CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

"Waste Heat Recovery based captive power generation by SKS Ispat Ltd"

Version: 1.2
Date: 12th September 2006

A.2. Description of the project activity:

SKS Ispat Limited (SKSIL) has set up an integrated sponge iron plant of 2,10,000 MT capacity at Village Siltara, district Raipur, Chattisgarh. There are 2 X 350 TPD Kiln and 2 X 100 TPD Kiln for sponge iron production. Total Heat Energy as available from the Direct Reduced Iron (DRI) Gas of 2 X 350 TPD Kiln and 2 X 100 TPD Kiln, on conversion to Electrical Energy, produces about 25 MW of Electrical Power respectively. Harnessing this Power by establishing a suitably designed Captive Power Plant at the tail end of the 4 numbers of DRI Kilns enables SKSIL to be self reliant in the arena of Power requirement for production of Steel and to reduce emissions of green house gases into the atmosphere by displacing grid power use as the case was prior project activity which is primarily fossil fuel based.

Each 350 TPD DRI Kiln for Sponge Iron production emits normally around 90000 Nm³/hour of hot gas (temperature of 950-1000ºC) that contains heat energy of ~29,000,000 Kcal/hour which, if not suitably utilized, goes to waste. Similarly exit gas flow for each 100 TPD kiln is around 30000 Nm³/hour at around 950ºC that contains heat energy ~ 9,000,000 Kcal/hour.

Though Power generation through this CPP route is not an attractive alternative for SKSIL but company has decided to implement this project to meet its power requirements and to fulfil objective of being an environmentally conscious organization. Use of waste gases for power generation is a potential "Clean Development Mechanism (CDM)" project under Kyoto Protocol of UNFCCC. Carbon credits will help create an additional revenue stream for the project and help in mitigating various risks associated with the project.

Environmental Well Being
In India coal is the primary source of energy for power generation and production processes. The demand for electrical energy has been steadily increasing. Expansion of the electrical supply to new areas and rapid industrialization are the main reasons for the growth in demand of power. The project activity contributes to the welfare of environment at large considering the carbon di-oxide emissions that would have been generated by a thermal plant of equal capacity. The project hence decreases the future needs for coal based power generation by the grid and thereby reducing the CO_2 emissions from the electricity sector.

Social Well Being
Chattisgarh is witnessing major shortage of power. It is estimated that Chattisgarh is expected to have a peak shortage of around 540 MW[1] during the current financial year and continue to remain so till 2009-

[1] Ministry of Power (MOP) data

10 in spite of the increase in the installed capacities. The proposed project thus shall help in meeting demand-supply gap in the state.

Economic Well Being

The project activity provides a fillip to economic activity in the region. Direct & Indirect Employment has been generated in the plant for the project implementation & management. The project activity will also reduce load on the state grid, this surplus power in grid could then be utilised for meeting energy security for the region.

Technological Well Being

Power generation using waste heat is a cleaner technology for power generation. The success of the project activity will catalyse more Waste Heat Recovery (WHR) based power projects to come in the region.

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	SKS Ispat Limited (SKSIL)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The project site is about 21 km from Raipur; it is situated 1 km off the Raipur- Bilaspur Road and is at a distance of about 21 Km from the Raipur Railway Station.

A.4.1.1. Host Party(ies):

India

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

Raipur

A.4.1.3. City/Town/Community etc:

Village: Siltara
District: Raipur
State: Chattisgarh

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

The plant is located at Siltara, which is a well developed industrial area. The plant site is situated at about 1 KM from NH-6 on Bilaspur-Raipur route. Nearest railway station (7 KM from site) is Mandhar on South Eastern railway between Mumbai and Calcutta route. The plant site is located at 81^{o}35 E Longitude 21^{o}20 N Latitude.

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

The project is categorized in Scope Number 1; Sectoral Scope- Energy industries (renewable/non-renewable sources) as per Sectoral scopes related approved methodologies and DOEs (version 07 Oct 05|12:34)

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

The DRI Gas, as it comes out of the After Burning Chamber, contains sufficient quantity of Heat - Energy. This energy waste could be abated by installing Waste Heat Recovery Boiler at the tail end of each DRI Kiln which in fact works as a cooler for the high temperature gas. Heat that is extracted from the hot gas is utilised in transforming water to high temperature – high pressure Steam to run conventional Condensing type Steam Turbo – Generator. There is a 25 MW Turbo-generator to be fed by 2 x 12 TPH and 2 x 38 TPH WHRB Boilers. The temperature and pressure maintained in the boiler are 495 ^{O}C and 66 Kg/cm2. It has been envisaged that the Captive Power Plant will operate in synchronous mode with 132 KV grid of Chattisgarh State Electricity Board.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The project proposes to generate electricity by using heat of waste gases. In the absence of project activity the waste hot gases would be released into the atmosphere via the stack and power generated would have been generated by coal based system or from the grid (which is also fossil fuel based).

The grid based power generation has been considered to be base line scenario. The project activity, in effect, displaces power that would otherwise be supplied from regional grid. Thereby anthropogenic emissions of anthropogenic green house gas (GHGs) by sources are reduced by above mentioned project activity.
The project activity is not financially attractive and faces many operational barriers. Without CDM benefits it would have not been possible to implement the project. However taking into account economic value of CERs and the group's policy to invest in renewable energy projects, project proponent have decided to use hydro energy for power generation.

The estimated total reduction in tonnes of CO2 equivalent over the crediting period of 10 years = 1167730 tCO2e for the 10 years crediting period

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Years	**Annual estimation of emission reductions in tones of CO2 e**
Jan 07-Dec 07	116773
Jan 08-Dec 08	116773
Jan 09-Dec 09	116773
Jan 10-Dec 10	116773
Jan 11-Dec 11	116773
Jan 12-Dec 12	116773
Jan 13-Dec 13	116773
Jan 14-Dec 14	116773
Jan 15-Dec 15	116773
Jan 16-Dec 16	116773
Total estimated reductions (tonnes of CO2 e)	1167730
Total number of crediting years	10 Years fixed crediting period
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	116773

A.4.5. Public funding of the project activity:

No public funding from annex-1 countries for the project.

SECTION B. Application of a baseline methodology

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

Methodology: "Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation"

Reference: Approved consolidated baseline methodology ACM0004/Version 02, Sectoral Scope: 1, 03 March 2006

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The position of the CDM project activity vis-à-vis applicability conditions in the ACM 0004/Verson02 is described in the following table.

Applicability Conditions in the ACM0004/Version02	**Position of the project activity vis-à-vis applicability conditions**
This methodology applies to project activities that generate electricity from waste heat or the combustion of waste gases in industrial facilities.	The project activity is a waste heat recovery based power project.
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, electricity; ♦ where no fuel switch is done in the process, where the waste heat or pressure or the waste gas is produced, after the implementation of the project activity	The project activity displaces electricity generation with fossil fuels in the electricity grid. No fuel switch is done in the steel making process after the implementation of the project activity.
The methodology covers both new and existing facilities. For existing facilities, the methodology applies to existing capacity, as well as to planned increases in capacity during the crediting period. If capacity expansion is planned, the added capacity must be treated as a new facility.	This is a new power generation facility.

B.2. Description of how the methodology is applied in the context of the project activity:

The project activity uses the approach described in the ACM0004/Version02**- "Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation"**

Step 1:
Identification of alternative baseline scenarios and selection of baseline scenario

The baseline scenario alternatives should include all possible options that provide or produce electricity for in-house consumption and/or sale to grid and/or other consumers. The project participant has excluded baseline options that:

- 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 (such as wind energy, geothermal etc)

The possible alternative scenarios in the absence of the CDM project activity are as follows:

1. **The proposed project activity not undertaken as a CDM project activity;**

   This alternative is in compliance with all applicable legal and regulatory requirements. But this alternative faces many barriers and would not have come up in the absence of CDM benefits (as detailed in section B.3) hence this option is not a part of baseline scenario.

2. **Import of electricity from the grid; *Existing scenario***

   SKSIL would continue to purchase required power from Chattisgarh State Electricity Board (CSEB) that belongs to WR grid network. An equivalent amount of CO2 emissions would take place at the thermal power plants supplying power to Western Regional grid. This alternative is in compliance with all applicable legal and regulatory requirements and can be a part of baseline option.

3. **New captive power generation on-site, using other energy sources than waste heat and/or gas, such as coal, natural gas, hydro, wind, etc;**

   For captive power consumption of ~25 MW, only feasible fuel option is coal. Natural gas, hydro and wind options are not available to the project promoter at the project site. Due to uncertainty related to WHRB based power and to have better control over power related cost SKSIL is also exploring option of setting up a 30 MW AFBC that would utilise char generated in kiln, coal washery rejects and coal for power generation. AFBC could be used as a backup option to deal with uncertainties related to WHRB. The advantages for this options are high PLF, well established technology, freely available Char/Dolochar and Coal fines within the company and from neighbouring sponge iron industries, thus the cost of fuel would be lowest per unit. Capital cost of coal based AFBC boiler is lower than waste heat recovery boiler. This alternative is in compliance with all applicable legal and regulatory requirements and can be a part of baseline option.

4. **New captive power generation on-site, using DG sets:**

   This alternative is in compliance with all applicable legal and regulatory requirements. However it is not an attractive option for meeting large power requirement in steel making process, also fuel prices variability is very high leading to high risk. However this alternative is in compliance with all applicable legal and regulatory requirements and can be a part of baseline option.

5. **Other uses of the waste heat and waste gas:**

No other use of waste gas is available hence this option is not a part of baseline scenario.

Parameter	*Alt-2*	*Alt-3*	*Alt-4*
Capital Cost	Nil	~Rs 2.66 Crores (only Plant & machinery and civil cost excluding IDC) This cost is based on detailed project report prepared for SKSIL by technical consultant for setting up 30 MW AFBC	Rs 3.5 Crores/MW Source: Central Electricity Authority in India.
Cost of Power	Rs 2.55 basic cost + demand charges	~Rs 1.36 Based on the cost estimations provided by technical consultant. Similar cost levels (~1.56) have also been worked out by Central Electricity Authority in India[2]. Rs 1.56 estimated by CEA is for a coal based power plant, in 30 MW AFBC waste products like char/coal washery could also be burnt hence reducing cost/unit 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. Coal based power plant is also a feasible option due to low capital cost & cost of power generation and this makes it the best option available to SKSIL for obtaining power requirement in its industrial complex. However as grid based power has lower emission factor as compared to coal based power generation, to be conservative "Import of electricity from the grid" has been considered as the baseline scenario in this project activity.

Step 2: Establish additionality of the project activity

The Project Activity is demonstrated as additional using latest version of the "*Tool for the demonstration and assessment of additionality*" agreed by the Executive Board. The details are provided in section B.3 of the PDD.

B.3. 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:

As per the decision 17/cp.7 Para 43, a project activity is considered additional if anthropogenic emissions of green house gases by sources are reduced below those that would have occurred in the absence of the registered project activity.

In the absence of project activity, there shall be extra burden on the electricity grid that shall be equal to the amount of electricity being generated by the project. The state grid comprises of a mix of power plants using hydro, nuclear and fossil fuels for power generation. The CO_2 emission factor calculated for the grid in accordance with the provisions of ***ACM0002/ Version 06*** is ***819.37 tonnes per GWh***.

In the following steps project activity is demonstrated as additional following the approach described in ***"Tool for demonstration and assessment of additionality"***.

Step 0: Preliminary screening based on the starting date of the project activity

The project activity has started power generation in May 2006 (it was a trial run, actual production started in August 2006). Purchase order for turbine placed in December 2004. The Project Proponent has decided to invest in the Project activity, after accounting for the benefits available under Clean Development Mechanism. The same has been recorded in various official documents (board resolution, DPR etc), where the proposed project was approved. These documents have been made available to DOE during validation of the project activity.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
All possible project alternatives are discussed in section B.2.

Step 2: Investment Analysis
At this step it has been determined whether the project activity is economically or financially viable and attractive without the sale of Certified Emissions Reduction (CER).

Sub Step 2a- Determining appropriate analysis method
Project developer has chosen to apply Investment comparison Analysis and has done comparison of Levelized cost of electricity production in Rs/kWh for WHRB with coal/char based AFBC system. In earlier version of PDD IRR was chosen for analysis, however as no power is sold to any outside agency so revenue generation is only notional hence IRR comparison might not be the best comparison parameter. Because of above reason, Levelized cost of electricity generation is chosen for comparison. Levelized cost analysis has also been reviewed by an independent financial consulting firm (Chartered Accountancy Firm) and was found to be correct.

Sub Step 2b- Applying the selected analysis method
Comparison of Levelized cost of electricity production in Rs/kWh for WHRB with coal/char based AFBC system.

Sub Step 2c- Calculation and comparison of financial indicators
Levelized cost analysis of power generation using Waste heat from WHRB and its comparison with Levelized cost of power generation in coal/char based AFBC

<u>Information & assumptions for WHRB:</u>
Capital Cost: Rs 8651 Lacs (Including Plant & machinery and Building & civil works, however Contingency, Margin money and preliminary expenses are not included). This cost level has been verified by reputed financial consulting firms in India which were appointed by financial lenders to review performance of SKSIL.
Debt/Equity Ratio: 60%-40% (as per capital structure in SKSIL)
Power Generation: 158868 MWhr (as per estimations given by technical consultant)
Expected return on equity: 16% (this is return which Govt of India guarantees for Independent Power producers (IPPs) in India.

O&M: 3.5% of capital cost
Debt details: 11.75%, 5 years tenure
Others: Minimum alternate tax, Corporate income tax rate (35.7%), demand charges for base load connection with grid (150 Rs/KVA/month), depreciation rate (7.84%) are as per current rules & regulations in India

WHRB cost details are part of appraisal report by a well known financial institution in India. Relevant documents are provided to DOE.

Information & assumptions for Coal/char based power project:
Capital Cost: Rs 7999 Lacs (Including Plant & machinery and Building & civil works, however Contingency, Margin money and preliminary expenses are not included)
Debt/Equity Ratio: 60%-40%
Power Generation: 95% Plant load factor
Expected return on equity: 16% (this is return which Govt of India guarantees for Independent Power producers (IPPs) in India.
O&M: 3.5% of capital cost
Debt details: 11.75%, 5 years tenure
Coal rate: Rs 1100/ton for 3200 GCV coal
Boiler Efficiency: 82%
Char Calorific value: 1600 Kcal/Kg
Washery Rejects: 1800 Kcal/Kg
Others: Minimum alternate tax, Corporate income tax rate, depreciation rate are as per current rules & regulations in India

SN	Parameters	Waste heat recovery based power generation	Coal/Char based power generation	Remarks
1	Levelized cost of power generation	Rs 1.62 [2](including variable cost, depreciation, interest payments, minimum demand charges paid for grid connection)	Rs 1.36 (including variable cost, depreciation, interest payments[3])	Cost of power generation using waste heat is not the most economical option available to SKSIL
2	Sensitivity of power generation cost based on 10% increase in PLF	Rs 1.48	PLF is already high at 95%, no further improve is feasible	Cost of power generation is still much lower than coal/char based power
3	Sensitivity of power generation cost based on 10% decrease in PLF	Rs 1.85	Rs 1.47	Cost of power generation is still much lower than coal/char based power

[2] Similar cost levels have also been estimated by independent agency, details provided to DOE

[3] Demand charges not included as coal/char based power project could be of larges size meeting entire plants requirement, also it has lesser degree of uncertainty related to power generation. However in case of WHRB, waste heat is not sufficient for entire plant's demand (especially peak load demand and growing future demand) also due to technical problems it can't be relied on completely, hence grid connection for minimum load would be required.

4	10% increase in fuel cost	No impact	Rs 1.40	Cost of power generation is still much lower than coal/char based power

Above analysis shows that power generation using waste heat from DRI kiln is not the most economical option. Cost of per unit power generation from WHRB is higher compared to coal/char because of following reasons

- High capital cost compared to AFBC (4 boilers are required for utilisation of waste gases from 4 kiln individually which further escalates the project cost. This is not a case for coal based power project because one large size boiler could be utilised for the same, also different material/equipments to tackle technical problems associated with waste gas)
- Low plant load factor for WHRB as compared to AFBC(due to various factors related to availability of waste gas which in turn depend upon operating performance of DRI kiln, availability related problems described in following section).

Above analysis demonstrates that project activity is not a financially attractive option even if all key assumptions on the basis of which cost/unit has been calculated are changed in both directions and is thus additional.

With CDM benefits Levelized cost of power generation becomes Rs 1.25/KWh which is lower than cost of power generation using coal/char. Hence CDM benefits removes main barrier against implementation of the project activity.

Step 3: Barrier analysis

Technology Barrier –
There were many other technological barriers faced by the project activity. There is almost no control over the Quality and Quantity of the flue gases, thus the designing of a proper waste heat recovery system to generate power with the available steam, which is generated out of the available waste heat, is a great technology barrier. This is one of the most important reasons for not having many WHRB plants in India coming up without CDM benefits. Due to these barriers[4] it was difficult for the project proponent to go ahead with the project.

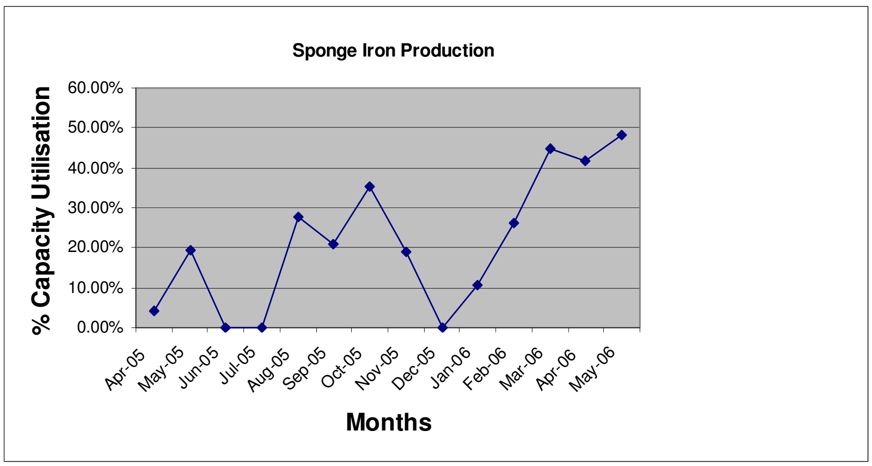
- **Availability Risk:**
    - The generation of Power from Waste heat from DRI kiln is dependent on the operation of the Sponge Iron Kiln. The kiln operation is the primary operation for the project promoter and WHRB is the passive portion of the combination. There are various factors which affect operations of DRI kiln. A few of them are related to Raw material (coal, iron ore) price & availability as well as sponge iron market situation (it faces interruptions & uncertainties). Process condition in DRI and quality of waste heat also affect power generation. Many of these factors could not be managed by project participant (because of no control over them) and hence poses a great barrier for implementation of the project activity.

[4] Many sponge iron companies who are already operating WHRB for sometime are facing various technical problems as described above.

- Due to various process parameters such as coal scarcity in DRI kiln, unavailability of large kilns at the same time (In the project activity at-least one 350 TPD kilns would be required in operation for power generation, else steam generation would not be sufficient to run the turbine), poor process parameters leading to accretion[5] (mouth of kiln gets blocked, this restricts flow of waste heat to WHRB); all these factors affect availability of DRI gas for power generation and might lead to stoppage of power plant..

- Steel business is a cyclical business and many times due to poor market conditions (It has been seen in the past that sponge iron plant[6] had to be shut down due to some unfavourable market condition such as low prices for end product, problems with iron ore availability[7] etc) sponge iron plant needs to be closed, and if kilns are closed, WHRB would not operate leading to power shortage for other steel making processes in the plant. Also if due to some process related issues kilns are down, it takes long time for restarting the plant. This is a major risk as during above situations plant operations would get hampered due to shortage of power.

- Availability risk is also evident by following sponge iron kilns capacity utilisation graph. It could be seen that during entire past one year capacity utilisation has been lower than 50% (in some months it has even touched no production situation as well). In this scenario of low availability setting up power plant based on waste gases from DRI kiln was a risky proposition for the project promoter and the project would not have come-up without CDM benefits.



Source: Plant production data

5 In the event the coal ash fuses at the temperature required for the iron ore reduction process to take place, then it inevitably results in accretion formation which continues to build in a ring formation along the inner circumference of the kiln which eventually closes the passage and does not allow the materials to travel to the other end. This requires the kiln to be shutdown (periodically) for the accretions to be removed, adversely affecting the efficacy and efficiency of the process and productivity of the kiln.----Source (Sponge Iron Manufacturer's Association (SIMA) technical paper

[6] Details about occasions during which sponge iron plant was shut down due to market situation are provided to DOE, also publicly available information regarding negative impact of market conditions on sponge iron plants is also provided to DOE.

[7] The Hindu newspaper (Mar 18, 2004), Indo Asian News Agency (Dec 9, 2005)

- **Quality of DRI Gas:**
  - The DRI gas stream contains very high particulate load, it leads to erosion and fouling problems in the boiler. The waste gas stream also contain high level of SO2 and SO3 in them which leads to formation of sulphuric acid in the boiler tubes and hence corrosion of tubes. Hence it is very important to keep waste gas temperature at a high level to avoid formation of sulphuric acid. Many technological innovations are required (such as high quality material usage for boiler designing) in the boiler designs to deal with above DRI gas quality related problems, hence capital cost required for WHRB is much higher than conventional power generation systems. Poor quality of waste stream also requires high maintenance for the system and thus high power generation cost.

To overcome technological challenges, additional investments and efforts are required however there were no additional returns/ benefits available from these investments/efforts.

Other Barriers

For SKSIL core business is steel and not power generation, and hence project promoters have a perception that due to uncertainties related to DRI gas availability & quality and other technological barriers, core business might suffer.

WHRB plant requires different and very sophisticated kind of skill sets for operations & maintenance of the plant. SKSIL plant people don't have required knowledge and exposures of the complications involved in waste heat based power generation, power plant operations, grid synchronization and its maintenance. Therefore there is a need for professional training programs in order to improving the skill of their personnel in power plant activities.

Steel business is currently on an upturn cycle, and may require additional investments in capacity expansion in future[8], but low return investment in WHRB shall reduce financial ability of project promoter to invest in any future possible capacity expansion. It would have been a better option to expand steel making capacity rather than investing in uncertain area of power generation using waste heat.

Step 4: Common Practice Analysis

As per recent report[9] conducted by Joint Plant Committee (JPC) constituted by Government of India, total number of coal based sponge iron plants in India are 147 and gas based sponge iron plants are 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 8 plants have captive power generation unit in the state of Chattisgarh. Among 8 WHRB plants in Chattisgarh, 4 have already been registered as CDM project activities[10]. Another 3 have applied for CDM registration and are in different stages of approval (as per

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8 Because of technical problems and financial barriers even in developed countries like US use of waste heat for power generation is very low. (source: Cogeneration & on-site power production)

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

[10] 4 out of 8 existing plants have 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, PDDs available on UNFCCC website). These data is indicative of the fact that despite DRI gas being of no alternative use, sponge iron plants have not opted for cogeneration power plants due to the barriers as described in sections above. The DRI based WHRB plants do face barriers which are real. The 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. This will also encourage other sponge iron plants in Chattisgarh and on national level to come up with cogeneration plants. This would provide the required impetus to technology providers to further their efforts towards better technology development for the use of DRI in power generation.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

For the purpose of determining GHG emissions of the **project activity**, following emission sources are included:

- CO2 emissions from combustion from auxiliary fossil fuels

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

CO2 emissions from fossil fuel fired power plants connected to the electricity system;
- CO2 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 will be calculated as described in ACM0002, both in terms of the relevant grid definitions and the emissions factors.

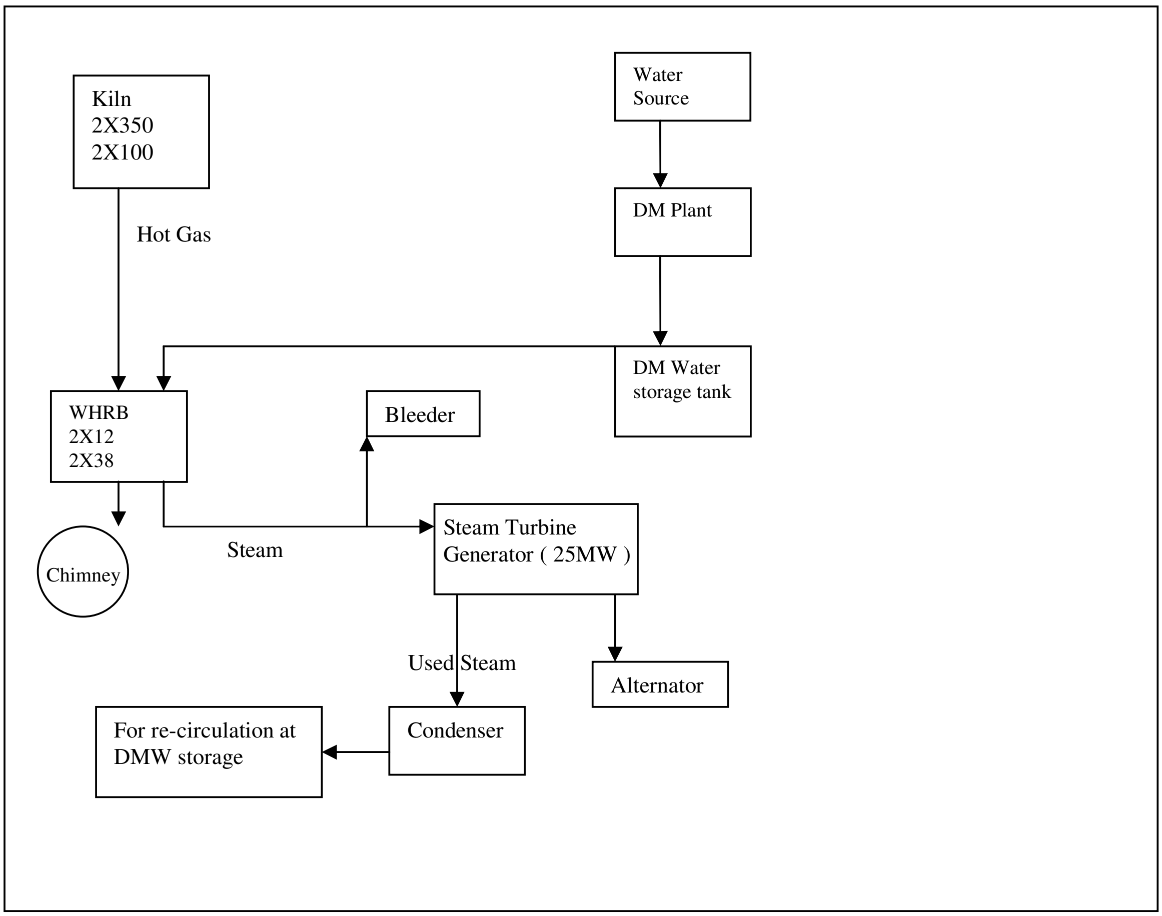
Following table illustrates which emissions sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

	Source	**Gas**	**Included?**	**Justification / Explanation**
Baseline	Grid Electricity Generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification- this is conservative

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

		N_2O	No	Excluded for simplification- this is conservative
Project Activity	On-site fossil fuel consumption due to the project activity	CO_2	Yes	May be an important emission source
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Combustion of waste gas for electricity generation	CO_2	No	It is assumed that this gas would have been burned in the baseline scenario.
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification



B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

The baseline was completed in October by SKS Ispat Limited and its CDM advisors.

Contact Details given in Annex – 1

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:

15/05/2006

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

30 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:

01/01/2007

C.2.2.2. Length:

10 years

SECTION D. Application of a monitoring methodology and plan

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

Methodology: “Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation”

Reference: Approved consolidated baseline methodology ACM0004/Version 02, Sectoral Scope: 1, 03 March 2006

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

The project activity meets the applicability criteria of the 'Approved baseline methodology ACM0004'. (Please refer to Section B.2. for details). The applicability criteria of the 'Approved monitoring methodology ACM0004' are identical to those of the 'Approved baseline methodology ACM0004'. Therefore the project activity has used the 'Approved monitoring methodology ACM0004' in conjugation with the 'Approved baseline methodology ACM0004' for the project activity.

The methodology requires monitoring of the following:

- Net electricity generation from the proposed project activity;
- Data needed to calculate carbon dioxide emissions from fossil fuel consumption due to the project activity;
- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);
- Data needed to recalculate the build margin emission factor, if needed, consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);
- Data needed to calculate the emissions factor of captive power generation

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

Project emission associated to the project activity is zero. Therefore this section is Not Applicable

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1.Qi	Volume of the auxiliary fuel used by project activity	*Plant records*	tonnes or m3	*M*	*Continuously*	*100%*	Electronic/ Paper	To be measured and used for estimation of Project emissions. *Archiving for Crediting period +2 years*
2.NCV$_i$	*Net calorific value*	*Plant records or IPCC data*	*TJ per t*	*M*	*Lot wise*	*Random*	Electronic/ Paper	Plant records may be used when the calorific value is specified in the purchase contract, otherwise IPCC data source. *Archiving for Crediting period +2 years*
3.EF$_i$	*Emission Factor*	*IPCC data*	*tC/TJ*	*IPCC defaults*	*Once a year*	*Random*	Electronic/ Paper	*Archiving for Crediting period +2 years*

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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. Project Emissions are given as:

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

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
4. EG_{GEN}	*Total electricity generated*	*Plant records*	*MWh/yr*	*M*	*Continuously*	*100%*	Electronic/Paper	Monitoring location: meters at plant and DCS will measure the data. Site supervisor would be responsible for regular calibration of the meter. A main meter and check meter would be provided for measuring total electricity generated. *Archiving for Crediting period +2 years*

5. EG_{AUX}	*Auxiliary electricity*	*Plant records*	*MWh/yr*	*M*	*Continuously*	*100%*	Electronic/Paper	Monitoring location: meters at plant and DCS will measure the data. Site supervisor would be responsible for regular calibration of the meter. Sourced from electricity used by generating equipment within the project boundary. A main meter and check meter would be provided for measuring auxiliary electricity. Recording frequency is hourly, consolidation will be done daily basis and monthly basis *Archiving for Crediting period +2 years*
6. EG_y	*Net electricity supplied*	*Plant records*	*MWh/yr*	*C*	*Hourly*	*100%*	Electronic/Paper	*EG_{GEN}-EG_{AUX}* *Archiving for Crediting period +2 years* Recording frequency is hourly, consolidation will be done daily basis and monthly basis
7. EFy	Emission factor	CO2 emission factor of the grid (Grid & IPCC data)	tCO2/MWh	C	Once during crediting period, fixed ex-ante	100%	Electronic	Calculated as a weighted sum of the OM and BM emission factors *Archiving for Crediting period +2 years*
8. $EF_{OM,y}$	Emission factor	CO2 Operating Margin emission factor of the grid (Grid & IPCC data)	tCO2/MWh	C	Once during crediting period, fixed ex-ante	100%	Electronic	As per ACM0002 *Archiving for Crediting period +2 years*

9. $EF_{BM,y}$	Emission factor	CO2 Build Margin emission factor of the grid (Grid & IPCC data)	tCO2/MWh	C	Once during crediting period, fixed ex-ante	100%	Electronic	Calculated as [Σi Fi,y*COEFi]/[Σm GENm,y] over recently built power plants defined in the baseline methodology *Archiving for Crediting period +2 years*
10. Fi,j,y	Fuel quantity	Amount of each fossil fuel consumed by each power source / plant	t or m3/yr	M	Once during crediting period, fixed ex-ante	100%	Electronic/ Paper	Obtained from the power producers, dispatch centers or latest local statistics. *Archiving for Crediting period +2 years*
11. COEFi,k	Emission Factor coefficient	CO2 emission coefficient of each fuel type and each power source / plant	tCO2 / t or m3	M	Once during crediting period, fixed ex-ante	100%	Electronic/ Paper	IPCC default values *Archiving for Crediting period +2 years*
12.GENj,y	Electricity quantity	Electricity generation of each power source / plant	MWh/ yr	M	Once during crediting period, fixed ex-ante	100%	Electronic/ Paper	Obtained from the power producers, dispatch centers or latest local statistics. *Archiving for Crediting period +2 years*

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Calculation of baseline emission

The baseline emissions are calculated as following:

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

EGy Net quantity of electricity supplied to the manufacturing facility by the project during the year *y* in MWh, and

EFy CO2 baseline emission factor for the electricity displaced due to the project activity during the year *y* (tCO2/MWh). The Emissions Factor for displaced electricity is calculated as in ACM0002.

<u>Estimation of Grid Emission factor:</u>

STEP 1: Calculate the Operating Margin emission factor

Simple OM approach is the most appropriate calculations method because in the WR grid mix, the low-cost/must run resources constitutes less than 50% of total grid generation. Simple OM factor is calculated as under.

$EF_{OM,simple,y}$ is calculated as the average of the most recent three years

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \; x \, COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

Where

$GEN_{j,y}$: The electricity (MWh) delivered to the grid by source j

$COEF_{i,j\,y}$: The CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), calculated as described below and

$F_{i\,,j,\,y}$: The amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y , calculated as described below

J, Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid

STEP 2: Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of WR grid, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \, x \, COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

Where

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ - Are analogous to the variables described for the simple OM method above for plants m.

Considered calculations for the Build Margin emission factor $EF_{BM,y}$ which is updated annually ex post for the year in which actual project generation and associated emissions reductions occur. The sample group m for the most recent year consists of the 20 (twenty) power plants that have been built most recently, since it comprises of larger annual power generation. (Refer to Annex 3)

Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group m of WR grid mix.

STEP 3: Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = W_{OM} \otimes EF_{OM,y} \oplus W_{BM} \otimes EF_{BM,y}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,Simple,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

There are no emission sources as leakage in the project activity.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Formula used for estimation of the total net emission reductions due to the project activity during a given year *y* is as under.

$$ER_y = BE_y - PE_y$$

Where

ER_y : Emissions reductions of the project activity during the year y in tons of CO_2

BE_y : Baseline emissions due to displacement of electricity during the year y in tons of CO_2

PE_y : The project emissions associated with the project activity during the year y in tons of CO_2

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1-2	*Low*	This data will be required for the calculation of project emissions. Use of FO is anyway going to be very low, and its effect would be minimal. The actual usage will be audited by third person using actual stock available onsite and total purchases made during that period (not involved in the usual plant operations) after every year.
4-5	*Low*	This data will be used for the calculation of project electricity generation. Check meters to be installed parallel to main meter and auxiliary power meter.
7-12	*Low*	This data will be required for the calculation of baseline emissions (from grid electricity) and will be obtained through published and official sources.

The parameters related to the performance of the project will be monitored using meters and standard testing equipment, which will be regularly calibrated following standard industry practices.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

Project activity has a team which is responsible for plant operations & maintenance. This team is responsible for data collection and archiving. This team will meet periodically to review CDM project activity check data collected, emissions reduced etc. On a periodic basis, the monitoring reports are checked and discussed by the senior team members. In case of any irregularity observed, it is informed to the concerned person for necessary actions. Detailed monitoring plan attached in annex-4.

D.5 Name of person/entity determining the monitoring methodology:

SKS Ispat Limited and its CDM advisors

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

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

In case Furnace Oil in used in DG set for providing backup power, there will be project activity emissions. Assuming 100 Kilo Litres of FO consumption during a year;

PEy = 100 X 0.04333 X 20.2 X 44/12 X 0.99
= 317.17 T CO2

E.2. Estimated leakage:

There are no emission sources as leakage in the project activity.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

PEy = 317.17 T CO2

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

SN	Operating Years	Baseline Emission Factor (tCO_2 / GWh)	Baseline Emissions (tCO_2)
1.	2007	819.37	117091
2.	2008	819.37	117091
3.	2009	819.37	117091
4.	2010	819.37	117091
5.	2011	819.37	117091
6.	2012	819.37	117091
7.	2013	819.37	117091
8.	2014	819.37	117091
9.	2015	819.37	117091
10.	2016	819.37	117091

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

SN	Operating Years	CO2 Emission Reductions (tCO2)

SN	Operating Years	CO2 Emission Reductions (tCO2)
1.	2007	116773
2.	2008	116773
3.	2009	116773
4.	2010	116773
5.	2011	116773
6.	2012	116773
7.	2013	116773
8.	2014	116773
9.	2015	116773
10.	2016	116773

E.6. Table providing values obtained when applying formulae above:

SN	Operating Years	Baseline Emissions (tCO2)	Project Emissions (tCO2)	Leakages (tCO2)	CO2 Emission Reductions (tCO2)
1.	2007	117091	317.17	0	116773
2.	2008	117091	317.17	0	116773
3.	2009	117091	317.17	0	116773
4.	2010	117091	317.17	0	116773
5.	2011	117091	317.17	0	116773
6.	2012	117091	317.17	0	116773
7.	2013	117091	317.17	0	116773
8.	2014	117091	317.17	0	116773
9.	2015	117091	317.17	0	116773
10.	2016	117091	317.17	0	116773

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including trans boundary impacts:

A rapid environment impact assessment study for the project was conducted by a well know environment consulting firm

The following are the salient conclusions of Environment Impact Study:

1. Air: The power plant is based on heat recovery system where hot flue gases of kiln of sponge iron plant are utilised for steam generation. The hot gases of kiln consist of particulate matter due to coal burning in the kiln. Particulate matter in air might also increase during project construction phase.
2. Waste water: Waste water generation from the plant is mainly from the following areas; cooling tower blow-down, DM regeneration, and Boiler blow-down and these effluents could easily be recycled in the system. No effluent generated in the project boundary is disposed in the public sewerage and water system etc
3. Solid Waste: No solid waste is generated from the plant
4. Noise: There will be marginal increase in noise levels during construction phase.
5. The project activity is implemented in government notified industrial region and has not effect on forest cover, local flora & fauna. No manpower displacement from current location is happening due to the project activity.

F.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:

As discussed above environmental impacts of the project can not be categorized as significant as per guidelines issued by regulatory authorities in host party.

SN	Impact	Mitigation Plan
1	***Air Environment***	During construction phase particulate matter increase in the atmosphere. Frequent water sprinkling in the vicinity of the construction site is undertaken. ESPs are installed to collect ash in the flue gas stream.
2	***Noise Environment***	There is marginal increase in noise levels during construction phase, which is a temporary phenomenon. Certain activities such as welding etc are conducted during night time.
3	***Land***	The site is free from vegetation and is within the steel plant premises. Hence no major destruction of vegetation is taking place.

SECTION G. Stakeholders' comments

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

The Chattisgarh Environment Conservation Board has conducted public hearing on 03/10/2005 in the premises of collectrorate district-Raipur. Public notices (in newspaper-*Navbharat Times & Dainik Bhaskar* and direct intimation in gram-panchayat) were issued to invite people for public hearing.

A CD of proceedings of public hearing was made. Minutes of meeting were also collated.

G.2. Summary of the comments received:

Project activity doesn't involve any significant negative impact over social structure and environment. Therefore all stakeholders had really shown their pleasure and support to the project activity. People have shown encouragement to the fact that the plant will provide employment to local people. People have also suggested that SKSIL shall help in development of green belt in nearby area.

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

No negative comment was received. (Comments received from stakeholders are well documented and can be presented for verification at the time of validation.)

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Participant

Organization:	SKS Ispat Limited
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URL:	
Represented by:	
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Salutation:	Mr.
Last Name:	Gupta
Middle Name:	
First Name:	Deepak
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from annex-1 countries is available to the project activity.

Annex 3

BASELINE INFORMATION

Grid Emission Factor for Western Region Grid-

Approach suggested in Approved Consolidated Methodology **ACM0002** is used to estimate the grid emission factor for the project activity.

STEP 1: Grid Selection
As per the guidelines provided by Meth Panel during 18th meeting, Western Region Grid is selected for estimating the grid emission factor. Generation data of power plants in the western region have been considered. Western Region Electricity Board (WREB) annual reports and Central Electricity Authority (CEA) data is used for this purpose.

Project Electricity System: "*It is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints as defined in ACM0002"*. For the purpose all the power generating units in the western region have been considered.

Connected Electricity System: "*It is defined as a regional electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints"*. For the purpose all the imports from other regional grids and exports to these regional grids are being considered.

STEP 2: Calculation of the Operating Margin emission factor (EF_{OM})
There are four methods suggested by the methodology ACM0002 –

1. Simple OM
2. Simple adjusted OM
3. Dispatch Data Analysis OM
4. Average OM

Among these four options the method of **Simple OM** is adopted for the project activity as –

1. Adequate data for Dispatch Data Analysis is not available, and
2. Low cost/ must run power sources contribute less than 50% of the total power generation in the region over the last five most recent years. The grid is thermal power dominated; more than 90% power is supplied using thermal energy sources. Less than 10% is provided by hydro, nuclear and wind energy sources.

Generation Mix of Power Generation in Western Grid for 5 Years

Type	2000-01	2001-02	2002-03	2003-04	2004-05
Thermal	129061.01	133565.00	137392.0	136699.4	141962.0
Gas	22312.84	18375.59	18713.3	22711.5	25807.3
Total (Thermal + Gas)	**151373.9**	**151940.6**	**156105.3**	**159410.9**	**167769.2**
Wind*	313.6	495.7	878.5	855.1	599.6
Hydro	7152.12	7984.3	8172.2	9391.6	10577.2
Nuclear	5902.62	6067.3	6200.0	5671.1	5099.7
Low cost/Must run	**13368.4**	**14547.4**	**15250.7**	**15917.7**	**16276.5**
Total	**164742.2**	**166487.94**	**171356.0**	**175328.6**	**184045.7**
% of Low cost/must run	**8.1%**	**8.7%**	**8.9%**	**9.1%**	**8.8%**

Unit	Million Units
Source	www.wreb.co.in
	*www.mnes.nic.in
	www.cea.nic.in

Simple OM: The Simple OM emission factor ($EF_{OM,simple}$) is calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants.

The vintage of data for estimating Simple OM taken is 3-year average based on the most recent statistics available. (OM for the year 2002-03, 2003-04 & 2004-05 has been considered)

CO2 emission factor for net electricity imports from a connected electricity system is being considered "0 tCO2/MWh" as suggested in ACM0002.

Opearting Margin for Western Grid 2004-05	
OM, 2002-03	0.943
OM, 2003-04	0.932
OM, 2004-05	0.928
Average OM	**0.934**

Western Grid Power Generation [2004-05]

Source	MoU	Thermal	Gas	
Gross Generation	MU	141961.97	25807.25	
Auxiliary Consumption	MU	11948.37	534.78	
Net Generation	MU	**130013.60**	**25272.47**	**155286.07**
Heat Rate	kcal/kWh	2357	2000	
Fuel CV	kcal/kg	3820	10350	
Fuel Consumption	Tonnes per annum	87592765	4986908	
Total Emissions	tCO2/ annum	131942292	12111642.27	**144053934.3**
Emission Factor	tCO2/ MWh	**0.928**		

Western Grid Power Generation [2003-04]

Source	MoU	Thermal	Gas	
Gross Generation	MU	136699.43	22711.47	
Auxiliary Consumption	MU	11165.38	424.99	
Net Generation	MU	**125534.05**	**22286.48**	**147820.53**
Heat Rate	kcal/kWh	2357	2000	
Fuel CV	kcal/kg	3820	10350	
Fuel Consumption	Tonnes per annum	84345695	4388690	
Total Emissions	tCO2/ annum	127051182.2	10658756.75	**137709938.9**
Emission Factor	tCO2/ MWh	**0.932**		

Western Grid Power Generation [2002-03]

Source	MoU	Thermal	Gas	
Gross Generation	MU	137392.00	18713.30	
Auxiliary Consumption	MU	12014.91	357.83	
Net Generation	MU	**125377.09**	**18355.47**	**143732.56**
Heat Rate	kcal/kWh	2341	2000	
Fuel CV	kcal/kg	4171	10350	
Fuel Consumption	Tonnes per annum	77112125	3616097	
Total Emissions	tCO2/ annum	126828040.8	8782369.112	**135610409.9**
Emission Factor	tCO2/ MWh	**0.943**		

STEP 3: Calculation of the Build Margin emission factor (EF_{BM})

Calculation of the Build Margin emission factor $EF_{BM,y\ ex\text{-}ante}$ is based on the most recent information available on the plants already built for sample group m at the time of PDD submission. The sample group m consists of the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (This sample group is larger than group consisting of the five power plants that have been built most recently).

Ownership	Fuel Type	Plant Name	Commissioned In	Unit Gross Gen	Unit Net Gen	Emissions
Gujarat	Thermal	Akrimopa Lignite	2005-06	0.0	0.0	0
Gujarat	Hydro	Sardar Sarovar	2004-05	42.1	41.9	0
Madhya Pradesh	Hydro	Sardar Sarovar	2004-05	150.1	149.3	0
Madhya Pradesh	Hydro	Indira Sagar 4	2004-05	138.2	137.5	0
Madhya Pradesh	Hydro	Indira Sagar 5	2004-05	120.1	119.5	0
Madhya Pradesh	Hydro	Indira Sagar 6	2004-05	41.7	41.5	0
Madhya Pradesh	Hydro	Indira Sagar 7	2004-05	25.2	25.0	0
Madhya Pradesh	Hydro	Indira Sagar 8	2004-05	0.8	0.8	0
Maharashtra	Hydro	Sardar Sarovar	2004-05	71.1	70.7	0
Gujarat	Gas	Dhuvaran	2003-04	701.0	670.0	327656154.6
Madhya Pradesh	Hydro	Indira Sagar 1	2003-04	300.2	298.7	0
Madhya Pradesh	Hydro	Indira Sagar 2	2003-04	390.8	388.9	0
Madhya Pradesh	Hydro	Indira Sagar 3	2003-04	314.9	313.3	0
Chattisgarh	Hydro	Gangrel	2003-04	7.5	0.0	0
Gujarat	Gas	Hazira CCGT 3	2002-03	386.2	376.6	180536451.8
Madhya Pradesh	Hydro	Bansagar II 1	2002-03	33.5	33.2	0
Madhya Pradesh	Hydro	Bansagar II 2	2002-03	34.9	34.7	0
Madhya Pradesh	Hydro	Bansagar III 3	2002-03	26.8	26.6	0
Maharashtra	Hydro	Yeoteshwar	2002-03	0.0	0.0	0
Gujarat	Gas	Hazira CCGT 1	2001-02	387.4	377.7	181064650.5
Gujarat	Gas	Hazira CCGT 2	2001-02	377.8	368.3	176586647.2
Madhya Pradesh	Hydro	Bansagar III 1	2001-02	24.8	24.6	0
Madhya Pradesh	Hydro	Bansagar III 2	2001-02	25.0	24.8	0
Maharashtra	Hydro	Khopoli	2001-02	264.7	263.1	0
Maharashtra	Hydro	Koyna IV 3	2000-01	721.3	716.6	0
Maharashtra	Hydro	Koyna IV 4	2000-01	225.9	224.4	0
Maharashtra	Hydro	Dhudhganga	2000-01	62.0	61.7	0
Maharashtra	Hydro	Bhivpuri	2000-01	251.4	249.0	0
Maharashtra	Thermal	Khaparkheda 3	2000-01	1603.6	1461.1	1425287196
Maharashtra	Thermal	Khaparkheda 4	2000-01	1493.7	1361.0	1327634225
Central	Thermal	VSTPS 8	2000-01	3858.5	3592.7	3586194895
Gujarat	Thermal	Surat Lignite 1	1999-00	858.8	774.2	798204471.6
Gujarat	Thermal	Surat Lignite 2	1999-00	946.5	853.3	879723898.5
Madhya Pradesh	Hydro	Rajghat 1	1999-00	18.9	18.7	0
Madhya Pradesh	Hydro	Rajghat 2	1999-00	11.0	10.9	0
Madhya Pradesh	Hydro	Rajghat 3	1999-00	13.9	13.7	0
Madhya Pradesh	Thermal	Sanjay Gandhi 4	1999-00	1474.1	1331.5	1370011529
Maharashtra	Hydro	Koyna IV 1	1999-00	529.6	526.2	0
Maharashtra	Hydro	Koyna IV 2	1999-00	268.5	266.8	0
Maharashtra	Hydro	Bhandardara	1999-00	36.7	36.5	0
Maharashtra	Hydro	Terwanmedhe	1999-00	0.1	0.1	0
Maharashtra	Gas	Dhabhol 1	1999-00	0.0	0.0	0
Maharashtra	Gas	Dhabhol 2	1999-00	0.0	0.0	0
Goa	Gas	Reliance Salgaonkar	1999-00	141.9	138.4	66332266.39
Central	Thermal	VSTPS 7	1999-00	3831.9	3567.9	3561481618
Gujarat	Hydro	Kadana 3	1998-99	95.6	94.7	0
Gujarat	Hydro	Kadana 4	1998-99	97.5	96.6	0
Gujarat	Gas	GPEC GT 1	1998-99	737.9	724.0	344927785.2
Gujarat	Gas	GPEC GT 2	1998-99	789.7	774.8	369136114
Gujarat	Gas	GPEC GT 3	1998-99	764.5	750.1	357356815.2
Gujarat	Gas	GPEC ST	1998-99	1341.5	1316.2	627051340.7
Gujarat	Thermal	Gujarat Electric Co. 1	1998-99	1657.0	1507.5	1540021033
Gujarat	Thermal	Gujarat Electric Co. 2	1998-99	1560.9	1423.0	1450759537
Maharashtra	Hydro	Manikdoh	1998-99	4.1	4.1	0
Maharashtra	Hydro	Surya	1998-99	14.0	13.9	0
Maharashtra	Hydro	Dimbhe	1998-99	9.1	9.0	0
Maharashtra	Hydro	Warna	1998-99	57.3	56.7	0
Gujarat	Gas	GIPCL Baroda GT 1	1997-98	258.4	252.0	120803732.9
Gujarat	Gas	GIPCL Baroda GT 2	1997-98	258.1	251.7	120664701.7
Gujarat	Gas	GIPCL Baroda GT 3	1997-98	245.2	239.1	114619241.5
Gujarat	Gas	GIPCL Baroda ST	1997-98	391.1	381.3	182816443.6
Gujarat	Thermal	Kutch Lignite 3	1997-98	481.2	423.3	520805141.7
Maharashtra	Hydro	Bhira PSU	1997-98	579.6	577.9	0
Maharashtra	Thermal	Chandrapur 7	1997-98	3376.3	3115.6	3032778839
Gujarat	Gas	Essar Gas GT 1	1996-97	736.2	723.2	344123801.3
Gujarat	Gas	Essar Gas GT 2	1996-97	725.2	712.4	338958672.3
Gujarat	Gas	Essar Gas GT 3	1996-97	702.4	690.0	328310560.1
Gujarat	Gas	Essar Gas ST	1996-97	1223.7	1202.1	571978444.4
Maharashtra	Hydro	Bhira - TR	1996-97	85.2	85.2	0
Maharashtra	Thermal	Dahanu BSES 2	1995-96	2164.4	2001.3	**24245826.2**
Central	Gas	Gandhar 4	1995-96	1488.0	1457.7	34416.1
Central	Nuclear	Kakrapar 2	1995-96	1262.7	1106.3	**704.5**

Build Margin for Western Grid 2004-05	
Build Margin	**0.704**

STEP 4: Calculate the Grid Emission Factor (*EF*)

Grid Emission factor is the weighted average of the Operating Margin emission factor (EF_{OM}) and the Build Margin emission factor (EF_{BM}):

$EF = wOM \text{ X } EF_{OM} + wBM \text{ X } EF_{BM}$

Where the weights *wOM* and *wBM*, by default, are 50% (i.e., $wOM = wBM = 0.5$), and EF_{OM} and EF_{BM} are calculated as described in Steps 2 and 3 above and are expressed in tCO2/MWh. The weighted averages applied by the project participants are fixed for the entire crediting period.

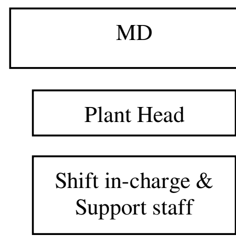
Combined Margin for Western Grid 2004-05	
OM, 2002-03	0.943
OM, 2003-04	0.932
OM, 2004-05	0.928
Average OM	**0.934**
BM	0.704
Combined Margin, CM	**0.819**

tCO2e/ MWh

<u>Annex 4</u>

MONITORING PLAN

Project Management Plan:



MD: Overall responsibility of compliance with the CDM monitoring plan
Power Plant Head: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation
Shift In-charge: Responsibility of daily report generation, log preparation, data recording, maintenance and calibration of monitoring equipments

Data Monitoring:

The methodology requires monitoring of the following:

- Net electricity generation from the proposed project activity;
- Data needed to calculate carbon dioxide emissions from fossil fuel consumption due to the project activity;
- Data needed to estimate combined margin- grid emission factor fixed ex-ante and hence no requirement to monitor data on periodic basis

Completeness-

For Electricity generation data: The project activity has installed the latest state of art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Real time data collection happens using these control systems. An hourly log of data is also prepared by the shift in-charge. A daily report of aggregation of these data is also prepared. Parameters monitored are the total power generated and auxiliary power generated. Apart from main meters there would be parallel check meters installed for main power and auxiliary power.

For FO consumption in DG set (project activity emissions): Actual usage would be monitored using dip level/ purchase and inventory data. Regular internal audit will ensure reliability of this data.

For data requirement to calculate OM & BM: WREB publishes yearly reports regarding the performance of the power plants attached to state grid. Apart from WREB, CEA and MOP also publish yearly power plants performance data. Grid emission factor is fixed ex-ante for the project activity for entire crediting period.

Reliability-

For Electricity generation data: automatic control meters regarding power generation are regularly maintained. The regular plant operating & maintenance procedures also include process of regular meter testing, calibration & maintenance. Also for key parameters (electricity generation) check meters would be installed. Main meters would be calibrated at-least once every year by national level independent third party.

Data Adjustments-
A coal based AFBC is also currently under implementation in the project boundary. Sometimes in case of kiln stoppage or some other situations steam from AFBC boiler could also be used in the 25 MW WHRB connected turbine. In such a scenario power generation from WHRB would be based on pro-rata basis on the steam supplied by WHRB to 25 MW turbine (steam generation is WHRB is being monitored as a normal monitoring procedure in the plant).

Uncertainty level of data points to be monitored (as per tables provided in Section D) is low and no data adjustment need is envisaged.

Frequency-
The measurement is recorded and monitored on a continuous basis. A daily log is prepared at the end of the day which is then used for monthly/yearly report.

Training-
Plant personnel are trained on plant operations & maintenance procedures. Technical training regarding equipments in use is provided by equipment manufacturer.

Archiving-
Credit period + 2 yrs

Details of energy meters

<u>Main Meter</u>
Make: SECURE
Class: 0.25
Type: E3V021, 3 PH 3 WIRE
IEC – 60687
11 KV/110 V, 2000/1 A
SR. NO: KAU02025

<u>Auxiliary Power Meter</u>
Make: CONZER
Class: 0.5
Type: EM6004, 3 PH 3 WIRE
11 KV/110 V, 300-200/1-1 A
SR. NO: 829259

Annex 5

Glossary

%	Percentage
BM	Build Margin
BEF	Baseline Emission Factor
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Carbon Emission Reduction
CM	Combined Margin
CO2	Carbon Di Oxide
DNA	Designated National Authority
DOE	Designated Operational Entity
EIA	Environmental Impact Assessment
GHG	Green House Gases
GWh	Giga Watt Hour
Gwh/ Year	Giga Watt Hour per Year
IPCC	Intergovernmental Panel on Climate Change
IPPs	Independent Power Producers
IRR	Internal Rate of Return
Kg / kWh	Kilo Gram per Kilo Watt Hour
kg CO_2 equ/kwh	Kilo Gram Carbon Di Oxide equivalent per Kilo Watt Hour
kg/kwh	Kilo Gram per Kilo Watt Hour
KP	Kyoto Protocol
KV	Kilo Volt
kw	Kilo Watt
kWh	Kilo Watt Hour
M	Meter
M & P	Modalities and Procedures
M & V	Monitoring and Verification
M Cum.	Million Cubic Meter
MNES	Ministry of Non-Conventional Energy Sources
MoEF	Ministry of Environment and Forests
MU	Miilion Units
MW	Mega Watt
NCV	Net Calorific Value
NTPC	National Thermal Power Corporation

OECD	Organisation for Economic Co-operation and Development
OM	Operating Margin
OM Expenses	Operation and Maintenance Expenses
PGCIL	Power Grid Corporation of India Ltd
PTCIL	Power Trading Corporation of India Limited
Rs.	Indian Rupees
T & D	Transmission and Distribution
UNFCCC	United Nations Framework Convention on Climate Change
WACC	Weighted average cost of capital
WREB	Western Regional Electricity Board

Annex 6

LIST OF REFERENCES

Website of United Nations Framework Convention on Climate Change, http://unfccc.int

UNFCCC, Clean Development Mechanism, CDM Project Design Document (CDM-PDD) version 02 (in effect as of: 1 July 2004)

UNFCCC, Clean Development Mechanism, Approved consolidated baseline methodology ACM0004

UNFCCC, Clean Development Mechanism, Annex 1, Tool for the demonstration and assessment of additionality EB 16 Report;

Detailed project report

Website of Central Electric Authority (CEA), Ministry of Power, Govt. of India- www.cea.nic.in

Website of Ministry Non-Conventional Energy Sources (MNES), Government of India, www.mnes.nic.in

IPCC-Good Practice Guidance

WREB Power generation, consumption data