CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

4MW Waste Heat Recovery based power project by GRSPL, India

Version 1.3
Date: 01/08/2007

A.2. Description of the project activity:

The project activity entails utilisation of waste heat of flue gases generated in DRI kilns of sponge iron plant of G.R. Sponge & Power Limited ("GRSPL" hereafter) for power generation. The power produced will be used to meet in-house power requirement of GRSPL. This will displace equivalent amount of power from the Chattisgarh State Electricity Board (CSEB) grid, which is part of Western Region (WR) grid in India and is primarily fossil fuel based. The project activity would result in reduced Green house gases (GHG) emissions by avoiding generation of equivalent power in grid connected power stations.

GRSPL produces sponge iron in two kilns of 100 TPD each. Annual sponge iron production is ~60000 TPA. The two kilns generate ~25000 Nm3/hr high temperature flue gases from each kiln. The temperature of flue gases from the kiln entering into Waste Heat Recovery Boiler (WHRB) is at ~950-1000 deg C. Waste heat of flue gases will be utilised in generation of steam in WHRB which would be further expanded in an extraction-condensing turbine of 8MW to generate power. Power generation from WHRB steam is equivalent to 4 MW and other 4 MW will be generated from steam in coal based Atmospheric Fluidised Bed Combustion (AFBC) boiler. Steam from WHRB and AFBC will be taken to turbine through a common header. In the absence of the project activity, GRSPL would have continued to draw power from CSEB grid, which is part of Western Region (WR) grid. The project activity thus displaces equivalent amount of power generation in WR grid connected power stations.

The project faces many barriers against its implementation and GRSPL envisage mitigating the risk in the project activity with CDM backed benefit.

Sustainability aspect of the project activity:
The proposed project activity has a number of sustainability aspects as described below –

- The project activity helps reduce GHG emission in power generation in the grid, which is primarily fossil fuel based
- It helps in conservation of natural resources i.e. fossil fuels in power generation
- It generates employment during construction/ commissioning and later on operation & maintenance of the plant
- It provides the necessary impetus to other industries to come up with similar projects and become self-sustainable for their power needs
- With many projects coming up, technology suppliers/manufacturers will put in more efforts/ funds in further improvement of equipment/ machinery and help in removing existing technological barriers to implementation of such project activities.

- Reduced emission of NOx and SOx due to avoidance of combustion of fossil fuels in power generation.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (yes/no)
Government of India	G. R. Sponge & Power Limited (GRSPL)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Host country: India

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

District: Raipur
State: Chattisgarh

A.4.1.3. City/Town/Community etc:

Village: Siltara Industrial Area

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project activity is located in Raipur District in the state of Chattisgarh. The project site is nearly ~17 km. from the nearest airport at Raipur and nearest highway is NH-200. Project site is located at Latitude: 21° 20’ to 21° 25’ N & Longitude: 81° 35’ to 81° 40’ E.

Physical address of the project site is:

G.R. Sponge & Power Limited
Plot-102, Phase II, Siltara Industrial Area
Raipur, Chattisgarh, India
Phone: 0771 - 2253704/ 2254802
Fax: 0771 – 2254873

The physical location is depicted in the maps below –

A.4.2. Category(ies) of project activity:

Approved consolidated baseline methodology **ACM0004 "Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation"**

Reference: Version 02, Sectoral Scope 01, dated 03rd March 2006

A.4.3. Technology to be employed by the project activity:

GRSPL is setting up 2X10 TPH WHRB for utilising high temperature heat of flue gases from DRI kilns. The temperature of flue gases After Burning Chamber (ABC) is at 950-1000 deg C. Steam is generated at 67 kg/cm2 and 490 deg C and expanded in one bleed cum condensing turbine of 8MW to generate power. WHRB steam generates 4 MW power equivalents. One Atmospheric Fluidised Bed Combustion (AFBC) boiler is also being installed, which runs on coal and char from the kiln. Steam from both WHRB and AFBC boiler through a common header is fed to turbine to run it at full rated capacity of 8MW.

WHRBs have been procured from M/s A.V.U. Engineers Pvt. Ltd. WHRB is based on four pass thermal technology. The four passes are divided in four zones for optimum heat transfer. First pass consists of zone of Water Cooled Membrane Walls for maximum recovery of heat through radiation. Second phase comprises of Super Heater with Membrane Walls. It is a two stage super heater and heat is transferred through convection and radiation to water walls. Apart from this Evaporator with Membrane Walls use heat through convection & radiation. In third phase, heat is recovered in economiser for feed water preheating. The fourth pass is connected to Electrostatic Precipitator (ESP) and helps in controlling flue gas temperature to required levels.

Waste Heat Recovery Boiler

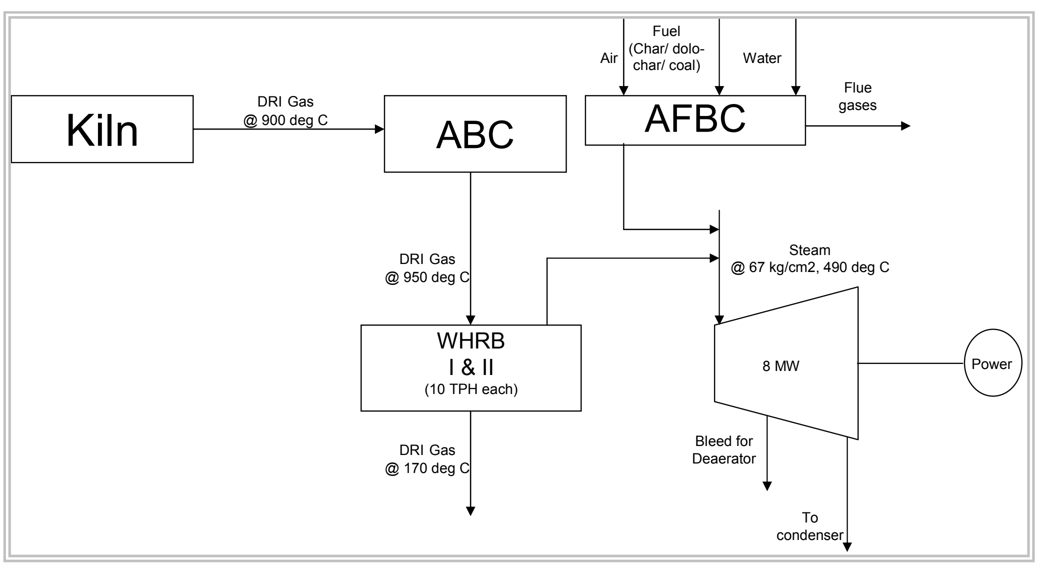
Capacity	10 TPH
Steam Pressure	67 kg/cm2
Steam Temperature	490 +- 5 deg C
Nos.	02 Nos.
Flue gas inlet temp.	950 deg C
Flue gas inlet to ESP	170 deg C
Make	M/s AVU Engineers Pvt. Ltd.

The dust in flue gases is arrested in 3 stages. One, at the furnace entry of boiler through dust hopper provided at the bottom of furnace. Second, the carry over dust from furnace are removed in super heater and collected at dust hopper at the bottom of super heater chamber. Third, dust particles are arrested at the bottom of economiser hopper.

Turbine

Rated Capacity	8 MW
Steam Inlet Pressure	64 kg/cm2
Steam Inlet Temperature	485 +- 5 deg C
Nos.	01 Nos.
Bleed pressure for deaerator	4 ATA
Make	Triveni Engineering

The turbine is a multistage, nozzle governed impulse type bleed cum condensing steam turbine of 8MW. Inlet steam conditions are 64 kg/cm2 and 485 deg c. The inlet steam flow is 36 TPH. Approx. 3 TPH Bleed is at 4 ata.



A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tones of CO2 e
2007-08	16340
2008-09	18301
2009-10	19608
2010-11	19608
2011-12	19608
2012-13	19608
2013-14	19608
2014-15	19608
2015-16	19608
2016-17	19608
Total estimated reductions (tonnes of CO2 e**)**	191509
Total number of crediting years	10 years fixed
Annual average over the crediting period of estimated reductions (tonnes of CO2e**)**	19151

A.4.5. Public funding of the project activity:

No public funding (ODA and/ or Annex 1 countries) for the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

- Approved consolidated baseline methodology **ACM0004 "Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation"**
  - Reference: Version 02, Sectoral Scope 01, dated 03rd March 2006
- Approved consolidated monitoring methodology **ACM0004 "Consolidated monitoring methodology for waste gas and/or heat and/or pressure for power generation"**
  - Reference: Version 02, Sectoral Scope 01, dated 03rd March 2006
- **Tool for the demonstration and assessment of additionality (version 02)**
  - Reference: Version 02, dated 28 November 2005

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

Methodology	Applicability Criteria	Project Status
Approved Consolidated methodology ACM0004;	This methodology applies to project activities that generate electricity from waste heat or the combustion of waste gases in industrial facilities.	The proposed project activity is a power generation project from waste heat from DRI kilns in a sponge iron plant
"Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation"	The methodology applies to electricity generation project activities: That displace electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels;	The project activity displaces Chattisgarh State Electricity Board power, part of WR grid.

B.3. Description of the sources and gases included in the project boundary

For the purpose of determining GHG emissions of the **project activity**, project participants shall include:

1. CO_2 emissions from combustion from auxiliary fossil fuels

For the purpose of determining **baseline emissions**, following emission sources have been included:

2. CO_2 emissions from fossil fuel fired power plants connected to the electricity system;
3. CO_2 emissions from fossil fuel fired captive power plants supplying the project site facility;

The **spatial extent** of the project boundary comprises the waste heat or gas sources, captive power generating equipment, any equipment used to provide auxiliary heat to the waste heat recovery process, and the power plants connected physically to the electricity grid that the proposed project activity will affect.

The combined margin is calculated as described in ACM0002.

Following emissions sources are included in the project boundary for determination of both baseline and project emissions.

Emissions	Source	Gas		Justification/ explanation
Baseline Emissions	Grid electricity generation	CO2	Included	Main emission source
		CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.
	Captive electricity generation	CO2	Excluded	There is no captive power generation at the project site.
		CH4	Excluded	Excluded for simplification. This is conservative.
		N2O	Excluded	Excluded for simplification. This is conservative.
Project Emissions	On-site fossil fuel consumption due to project activity	CO2	Excluded	No fossil fuel combustion in the project activity is envisaged.
		CH4	Excluded	Excluded for simplification
		N2O	Excluded	Excluded for simplification
	CO_2 emissions from combustion from auxiliary fossil fuels Combustion of waste gas for electricity generation	CO2	Excluded	Excluded as combustion of waste gases not required.
		CH4	Excluded	Excluded for simplification
		N2O	Excluded	Excluded for simplification

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The baseline scenario alternatives include all possible options that provide or produce electricity for in-house consumption excluding baseline options that either do not comply with legal and regulatory requirements or depend on key resources such as fuels, materials or technology that are not available at the project site

The identified possible alternative scenarios in absence of the CDM project activity would be as follows:

1. The proposed project activity not undertaken as a CDM project activity
2. Import of electricity from the grid as continuation of current scenario
3. Captive power generation based on coal
4. Captive power generation based on diesel
5. Captive power generation based on gas
6. Captive power generation based on hydro/ wind

7. Other uses of waste heat

All above options have been analyzed on whether these comply with the legal and regulatory requirements and/or depend on key resources such as fuels, materials or technology that are not available at the project site.

Power Source	Explanation
Proposed project activity from GRSPL not undertaken as CDM project activity	Energy source required in power generation in the project activity is available as waste heat in high temperature flue gases from DRI kilns of GRSPL sponge iron plant. This alternative is in compliance with all applicable legal and regulatory requirements but faces many barriers and would not have come up in the absence of CDM benefits (as detailed in section B.5) hence this option is not a baseline option.
Coal based CPP	Chattisgarh State is one of the three states (others are Orissa and Jharkhand) which have most of the coal deposits in India. As per Ministry of Coal (http://www.coal.nic.in/), Government of India, these 3 states contribute ~70% of the total coal reserves in India and Chattisgarh's contribution is at 23%. Availability of coal for power generation in Chattisgarh is a non-issue. This is reflected by the fact that power generation based on coal combustion contributes to about 95% for utilities (Annual General Review 2004-05: Central Electricity Authority, CEA; http://www.cea.nic.in/power_sec_reports/general_review/0405/ch3.pdf). The advantages for this option are high PLF, well established technology, easily available char and coal fines within the company and from neighbouring sponge iron industries (these are available free of cost to the project promoter). This alternative is in compliance with all applicable legal and regulatory requirements and can be a baseline option.
Diesel based CPP	Availability of diesel for DG set is not a problem in Chattisgarh and is a likely proposition for GRSPL. This alternative is in compliance with all applicable legal and regulatory requirements and can be a baseline option.
Gas based CPP	In India there are total 147 coal based sponge iron plants and only 3 of these are based on natural gas. All the 3 units are based in the western part of India where plants have proximity to natural gas (Survey of the Indian Sponge Iron Industry, JPC report, 2005-06). None of the gas based units is based in Chattisgarh because natural gas is not available in Chattisgarh (availability of gas is restricted only to western region of India). Hence, this option is ruled out as an alternative baseline scenario.
Renewable power	This option is in line with legal and regulatory requirements of centre and state as applicable. But the sources of hydro and/ or wind are not available to the project proponent at the site; hence ruled out as plausible alternative scenario.
Other uses of waste heat	Waste gases from the kiln do not have any other alternative use but the project activity and so is not a baseline option.
Import from Grid	This alternative is in compliance with all applicable legal and regulatory requirements and can be a baseline option. GRSPL had been drawing grid power prior the project activity.

Hence, identified alternatives available to GRSPL for power are following:

1. Import of electricity from the grid as continuation of current scenario
2. Captive power generation based on coal
3. Captive power generation based on diesel

Parameter	***Grid based power***	***Coal based CPP***	***Diesel based CPP***
Capital Cost	Nil	~Rs 4.0 Crores/ MW Source: Central Electricity Authority in India.	Rs 3.5 Crores/MW Source: Central Electricity Authority in India.
Cost of Power	Rs 2.55 basic cost + demand charges	~Rs. 1.56/ kWh Source: Central Electricity Authority in India. The cost of power generation using coal would be lower for GRSPL as coal char, fines are available free of cost. Char from the DRI kilns is also available and that can be used along with coal as fuel to generate power in AFBC and that will further reduce the cost of power generation.	~ Rs 5.96/kWh Source: Central Electricity Authority in India.

Based on the above information it is evident that “Import of electricity from the grid” requires the minimum investment. However, unit power generation is the lowest for the coal/ char based power plants. However as grid based power has lower emission factor compared to that from coal based power generation, to be conservative “Import of electricity from the grid” has been considered as the baseline scenario in this project activity.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

Additionality of the project activity is determined based on **Tool for the demonstration and assessment of additionality** (version 02); dated 28 November 2005.

This document provides for a step-wise approach to demonstrate and assess additionality. These steps include:

1. Identification of alternatives to the project activity;

2. Investment analysis to determine that the proposed project activity is not the most economically or financially attractive;
3. Barriers analysis;
4. Common practice analysis; and
5. Impact of registration of the proposed project activity as a CDM project activity.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

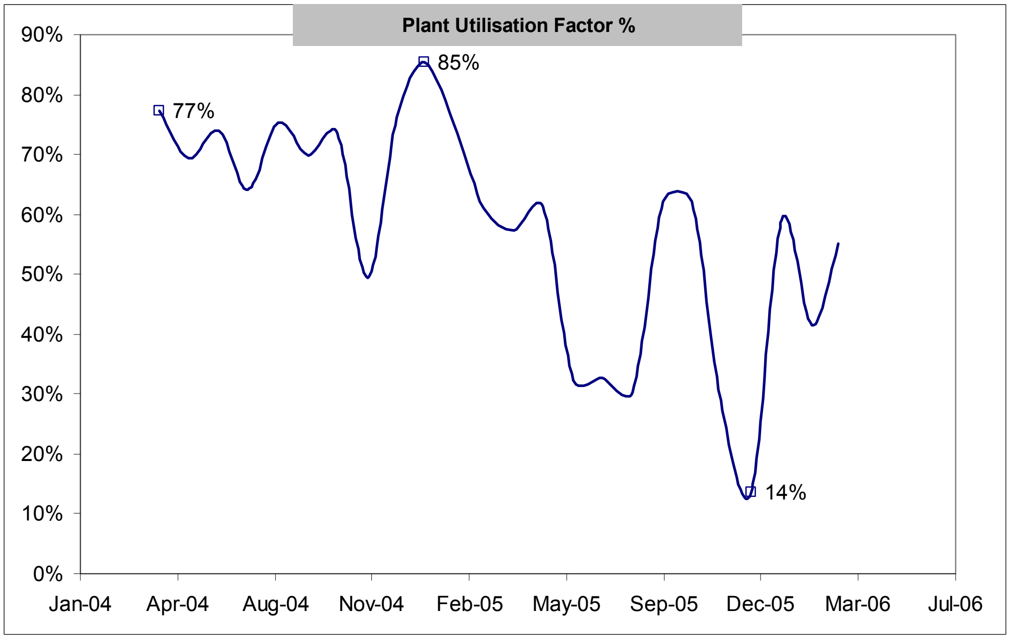
Sub-step 1a. Define alternatives to the project activity:
As explained in section B.4 following are considered plausible alternatives to proposed project activity:

1. The proposed project activity not undertaken as a CDM project activity
2. Import of electricity from the grid as continuation of current scenario
3. Captive power generation based on coal
4. Captive power generation based on diesel

Sub-step 1b. Enforcement of applicable laws and regulations:
All the alternatives listed as above are well in line with the regulatory requirements of the state and central authority in India and neither of these is prohibited from prevailing rules and regulations. Thus, all the alternatives qualify for the next step of the tool.

Step 3: Barrier Analysis

Technological barriers
Fluctuating production from kiln
Success of the proposed project activity depends on uninterrupted supply of waste gases from kilns at consistently high temperatures to waste heat recovery boilers. However, supply of high temperature flue gases depends on continuous operation of kilns. Inconsistent availability of flue gases from kilns is a major risk for setting up a WHRB, this risk is also evident from the fact that kiln utilisation factor at MSPPL has not been quite consistent due to various reasons in recent past. This variation in production from the kiln has direct impact on quantity of coal burned in kiln and hence on the quantum of waste gas generation. Production data of GRSPL for the past 24 months shows that production of kiln has not been consistent with plant utilisation factor becoming as low as 14% over this period. Low capacity utilisation of kilns would have direct impact on project's viability.



Low capacity utilization of kilns may be linked to operational problems, technological issues and unavailability of raw material for kiln operation. These points have been discussed in following sections.

Raw material un-availability

As per the survey from Joint Plant Committee (JPC) set up by Government of India, major constraints toady faced by Indian sponge iron industry are related to raw material (availability & prices), power and to some extent labour & investments. Management of iron ore for kiln is a major hurdle in successful and continuous operation of kiln. With growing numbers of sponge iron plants, this situation will only become worse affecting small & medium industries more. A feature in Jan 2006 edition of Steel World[1] reports that 70 of 115 units in Chattisgarh went on strike in December 2005 and stopped production due to recurring shortage of iron ore. The scarcity of raw material has a direct impact on price of raw materials and that also makes the entire project risky.

Raw material quality

Availability constraint for raw material has forced industries to opt for iron ore of lesser quality. Quality of iron ore is judged on the basis of Fe content, moisture level and presence of fines in it. Fines in iron ore is not desired as most of the fines escape during reduction process from the kiln and result in more losses & low production. The presence of fines in flue gases also causes problems in WHRB operation. Similarly presence of iron ore with size larger than normal requires more coal. This leads to more load in form of particulate matter in flue gases. Also particulate matter carries some heat of coal and quantum of actual usable energy is reduced at WHRB inlet.

Problems in operation & maintenance[2]

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[1] http://www.steelworld.com/analysis0106.pdf ; "*Ban on ore exports gaining momentum*"

[2] http://www.steelworld.com/technology7.pdf ; "*Sponge Iron Industry – An overview of problems & solutions*"

- Handling of high particulate matter laden waste gas from kiln is tricky. High PM level causes erosion and abrasion of mechanical parts which is speeded up at high temperature of these gases. Higher rate of erosion than normal may lead to more frequent changes in mechanical parts/ machinery resulting in more shutdown and/ or breakdown of system.

- Other than erosion of parts, fusion of ash and formation of clinker build up at high temperatures is another area of concern. This phenomenon is called "Accretion". Accretion leads to clinker build up inside the kiln, restricting its opening, which requires frequent cleaning and hence more kiln stoppages or shorter campaign life. Shorter campaign life directly impacts availability of waste gases for power generation in project activity. This is further affected if inferior quality of raw material is used in kiln. The problem is particularly severe to small capacity kilns with smaller sizes as in the project activity.

- Presence of sulphur aggravates the situation as it restricts the temperature gradient available for utilization. For, if temperature of waste gas is brought below 170 deg C, then possibility of sulphuric acid formation in the system is increased leading to corrosion of vital machinery/ parts in down stream. This keeps a tab on extent of utilization of waste heat in the system in power generation. The presence of moisture at times complicates the situation as it speed up the formation of acid in economiser area. In case of WHRB the economiser life may be affected because of formation of sulphurous and sulphuric acid in economiser.

The above problems associated with kiln operation result in fluctuating production i.e. fluctuating quantum of waste heat availability for steam generation in WHRB. This is specific to WHRB operation only and not the case with coal/ char based AFBC boilers.

Barriers due to prevailing practice

GRSPL is one of the units of Agrawal Group (others are Ramesh Steel Industries & Ramesh Steel Industries Unit-II). Ramesh Steel Industries is a rolling unit & Ramesh Steel Industries unit-II is rolling unit with mini steel plant having 2 Nos. of 2500 kW Induction Furnaces operating since March 2003. Ramesh Steel Industries has a contract demand of 7000 kVA from Chattisgarh State Electricity Board. GRSPL started its first DRI kiln of 100TPD in Feb. 2004. The Sponge Iron so produced was used captively in Ramesh Steel Industries Unit-II. Later in year 2005, GRSPL started production in another 100TPD Kiln. Simultaneously GRSPL thought that they should go for power plant as GRSPL could generate 4MW through WHRB (from the two kilns together) & 4MW by setting-up an AFBC Boiler (Installation of AFBC was required to support power generation from WHRB as it is highly uncertain due to various reasons). The power generation potential from the power project was more than the in-house requirement at the sponge iron plant of GRSPL, it thought of wheeling additional (approx. 4 MW) power to Ramesh Steel Industries Unit-II which had been buying power from the state grid with balance to be consumed at GRSPL in exiting units and also by installing additional capacity of Induction Furnace at GRSPL. But in view of financial constraints GRSPL decided to go for power generation through WHRB initially with turbine capacity of 8MW with plan to expand later through AFBC installation. Accordingly GRSPL applied for financial support from Andhra Bank. Meanwhile, CSERC issued a tariff order changing from existing single part tariff to two-part tariff for Mini Steel Plants. Simultaneously substantial wheeling charges were imposed on captive power producers (wheeling charges had been revised to Rs. 0.22/ kWh and 6% in kind of the total power injected) along with huge transmission charges in cash and kind (3.71% of the total power injected). So it became unviable for GRSPL to wheel power to its own unit Ramesh Steel Industries as the sale realisation dropped to ~Rs.1.80/kWh. GRSPL also thought of the possibility of selling additional power to third party, which could not be found out as viable option as the sale realisation was too low. Under these circumstances GRSPL had to acquire neighbouring Ferro Alloys Unit (M/s Agrawal Sponge Pvt. Ltd.-Ferro Alloys Division) in the name of group unit M/s G.R. Minerals & Industries Pvt. Ltd. so as to enable power transfer from the project activity to the unit and surplus to be made available for sale to state grid. But it faced another constraint as it was made mandatory (Central Electricity Act) to use 51% power for captive purpose to become eligible for sale of balance 49% @ 2.32 to CSEB and it should be firm power. For this, M/s G.R. Minerals & Industries Pvt. Ltd. also had to acquire 26% stake in GRSPL to become eligible captive end-user of power plant. The unit is still lying idle waiting to get power from GRSPL. GRSPL faced a number of such barriers to make this project happen and also, investments in other units increased load on account of additional interest burden.

Lack of managerial resources
Power generation is not a core business activity for GRSPL and this is the first power generation project for them. GRSPL lacked expertise and experience in operation of such project activity. Operation of WHRB & turbine and synchronisation with kiln operation and production of sponge iron perceived a big task by the project proponent. The operation of WHRB based power generation has specific problems as described above.

All these barriers as described above pose many obstacles for such project activity to happen and hence it is not a business-as-usual scenario.

Step 4: Common Practice
As per one report[3] conducted by Joint Plant Committee (JPC) constituted by Government of India, the total no of coal based sponge iron plants in India is 147 and gas based sponge iron plants is 3 with a cumulative capacity of 17 million tonnes. Out of 147 coal based sponge iron plants, 38 plants are located in the state of Chattisgarh. Only 16 units out of 147 have existing facilities for captive power plant. Chattisgarh has 8 of these 16 plants. These data is indicative of the fact that despite DRI gas being of no alternative use, sponge iron plants have not opted for power plants due to the barriers as described in sections above. The DRI based power plants do face barriers which are real. Among 8 power plants in Chattisgarh, 4 have already been registered as CDM project activities[4]. Another 3 have applied for CDM registration and are in different stages of approval. GRSPL's project activity is a similar activity and is a fit case for CDM registration.

Step 5: Impact of CDM registration
The registration of the proposed project activity as CDM project would help in covering the risks involved with such projects. This will help in enhancing the viability of project which otherwise is affected by low PLF, unavailability of DRI gas due to shut-down or break-down and other factors related

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[3] "*Survey of the Indian Sponge Iron Industry : 2005-06*" by Joint Plant Committee

[4] 4 registered CDM projects in Chattisgarh:

- Godavari Power & Ispat Limited , http://cdm.unfccc.int/Projects/DB/SGS-UKL1139564002.3/view.html
- Jindal Steel & Power Limited http://cdm.unfccc.int/Projects/DB/BVQI1143808492.42/view.html,
- Monnet Ispat Limited http://cdm.unfccc.int/Projects/DB/SGS-UKL1146048256.38/view.html &
- Vandana Global Limited http://cdm.unfccc.int/Projects/DB/SGS-UKL1147179019.14/view.html

to low capacity utilization of kiln and subsequent lower availability of high temperature waste gases. This will also encourage other sponge iron plants in Chattisgarh and on national level to come up with similar power plants. This would provide the required impetus to technology providers to further their efforts towards better technology development for the use of DRI kiln gas energy in power generation. As the power generation based on WHRB is highly unstable, benefits accruing from CER sale in the project activity would provide much needed financial support.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Project Emissions

Project Emissions are applicable only if auxiliary fuels are fired for generation startup, in emergencies, or to provide additional heat gain before entering the Waste Heat Recovery Boiler.

$$PE_y = \sum_i Q_i \times NCV_i \times EF_i \times \frac{44}{12} \times OXID_i$$

where:

PE_y = Project emissions in year y (tCO_2)

Q_i = Mass or volume unit of fuel *i* consumed (t or m3 or KL)

NCV_i = Net calorific value per mass or volume unit of fuel *i* (TJ/t or m3 or KL)

EF_i = Carbon emissions factor per unit of energy of the fuel *i* (tC/TJ)

$OXID_i$ = Oxidation factor of the fuel *i* (%)

Baseline Emissions

$$BE_{electricity,y} = EG_y \cdot EF_{electricity,y}$$

where:

EG_y = Net quantity of electricity supplied to the manufacturing facility by the project during the year y; MWh

EF_y = CO_2 baseline emission factor for the electricity displaced due to the project activity during the year y; tCO_2/MWh

CO2 baseline emission factor in the baseline scenario is determined to be grid power supply, the Emissions Factor for displaced electricity is calculated as in ACM0002.

Leakage

No leakage is considered.

Emission Reduction

$$ER_y = BE_y - PE_y$$

where:

ER_y = Emissions reductions of the project activity during the year y in tons of CO2,

BE_y = Baseline emissions due to displacement of electricity during the year y in tons of CO2,

PE_y = Project emissions during the year y in tons of CO2

Grid Emission Factor
Grid Emission Factor for Western Grid (Grid in the project activity) has been taken from "CO2 Baseline Database for the Indian Power Sector" – Central Electricity Authority (CEA); Ministry of Power

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

(Copy this table for each data and parameter)

Data / Parameter:	**CM**
Data unit:	tCO2/ MWh
Description:	Combined Margin – WR grid
Source of data used:	"CO2 Baseline Database for the Indian Power Sector" – Central Electricity Authority (CEA); Ministry of Power (2004-05)
Value applied:	0.890
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Project Emissions:
No fuel combusted during start up in waste heat recovery boiler
hence,
PEy = 0.0 tCO2e/ annum

Baseline Emissions:
Power generation capacity from waste gas = 4 MW
Plant run hours = 6000 per annum for first year & 6720 in second year and 7200 per annum for subsequent years
Load factor = 85 %
Auxiliary consumption = 10 %
Grid emission factor = 0.89 tCO2e/ MWh
Net power generation = 4 X 6000 X 0.85 X (1-0.1) = 18360 MWh per annum

Baseline emissions BEy = 18360 X 0.89 = 16340 tCO2e per annum

Emissions reduction = 16340 – 0.0 = 16340 tCO2e per annum

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

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
2007-08	0.0	16340	0	16340
2008-09	0.0	18301	0	18301
2009-10	0.0	19608	0	19608
2010-11	0.0	19608	0	19608
2011-12	0.0	19608	0	19608
2012-13	0.0	19608	0	19608
2013-14	0.0	19608	0	19608
2014-15	0.0	19608	0	19608
2015-16	0.0	19608	0	19608
2016-17	0.0	19608	0	19608
Total (tonnes of CO2e)	0.0	191509	0	191509

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**$EG_{,y}$**
Data unit:	MWh
Description:	Net power supplied to manufacturing facility due to waste heat recovery
Source of data to be used:	Plant operation data on power generation in project activity
Value of data applied for the purpose of calculating expected emission reductions in section B.5	18360
Description of measurement methods and procedures to be applied:	Net power generation due to waste heat recovery from DRI kilns is calculated as explained in Annex 4 of this document. Frequency of measurement: Continuously
QA/QC procedures to be applied:	Energy meter is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration: Yearly
Any comment:	

Data / Parameter:	$EG_{net, y}$
Data unit:	MWh
Description:	Net power generation from turbine
Source of data to be used:	Plant operation data on power generation in project activity
Value of data applied for the purpose of calculating expected emission reductions in section B.5	36720
Description of measurement methods and procedures to be applied:	Net power generation from turbine is calculated based on Gross Power generation and Auxiliary power consumption in the power plant Frequency of measurement: Continuously
QA/QC procedures to be applied:	Energy meter is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration: Yearly
Any comment:	

Data / Parameter:	$EG_{gross, y}$
Data unit:	MWh
Description:	Gross power generation from turbine
Source of data to be used:	Plant operation data on power generation in project activity
Value of data applied for the purpose of calculating expected emission reductions in section B.5	40800
Description of measurement methods and procedures to be applied:	Gross power generation from turbine is directly measured using meters installed at the project site. Frequency of measurement: Continuously
QA/QC procedures to be applied:	Energy meter is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration: Yearly
Any comment:	

Data / Parameter:	$EG_{aux, y}$
Data unit:	MWh
Description:	Auxiliary power consumption in power generation plant
Source of data to be used:	Plant operation data on power generation in project activity
Value of data applied for the purpose of	4080

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Auxiliary power consumption in the power generation plant is directly measured at the project site. Frequency of measurement: Continuously
QA/QC procedures to be applied:	Energy meter is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration: Yearly
Any comment:	

Data / Parameter:	**tG_{WHRB}**
Data unit:	Tonne/ day
Description:	Steam supplied from WHRB in project activity
Source of data to be used:	Plant operation data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	432
Description of measurement methods and procedures to be applied:	Steam flow from WHRB to the turbine is directly measured using flow meters installed at WHRB outlet Frequency of measurement: Continuously
QA/QC procedures to be applied:	Energy meter is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration: Yearly
Any comment:	

Data / Parameter:	**tG_{AFBC}**
Data unit:	Tonne/ day
Description:	Steam supplied from AFBC in project activity in year y
Source of data to be used:	Plant operation data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	432
Description of measurement methods and procedures to be applied:	Steam flow from AFBC to the turbine is directly measured using flow meters installed at AFBC outlet Frequency of measurement: Continuously

QA/QC procedures to be applied:	Energy meter is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration: Yearly
Any comment:	

Data / Parameter:	**$tG_{turbine}$**
Data unit:	Tonne/ day
Description:	Steam supplied to turbine inlet in project activity
Source of data to be used:	Plant operation data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	864
Description of measurement methods and procedures to be applied:	Steam flow to the turbine is directly measured using flow meters installed at turbine inlet Frequency of measurement: Continuously
QA/QC procedures to be applied:	Energy meter is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration of meter: Yearly
Any comment:	

Data / Parameter:	**P_{WHRB}**
Data unit:	kg/cm2
Description:	Pressure of steam supplied from WHRB
Source of data to be used:	Plant operation data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Steam pressure is directly measured using pressure gauge installed online Frequency of measurement: Daily
QA/QC procedures to be applied:	Pressure gauge is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration of meter: Yearly
Any comment:	

Data / Parameter:	**T_{WHRB}**

Data unit:	Deg C
Description:	Temperature of steam supplied from WHRB
Source of data to be used:	Plant operation data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Steam temperature is directly measured using temperature gauge installed online Frequency of measurement: Daily
QA/QC procedures to be applied:	Temperature gauge is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration of meter: Yearly
Any comment:	

Data / Parameter:	$\mathbf{P_{AFBC}}$
Data unit:	kg/cm2
Description:	Pressure of steam supplied from AFBC
Source of data to be used:	Plant operation data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Steam pressure is directly measured using pressure gauge installed online Frequency of measurement: Daily
QA/QC procedures to be applied:	Pressure gauge is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration of meter: Yearly
Any comment:	

Data / Parameter:	$\mathbf{T_{AFBC}}$
Data unit:	Deg C
Description:	Temperature of steam supplied from AFBC
Source of data to be used:	Plant operation data
Value of data applied for the purpose of calculating expected	-

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Steam temperature is directly measured using temperature gauge installed online Frequency of measurement: Daily
QA/QC procedures to be applied:	Temperature gauge is calibrated as per calibration frequency by eligible external agencies. Frequency of calibration of meter: Yearly
Any comment:	

B.7.2 Description of the monitoring plan:

GRSPL has procedures for monitoring and recording data on operation & maintenance of the plant/ equipments. The equipments used for CDM project are part of these procedures and document on maintenance and rectification done on all the equipments are maintained.

Unit Head is responsible for the overall functioning of the sponge iron plant & power plant. GRSPL adopts following procedures to assure the completeness and correctness of the data needed to be monitored for CDM project activity.

Formation of CDM Team:
A CDM project team is constituted with participation from relevant sections. People are trained on CDM concept and monitoring plan. This team is responsible for data collection and archiving. This team meets periodically to review CDM project activity, check data collected, emissions reduced etc. On a monthly basis, the monitoring reports are checked and discussed by the senior CDM team members/managers. In case of any irregularity observed by any of the CDM team members, it is informed to the concerned person for necessary actions. Further these reports are forwarded to the management monthly basis.

- *Unit Head:* Overall responsibility of compliance with the CDM monitoring plan.
- *Power plant In-charge:* Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation
- *Shift In-charge:* Responsibility of daily report generation

Day to day data collection and record keeping:
Plant data is collected on operation under the supervision of the respective Shift-in-charge and record is kept in daily logs.

Checking data for its correctness and completeness:
The CDM team is overall responsible for checking data for its completeness and correctness. The data collected from daily logs is forwarded to the central lab after verification from respective departments.

Reliability of data collected-
The reliability of the meters is checked by testing the meters on yearly basis. Documents pertaining to testing of meters are maintained.

Frequency-
The frequency for data monitoring shall be as per the monitoring details in Section B.7.1 of this document.

Archiving of data-
Data shall be kept for two years after the crediting period (total 12 years)

Calibration of instruments:
GRSPL has procedures defined for the calibration of instruments. A log of calibration records is maintained. Electrical department in the company is responsible for the upkeep of instruments in the plant.

Maintenance of instruments and equipments used in data monitoring:
The operation department is responsible for the proper functioning of the equipments/ instruments and informs the concerned department for corrective action if found not operating as required. Corrective action is taken by the concerned department and a report on corrective action taken is maintained as done time to time along with the details of problems rectified.

Internal audits of CDM project compliance:
CDM audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing.

Emergency preparedness:
The project activity does not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Report generation on monitoring:
After verification of the data and due diligence on corrective ness if required an annual report on monitoring and estimations shall be maintained by the CDM team and record to this effect shall be maintained for verification.

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

Date: 30/07/2006

Mr. Ramesh Agrawal
G.R. Sponge & Power Limited (Also a project participant)
Plot-102, Phase II, Siltara Industrial Area
Raipur (C.G.)
Phone: 0771 - 2253704/ 2254802
Mobile: 98261 26001
Fax: 0771 – 2254873
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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

06/09/2005

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

25 years

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

C.2.1. Renewable crediting period

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

>>
NA

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/07/2007 (or from the date of registration which ever is later)

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

GRSPL has conducted a Rapid Environment Impact assessment study for the project. This was done as per guidelines from Ministry of Environment & Forest (MoEF).For the study an area of 10 km radius was considered around the project site. Following areas were covered in the study –

1. Assessment of existing level of pollution on Air, water, noise, which included monitoring of ambient air quality for SPM, RSPM, NOx, SOx and CO

2. Collection of metrological data
3. Assessment of existing status of water, air, flora, fauna, demographic and socioeconomic factors
4. Assessment of impact of construction activities
5. Study of proposed pollution control equipments
6. Study of short term and long term impacts on endangered species and wild life, plants and economically important crop

The report was submitted to Chattisgarh Environment Conservation Board (CECB).

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

For evaluation of impacts by project activity on environment Battelle Environment Evaluation System (BEES) has been used. Impacts are tabulated as below on various aspects-

Biological Environment	Natural vegetation is not considerable and there are no rare and/ or endangered species within 10 km range.	No impact on these parameters envisaged
Water environment	No industrial waste water generated from the plant Domestic waste will be treated prior to disposal in septic tanks followed by soak pit.	No adverse impact envisaged
Air environment	During construction and other infrastructural activities and increased movements of vehicles, the level of suspended is likely to go higher slightly. No significant SO2 and NOx contribution from the plant are envisaged. Stack height is designed considering SO2 emissions.	No adverse impact envisaged
Land environment	Forest cover is not available in the project area. There will be no soil erosion as garland drain and sump will be constructed.	In development of green belt any adverse impact will be minimised.
Noise environment	Increased vehicular movement and construction activities may result in impact on noise environment. Occupational noise exposure is minimised using protective gears.	No adverse impact
Socio-economic environment	The construction and operation activities will create some new employment at local and regional	No adverse impact

	level. Positive impacts are anticipated due to project activity.	

SECTION E. Stakeholders' comments

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

Stakeholder consultation is carried out at different levels to cover a wide section of population. Local people, local government authorities and pollution control board were identified as stakeholders to project activity. GRSPL invited local people to attend a general meeting on project activity through public notice. An advertisement seeking views of all was published on 29/08/2006 in local daily Navabharat. Local gram panchayat and office of district authority were also consulted regarding the project activity. Minutes of meeting were compiled and recorded. Letters to gram panchayat and District Magistrate were sent on 24/08/2006.

E.2. Summary of the comments received:

Stakeholders appreciated efforts from GRSPL and extended their support for future projects also. They told that the project activity would help in pollution reduction in the region. Gram Panchayat Sarpanch applauded efforts from GRSPL and expressed his pleasure for setting up waste heat recovery based power project. He admitted that project activity would help in environment conservation.

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

Project activity received no negative comment from any of the stakeholders consulted.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	G. R. Sponge & Power Limited
Street/P.O.Box:	Plot No – 102
Building:	Phase II, Siltara Industrial Area
City:	Raipur
State/Region:	Chattisgarh
Postfix/ZIP:	
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E-Mail:	rameshsteel@yahoo.co.in
URL:	
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Agrawal
Middle Name:	
First Name:	Ramesh
Department:	
Mobile:	98261 26001
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Direct tel:	0771-2253704
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex 1 and / or ODA for the project activity.

Annex 3

BASELINE INFORMATION

Grid emission factor for the Western Grid is taken as suggested in "**CO2 Baseline Database for the Indian Power Sector"** by Central Electricity Authority (CEA), Ministry of Power, Government of India.

The value for Combined Margin for Western Grid (grid in the project activity) is given as 0.890 tCO_2e/ MWh.

Annex 4

MONITORING INFORMATION

Power generation from WHRB:
In the project activity, steam from WHRB and coal based AFBC is fed to the turbine through a common header. Steam flow meters are installed at respective boiler outlets and also at turbine inlet. Gross power generation from turbine is measured directly. Net generation is calculated by deducting auxiliary power consumption from gross power generation. The quality of steam from WHRB and AFBC i.e. temperature and pressure are same and so power linked with WHRB steam will be calculated pro-rata for the fraction of total steam energy supplied to the turbine.

Data to be monitored:

1. Steam quantity from WHRB in project activity to common header
2. Steam quantity from AFBC to common header
3. Steam quantity at turbine inlet
4. Gross power generation from turbine in power plant
5. Auxiliary power consumption in power plant
6. Pressure and temperature from WHRB and AFBC boilers

Calculation for net power generation attributable to steam from WHRB in project activity:

Step1: Net power generation from turbine in project activity

Net power generation from turbine = Gross power generation – aux power consumption

Step 2: Fraction of steam energy supplied due to WHRB

Option 1:
Fraction of steam energy from WHRB = Steam energy supplied from WHRB to common header / total steam energy input at turbine inlet from common header

Option 2:
Fraction of steam energy from WHRB = (total steam energy input at turbine inlet from common header - Steam energy supplied from AFBC to common header)/ total steam energy input at turbine inlet from common header

Choose from option 1 & option 2; whichever is less. This gives conservative estimations as any loss of steam in the way to turbine has been accounted towards WHRB steam.

Step 3: Net power generation from WHRB steam

Net power generation due to WHRB = Fraction of steam from WHRB X net power generation from the turbine

Estimation of steam energy Steam energy = Quantity of steam X Steam enthalpy

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