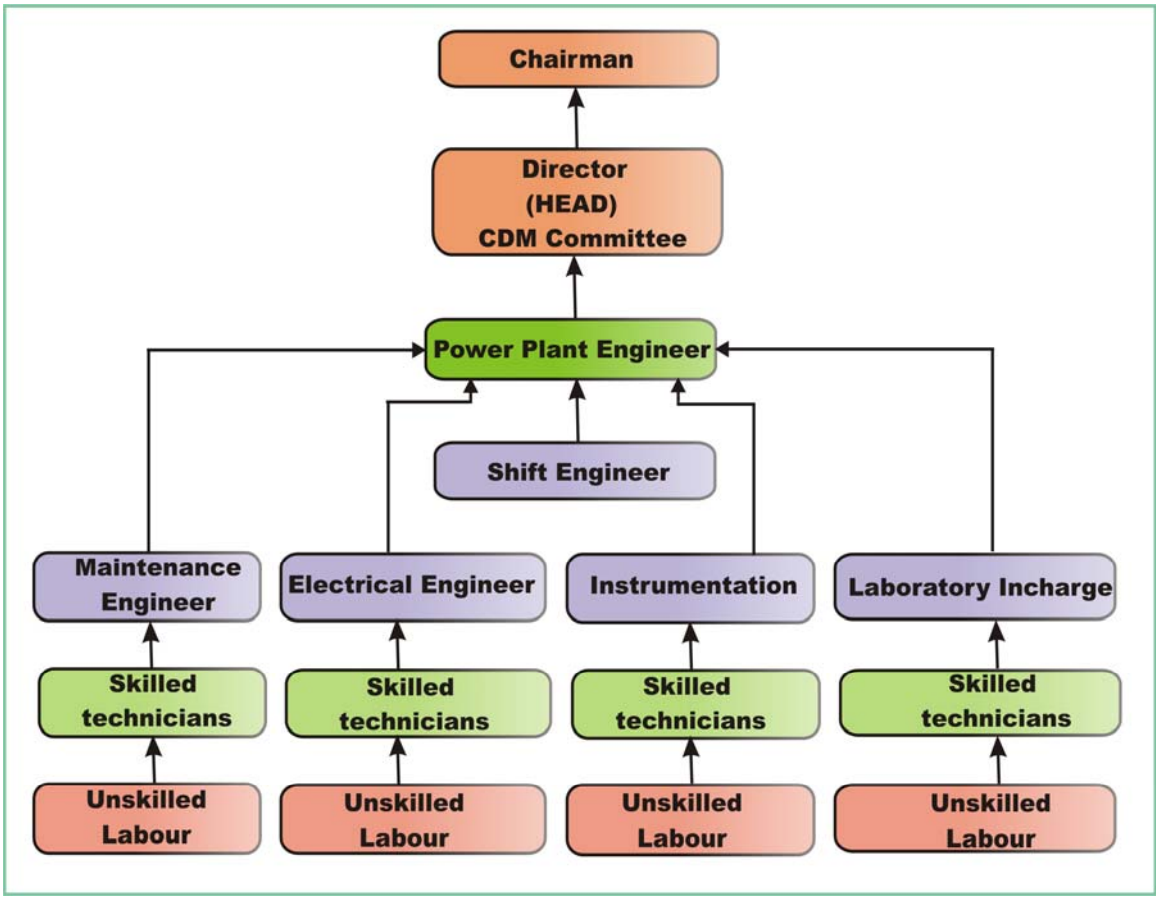
According to Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website, the project has been identified to belong to Type I.C. [Thermal Energy for the user with or without electricity]. Point 17 (b) of the same document specifies that for the said category of CDM project, 'Monitoring includes metering the thermal and electrical energy generated for co-generation projects. In the case of co-fired plants, the amount of fossil fuel input shall be monitored. In the case of co-fired plants, the amount of fossil fuel input and its energy content shall be monitored".

The data, which are critical in calculating emission reductions by project activity, shall strictly be monitored at the site by means of accurately calibrated instruments dedicated for the intended purposes. The data and parameters which need to be monitored have been summarized in the following table:

Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	*Electricity Generation*	*Plant*	*kWh*	*M*	*monthly*	*100%*	*Electronic*	*Total electricity generated, auxiliary consumption & Net export to the paper division to be monitored*
2	*Auxiliary Consumption*	*Plant*	*kWh*	*c*	*monthly*	*100%*	*Electronic*	*-do-*
3	*Electricity Captive Consumption*	*Plant*	*kWh*	*m*	*monthly*	*100%*	*Electronic*	*-do-*
4	*Steam Generation*	*Plant*	*TPH*	*m*	*continuous*	*100%*	*Electronic*	*-do-*
5	*Biomass-* $Q_{biomass}$	*Plant*	*MT*	*m*	*monthly*	*100%*	*Electronic*	*Biomass consumption for the generation of power to be monitored*
6	*Biomass* $NCV_{biomass}$	*Actual Sample /IPCC Standard*	*kCal/Kg*	*m*	*Annual*	*Sample Basis*	*Paper*	*Used for calculation of biomass requirement for generation of power*
7	*Auxiliary Fuel-* $Q_{auxilliary}$	*Plant*	*MT*	*m*	*monthly*	*100%*	*Electronic*	*Fossil fuel consumption for the generation of power to be monitored*
8	*Auxiliary Fuel-* $NCV_{auxilliary}$	*Actual Sample /IPCC Standard*	*kCal/Kg*	*m*	*Annual*	*Sample Basis*	*Paper*	*Used for calculation of biomass requirement for generation of power*
9	*Transport Trucks unloaded at site*	*Plant*	*Numbers*	*m*	*monthly*	*100%*	*Paper*	*Biomass transportation for the generation of power to be monitored*
10	*Oxidation Factor*	*IPCC*		*e*	*Annual*	*Secondary Source*	*Paper*	*Used for calculation of Carbon Emission Co-efficient*
11	*Carbon Emission Factor*	*IPCC/ IICUNFCC*		*e*	*Annual*	*Secondary source*	*Paper*	*Used for calculation of Carbon Emission Co-efficient*
12	*Baseline Emission Factor for Western Grid of India*	*CEA*	*Kg* CO_2 *per kWh*	*c*	*Annual*	*Secondary source*	*Paper*	*Used for calculation of Carbon Emission Reductions*
13	*Biomass Assessment*	*Secondary & primary sources*	*MTPA*	*e*	*Annual*	*10%*	*Paper*	*Used for calculation of Carbon Emission Reductions*

HAIL has an operational and management structure in place, which has set procedures and systems to monitor emission reductions and any leakage effects, 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 / committee comprising of persons from relevant departments would be constituted, who would be responsible for carrying out the procedures set by the manual.

Capacity Building measures would be imparted to the CDM team on maintenance procedures, calibration, monitoring and reporting aspects related to monitoring emission reductions. Internal audits, verifications and emergency preparedness are a significant part of the manual. In the CDM team, a special group of operators would be formed who would be assigned the responsibility of monitoring different parameters and record keeping as per the set procedures. Reviews would be done on a regular basis to ensure conformance with the standards. The procedures for project management have been reviewed and have been included in the CDM Manual. More details relevant to CDM committee and its operations are made available in the HAIL CDM Manual at the project site.



B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

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Date of Completion: 10-05-2007
Hanuman Agro Industries Limited & the associate consultant S.R. Corporate Consultant (P) Ltd

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

20-01-2005

C.1.2. Expected operational lifetime of the project activity:

>>

25 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

>>

As per UNFCCC guidelines, the options are open for 7 years crediting period, which is renewable, or 10 years crediting period that is fixed. Renewable crediting period is opted by us.

C.2.1.1. Starting date of the first crediting period:

>>

30-05-2007

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

NA

C.2.2.2. Length:

>>

NA

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

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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 will meet all environmental legislations as set out by the Chhattisgarh Environment Conservation Board (the State Pollution Control Board) and there will be 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 will 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 is 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.	**If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

>>

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 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 will arise as a result of the project activity.

SECTION E. Stakeholders' comments

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E.1. Brief description how comments by local stakeholders have been invited and compiled:

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The project activity has been implemented by HAIL at their Industrial complex located in Paragoan, Raipur district of Chhattisgarh State. The project will use 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 CO_2. 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 their opinions on the project.

E.2. Summary of the 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 will provide 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 will 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.	**Report on how due account was taken of any comments received:**

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No adverse comment has been raised by any of stakeholder

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funding from any Annex I party is available.

Annex 3

BASELINE INFORMATION

Included in PDD, please refer section B.6

Annex 4

MONITORING INFORMATION

Included in PDD, please refer section B.7

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