Vandana Vidhyut Limited

“Biomass Based Power Project”

CDM Project Design Document

Contents

Annexes

Appendices

A. General description of project activity

A.1 Title of the project activity:

RICE HUSK BASED POWER PROJECT

A.2 Description of the project activity

Background

Vandana Vidhyut Limited (VVL) incorporated on 10th November, 1995 has been promoted by Shri GP Agrawal and Shri PK Agrawal, to set up a 7.7 MW rice husk based power plant at Sirgitti Industrial Area, Bilaspur, Chattisgarh.

The company belongs to Vandana Group of Industries, which is one of the leading, reputed and professionally managed industrial groups of Chattisgarh [earlier eastern Madhya Pradesh]. The group is engaged mainly in the manufacturing of High Tensile Steel (HTS)/Galvanised Iron (GI) and other wires, High Density Poly Ethylene(HDPE)/Poly Propylene (PP) woven sacks, Steel products, Re-rolled items, Steel ingots and heavy structurals, elastic clips and processing of steel products.

Purpose

The purpose of the project essentially is to utilize available rice mill generated rice husk as a sustainably grown and un-utilized waste biomass resource effectively for generation of steam and electricity. Surplus electricity will be sold to the state grid as per terms of the Power Purchase Agreement (PPA) with Chattisgarh State Electricity Board (CSEB). The power plant will consume approximately 1.5 tonnes(t) of rice husk per MW[1] of power generation. The entire rice husk requirement for the project is met from the rice mills located within a radius of 100 kms from the project site (around 144 mills).

The project consumes on an average 10% of the generation for auxiliary consumption, and the rest is exported to the state grid. The project will help to reduce the ever-increasing

[1] Detailed Project Report for Rice husk based Power Plant of VVL

demand and supply gap of electricity besides contributing towards economic growth and development of the area.

Salient Features of the Project

VVL has implemented a modern 7.7 MW power project based on rice husk, which will export surplus power to CSEB grid after meeting in-house auxiliary demand. Coal is co-fired with rice husk to maintain consistency in generation. Provisions of co-firing will also take care of any exigency arising from shortage of supply of rice husk.

The power is produced by operating a 7.7 MW fully condensing steam turbine with alternator. Major equipments of the power project under implementation comprises of 35 tonnes per hour (tph) capacity fluidised bed combustion type boiler with the outlet steam parameters of 66 kg/cm^2 and 500^oC and the bleed-cum-condensing type 7.7 MW capacity turbo-generator.

The plant is designed with all other auxiliary plant systems like

- Rice husk and coal handling system with storage and processing arrangements
- Ash handling system
- Air pollution control devices
- Plant water system including DM water plant, cooling water system make-up, plant/service water system etc.
- Cooling water system and cooling tower
- De-Mineralized (DM) water plant
- Compressed air system
- Fire protection system
- Air conditioning and ventilation
- Complete electrical system for power plant and grid interconnection including power evacuation, instrumentation and control systems etc.

Availability of Rice Husk: Bilaspur district has a major contribution in the naming "*Dhan Ka Katora*" [Rice Bowl] for the entire Chattisgarh region. The location has been chosen primarily because of its proximity to adequate rice mills located within a radius of 100 kms from the project site.

Rice husk is generated in huge amounts in the state and a large proportion is disposed through use as fertilizer or fodder, or utilization as fuel for boilers and in brick manufacturing, tiles manufacturing, packaging, particle board manufacturing etc. The total milling capacity of the 144 rice mills identified in the locality [within 100 km radius] is 127 tph[2]. A total quantity of about 15.4 million tonnes per annum[2] of rice husk is available from the area as against company's design requirement of 91476 tonnes per annum (tpa) *[7.7 MW x 1.5 t of rice husk per MW x 24hrs x 330 days]* of rice husk. The rice husk used for the year 2002-03 is 49388 t with co-firing of 9785 t of coal. VVL has signed agreements with several rice mills for assurance of supply of rice husk throughout the year.

Rice mill	**Assurance of supply of rice husk as per Agreement [tpa]**
M/s Coal Man, Vidya Nagar, Bilaspur, Chattisgarh	36,000
M/s Goyal Transport Company Main Road, Belha, Bilaspur, Chattisgarh	18,000
M/s Fulaira Trading, Agrasen Marg, Kharsia, Raigarh, Chattisgarh	36,000
TOTAL	**90,000**

Power Export

The CSEB sub-station of 33 kVA is located at 1.5 kms from the plant site. The power is generated at the plant at 11 kVA which is stepped up to 33 kVA for supply/wheeling through the CSEB sub-station to the customers. Transmission and Distribution losses are very low owing to proximity of the CSEB sub-station.

As per the prevailing policy of the Government of Chattisgarh and the provisions of CSEB, in accordance with Power Purchase Agreement (PPA) duly approved by CSEB, an energy producer can export the surplus electric energy through CSEB. In the PPA with CSEB, CSEB has agreed to wheel the electricity generated, through CSEB's transmission system, for sale to third party or sale to CSEB or captive consumption subject to deduction of wheeling charges as prescribed by Board from time to time. The sale of electrical energy will be @ Rs. 2.25 per unit.

[2] Detailed Project Report for Rice husk based Power Plant of VVL

Sale of Rice Husk Ash (RHA):

The ash is sold off to

- Brick manufacturers
- Cement plants
- Closed Mines
- Farmers for use in agriculture

The company has plans for installation of fly ash brick manufacturing plant for 30000 bricks per day and ash utilization to an extent of 16.5 tonnes.

Implementation schedule

Vandana Vidhyut Limited commenced generation in October 2001. Initially it started off at a capacity generation of 6 MW as per power purchase agreement dated 02/09/2000 with CSEB and went in for capacity enhancement to 7.7 MW in 2002-03 with minor technical modifications in the boiler and gearbox. The first Supplementary PPA with CSEB for enhancement of capacity of power plant dated 24/04/03 accommodates for 8 MW of generation.

Financial Plans

Project cost is estimated at Indian Rupees (INR) 254.85 million of which INR 65 million is raised from equity while the rest through long term debts and unsecured loans. The long-term debts are raised through Indian Renewable Energy Development Agency (IREDA). The project cost includes land and site development cost, project installation cost and cost of other accessory assets.

Project's contribution to sustainable development

Government of India has stipulated the following indicators for sustainable development in the interim approval guidelines[3] for CDM projects.

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

The project activity located in a rural belt will contribute positively to the 'Sustainable Development of India'. The four pillars of sustainable development have been addressed as follows:

1. **Social well-being**: The location in a rural backward area will have associated socio-economic benefits generating both direct and indirect employment in the area of skilled jobs 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 reduce the gap of electricity demand and supply at local and national level.

2. **Economic well-being**: The increase in demand of rice husk exerted by the project will have a local effect on its price and will generate additional revenue for the rice millers. Generation of electricity using the same as fuel will contribute to the economic well-being by generating revenue and inflow of funds. Local and central government will also be financially benefited from the project.

3. **Environmental well-being**: The project activity is a renewable energy power project, which will use rice husk generated from the rice mills in the locality as a fuel for power generation and export clean power to CSEB grid. This electricity generation will substitute the power generation by CSEB using conventional fuels or make power available for additional demand. Thus it will reduce the CO_2 emissions and save the equivalent amount of conventional fuel which is a non-renewable resource. Indian

economy is highly dependent on "Coal" as fuel to generate energy and for production processes. Thermal Power Plants are the major consumers of coal in India. There is a considerable gap between the demand and supply of electricity. Excessive demands for electricity place immense stress on the environment. Changing coal consumption patterns will require a multi-pronged strategy focusing on demand, reducing wastage of energy and the optimum use of Renewable Energy sources. The project contributes towards achieving the same.

4. **Technological well-being**: The plant will use efficient and environment friendly technology of renewable energy sector. The technology is new though established. It includes a modern Fluidised Bed Combustion (FBC) boiler designed to operate with co-firing of two fuels – coal and rice husk.

Thus we see that this project activity has excellent contributions towards sustainable development and addresses the key issues by —

- Export of power to the state grid and thereby eliminating the generation of equivalent quantity of power using conventional fuel.
- Conserving coal, a non-renewable natural resource
- Making coal available for other important applications
- Reducing GHG emissions
- Contributing to a small increase in the local employment in the area of skilled jobs for operation and maintenance of the equipment.
- Adding to the economic well being of the locality
- Adopting a advanced and sustainable technology for long term benefits.

A.3. Project Participants

Vandana Vidhyut Limited, Bilaspur, Raipur, Chattisgarh, India - Project Promoter

Contact: ***Shri GP Agrawal, Director***
Vandana Vidhyut Limited

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

Vandana Bhawan, M.G. Road,
Raipur – 492001, Chattisgarh, India

A.4 Technical Description of the project activity

A.4.1 Location of the project activity:

A.4.1.1 Host country Party(ies): **India**

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

A.4.1.3 City/Town/Community etc: **Bilaspur**

A.4.1.4 Detailed description of the physical location, including information allowing the unique identification of this project activity:

The project location is at Sirgitti Industrial Area of Bilaspur District, Chattisgarh State, India. The location is selected considering various aspects like availability of rice husk in sufficient quantity throughout the year, availability of water and grid connectivity. The location also has the abundant availability of skilled and semi-skilled labour and well connected with road, rail, air and communication.

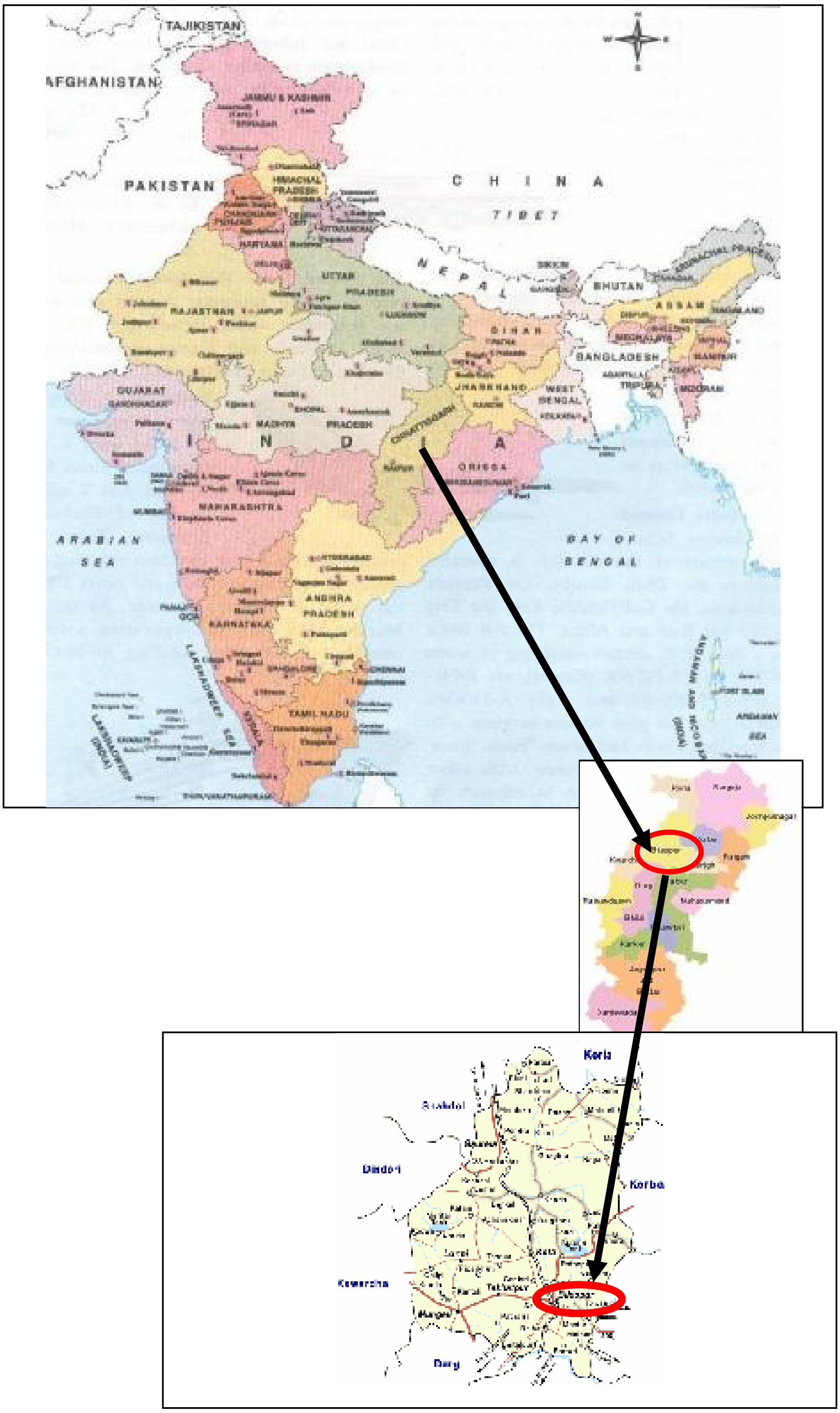
Bilaspur is located in eastern part of Chhattisgarh and falls within latitude 21°47'N to 23°8'N and longitude 81°14'E to 83°15'E. The district is surrounded by Koriya district in the North, Shahdol district of Madhya Pradesh in the South, Raipur district in the East and Korba, Janjgir-Champa district in the West. The total area of Bilaspur is approximately 6,377 sq.km. after the bifurcation of old Bilaspur district in three districts (New Bilaspur, Korba and Janjgir-Champa District). The New Bilaspur district is hilly towards North and plane in South. Temperatures are higher towards the South. The maximum temparature of Bilaspur district is 45°C and average rainfall is 1,220 mm approximately. Major rivers which surrounds Bilaspur district are Agaar, Maniyaar and Arpa .

Location advantages:

- Proximity to raw materials
- Sufficiency of availability of the same
- Proximity to CSEB substation through which power will be transmitted to the grid
- Water availability

- Well developed infrastructural facilities [transport, telephone exchange, banks, other civil amenities and housing facilities at nearby Bilaspur town]
- Abundance of skilled and semi-skilled labour
- Proximity to highways, town [Sirgitti, 10 km from Bilaspur town], railway station [Bilaspur]

All these factors have led to the unique identification of the project activity. The geographical location with rail/road connectivity of Bilaspur is detailed in the maps below.



Maps not to scale

A.4.2 Type and category (ies) and technology of project activity

Type and category of project activity

The project falls under the UNFCCC small-scale CDM project activity categories under Type-I with project activity being renewable electricity generation for a system.

Main Category: **Type I - Renewable Energy Power project**

Sub Category: **D – Renewable Electricity Generation for a Grid (Rice husk based Power Generation Project)**

Project is a grid-connected rice husk based power plant with coal being co-fired with rice husk in the FBC boiler, with a high-pressure steam turbine configuration having a capacity of 7.7 MW. As per paragraph 2 under Type I.D of Appendix B of the UNFCCC-defined **simplified modalities and procedures (M&P) for small-scale CDM project activities** (Version 05: 25 February 2005)**, in case of a unit which co-fires renewable biomass [rice husk] and non-renewable fossil fuel [coal] the capacity of the entire unit shall not exceed the limit of 15 MW**, for the project to qualify as a small-scale CDM project.

Evidently, the project qualifies as a small scale one under Type I.D.

Project Activity with technology details

Rice husk as fuel for energy

The project participant has identified the scope for utilization of rice husk. The project needs around 1.5 tonnes of rice husk per MW of power generation. The husk surrounding the kernel of rice accounts for about 20% by weight of harvested paddy. The characteristics of rice husk vary with type but typical characteristics are –

Ultimate analysis:

C – 38.1%

O_2 – 29.34%

Moisture – 8.92%

Ash – 17.34%

Others - [N_2 (1.5%) + H_2 (4.7%) + S (0.1%)] – 6.3%

Calorific Value: 3000-3500 kcal/kg

Such a biomass gives more thermal energy with less carbon dioxide emission on account of possessing the hydrocarbon chain in the form of cellulose and lignin.[4]

Co-firing of Coal:

The project co-fires coal with rice husk into the FBC boiler in case of exigency. This maintains the consistency of steam generation at the design specification inspite of deteriorations in quality of rice husk obtained or inadequate availability of rice husk quantity and to achieve extended operating hours under constraints of adequate storage facility for the huge quantity of rice husk required during lean periods. Ministry of Non-Conventional Energy Sources (MNES) – Power Group, has allowed use of fossil fuel upto 25% in biomass power generation as support fuel to achieve extended operating days in a year. Provisions of co-firing will also take care of any emergency arising from shortage of supply of rice husk.

The coal co-fired with rice husk is brought from the South Eastern Coalfields Limited (SECL) and the average quality is given below:

Proximate Analysis Report [as per VVL analysis reports]–

Moisture – 6.6%
Volatile – 26.02%
Ash – 43.41%
Fixed Carbon – 23.19%
Calorific Value = 3513 kcal/kg
Generally E and F grades of coal are used in the thermal power plants in Chattisgarh. The VVL plant uses generally Grade F. To have an estimate of the project emissions due to co-firing of coal with rice husk [calculated in Section E of this document], a total carbon content of 40% in has been considered. *[this value is considered to arrive at a conservative estimate of emission reduction – generally the coal supplied to power plants in the area vary between 33-38% in %C]*

---

4 Source- *The Hindu: Potential seen for rice husk ash-based power plants.htm*

A brief on the technology:

The power plant is based on Rankine Cycle. The steam generator is designed to operate on any combination of rice husk and coal to ensure consistent plant efficiency even in times of rice husk deficiency, if any. The power plant will have one condensing steam turbo generator unit with a matching boiler of travelling grate type design capable of firing multi-fuel with rice husk as the primary fuel. There is one 35 tph, 66 kg/cm^2, 500^0C high pressure boiler and a single bleed cum condensing steam turbine generator (STG) of 7.7 MW capacity. The 35 tph of steam from boiler is fed into the 7.7 MW bleed cum condensing turbine.

The boiler is of Fluidized Bed Combustion type and has the advantages of high thermal and combustion efficiency reducing quantity of husk needed, to a minimum, automatic operation for consistent high efficiencies and reduced need for manpower.

Steam Turbine of fully condensing mode with suitable alternator generator will be installed for generating electricity. The turbines are of the single cylinder, single exhaust fully condensing type, designed for high operating efficiencies and maximum reliability.

A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

The power plant uses environmentally sustainable grown biomass and in case of exigencies can use coal as fuel. The GHG emissions of the combustion process, mainly CO_2, are consumed by plant species, representing a cyclic process. Since, the biomass contains only negligible quantities of other elements like Nitrogen, Sulphur *etc.* release of other GHGs are considered as negligible. The biomass is CO_2 neutral and thus environmentally benign, limiting greenhouse effect.

The VVL project will generate 7.7 MW power at capacity and export to CSEB grid with only a small percentage being used for meeting its auxiliary power needs. The Plant Load

Factor (PLF) for the first year of operation in 2001-02 has been 52.51% while in 2002-03 the PLF has been 98%.

The plant has been commissioned in October, 2001 and generated 13.16 GWh of electric energy units in the year 2001-02 and 51.51 GWh in the year 2002-03. At capacity of 7.7 MW the plant is expected to generate 57.3 GWh in a year. A constant value of the plant generation at the 2002-03 level has been assumed for the entire crediting period, to remain on the conservative side for estimation of CER benefits.

Net export to the grid in the year 2002-03 has been 45.41 GWh [= 45.41 MUs]. Therefore a conventional electrical energy equivalent of 454.1 Million Units for a period of 10 years in Chattisgarh would be replaced by the exporting power from the 7.7 MW non-conventional renewable resource (rice husk) based power plant with CO_2 emission reduction of 298000 tonnes in 10 years. Without project activity, the same energy load would have been taken up by state grid fed primarily of thermal power plants and corresponding emission of CO_2 would have occurred due to combustion of conventional fuels like coal / gas.

As per the prevailing policy of the Government of Chattisgarh and the provisions of CSEB, power is exported through CSEB grid in accordance with Power Purchase Agreement (PPA) duly approved by CSEB. In the PPA with CSEB, CSEB has agreed to wheel the excess power generated through CSEB's transmission system.

The 16th Electric Power Survey (EPS) released in September, 2000 by the Central Electric Authority (CEA) provides the detailed estimates of demand for electricity for the period 1998-99 to 2004-05 with perspective demand upto 2016-17. However, the EPS does not provide demand estimates for the newly formed states including the state of Chattisgarh (as Chattisgarh was till then a part of MP). The Government of Chattisgarh has done a separate study which is presented in their 'Position Paper – Power' a part of the Final Report on Infrastructure Development Action Plan for Chattisgarh *[chhattisgarh.nic.in/opportunities/Power.pdf]*. The report projects a power deficit state in the future.

The power position based on actual data as published by CSEB in their website –

Table A.1 Power Position (as on 01.10.2002)

Installed Thermal Capacity	-	1250 MW
Installed Hydel Capacity	-	120 MW
Total	**-**	**1370 MW**
Central Sector Share	-	498 MW
Peak Demand (Restricted)	-	1500 MW
Average Demand	-	1175 MW

[Source: 'CSEB website – Power Position']

Table A.2 The demand-supply position for the period April – July, 2003 is as follows:

		All India	Chattisgarh
1	Demand [MU]	178801	3564
2	Supply [MU]	166109	3391
3	Deficit [MU]	12692	173
4	% deficit	7.1	4.9

[Source: http://cea.nic.in/data/opt2_powersupply.htm]

In view of the above, the CSEB will be a continuous buyer of energy from the VVL project. Further, the fulfilment of obligation to generate power from non-conventional energy sources by at least 10% of the total installed generation capacity, in near future will be binding upon CSEB to purchase power from projects of renewable energy type. Such policy measures are under discussion.[5] So far there is no such binding on CSEB and VVL has taken a pro-active step to develop such technically advance biomass power project in the Chattisgarh state. The power plant is not only justified in view of shortage both in peak power availability but also due to eco-friendly power generation.

[5] Source: *www.powermin.nic.in*

A.4.4 Public funding of the project activity

No public funding from parties included in Annex I to the UNFCCC, is available to the project.

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

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:

- 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 VVL's case, it clearly 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 Vandana Group of Industries has several other diverse businesses but not a power plant. The conditions in para 2 of Appendix C confirm that the small-scale project activity is not a debundled component of a larger project activity.

B. Baseline methodology

B.1 Title and reference of the project category applicable to the project activity

Title: ***Renewable electricity generation for a grid***

Reference: This is a rice husk based power project and falls under the category of **Renewable Energy Projects** as per Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website. Since it generates electricity from a renewable biomass resource with co-firing of fossil fuel (coal) and exports to the CSEB grid it comes under Category I.D *[Renewable electricity generation for a grid]*. Projects which generates electricity using renewable sources as solar, hydro, tidal / wave, wind, geothermal and biomass are included under Category I.D.

Details of **approved methodology for baseline calculations** for small scale CDM projects of Category I.D [less than 15 MW capacity] is specified in Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website.

The VVL project will be feeding power to the CSEB state grid. The generation mix of the CSEB state grid comprises of coal based power generation, gas based projects, hydro projects, and one nuclear project. The major share (more than 90%) belongs to the coal based thermal power plants. A methodology for baseline calculation has been followed which best estimates the most conservative emission reduction in terms of kgCO_2equ/ kWh considering all the factors influencing the generation mix of the state grid.

B.2 Project category applicable to the project activity

Document Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website, provides guidelines for preparation of Project Design Document (PDD) including baseline calculations. As per this document the project falls under Category I.D – Renewable electricity generation for a grid.

Baseline methodology for this category has been detailed in paragraph 7 under Category I.D of this document. It states that the **baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO_2/kWh) calculated as under**:

a) The average of the "approximate operating margin" and the "build margin",

where,

i) The "approximate operating margin" is the weighted average emissions (in kgCO_2equ/kWh) of all generating sources surviving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

ii) The "build margin" is the weighted average emissions (in kgCO_2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants;

OR

b) The weighted average emissions (in kgCO_2equ/kWh) of current generation mix.

A complete analysis of Chattisgarh's electricity grid has been carried out along with the study of various related issues like technology scenario, policy matters, economic conditions, development of renewable energy projects *etc.* for preparation of baseline scenario and calculation of baseline emission factor of the grid.

The project activity would displace an equivalent amount of electricity that would have been drawn from the grid generation-mix. Since the displaced electricity generation is the element that is likely to affect both the operating margin in the short run and the build margin in the long run, electricity baselines should reflect a combination of these effects. Therefore the most appropriate approach for baseline methodology would be as described in paragraph 7 under Category I.D of Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website.

In this project case, the project is small-scale only having generation capacity of 7.7 MW. Hence this is a operating margin scenario where we can assume that the principal effect will be on the operation of current or future power plants. However in view of the predicted power deficit status of the state in future, a delay effect in future power plants may creep in due to the occurrence of this project although to a limited extent. Ideal baseline approach is envisaged as the one that combines both Operating and Build Margin as prescribed in first alternative given in *paragraph 7 under Category I.B of the UNFCCC M&P for small scale projects*.

The other alternative is to go by the weighted average emissions (in $kgCO_2/kWh$) of all existing sources of power generation in the grid mix, and arrive at the baseline emission factor.

Both the baseline calculation methods have been applied and the one leading to a conservative value of baseline emission factor has been considered.

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity

That the project activity qualifies to use simplified methodologies has been justified in Section A.4.2 where it has been shown to qualify as a small scale CDM project of Category I.D.

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.

This project activity is a renewable energy project with net zero CO_2 emission due to carbon sequestration. Paddy re-grown at the same rate as it is being harvested, acts as a sink for atmospheric carbon dioxide and the net flux of CO_2 to the atmosphere is zero. An analysis of the state grid generation mix gives the baseline emission factor in kgCO_2/kWh for the credit period, and the CO_2 certified emission reductions [CERs] that the project activity will reduce, by substituting an equivalent grid supply. Since, the biomass contains only negligible quantities of other elements like Nitrogen, Sulphur *etc.* release of other GHGs are considered as negligible.

Barriers and Additionality

Attachment A to Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website asks for an explanation to show that the project activity would not have occurred anyway due to atleast one of the following barriers:

(a) Investment barrier

(b) Technological barrier

(c) Barrier due to prevailing practice

(d) Other barriers

Investment barriers

The cost of biomass during the financial closure was around INR 350/ton, which increased to more than INR 450/ton in less than a year and was around INR 550/ton in the second half of 2004. This escalation in the biomass prices was because of increase in demand of this fuel and transportation cost. Also with the successful operation of the project activity the supply of biomass has become an organized business for the suppliers.

Annual expenditure on biomass (@ INR 350/ton) = INR 32,016,600

Annual expenditure on biomass due to increased cost (@ INR 550/ton) = INR 50,311,800

Annual increase in expenditure due to increased cost of biomass:

INR 50,311,800 – INR 32,016,600 = INR 18,295,200

This increase in cost of biomass will be significantly compensated by the proposed carbon financing and will help to improve the sustainability of the project which will otherwise be rendered financially unstable.

Technological barrier:

Use of rice husk based boiler for power generation is not a time-tested business proposition.

There are certain known risks associated with the project implementation. In order to export to grid the power plant was required to be synchronized with the Chattisgarh state grid. Synchronization of the project activity with the grid and operating the project activity in the island mode in circumstances of grid failure had its associated institutional and operational barriers which VVL had to overcome in order to implement the project activity.

Operational risks related to Synchronization

Synchronization of a biomass based power project activity has its associated technical and operational risks which were discussed in the VVL management meeting at the preliminary stage before start of construction. VVL undertook this operational risk so as to reduce CO_2 emissions. The operational risks are detailed below.

Stable voltage and frequency are two important factors that contribute to effective functioning of the grid. The standard alternating current frequency in India is 50 Hertz. As long as the demand and generation is balanced, the frequency of the grid remains at 50 Hertz. But when the demand increases in excess of generation, the generators get over loaded and the rotation of the alternators vary resulting in reducing the frequency and vice-versa. The frequency variation is measured by a parameter known as df/dt ratio.

The project activity is connected with CSEB Sirgitti Grid Substation through 1.5 km long dedicated single circuit 33kV overhead line which is highly unstable. Incidents of frequency variations are very common in this grid circuit. Sustained high/low frequency operation or permitting the frequency variation in a wide range or abrupt changes in the frequency levels lead to thermal and electrical shocks to the system causing damage not only to the auxiliary equipments like motors and pumps but also to turbines and generators of project activity. Last stage blades of the turbine of the project activity are particularly susceptible to damage due to sustained low frequency operations. Further with abrupt frequency variations of the grid the turbine of the project activity trips resulting in a complete shutdown of the project activity. This incident would ultimately result in the VVL plant shutdown and the production process would be hampered. The restoration time of the grid normally varies from few hours to a day causing colossal amount of financial, industrial, economic and societal damages, directly or indirectly.

[A] Small frequency variations

In order to reduce the damage caused due to the frequency variations in the grid, VVL installed an Islanding Vector surge relay which would be activated under small frequency variations (0 to 10 for 1 second) and prevent the turbine from tripping. On activation, the Vector surge relay would enable the project activity to disconnect grid connectivity and operate in a stand-alone mode.

Past records reflect that the number of such incidents of stand alone mode of operation due to intermittent frequency variation may be as high as 20 per month.

- These frequent / intermittent small variations in the frequency cause thermal shocks to the system. As per the manufacturer (BHEL), the turbine is designed for 1000 thermal shocks in its life period. Hence frequent occurrence of such incidents reduces the operating life of the turbine.

- Sustained operation under this condition would severely affect the performance of the turbine and reduce its life. Under lower load operation of the project activity
  (a) The vibration levels of turbine are higher than the standard levels, leading to more wear and tear of interfaces between the fixed and rotary parts inside the turbine.
  (b) The turbine develops a back pressure[6], which affects the life of the thrust bearing. Replacement of the thrust bearing can affect the plant production over a period of seven days causing a substantial amount of financial losses.
  (c) The amount of vacuum required is much more than the standard requirements, which is very difficult to achieve continuously especially in the summer season when the temperature is high. Without the required vacuum, steam expansion pattern inside the turbine get affected and as a result back pressure is created on the rotor. This develops undue stresses on the blades of the rotor, which reduce the life and reliability of the turbine.

[B] Large frequency variations

The Islanding Vector surge relay would not function under large frequency variations resulting in the turbine tripping. Past records state that the frequency of such incidents of project activity failure due to turbine tripping is once in a month, which is detrimental to the performance and the life of the turbine. This incident would ultimately result in the VVL plant shutdown and the production process is hampered.
These large variations in frequency and voltage would cause greater thermal shocks to the system affecting the operating life of the turbine.

VVL undertook this project activity inspite of all these operational risks associated to project activity implementation.

There are uncertainties related to achieving higher steam temperature and pressure parameters by using rice husk as primary fuel because it has tendency of sticking to the boiler tube surface. Moreover, there are high possibilities of rice husk getting wet in the monsoon which poses serious problems in fuel efficiency and also increases the cost.

[6] The axle thrust is balanced in the normal load of operation

Compared to project activity a coal based power plant would have been a less technologically advanced alternative with lower risks associated with performance uncertainty, but would have led to higher GHG emissions.

The project proponent plans to bring in the expertise of people in the field of power generation to further develop the technology for effective utilisation of rice husk as fuel in boilers.

The associated CDM benefits with such a project activity played a key role in motivating the project proponent to invest in spite of the perceived technological risks.

Barriers due to prevailing practice:

Rice husk based power plants are not a prevailing practice in the Chattisgarh scenario. This is only the second such project in the state. 85-90% of the power generation is from coal based TPPs.

There are huge coal reserves in the vicinity, offering cheap pithead power generation opportunities [*e.g.* South Eastern Coalfields Limited] and there is enough water from the State's largest reservoir of Hasdeo Bango. 84% of India's coal is in Chhattisgarh and two other States. There are adequate coal supplies — South Eastern Coalfields Ltd, Bilaspur is in the process of doubling its production from 35 million tonnes to 70 million tonnes per annum.[7] The business as usual (BAU) scenario in Chattisgarh may be considered as thermal power generation using coal as 85-90% of the power generation comes from such sources. In the similar project sector, socio-economic environment, geographic conditions and technological circumstances, the project activity uses a technology, which shows very limited penetration.

Other Barriers:

- Human component: Energy is not a core business of VVL. The project developers belong to the Vandana Group of Industries which has never before taken up a power

[7] Source: http://www.chattisgarh.nic.in/power

generation project. The group is engaged mainly in the manufacturing of HTS/GI and other wires, HDPE/PP woven sacks, steel products, re-rolled items, steel ingots and heavy structurals, elastic clips and processing of steel products. The rice husk based power project is a steep diversification from the core business fields to power sector economics, where the project proponent has to meet challenges of power policies, delivery/non-delivery of power, techno-commercial problems associated with electricity boards.

- Information component: Lack of institutions giving information and advice, Lack of awareness among users on government rules and incentives, not enough technical and economic information to make a decision; The use of rice husk for power generation is not a time-tested business proposition and there may be certain unknown risks associated with the project which exposes the fore-runners such as VVL to failure risks. Moreover, the promoters have limited knowledge and exposure of complications associated with commercial production and sale of power.

- Regulatory Barrier: The project activity is not mandated by the law either from the Centre or the State. Although the MNES and the state government are promoting such renewable energy endeavours, there is no legal binding on either the state or the promoter to come up with such biomass based power plant.

The analysis of barriers to the project leads to the conclusion that the project might not have occurred due to any of the barriers identified above and a corresponding demand would have been exerted on the CSEB grid. Hence the project activity merits additionality from the above analysis.

Based on the Baseline Calculation Methodology, it is calculated that (see section E and Appendix III for the calculation) the project activity will avoid 298000 tonnes of CO_2 equ emissions in a 10 year credit period, compared to an equivalent supply from the state grid. Hence, the project activity is not a baseline scenario and without the project activity there will be emission as per the carbon intensity of the grid to which the project activity is supplying electricity.

In spite of the limitations, VVL is one such entrepreneur to initiate this GHG abatement project under Clean Development Mechanism. VVL's success in overcoming the above-identified barriers with the much needed leverage from CDM benefits, will encourage other entrepreneurs to come up with similar project activities. From the barrier analysis done above it is understood that the project activity is additional.

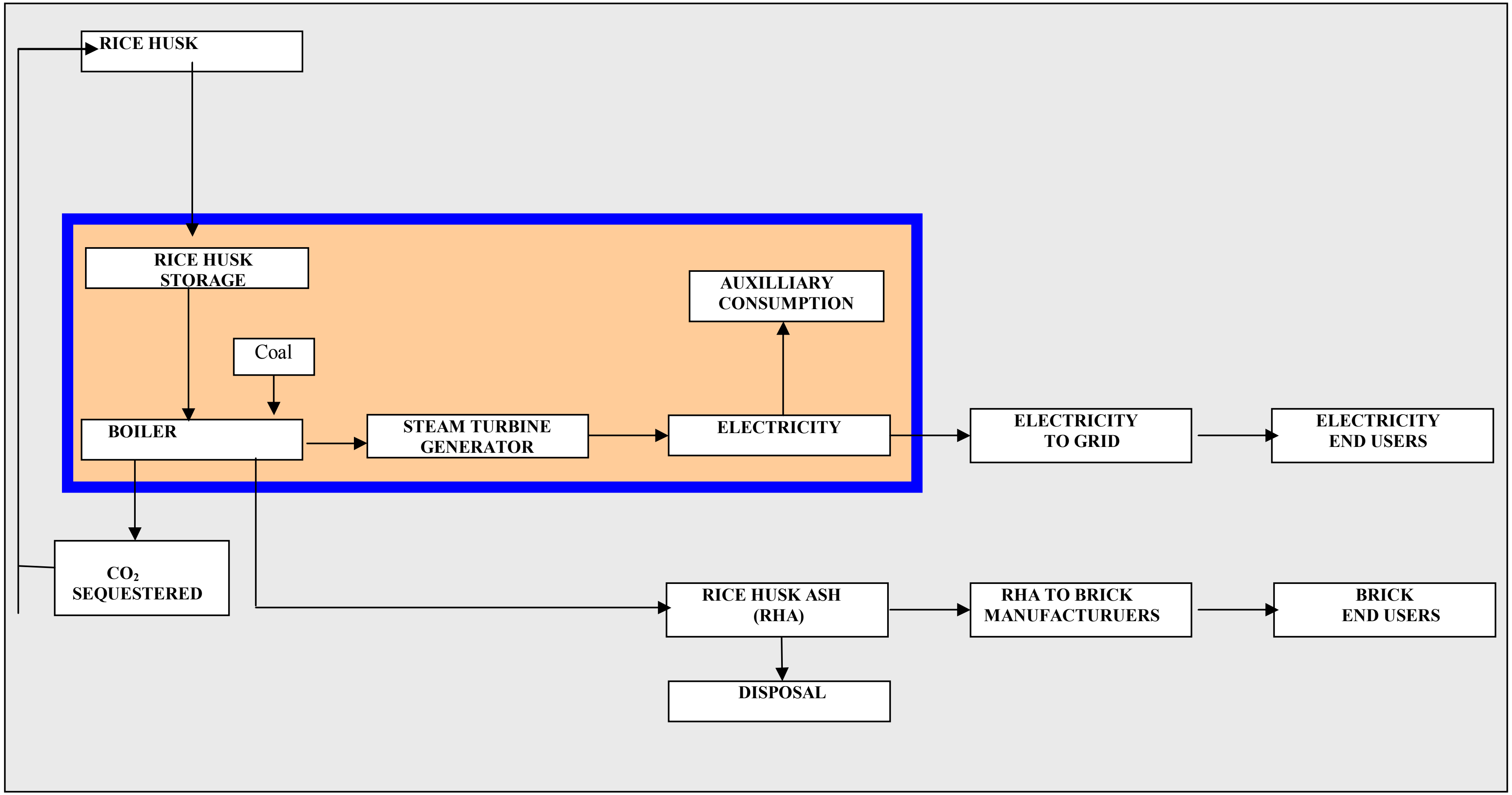
B.4 Description of the project boundary for the project activity

Project Boundaries

The project boundary as specified under Category I.D of small scale CDM project activities in Appendix B of the simplified M&P for the same shall encompass the physical, geographical site of the renewable generation source.

For the project activity the project boundary is from the point of fuel supply to the point of power export to the grid where the project proponent has a full control. Thus, boundary covers fuel storage and processing, boiler, steam turbine generator and all other accessory equipments. Individual power plants (existing and implemented under project activity) supplying to the state grid are considered in the baseline boundary for estimation of baseline emission rate. Since, the project would not have any impact on transmission and distribution losses it is not included in the project boundary. Using part of the available rice husk, being wasted earlier, in the project, will not affect current needs for other fuels and therefore the emissions from any other fuel-use are not included in the system boundary.

Flow chart and project boundary is illustrated in the following diagram [the **thick** blue line demarcates the boundary]:



B.5 Details of the baseline and its development

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in Appendix B of the simplified M&P for small-scale CDM project activities:

The baseline methodology has followed the one specified under Project Category I.D. in Appendix B of the Simplified M&P for small scale CDM project activities.

All existing sources of power generation have been considered from various sources like the CEA web-site, CSEB web-site, other power related websites and documents on CSEB's plans for the future. Percentage share of power generation from different fuel sources has been calculated. The IPCC emission factors for different sources of power generation have been considered.

The baseline has been considered as the conservative of the two values arrived at, using the two methods – 'combined margin' and 'weighted average of all emissions'.

The calculation of the Emission Factor and corresponding CO_2 emission reductions have been done in an excel sheet which is enclosed as Appendix III and the same has been explained in Section E.

Steps in Application of Methodology in the context of the project:

The project activity will increase installed capacity (marginally) of state grid. Also, it will have a delaying effect on the capacity addition program for the state and reduce the carbon intensity of the grid mix.

The methodology demands extensive background data for analysis and application. For detailed analysis, data/information was collected from government/non-government organisations and other authentic sources; Above-mentioned methodology of baseline analysis is used as under for baseline emission factor estimation and estimation of resulting CO_2 emission reduction due to the project.

- Study of Current Power Scenario and Policies

- Study of Chattisgarh Government policy/guidelines of CSEB for generation of electricity by private participants.

- Required data / information from CSEB regarding present generation mix, sector wise installed capacities, generation efficiencies, technology used for power generation, present condition to meet peak demand and energy requirements etc.

- Study of present status of renewable energy and policy / plan for development of renewable energy projects in the state.

- Calculation of net baseline factor of CSEB grid using individual emission factors for conventional fuels used for power generation.

- Estimation of electricity generation by the project activity, which will replace grid electricity, which receives power from various power generation stations.

- Estimation of CO_2 emission reductions due to supply of clean electricity to CSEB grid by the project.

The Chattisgarh power scenario is represented in the tables below:

Table B.1 Capacity and Generation Status of private power plants

	GENERATION CAPACITY (MW)	MU s to CSEB grid	
		2001-02	2002-03
PRIVATE			
TPP – Captive			
Existing			
Jindal Steel & Power Ltd	95	560	560.3
GAS BASED			
None	0	0	0
HYDEL			
None	0	0	0
Renewable – rice husk			
Indo Lahiri	6	35.64	35.64

N.B.: Plants generating electricity entirely for captive consumption have not been considered

Table B.2 Capacity and Generation Status of central power stations

	GENERATION CAPACITY (MW)	ALLOCATION TO CHATTISGARH (MW)	ALLOCATION TO CHATTISGARH (%)	State's share of MU s	
				2001-02	2002-03
CENTRAL					
TPP					
Existing					
NTPC Korba	2100	308	14.67	2433.49#	2415.01#
Vindyachal	1000	106	10.6	1652.43#	1795.11#
Sub Total	**3100**	**414**	**25.27**	**4085.93**	**4210.12**
GAS BASED					
Kawas	645	33	5.12	192.22#	215.29#
Gandhar	648	28	4.32	156.16#	145.70#
Sub Total	**1293**	**61**	**9.44**	**348.38**	**361**
HYDEL					
None	0	0	0	0	0
NUCLEAR					
Kakrapara	440	23	5.23	186.67#	191.74#

Source: www.ntpc.co.in, www.npcil.org, CEA document

estimated from MW allocation share

Table B.3 Capacity and Generation Status of CSEB power Plants

	GENERATION CAPACITY (MW)	MU s to CSEB grid	
		2001-02	2002-03
STATE			
TPP			
Korba East II (4x40)	160	989	863
Korba East III (2 x 120)	240	1231	1159
Korba West (4 x 210)	840	5536	5570
Sub Total	**1240**	**7756**	**7592**
GAS BASED			
Not applicble	0	0	0
HYDEL			
Mini Mata Hasdeo Bango(3x40)	120	392	247
Rudri Mini/ Micro Hydel	0.2	-	-
Sub Total	**120.2**	**392**	**247**

The value of the Emission Factor (EF) from the 'combined margin method' = 1.000 kgCO_2/kWh

The value of the EF from 'weighted average of all emissions'= **0.972** kgCO_2/kWh

[Refer to Chapter E for calculation]

The conservative value of Emission Reduction estimated with the value of emission factor from the weighted average method (0.972 kgCO_2 /kWh) has been considered as the emission reductions from the project activity.

Baseline Calculation

CSEB grid has been considered for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. As mentioned earlier, in the CSEB generation mix, coal and gas based power projects are responsible for GHG emissions.

We have considered two scenarios for baseline calculation as under:

1. The average of the approximate operating margin and the build margin
2. The weighted average emissions of the current generation mix

Actual/Standard IPCC emission factors have been applied for the calculations under the two scenarios.

Scenario-wise, description of estimation of CO_2 emissions is as under

Scenario 1: The average of the approximate operating margin and the build margin.

- Approximate operating margin and build margin is calculated as per the OECD and IEA reference document and UNFCCC methodology specified for small scale activities.
- For estimation of operating margin, weighted average of all resources, excluding hydro, geothermal, wind, low-cost biomass and solar generation and captive waste heat recovery based generation is considered
- For estimation of the build margin (or 'recently built') the weighted average emissions (in $kgCO_2/kWh$) of recent capacity additions to the system is considered. The greater of the following two options are considered –

  i. The plants contributing to most recent 20% of the gross MWh generation [as specified in pargraph 7 under category I.D of Appendix B of the simplified M&P for small-scale CDM project activities, if 20% falls on part capacity of a plant that plant is included in the calculation]

  ii. MWh from the 5 most recent plants

- For estimation of operating margin, the emission factors for coal has been considered as the IPCC factor 1.085 $kgCO_2/kWh$ and for gas based plants the IPCC emission factor 0.418 $kgCO_2/kWh$ has been considered

- For estimation of Build Margin, for coal and gas based power plants the IPCC emission factor [1.085 and 0.418 $kgCO_2$ /kWh respectively] have been used. Relevant details of power projects for build margin calculation are given in the following table:

Plants to be considered for calculation of build margin

Sl. No.	Power plant name / location	Fuel Type	Capacity	Year of commiss-ioning	Plant Total Capacity	Share for Chhattisgarh in **2001-02** from the Plant	Share for Chhattisgarh in **2001-02** from the Unit
			[MW]		[MW]	[MU]	[MU]
1.	Vindhyachal (Unit-VIII)	Coal	500	February'2000	1000	1652.43	826.22
2.	Vindhyachal (Unit-VII)	Coal	500	March'1999	1000	1652.43	826.22
3.	Kakrapara (Unit-II)	Nuclear	220	1st September1995	440	186.67	93.33
4.	Gandhar (Unit-IV)	Gas	255	March'1995	648	156.16	61.45
5.	Gandhar (Unit-I)	Gas	131	March'1994	648	156.16	31.57
6.	Gandhar (Unit-II)	Gas	131	March'1994	648	156.16	31.57
7.	Kakrapara (Unit-I)	Nuclear	220	6th May'1993	440	186.67	93.33
8.	Kawas (Unit-VI)	Gas	110.5	March'1993	645	192.22	32.93
9.	Kawas (Unit-V)	Gas	110.5	February'1993	645	192.22	32.93
10.	Kawas (Unit-IV)	Gas	106	August'1992	645	192.22	31.59
11.	Kawas (Unit-III)	Gas	106	June'1992	645	192.22	31.59
12.	Kawas (Unit-II)	Gas	106	May'1992	645	192.22	31.59
13.	Gandhar (Unit-III)	Gas	131	May'1992	648	156.16	31.57
14.	Kawas (Unit-I)	Gas	106	March'1992	645	192.22	31.59
15.	Vindhyachal (Unit-VI)	Coal	210	February'1991	1000	1652.43	347.01
16.	Vindhyachal (Unit-VI)	Coal	210	March'1990	1000	1652.43	347.01
Total Generation							**2881.50**
20% of Gross Generation							**2672.92**

Scenario 2: The weighted average emissions of the current generation mix.

Similar to the scenario 1, baseline calculations are carried out under this scenario.

- For estimation of net CO_2 emission factor, weighted average of all resources, including hydro, geothermal, wind, low-cost biomass and solar generation *etc.* is considered.
- CO_2 emission factor due to combustion of coal and gas for power generation is considered as per IPCC standard emission factor
- The emission factors for coal has been considered as the IPCC factor 1.085 kgCO_2/kWh and for gas based plants the IPCC emission factor 0.418 kgCO_2/kWh has been considered.

Since there is a gap in demand and supply scenario in Chattisgarh, the export of power to CSEB grid will replace or get absorbed to partially fulfil the CSEB power requirement. If the same amount of electricity is generated by a mix of coal and gas based power project, it will add to the emissions that is getting reduced by the project activity. Hence, the baseline calculated using above methods/ scenarios would represent the anthropogenic emissions by sources (coal and gas power plants) that would occur in absence of the project activity.

The total CERs in a 10 year crediting period, for Scenario I and Scenario II are 310590 and 298000 respectively [*Section E*]. Being the conservative approach for estimation of CO_2 emission reductions, the Scenario II value has been considered for estimation of CER benefits.

B.5.2 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

April 2005

B.5.3 Name of person/entity determining the baseline:

Experts and consultants of VVL.

C. Duration of the project activity and crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

April 2000

C.1.2 Expected operational lifetime of the project activity:

Lifetime of the project: 20 years

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

C.2.1 Renewable crediting period:

C.2.1.1 Starting date of the first crediting period:

C.2.1.2 Length of the first crediting period:

C.2.2 Fixed crediting period:

C.2.2.1 Starting date: **01 April, 2002**

C.2.2.2 Length (max 10 years): **10 years**

D. Monitoring methodology and plan

D.1 Name and reference of approved methodology applied to the project activity

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 Category I.D [renewable electricity generation for a grid]. Paragraph 9 under Category I.D of the same document specifies that for the said category of CDM project, **'Monitoring shall consist of metering the electricity generated by the renewable technology. In the case of co-fired plants, the amount of biomass input and its energy content shall be monitored'.**

D.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Since the project is a grid connected renewable energy project, emission reduction quantity totally depends on the units of energy in kWh exported to the grid and the baseline emission of the state grid. The methodology covers the monitoring of units exported and the other parameters affecting the quantity of power export and CO_2 emissions. The project co-fires rice husk and coal and hence, the methodology also includes monitoring the amount of rice husk input and the energy availability from the same. Thus the monitoring methodology under Category I.D of the Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website is aptly applicable to the project activity. The net CERs will result from the units of power available from the rice husk. The methodology will additionally include monitoring of the coal co-fired with rice husk. The CO_2 emissions arising from coal co-firing and treated as project emissions will be deducted from the baseline emissions arrived from the total kWh exported by the power plant and the baseline emission factor.

Description of the Monitoring Plan

The Monitoring and Verification (M&V) procedures define a project-specific standard against which the project's performance (*i.e.* GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of

GHG emissions with specific focus on technical / efficiency / performance parameters. It also allows scope for review, scrutiny and benchmarking of all these information against reports pertaining to M & V protocols.

The M&V Protocol provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

The project revenue is based on the units exported as measured by power meters at plant and check meters at the high-tension substation of the CSEB. The monitoring and verification system would mainly comprise of these meters as far as power export is concerned. The rice husk input is also to be monitored. The export of electricity will be through invoices to CSEB. The invoices, based on meter readings will also be covered in the regular finance audit.

The measurement of the quantity of rice husk used will produce evidence to the quantity of energy generated with zero net CO_2 emissions. The CERs will be generated from the quantity of power generation from rice husk. The determination of quality and quantity of coal co-fired with rice husk will help us to determine the project emissions due to this in terms of mass CO_2.

The project employs Distributed Control System (DCS) type monitoring and control equipment that will measure, record, report, monitor and control various key parameters. Parameters monitored will be quantity and quality of rice husk fuel used, quantity and quality of coal used, total power generated, power exported to the grid, *etc.*(details enclosed in the tables given below). These monitoring and controls will be the part of the DCS of the entire plant. All monitoring and control functions will be done as per the internally accepted standards and norms of VVL.

The instrumentation system for the project will mostly comprise microprocessor-based instruments of reputed make with desired level of accuracy. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.

The quantity of emission reduction claimed by the project will only be a fraction of the total generated emission of the grid, which depends on the actual generation mix of the grid in a particular year.

CSEB publishes yearly reports regarding the performance of all power generation units (which include private sector generation units and CSEB's own generation units). Hence, authentic data related to the measurements, recording, monitoring and control of the generation mix of the CSEB grid is ensured.

The CSEB report contains all information regarding type of generation like hydro, thermal, nuclear, renewable *etc*., installed capacity, de-rated capacity, performance of generating unit, actual generation, capacity additions during the year, *etc*. which can be used for verification of generation mix and emission factors for baseline calculation for a particular year.

GHG SOURCES

Direct On-Site Emissions

Direct on-site emissions after implementation of the project arise from the burning of rice husk in the boiler. These emissions mainly include CO_2. However, the CO_2 released equals the amount of CO_2 taken up by the equivalent paddy plantation / biomass during growing, therefore no net emissions occur. Since the rice husk is co-fired with coal, the maximum usage of coal being restricted to 25% (w/w), the other direct on-site emission source is combustion of coal in the boiler. In order to arrive at the actual CERs due to rice husk usage, the CO_2 generation from coal combustion is calculated as project emission and deducted from the emission reduction that would have occurred if rice husk had been used at 100%. The methodology should include monitoring the quality and quantity of coal used and the percentage of coal usage.

The rice husk availability varies seasonally. Paddy is cultivated in the Chattisgarh division mainly in 2 seasons – Kharif, from February to May and Rabi, from June to October. Adequate storage is required for 3 months [November to January]. Methane emissions may only occur under anaerobic conditions in such storage. This is not expected to contribute significantly to GHG emissions even under anaerobic conditions.

In principle nitrous oxide (N_2O) emissions could also arise from storage. However, no data on emission from storage is available. We assume the amount of CH_4 and nitrous oxide emissions formed due to rice husk storage to be comparable to the amount of CH_4 and N_2O emissions arising from rice husk when left on the field. As a consequence, the CH_4 and N_2O emissions will not be influenced by the project and will therefore not be taken into account for monitoring.

Direct Off-Site Emissions

Direct off-site emissions in the project arise from the rice husk transport. However, in the baseline, fuel transport also has to be taken into account. On average, the distance over which fuels have to be transported will be larger for fossil fuel-fired power stations because of a larger distance to coal mines and ports for the project.

It is estimated that the transport of rice husk from the rice mills within 100 km radius, will contribute to emission much less than transport emissions in the baseline. To provide a conservative estimate of the emission reductions, the reduction in transport emissions in the project compared to the transport emissions in the baseline is not taken into consideration. Transport emissions are therefore not taken into account.

Since the project uses rice mill generated rice husk only, no additional biomass is grown on account of the project. Therefore the project does not result in an additional uptake of CO_2 by sinks.

Indirect On-Site Emissions

The indirect on site GHG source is the consumption of energy and the emission of GHGs involved in the construction of rice husk based power plant.

Considering the life cycle assessment of the total power generated and the emissions to be avoided in the life span of 15 –20 years, emissions from the above-mentioned source is too small and hence neglected.

No other indirect on-site emissions are anticipated from the project activity.

Indirect Off-Site Emissions

The indirect off-site GHG source is the emission of GHGs that are involved in the process construction and erection of the transmission lines from the nearest sub station, up to the point from where the project wheels the power.

Same as above, considering the life cycle assessment of the total power generated and the emissions to be avoided in the life span of 15–20 years, emissions from this source is also too small and hence neglected.

Fuel Requirement, Availability and Utilization

Quantity of the rice husk used in the boiler as fuel

The rice husk received from the rice mills will be stored in the plants storage area specially designed for such storage. From the storage area the rice husk will be transferred to the intermediate bunkers by bucket elevator/belt conveyor. An approximate measure of the shift-wise usage of rice husk is done at this point by scaling the bunker. The same record is maintained manually in a register.

Belt conveyors transfer the rice husk from the bunkers to the feeding hopper of the boiler, from where rice husk is fed into the FBC boiler. Control of fuel feeding is done by controlling the rpm of the motors operating in the feeder system. The amount of rice husk purchased, can be verified on invoices / receipts from farmers and/ or fuel contractors.

Quantity of the coal used in the boiler as fuel

Co-firing of coal with rice husk demands a similar monitoring system in place for the amount of coal fired.

Quality of Rice husk used in the boiler

The main type of fuel for the power generation is only rice husk. The properties of the rice husk from ultimate analysis, calorific value, ash composition *etc.* are already established and will be consistent in the region. However, it is proposed to monitor various properties of rice husk used as fuel, by taking samples at random, so that in case of any drastic change in the properties, corrective actions can be taken. The measurement of fuel properties like ultimate analysis, calorific value etc. will be done at the unit's own laboratory as per international practices and data or documents will be kept open for verifiers. Same will be verified periodically by getting the analysis done from reputed laboratories in the country. A proper MIS for such data shall be in place.

Quality of coal co-fired with rice husk in the boiler

Coal is co-fired with rice husk in the FBC. The properties of the coal from analysis - calorific value and composition *etc.* are already established and will be consistent in the region. A monitoring protocol similar to that of rice husk should be maintained for coal.

Operational Parameters of the power generating Unit

Total Power Generated

The total power generated by the power project will be measured in the plant premises to the best accuracy and will be recorded, monitored on a continuous basis through DCS. All measurement devices will be microprocessor based with best accuracy and will be procured from reputed manufacturers. All instruments will be calibrated at regular intervals. All instruments carry tag plates, which indicates the date of last calibration and the date of next calibration. The parameter will substantiate the smooth operations of the power plant. During verification the total power generated would be verified as compared to the power exported to the grid.

Power consumed by the plant auxiliaries

The power consumed by plant auxiliaries will be recorded in the plant premises to the best accuracy. This will be recorded monitored on a continuous basis through DCS. All measurement devices will be microprocessor based with best accuracy and will be procured from reputed manufacturers. All instruments will be calibrated at regular intervals. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. The total quantum of power consumed by the auxiliaries would affect the total power to the exported to the grid and therefore the amount of GHG reductions. Therefore any increase in the consumption pattern of the auxiliary system would be attended to.

Power exported to the grid

The project developer will install all metering and check metering facilities within the plant premises as well as in the grid substation where exported power is connected to the grid. The measurement will be recorded and monitored on a continuous basis by both CSEB and the project developer through DCS. In addition to the records maintained by the promoter, CSEB also monitors the actual power exported to the grid and certify the same. All measurement devices will be of microprocessor based with best accuracy and will be procured from reputed manufacturers. All instruments will be calibrated at regular intervals. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration.

Efficiency of the power generation activity.

High-pressure FBC boiler of 66 kg/cm^2 at 500^oC will be used by the project. The performance of the boiler is already predicted and can be verifiable. However, the boiler for the project is a multi-fuel fired boiler, which can use both rice husk and coal. The inlet and outlet steam parameters will be measured and monitored along with the parameters of fuel and feed water.

Fully condensing type of steam turbine with generator set of 7.7 MW will be used by the project. Quantity with major quality parameters of the steam at the inlet to the turbine will be measured on-line and monitored through DCS.

Based on the measured input and output parameters the system efficiency will be calculated and monitored by DCS. In case of any irregularity, the root cause of the deviations would be identified and the necessary corrective actions will be taken.

All the above parameters / factors will demonstrate the performance of the project at any point of time.

D.3 Data to be monitored:

a) Parameters affecting the emission reduction potential of the project activity

ID Number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
1	Power	Total electricity generated	kWh	m	continuous	Total	Electronic	3 years after issue of CERs	Measured in plant premises and monitored and recorded continuously through DCS. Manufacturers of equipments should be of repute.
2	Power	Power export	kWh	m	continuous	Total	Electronic	3 years after issue of CERs	As per CSEB regulation
3	Power	Auxiliary consumption	kWh	m	continuous	Total	Electronic	3 years after issue of CERs	

b) Fuel related parameters affecting the project activity

ID Number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
1	Fuel Quantity	Type of fuel used - biomass - coal	t	m	Daily	>95%	Electronic	3 years after issue of CERs	To be monitored at purchase and usage.
2	Fuel Quality	Calorific Value of fuels used - biomass - coal	kcal/kg	Actual sample testing	Monthly	Grab sample	Paper	3 years after issue of CERs	Sample testing
3	Fuel Quality	Carbon content in coal	%	Actual sample testing	Monthly	Grab sample	paper	3 years after issue of CERs	Sample testing

* 95% of hourly data recorded

c) Parameters affecting the efficiency of the project activity

ID Number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
1	Equipment/ Operation specific	Efficiency of power generation activity	%	c	Continuous (per hour)	Total	Paper	3 years after issue of CERs	
2	Operation specific	Plant heat rate	kcal/kWh	c	Continuous (per hour)	Total	Paper	3 years after issue of CERs	

(d) Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored. (data items in tables contained in section D.3 (a to f) above, as applicable)

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
D.3.(a)1	Low	Yes	This data will be used as supporting information to calculate emission reductions by project activity.
D.3.(a)2	Low	Yes	This data will be used for calculation of emission reductions by project activity.
D.3.(a)3	Low	Yes	This data will be used as supporting information to calculate emission reductions by project activity.
D.3.(b)1	Low	Yes	This data will be used for calculation of emission reductions by project activity.
D.3.(b)2	Low	Yes	This data will be used as supporting information to calculate emission reductions by project activity.
D.3.(b)3	Low	Yes	This data will be used as supporting information to calculate emission reductions by project activity.
D.3.(c)1	Low	Yes	This data will not be directly used for calculation of emission reduction
D.3.(c)2	Low	Yes	This data will not be directly used for calculation of emission reduction

D.4 Name of person/entity determining the monitoring methodology:

Experts and consultants of VVL.

E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

E.1.1 Selected formulae as provided in Appendix B:

Formula not in Appendix B.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

The project leads to GHG on-site emissions in the form of CO_2 emissions from combustion of rice husk and CO_2 emissions due to combustion of co-fired coal. The project uses an environmentally renewable resource in the form of rice husk as fuel for power generation.

The CO_2 emissions from rice husk combustion process will be consumed by the paddy plantations, representing a cyclic process of carbon sequestration. Since the husk contains negligible quantities of other elements like Nitrogen, Sulphur etc. release of other GHG emissions are considered negligible. Under the MNES guideline, biomass projects are permitted to use a maximum of 25% w/w of fossil fuel as support fuel.

Coal is co-fired with the rice husk into the FBC boiler. The plant has used around 16.5% w/w of coal on an aggregate basis in the FY 2002-03 and is expected to reduce on the same in the coming years. The figures for the FY 2002-03 has been used for estimation of the project emissions in the form of CO_2 from combustion of coal that is co-fired with rice husk.

Formula used:

[I] CO_2 Emission [in kg] = stoichiometric CO_2 from carbon content of coal

[assuming complete combustion of coal]

The VVL plant uses generally Grade F coal as evident from the calorific values of the samples of coal. To have a conservative estimate of the leakage quantity a total carbon content of 40% has been considered which is on the higher side with Chattisgarh scenario in view.

Referring to the monthly coal consumption figures over the FY 2002-03 total quantity of 9785 MT of coal was co-fired with rice husk as fuel. Assuming the plants performance to be constant at the 2002-03 level and the coal consumption figure also at a constant level over the crediting period, the stoichiometric CO_2 release from the same amount of coal is:

(44/12) * (0.40*9785) = 14351.33 tonnes of CO_2 per annum ≈ 14351tonnes of CO_2 per annum

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

According to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, if the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.

No such leakage is applicable for the concerned project activity. However, the GHG emissions outside the project boundary in transportation of rice husk from the supplying rice mills within a 100 km radius to VVL plant at Sirgitti Industrial area has been considered as leakage and addressed accordingly. The same type of GHG emissions occur during transportation of coal from coal mines to respective power plants and since the distance between the coal mines and power plant is quite higher as compared to the transportation distance of rice husk, the GHG emissions are higher in the earlier. Considering only the transportation leakages for the two fuels, there is a net positive addition on the baseline emission which will result in net increase in CO_2 reduction from the project. To be on conservative side, this CO_2 emission due to coal transportation and husk transportation has not been considered while calculating the baseline emissions and project emissions respectively.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

Project Activity Emissions = (14351) + 0 ≈ **14351 MT of CO_2 per annum**.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

CSEB grid is considered for baseline analysis and calculation of anthropogenic emissions by fossil fuels during power generation. As mentioned in Section B, in the CSEB generation mix, coal and gas based power projects are responsible for GHG emissions. We have considered here two scenarios for baseline calculations as under:

- The average of the approximate operating margin and the build margin (Combined Margin).
- Weighted Average of all the emission sources

Formula used for estimation of the anthropogenic emissions by sources of greenhouse gases of the baseline is as under.

Scenario 1: The average of the approximate operating margin and the build margin (Combined Margin)

- **Baseline Power generation**

  $$P_{wlc} = P_{tot} - P_{lrc}$$

  Where,

  P_{wlc} - Power generation by all sources, excluding hydro, biomass and nuclear.

  P_{tot} - Power generation by all sources of grid mix.

  P_{lrc} - Power generation by hydel, nuclear, biomass, projects

- **Sectorwise baseline Power generation**

$$P_{fuel} = \frac{P_f}{P_{wlc}} x100$$

Where,

P_{fuel} - Share (in %) of power generation by each fuel used (coal and gas in present scenario), out of total power generation excluding P_{lrc}

P_f - Power generation by fuel used. (in Million kWh units)

- **Calculation of Operating Margin emission factor**

$OM_{bef} = \sum P_{fuel}\, x\, E_{fuel}$ for base year for Scenario 1

Where,

OM_{bef} - OM Emission factor of baseline calculated for each year (kg/kWh)

E_{fuel} - Emission factor (actual or IPCC) for each fuel type considered (*e.g.* coal, gas).

- **Calculation of Build Margin emission factor for each source of baseline generation mix**

BM_{yr} = weighted average of emissions by recent 20% capacity additions.

Where

BM_{yr} = Build Margin for base year.(kg/kWh) = $\left(\frac{\sum P'_f E'_f}{\sum P'_f} \right)$

Where

P'_f - Generation capacity from specific fuel in the most recent 20% power plants

E'_f - Emission factor for the specific fuel in the most recent 20% power plants built

- **Combined Margin Factor**

  CMF for each year crediting period

  = $(OM_{bef} + BM_{yr}) / 2$ (in kg/kWh)

  Final (Net) Baseline Emission Factor (NEF_B)= 1.000 $kgCO_2$/kWh

  [Refer to Baseline Excel sheet in Appendix III]

- **Power generation and export by project activity**

  $$TP_{gen} = TP_{\exp} + TP_{loss}$$

  Where,

  TP_{gen} - Total power generated

  TP_{exp} - Total clean power export to grid per annum by project activity

  TP_{loss} - T & D Loss [assumed negligible as the CSEB substation is located at a short distance]

  (all power units are in Million kWh)

The power export to grid is metered by the plant and the actual values of exported units of power for 2002-03 has been considered as the fixed rate of exported units of power per year, throughout the crediting period.

- **Emission Reduction by project activity**

  $$ER = TP_{\exp} x(NEF_B - NEF_P) - EL$$

  Where,

  ER - Emission reduction per annum by project activity (tones/year)

  TP_{exp} - Total clean power export to grid per annum

  NEF_B - Final Emission Factor of baseline

  NEF_P - Net Emission Factor of project activity [= 0]

  EL – Emission Leakage (tonnes/year) [= 0]

Step by step calculation using Combined Margin Methodology of CO_2 emissions due to burning of coal and gas for power generation and emission reductions by project activity is as under:

Step 1	**:**	Net operating emission factor for coal	=	Actual emission factor for coal x % of generation by coal out of total generation excl. RE projects.
Step 2	**:**	Net operating emission factor for gas	=	Step 1 is to be repeated for gas
Step 3	**:**	Operating margin factor	=	Net emission factor for coal + Net emission factor for gas
Step 4	**:**	Built margin factor	=	Weighted average of emission factors of most recent 20% plants
Step 5	**:**	Average of operating and build margin factor	=	(Operating margin factor + Built margin factor) / 2
Step 6	**:**	Units exported to CSEB	=	Net metered units exported to CSEB grid
Step 7	**:**	CO_2 emission reduction	=	Units exported to CSEB grid x average of operating and build margin factor.

Scenario 2: Weighted average emissions from all generation sources

- **Baseline Power generation**

  P_{tot} - Power generation by all sources of grid mix.

- **Sectorwise baseline Power generation**

$$P_{fuel} = \frac{P_f}{\mathrm{P_{tot}}} x100$$

Where,

P_{fuel} - Share (in %) of power generation by each fuel used (coal and gas in present scenario), out of total power generation

P_f - Power generation by fuel used. (in Million kW units)

- **Calculation of Weighted Average Emission Factor**

$$WA_{bef} = \sum P_{fuel}\, x\, E_{fuel}$$ for base year and for each year of credit period for

Where,

WA_{bef} - WA Emission factor of baseline calculated for each year (kg/kWh)

E_{fuel} - Emission factor (actual or IPCC) for each fuel type considered (*e.g.* coal, gas).

Final WA_{bef} [Baseline excel sheet in Appendix III] = **0.972 $kgCO_2/kWh$**

- **Power generation and export by project activity**

TP_{exp} - Total clean power export to grid per annum by project activity

- **CO_2 equivalent Emission Reduction by project activity**

$$ER = TP_{exp}\, x\, (WA_{bef} - NEF_P) - EL$$

Where,

ER - Emission reduction per annum by project activity (tonnes of CO2 equ/year)

TP_{exp} - Total clean power export to grid per annum (MU)

WA_{bef} - Final Weighted Average Emission Factor of baseline

NEF_P - Net Emission Factor of project activity baseline

EL – Emission Leakage (tonnes/year)

Step by step calculation using Weighted Average Methodology of CO_2 emissions due to burning of coal and gas for power generation and emission reductions by project activity is as under:

Step 1	**:**	Net emission factor for coal	=	Actual emission factor for coal x % of generation by coal out of total generation.
Step 2	**:**	Net emission factor for gas	=	Step 1 is to be repeated for gas.
Step 3	**:**	Total net emission factor	=	Net emission factor for coal + Net emission factor for gas
Step 4	**:**	Units exported to CSEB		(Power export for the year 2002-03)
Step 5	**:**	CO_2 emission reduction	=	Units exported to CSEB grid x total net emission factor.

E.1.2.5Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Following formula is used to determine Emission reduction

CO_2 emission reduction due to project activity

> **= [**Net CO_2 baseline emission factor (in kg CO_2/kWh) * Electricity exported to grid in kWh/yr**]** - Net project emissions *[as calculated in section E 1.2.3]*

For Scenario 1: Average of Approximate Operating Margin and Build Margin

Net CO_2 baseline emission factor = 1.000 kgCO_2/kWh

Electricity exported to grid = 45.41 MU per year

Net project emissions = 14351 tonnes of CO_2 equ per year [*Section E 1.2.3*]

Emission reduction potential = [(1.0 kgCO_2/kWh)*(45.41 MU)*1000] tonnes of CO_2/year – Net project emissions

= 31059 tonnes of CO_2 equ **/year** ie. **310590 tonnes** of CO_2 in 10 years.

For Scenario 2: Weighted Average emissions of grid generation mix

Net CO_2 baseline emission factor = 0.972 kgCO_2/kWh

Electricity exported to grid = 45.41 MU per year

Net project emissions = 14351 tonnes of CO_2 equ per year [*Section E 1.2.3*]

Emission reduction potential = [(0.972 kgCO_2/kWh)*(45.41MU)*1000] tonnes of CO_2/year – Net project emissions **= 29800 tonnes of CO_2 equ /year**

ie. **298000 tonnes** of CO_2 in 10 years.

The conservative estimate in Scenario II is considered as the CERs from project activity.

E.2 Table providing values obtained when applying formulae above:

Sl. No.	Period	Baseline emissions [tonnes of CO_2 equ]	Project emissions [tonnes of CO_2 equ]	CERs [tonnes of CO_2 equ]
1.	2002 – 2003	44151	14351	29800
2.	2003 – 2004	44151	14351	29800
3.	2004 – 2005	44151	14351	29800
4.	2005 – 2006	44151	14351	29800
5.	2006 – 2007	44151	14351	29800
6.	2007 – 2008	44151	14351	29800
7.	2008 – 2009	44151	14351	29800
8.	2009 – 2010	44151	14351	29800
9.	2010 – 2011	44151	14351	29800
10.	2011 – 2012	44151	14351	29800
	TOTAL	441510	143510	298000

F. Environmental impacts

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

The assessment of Environmental Impact for the project activity has been carried out as required under Environmental (Protection) Act 1986, Government of India, mandatory for expansion or modernization of any activity or for setting up new projects listed in Schedule I of the notification.

As the project would utilize the rice husk for power generation and combust the same in a controlled way, this thereby eliminates the environmental consequences of fugitive emissions that arise due to the usual methods of rice husk disposal i.e., open air burning or dumping.

The SO_x, and NO_x, emissions form rice husk combustion will be much lower compared to the conventional fossil fuel, coal, and is well within the limits as prescribed by the different state and national environmental statutes. The project is situated in a very large area with considerable amount of tree plantations, which will buffer any noise arising out of the functioning of the plant.

The disposal of fly ash is properly done in order to prevent it from escaping to the atmosphere or entering the local waterways via run off.

In addition to the above, monitoring of the following are done on a regular basis:

- Air emission from stack
- Ambient air quality
- Noise level monitoring
- Water quality
- Occupation health and safety
- Records of accidents

Summary of Environmental Impact

Evaluation of environmental impacts

The impacts of the project on the various environmental parameters have been evaluated in an EIA study conducted by VVL. It reveals that the project does not have any adverse environmental impacts. The impacts due to the project are positive after implementation of the Environment Management Plan (EMP).

Effect on Biological Environment

The project operation will neither affect the biological environment in the study area nor in adjoining areas. VVL has developed green belt around their factory premises which act as a buffer zone and attenuates most of the noise pollution and fugitive emission from the factory. Under EMP, VVL is undergoing plantation inside the premises with hardy local species.

Effect on Water Quality

The existing quality of aquatic environment is satisfactory and the same has been observed from data obtained for surface water in the vicinity. Project would not affect water quality of the nearby area in any situation. The blow-down water from cooling tower is re-circulated after sedimentation of the solids with help of coagulant.

The water with high solid content is being used for plantation. To ascertain the quality of water and water pollution monitoring, wastewater quality analysis is carried out in regular intervals, thrice a year.

The plant does not envisage any further construction of residential quarters on the premises, hence there is little possibility of increase in the quantity of sewage generation.

Effect on Air Quality

This is a rice husk based 7.7 MW power plant with coal being co-fired with rice husk at less than 25% w/w. The combustion of the said mix of fuels in the boiler gives rise to related air emissions which is treated in an ESP and discharged through a stack.

With combustion of rice husk and coal for generation of power pollutants generated are Suspended Particulate Matter (SPM), Oxides of Nitrogen (NO_x) and Carbon mono-oxide (CO). The SPM as ash is controlled by high efficiency Electro-Static Precipitator (ESP) in line. High efficiency (> 99%) ESP ensures SPM levels less than 150 mg/Nm^3 in the stack. There is negligible amount Sulphur di-oxide (SO_2) emission as low sulphur content coal is used as fuel after coal beneficiation which further reduces the sulphur content in the flue gas. The NOx emissions are also very less. A stack of adequate height has been provided which further helps in fast dispersion of pollutants into the atmosphere, thus, reducing their impact in the vicinity of the project area. The stack height is above the required stipulated height for such operations as per CPCB norms. The flue gases are passed through ESP before discharging into the atmosphere through the stack.

The EMP envisages periodical monitoring of the emissions from the stack once every month. Any deviations from the original levels shall indicate inefficient functioning of the ESP or higher sulphur content levels of the fuel. Remedial action shall be taken immediately and efficacy ascertained. Thus with pollution abatement devices and proper conduction of EMP, air pollution impacts due to running of power plant does not remain a matter for concern.

Other sources of air pollution include the manual unloading of rice husk from trucks and loading the same on the conveyor belt from the storage godown, which results in fugitive emission.

The workers working in such zones have been provided with nose mask as protective gear. Sprinkling of unused blow down water is carried on to suppress fugitive dust emission in the work place. Adverse impact on the air quality is expected from truck/tractor exhaust and dust due to transport of fuel to the site. However with the positive nature of the project such indirect off-site emission may be considered negligible.

Effect on land environment/ soil

The evaluation of the impacts on the land environment indicates no detrimental effect due to project's activity. The domestic treated effluent from factory's sewerage is used for watering the plants inside the premises. Reuse of treated sewage enhances the organic content of soil in the plantation areas inside plant premises.

Effect of Noise pollution

Noise level rise due to operation of various equipments and transportation has minor impact on the employees from the point of view of occupational hazard. The workers use precautionary measures to prevent the harm and the motors and machineries with high-pitched noise has been provided with silencer casings. A routine check up of noise contour in and around the plant with Sound Pressures Level Meter is being done on regular basis to ensure that the noise level is well under control (about 80 dBA).

Solid Waste Management

The main problem of solid waste is the flyash that is being generated in the process of power generation mainly from coal. However the company collects and sells it to cement plants and local brick manufacturers under contractual agreements.

Socio-economic effects

There is no negative impact on the socio-economic front of the area from the operation of the VVL power plant. On the contrary the populace of the region is benefited due to the fact that the plant employs quite a number of people either directly or indirectly. The region also experiences technological development through this project.

Establishment of the plant has also encouraged ancillary industries in the vicinity as well as shopping centers. Thus with such industrial development, future prospect of the region seems to be positive.

Aesthetic environment

There will not be any detrimental effect on the aesthetic environment. The project is located in an industrial area. The development of green belt by the industry would rather enhance the same in the vicinity.

Overall impact

An overall positive impact is assessed for the project. The net effect on biological environment would be positive with the company's vegetation and plantation scheme as outlined in the EMP. The net impact on environmental pollution would be positive. The negative effects due to emission of particulate matter, gases and increased noise levels are controlled and prevented by pollution control measures in the form of air pollution control devices of adequate capacity and employee health & safety norms in practice. The aesthetic environment would have a positive value addition with the vegetation and plantation schemes of the company. Moreover, the human-interest parameters show encouraging positive impacts due to increased job opportunities, transportation, medical facilities, housing etc. These have long-term socio-economic benefits.

G. Stakeholders comments

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

Identification of Stakeholders

Vandana Vidyut Limited at Bilaspur has implemented the present 7.7 MW non-conventional renewable energy source rice husk based power plant. The project uses rice husk generated by the rice mills located within a radius of 100 km as the fuel. The GHG emissions of the combustion process, mainly CO_2 are sequestered by paddy plantation, representing a cyclic process. So the project leads to zero net GHG on-site emissions.

The stakeholders identified for the project are as under.

- ✓ Local Authority
- ✓ Local community
- ✓ Chattisgarh State Electricity Board (CSEB)
- ✓ Chattisgarh Electricity Regulatory Commission (CERC)
- ✓ Chattisgarh State Renewable Energy Development Agency (CSREDA)
- ✓ State Pollution Control Board
- ✓ Environment Department, Govt. of Chattisgarh
- ✓ Ministry of Environment and Forest (MoEF), Govt. of India
- ✓ Ministry of Non-conventional Energy Sources (MNES)
- ✓ Ground water Department
- ✓ Non-Governmental Organizations (NGOs)
- ✓ Consultants
- ✓ Equipment Suppliers

Stakeholders list includes the government and non-government parties, which are involved in the project at various stages. VVL has not only communicated with the relevant stakeholders under statutory obligations but also have engaged the other stakeholders in a proactive manner in expressing and accounting their opinions on the project.

G.2 Summary of the comments received:

Stakeholders Involvement

The village Panchayat / 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 very necessary. VVL has already completed the necessary consultation and documented their approval for the project.

The local community mainly comprises of the local people in and around the project area. The roles of the local people are as a beneficiary of the project. They supply of raw material i.e, rice husk form rice mills for the power plant. In addition to this, it also includes local manpower working at the plant site. Since, 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 a barren land of the industrial area. In addition to the above, the local population is also an indirect consumer of the power that is generated and supplied from the power plant because of the fact that the power sold to the grid improves the power reliability and stability in the local electricity network.

The distance between the power plant and CSEB sub-station for evacuation of power is not too high, installation of transmission lines does not create any inconvenience to the local population.

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.

State Pollution Control Board and Environment Department of the Government of Chattisgarh have prescribed standards of environmental compliance and monitor the adherence to the standards.

As proposed by the promoter of the project, water requirements of the project are met through deep tube wells. Study conducted to assess environmental impact suggests that the project is located in a plain terrain with gentle undulations here and there. River *Arpa* flows at a distance of 3.8 Kms from the project site. The river is perennial is nature and even during peak summer there is sufficient water flow in the river. So there is sufficient ground water available throughout the year without causing any scarcity of water in the surrounding areas due to the project.

Chattisgarh State Renewable Energy Development Agency (CREDA) is one who implements policies in respect of non-conventional renewable power projects in the state of Chattisgarh. CREDA has accorded its support for the project. Further, State's apex body of power is CSEB and they have already issued consent for the installation and operation of the rice husk (biomass) based power plant of 7.7 MW capacity under section 44 of the Electricity (Supply) Act, 1948.

As a buyer of the power, the CSEB is a major stakeholder in the project. They hold the key of the commercial success of the project. CSEB has already cleared the project and VVL has signed the Power Purchase Agreement (PPA) with CSEB.

The Government of India, through MNES, has been promoting energy conservation, demand side management and viable renewable energy projects including wind, small hydro, solar and biomass power generation projects.

One of the most crucial stakeholders is the Rice mill Association. One such Association has patronised the project.

Projects consultants are to be involved in the project to take care of the various pre contact 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, successful commissioning and trial run.

G.3 Report on how due account was taken of any comments received:

The relevant comments and important clauses mentioned in the project documents / clearances like Detailed Project Report (DPR), environmental clearance, Power Purchase Agreement (PPA), local clearances *etc.* were considered while preparing the CDM Project Design Document. The VVL representative met with the local NGOs and apprised them about the project and sought their support for the project.

As per UNFCCC requirement the PDD will be published at the validator's web site for public comments.

Annex 1

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

(Please repeat table as needed)

Organization:	Vandana Vidhyut Limited
Street/P.O.Box:	M. G. Road
Building:	Vandana Bhawan
City:	Raipur
State/Region:	Chattisgarh
Postcode/ZIP:	492001
Country:	India
Telephone:	0771 - 2535440
FAX:	0771 - 2535804
E-Mail:	Vil-nib@sancharnet.in
URL:	
Represented by:	Mr. Satish Kumar
Title:	Manager (F & A)
Salutation:	Mr.
Last Name:	Kumar
Middle Name:	
First Name:	Satish
Department:	F & A
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Till now funding from any Annex I party is not available.

Appendix I : Abbreviations

BAU	Business as Usual
BM	Build Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CH_4	Methane
cm	Centimetre
CM	Combined Margin
CMF	Combined Margin factor
CO_2	Carbon di-oxide
CPCB	Central Pollution Control Board
CSEB	Chattisgarh State Electricity Board
DCS	Distributed Control System
DM	De-Mineralised
DPR	Detailed Project Report
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
EPS	Electric Power Survey
CER	Emission Reduction Unit
ESP	Electro Static Precipitator
FBC	Fluidized Bed Combustion
FY	Financial Year
GHG	Greenhouse Gas
GI	Galvanised Iron
GWh	Giga Watt hour
HDPE	High Density Poly ethylene
HTS	High Tensile Steel
IEA	International Energy Agency
IPCC	Intra-governmental Panel for Climate Change
IREDA	Indian Renewable Energy Development Agency
kg	Kilogram
$kgCO_2$ equ	Kilogram of carbondioxide equivalent
km	Kilo metres
KVA	Kilo Volt Ampere
kW	Kilo Watt

kWh	Kilo Watt hour
M & P	Modalities and Procedure
MIS	Management Information System
MNES	Ministry of Non-conventional Energy Sources
MP	Madhya Pradesh
MT	Metric Ton
MU	Million units
MW	Mega Watt
N_2O	Nitrous Oxide
NTPC	National Thermal Power Corporation
OECD	Organisation for Economic Co-operation and Development
OM	Operating Margin
p.a	Per annum
PLF	Plant Load Factor
PP	Polypropylene
PPA	Power Purchase Agreement
SEB	State Electricity Board
SECL	South Eastern Coalfields Limited
SPM	Suspended Particulate Matter
STG	Steam Turbine Generator
T & D	Transmission and Distribution
tph	Tonnes Per Hour
TPP	Thermal power Plant
UNFCCC	United Nations Framework Convention on Climate Change
VVL	Vandana Vidhyut Limited
w/w	Weight by weight

Appendix II : List of References

Sl..No.	Particulars of the references
1.	Kyoto Protocol to the United Nations Framework Convention on Climate Change
2.	Website of United Nations Framework Convention on Climate Change (UNFCCC), **http://unfccc.int**
3.	UNFCCC Decision 17/CP.7 : Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol.
4.	UNFCCC , Clean Development Mechanism Simplified Project Design Document For Small Scale Project Activities (SSC-PDD) *[Version 01 : 21 January, 2003]*
5.	UNFCCC document : Annex B to attachment 3 Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories *[Version 02: 2 December, 2003]*
6.	Practical Baseline Recommendations for Green House Gas Mitigation Projects in the Electric Power Sector, OECD and IEA Information
7.	Various project related information / documents / data received from Vandana Vidhyut Limited
8.	An Overview of CSEB; CSEB-1_2Energy 02.htm; Chattisgarh State – Power.htm
9.	Website of Central Electricity Authority (CEA), Ministry of Power, Govt. of India - **www.cea.nic.in**
10.	CEA published document "Sixteenth Electric Power Survey of India"
11.	CEA published Report on "Power on Demand by 2012, Perspective plan studies"
12.	CEA Report on, Fourth National Power plan 1997 – 2012.
13.	Website of Ministry of Power (MoP), Govt. of India **www.powermin.nic.in**
14.	A paper on Anthropogenic Emissions from Energy Activities in India: Generation and Source Characterisation by Moti L. Mittal and C. Sharma.
15.	Website of Indian Renewable Energy Development Agency (IREDA), **www.ireda.nic.in**
16.	Detailed Project Report of VVL
17.	EIA Report of VVL
18.	http://www.chattisgarh.nic.in/power/power1
19.	http://www.cseb-powerhub.com/
20.	http://www.chattisgarh.nic.in/opportunities/Power
21.	http://www.ntpc.co.in
22.	http://www.jindalsteelpower.com
23.	http://www.powercitykorba.com
24.	http://www.npcil.org
25.	http://www.osc.edu/research/pcrm/emissions/