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:

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Waste heat recovery based captive power project at Monnet

A.2. Description of the project activity:

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Purpose

Monnet Ispat Limited (MIL) has implemented Waste Heat Recovery (WHR) based Power Project (power plant) at their steel plant. The purpose of the waste heat recovery project is to maximise the energy efficiency of the sponge iron manufacturing thereby recovering the high amount of heat escaping in the flue gases and converting it into useful power leading to environmental improvement as well as energy conservation. The project is recovering the sensible heat present in the waste gases coming out from the Direct Reduction Iron (DRI) Kiln for generating power. This generation will partially meet the power requirement of MIL

Salient Features Of The Project

MIL has a sponge iron and steel plant with an average sponge iron production of 230,000 tons/annum at Raipur in Chhattisgarh state. Operation of DRI kiln releases large amount of gases at a high temperature of 900-950 °C. As per the normal practice, these waste gases are released in the atmosphere after air scrubbing. In this way, the sensible heat of the waste gases goes unutilised. This is a loss in terms of energy as the escaping gases have the potential of producing large amount of steam through a heat exchanger, which can either be used for power generation or in the process of the plant.

Before the installation of the power project, the entire power requirement for the steel plant was met from the supplies of Chattisgarh State Electricity Board (CSEB), the state utility. The flue gases fromt he kiln were passed through a Venturi Scrubber and were allowed to escape leading to loss of precious energy. MIL has now replaced their venturi scrubber with a waste heat recovery boiler and Electro Static Precipitator (ESP). MIL has implemented a modern waste heat recovery based power project (Captive Power Plant/CPP) with the waste gases of the kilns as their energy source.

The project activity has also reduced the transmission and distribution losses of the grid as power is being consumed at the same place where it is getting generated. In addition, the power consumption for the venturi scrubber has also been avoided leading to more savings in the power.

Project's Contribution to Sustainable Development

The project has contributed to the Sustainable Development in the following way:

1. The installation of the waste heat recovery power plant is leading to the displacement of grid power (predominantly coal based). Thus the fossil fuel which otherwise would have been burned to produce the equivalent power will now be saved by the waste heat recovery plant.
2. The saving of power is at grid and is allowing it to be diverted to other needy sections of the economy.
3. It is also making coal available for other commercial purposes like metallurgical applications where it will add more value to the product.
4. The project is also reducing the quantum of local pollutants to a large extent.
5. Increase in employment of the local residents

A.3. Project participants:

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Name of Party involved* ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	The Party involved wishes to be considered as project participant (Yes/No)
Government of India (host)	Monnet Ispat Limited	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>

India

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

>>

Chhattisgarh

A.4.1.3. City/Town/Community etc:

>>

Raipur

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

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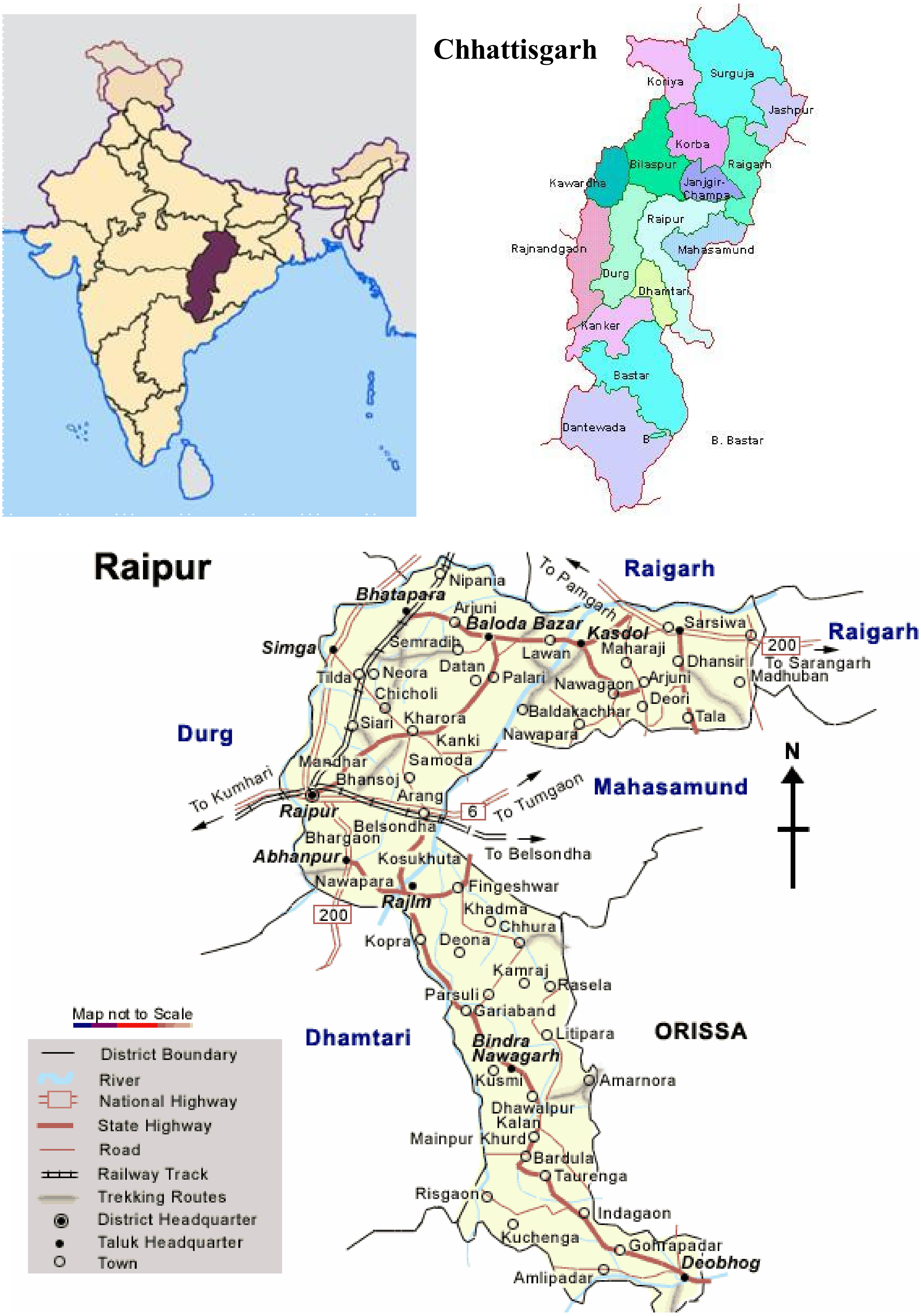
Project has been implemented at the premises of MIL, Mandir Hasaud, Raipur, Chhattisgarh, India.



Location of Project Activity (map not to scale)

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

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The project activity is a large scale potential CDM project which fits under the Category 1: Energy Industries (renewable / non-renewable sources) as per "List of Sectoral Scopes", Version 03.

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

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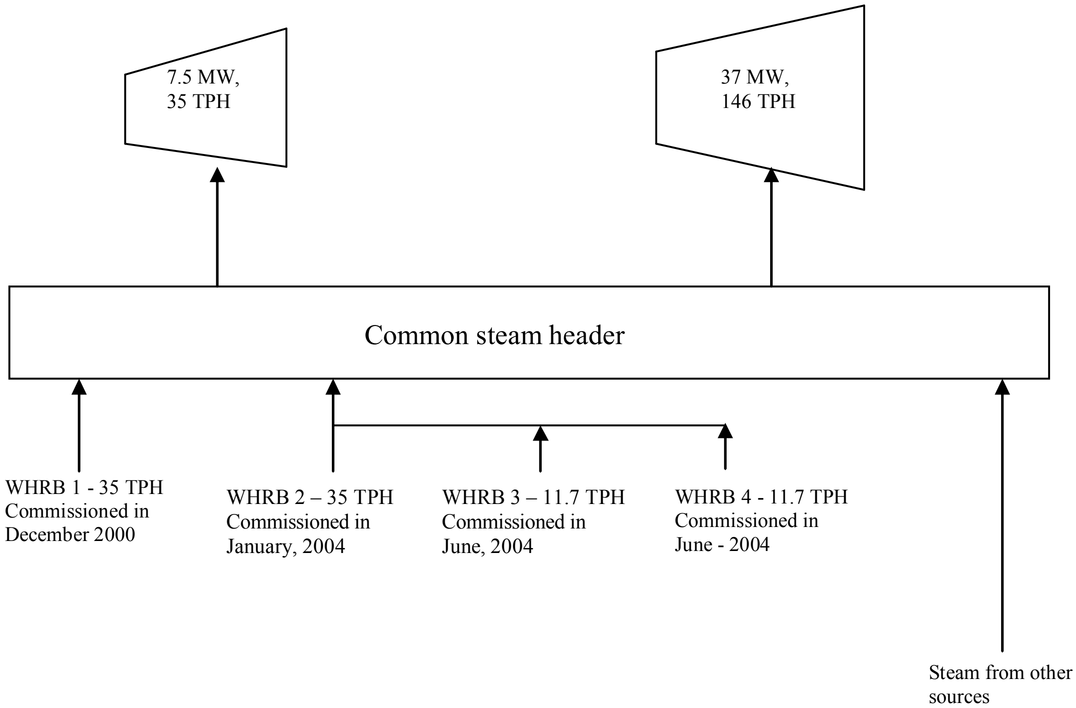
The power plant is utilising the kiln waste gases as fuel to generate power for the captive consumption of MIL. The exhaust waste gases of the DRI Kiln are at a temperature of the order of 900-950 °C. The Waste Heat Recovery Boiler transfers the sensible heat energy of the waste gas (earlier lost in the atmosphere) to generate steam. Four medium pressure waste heat recovery (WHR) boilers (66 kg/cm^2 & 495 °C) and high efficiency, multistage Steam Turbine & Generator (STG) sets are in operation to generate power and meet the plant's energy requirement.
After maximum heat recovery, the waste gas exiting the WHR boilers passes through a multi-field ESP to remove Suspended Particulate Matter (SPM) in the exhaust gases. The SPM collected in the hoppers of the ESP is disposed off as dry ash. Other systems required for power plant include, transformers, circulating cooling water system, DM Plant, supplementary fuel and ash handling system, compressed air system etc. The technology used to generate electricity is technically and environmentally safe and does not lead to enhanced environment damage in any way during the lifetime of the project.
The DRI kiln takes a planned shutdown for a period of 30 days in an operating year and the different kilns are stopped at different intervals of the year so that the steel plant keeps on functioning round the year. Power plant will also be shut down for maintenance as per the requirement. It is expected that on an average the power plant will run for at least 320 days in a year.
The project has been installed in stages. The plant consists of 2 turbines, a 8.0 MW turbine installed in stage I in 2000 and another 37 MW turbine whose installation started in March 2003 and has been commissioned on January 1, 2004.
The 35 TPH waste heat recovery boiler installed in stage I was feeding steam to turbine I before the commissioning of stage II. In stage II, another 35 TPH WHR boiler was installed on kiln 2 of 300 Tonnes per day (TPD) capacity which also feeds the steam to common header. Apart from the above mentioned two WHR boilers, another two boilers of small capacity of 11.7 TPH each have been installed on kiln no. 3 & 4 each of capacity of 100 TPD They will also provide steam to the common header for onward supply to the plant.

There is no transfer of technology and know how to the host party since technology is readily available in host country (India) from reputed manufacturers.



Project Configuration of Monnet Power Limited

Implementation schedule

The stage I power plant comprising of one 35 TPH boiler and one 8 MW STG, which was commissioned in December 2000. Another WHR boiler of 35 TPH was installed in year 2003 and two other WHR boilers have come up on the kiln no. 3 and 4. The net carbon credits are being sought only for the waste heat recovery based power generation.

Table A1

S.No	**Unit**	**Date of Commissioning**
1.	35 TPH Boiler (WHR I)	December 2000
2.	8 MW Turbine (TG I)	December 2000
3.	35 TPH Boiler (WHR II)	January 2004
4.	37 MW Turbine (TG II)	January 2004
5.	11.7 TPH Boiler (WHR III)	June 2004
6.	11.7 TPH Boiler (WHR IV)	June 2004

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:

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The Chhattisgarh state government power department do not compel sponge iron and steel industries to utilize the heat content of the waste gases generated from the reduction kilns and generate electricity. The project proponent has implemented the project activity over and above the national or sectoral requirements. The GHG reductions achieved by the project activity are additional to those directed by the governmental policies and regulations. The other "additionality" criteria of the project activity are dealt with in section B.3.

In the absence of the project activity, the power requirement of MIL was met by the state grid supply. An equivalent amount of CO_2 emissions would have resulted at the thermal power stations to generate electricity to meet MIL's power requirements. The primary objective of the project activity is to generate electricity from waste heat of the hot gases and displace the predominantly thermal based grid. The project activity, therefore, contributes to reducing the power demand on the grid. This would marginally alter the combined margin of the grid mix further reducing anthropogenic emissions by sources that would have occurred in the absence of the project activity.

Therefore, there is an additional reduction of GHG emissions (CO_2) that would not occur in absence of the project activity since the plant would draw electricity from the grid contributed mainly by thermal power plants.

The project will also save lot of energy by eliminating the energy component of the venturi scrubber. (As a conservative approach, the CO_2 emissions reductions due to closure of venturi scrubber operations has not been considered).

Considering the Western grid emission factor as baseline factor, net CO_2 emission reduction of 118,383 tonnes/annum is estimated after deducting the project emissions. Without project activity, the same energy load would have been taken up by the grid generation mix and emission of CO_2 would have occurred due to combustion of carbon emissive fossil fuels like coal.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
2004-05	118,383
2005-06	118,383
2006-07	118,383
2007-08	118,383
2008-09	118,383
2009-10	118,383
2010-11	118,383
2011-12	118,383
2012-13	118,383
2013-14	118,383
Total estimated reductions (tonnes of CO_2e)	**1,183,835**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	118,383

A.4.5. Public funding of the project activity:

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No public funding from parties included in Annex-I is involved in the project activity

SECTION B. Application of a baseline methodology

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

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Title: "Consolidated baseline methodology for waste gas and/or heat for power generation"
Reference: UNFCCC Approved consolidated baseline methodology **ACM0004 / Version 01**, Sectoral Scope: 01, 8 July 2005.

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

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The methodology ACM0004 is applicable to project activities that generate electricity from waste heat or the combustion of waste gases in industrial facilities.
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 the waste gas is produced 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.
MIL is the industrial facility where the project activity is coming up. The project activity will utilize the waste gases emanating from the DRI kilns of the industrial facility to produce electricity. The generated electricity will be displacing the electricity generation by the fossil fuel based power plants of the grid. Also in the project activity no fuel switch is being done in the process where the waste heat is produced. The project activity satisfies all the applicability conditions as specified in the methodology ACM0004, thence the said methodology is applicable for the project activity.

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

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The methodology as applied to the project activity involves the identification of alternative baseline scenarios that provide or produce electricity for in-house consumption excluding 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.

The possible **alternative baseline scenarios** are as follows:
Alternative 1: The project activity not undertaken as a CDM project activity
MIL may set up a waste heat recovery based electricity generation at its facility for meeting in-house requirements. This alternative is in compliance with all applicable legal and regulatory requirements. However, this alternative faces a number of barriers (as detailed in Section B3 below) making it predictably prohibitive. Hence this option is not a part of baseline scenario.
Alternative 2: Import of electricity from the grid – continuation of current scenario
MIL continues to purchase required electricity from the grid i.e., Chattisgarh State Electricity Board (CSEB). An equivalent amount of CO_2 emissions would take place at the thermal power plants supplying

power to CSEB grid. This alternative is in compliance with all applicable legal and regulatory requirements and can be a part of baseline scenario.

Alternative 3: Coal based captive power generation on-site

An equivalent coal based captive power plant put up at MIL. Although, this alternative is in compliance with all applicable legal and regulatory requirements it is dependant on the availability of coal.

Alternative 4: Diesel based captive power generation on-site

An equivalent diesel based captive power plant put up at MIL. Although, this alternative is in compliance with all applicable legal and regulatory requirements it is economically prohibitive given the rising crude prices and thereby higher cost of generation. Thus it can be excluded from the baseline scenario.

Alternative 5: Gas based captive power generation on-site

MIL may generate its own power using natural gas based captive power plant. Although this alternative is in compliance with all regulatory and legal requirements it is not a realistic alternative due to non-availability of natural gas distribution network in Chattisgarh[1]. Therefore, alternative 5 may be excluded from baseline scenario.

Among all these alternatives the one that does not faces any prohibitive barrier and is the most economically attractive should be considered as the baseline scenario. Thus from the above identified alternatives it can be found that alternative 2 and alternative 3 are the most likely alternatives for the baseline scenario. Although alternative 3 is economically attractive but is dependant on getting of coal mines on lease. Thus **alternative 2: Import of electricity from the grid** would be the most likely **baseline scenario** as it faces no prohibitive barrier and is also economically attractive. Moreover the baseline emission factor of the grid is more conservative than that of the coal based captive power generation as the grid mix consists of coal, gas, hydro, nuclear and renewable energy sources.

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:

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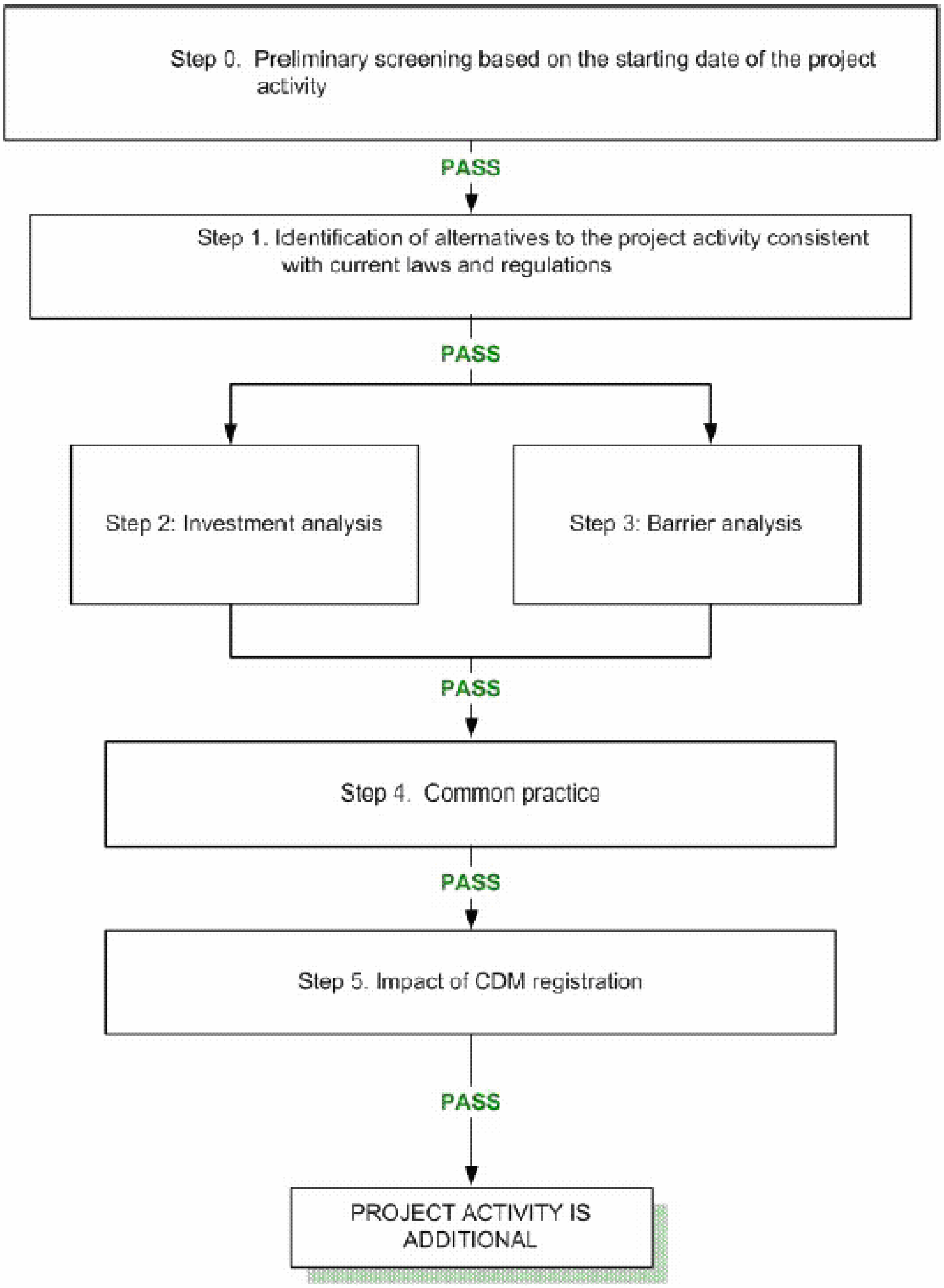
The methodology requires the project proponent to determine the additionality based on 'Tools for demonstration and assessment of additionality' as per EB-16 meeting. The flowchart in the figure below provides a step-wise approach to establish additionality of the project activity.

[1] State wise/Sector wise Allocation of Natural Gas - http://petroleum.nic.in/ngbody.htm


Step 0. Preliminary screening based on the starting date of the project activity
PASS
Step 1. Identification of alternatives to the project activity consistent with current laws and regulations
PASS
Step 2: Investment analysis
Step 3: Barrier analysis
PASS
Step 4. Common practice
PASS
Step 5. Impact of CDM registration
PASS
PROJECT ACTIVITY IS ADDITIONAL

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

If project participants wish to have the crediting period starting prior to the registration of their project activity, they shall:
(a) *Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of a first CDM project activity, bearing in mind that only CDM project activities submitted for registration before 31 December 2006 may claim for a crediting period starting before the date of registration*:

MIL wishes to claim for the retroactive credits period and proposes to get the project activity registered with UNFCCC before December 31, 2006.

(b) *Provide evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity.*

Adequate evidence is available with MIL which shows that CDM benefits were seriously considered to proceed with project activity. The documentation will be made available to the Designated Operational Entity (DOE) during validation.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Sub-step 1a. Define alternatives to the project activity:
Sub-step 1b. Enforcement of applicable laws and regulations:
As discussed in section B2 above, there were five possible alternatives available with the project proponent to provide this service among which three were feasible. They are:
Alternative 2: Import of electricity from the grid – continuation of current scenario
Alternative 3: Coal based captive power generation on-site
Alternative 4: Diesel based captive power generation on-site
These alternatives are in compliance with all applicable legal and regulatory requirements. There is no legal binding on MIL to implement the project activity. In India it is not mandatory for such units to implement waste heat recovery based power generation plants from waste gases of the kilns.

Step 2: Investment analysis

Or

Step 3: Barrier analysis

MIL proceeds to establish project additionality by conducting the Step 3: Barrier Analysis.
The project proponent is required to determine whether the proposed project activity faces barriers that:
(a) Prevent the implementation of this type of proposed project activity; and (b) Do not prevent the implementation of at least one of the alternatives through the following sub-steps:
Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

The project activity had its associated barriers to successful implementation, which have been overcome by MIL to bring about additional green house gas reductions. The barriers are detailed below:

Technological barriers:

- ***Dirty waste gas***: the gas leaving the kiln has a very high particulate load that can create erosion and fouling problems on the gas side of the boiler tubes. The waste gases emanating from the kilns have high levels of SO2 and SO3 in them. The waste gas must therefore be kept at a temperature greater than 150°C to prevent the condensation of these gases as sulphuric acid. Sulphuric acid is highly corrosive and would severely damage downstream equipment such as the electrostatic precipitator, fans, dampers and the exhaust stack. Also there is nitrate stress corrosion cracking likely in waste heat recovery boilers[2].
- ***Input heat variations***: The gas generated by the DRI kiln varies widely in both flow and heat over short periods of time. Thereby the power output would also be varying thus incorporation of an attemperator (an over-sized steam drum) will be required so that the effects of such wide variations are effectively balanced out.
- ***Maximising electricity production***: To maximise the electricity production from the waste gases high pressure and high temperature configuration is being utilised in the project activity. A fully condensing turbine which gives the maximum power output is being used in the project activity. Also the flue gas exit in the project activity is being kept to the lowest possible maximising the heat recovery from the waste gases.
  An economiser design was adopted to prevent corrosion while maximising electrical output. The economiser ensures that the gas temperature remains above the acid dew point before the exhaust stack. The heat extracted from the gas in the condensate heater is used to preheat the condensate entering the deaerator of the boiler, eliminating the use of steam for preheating and thus providing the capacity to generate additional power.
  Another aspect of the design that promotes maximum electricity output is the boiler cleaning system. Soot blowers will be installed to clean the boiler and economiser tubes. The soot blowers will shake the dust from the tubes thereby maintaining the heat transfer area for heat recovery.
- ***Priority of kiln output***: As the core business of Monnet is to produce steel, it is important that the Waste Heat Recovery Plant not dictate kiln operations. A waste gas bypass system was installed to allow kiln operation during maintenance shutdowns of the boiler.
  During bypass operation, water sprays are used to cool the waste gas from 900°C (exit temperature form the kiln) to about 200°C in order to protect the electrostatic precipitator, ducts and fans. Such cooling and the resulting thermal shock, if performed in a traditional ducting lined refractory, would result in cracking and dislodging of the lining. The alternative adopted for the quench tower was an internally insulated structure consisting of an internal single plate construction made from high temperature steel plates.
- ***Safe and reliable connection to the electricity grid***: Digital High Voltage protection relays will be required for the connection of the system to the grid. This includes distance protection, generator protection, transformer protection and protection against pole slipping on the generator. The relays are linked back to the main DCS for the plant, providing extensive monitoring and status information, and allowing disconnection and reconnection with grid as required.

Other Operational barrier(s)

[2] Nitrate Stress Corrosion Cracking in Waste Heat Recovery Boilers , R.G.I. Leferink, W.M.M. Huijbregts. C , Anti-Corrosion Methods and Materials, Vol 49 (2002), No 2, p 118-126

Besides all these risks and barriers regarding grid connectivity and stand alone operations, the project activity faces operational risks related to the waste gas generation and its heat content, which effect the successful implementation of the project activity.

- The non-availability of waste gases due to any technical fault in the kiln will prevent power generation in the project activity. If the heat content of the waste gas is not sufficient, the project activity will directly be affected since there are no inbuilt provisions to increase waste gas temperatures through auxiliary fuel firing.

Cumulative effect of sustained variable frequency operation due to fluctuations in waste gas supply (flow rate & temperature) may have substantial bearing in safe and sustained operation of assets like the power plant equipments.

Quality of products of a number of process industries like rolling mills is heavily dependent on the quality of power supply. Poor quality of power supply not only results in reduced life of equipment but also in poor quality of products.

Non-availability of waste gas at the required temperature can also result in a complete closure of the project activity. Also resumption of production process takes a long time. Hence the power interruption even for a short spell can destabilize the manufacturing process, besides causing production loss and damage to the sophisticated equipments due to thermal shock.

Lack of relevant technical background

Energy generation is not a core business of MIL. The project promoters have never before taken up a power generation project. The project promoters of MIL are engaged mainly in the manufacturing sponge iron and steel billets. The waste heat recovery based power project is a steep diversification from the core business fields to power generation where the project proponent has to meet challenges of captive power policies, delivery/non-delivery of power, and techno-commercial problems associated with electricity boards. The main barrier to the implementation of the waste heat recovery based power generation is the perceived risk of adopting a new and somewhat unknown (at least to MIL Resources) technology. Most businesses would agree that it is far easier to adopt traditional, well established processes. However, this means that the benefits of newer technologies are frequently overlooked. MIL had to look closely at what financial and environmental benefits the project offered, and at how the company could minimise its exposure to risk. In the end, by weighing the risks against the benefits of the project and the CDM benefits accruing due to the project activity, the decision was made to go ahead.

Sub-step 3: Show that the identified barriers would not prevent a wide spread implementation of at least one of the alternatives (except the proposed project activity already considered in Step 3a).

This is demonstrated in Section B.2. above MIL's project activity is a waste heat recovery based power project utilizing waste heat from DRI kiln. MIL would not have faced any regulatory barrier in case it would opt for import of power from grid since before project activity MIL was already connected to the grid for in-house power requirements. In this scenario it would not have faced the investment barrier as no special investments are required to meet the demand. Also for import of grid power, MIL does not face any barriers, as in the case of generation and synchronization of waste heat based power. Therefore, it is most likely that in absence of the project activity MIL could opt for the business-as-usual scenario, i.e. letting off the waste heat into the atmosphere and import of equivalent electricity from state grid to cater to its needs.

Step 4: Common Practice analysis:

Based on the information about activities similar to the proposed project activity, the project proponent is supposed to carry out common practice analysis to complement and reinforce the barrier analysis. The project proponent is required to identify and discuss the existing common practice through the following sub-steps:

Step 4a: Analyze other activities similar to the proposed project activity
The methodology requires the project proponent to analyze the prevailing practices in the similar industries in order to assess the most common course of action among the identified baseline options.
Table below summarizes the common practices adopted by sponge iron manufacturing industries to meet their power requirement. As per Table, 14 sponge iron plants imported electricity from the grid. There are no sponge iron plants, which generated their own power from fossil fuel based power plant. The Alternative 2 occurs in 82 % of the similar industries and is therefore a common practice. Therefore from the assessment of common practices adopted by the sponge iron units it is evident that Alternative 2: Import of electricity from grid, is the most common course of action among the identified baseline options.

The power requirement of sponge iron manufacturing industries are met by	
Alternative 2***: Import of electricity from the grid***	***14***
Alternative 3***: Fossil fuel based captive power plant***	***0***
Project Activity: Waste heat recovery based power plant	***3***
Total number of Sponge Iron Manufacturing Industries	***17***

The above analysis shows that the proposed project activity has not been a common practice amongst plants facing similar techno-economic circumstances in the region.

Step 4b: Discuss any similar options that are occurring
The upturn in the general economy and the steel sector has resulted in the expansion and setting up of many sponge iron industries in India and in particular in Chhattisgarh state. There are around 47 sponge iron plants in operation or being implemented in the state. As per the list of memorandum of understanding (MoU) signed (till August 2004) by the Government of Chhattisgarh and Chhattisgarh State Industrial Development Corporation (CSIDC), there are around 27 sponge iron industries proposed to be set up in the state[3]. The sponge iron plants that are existent in the state which have waste heat recovery based power generation activity are primarily coming up after taking the CDM funding into consideration. This is a clear indication that due to the barriers discussed earlier waste heat recovery from the DRI kiln is not a common practice. Moreover currently the plants which are coming up in the region have opted for waste heat recovery systems have done so only on the basis of CDM funding.

Step 5: Impact of CDM registration

The project activity getting registered as CDM project would give instant visibility and would act as a precursor for other industries to invest in waste heat recovery based power generation.
Successful implementation and running of the project activity on a sustainable basis requires continuous investments in technological up gradation. It also requires manpower training and skill development on a regular basis. The project proponent could get the necessary funding from selling the project related CERs. Apart from these, registration of the project under CDM would enhance the visibility would aid CSEB in appreciating the GHG emission reduction efforts of the project proponent. Further CDM fund will provide

[3] http://chhattisgarh.nic.in/departments/sipb/mou-eng.pdf

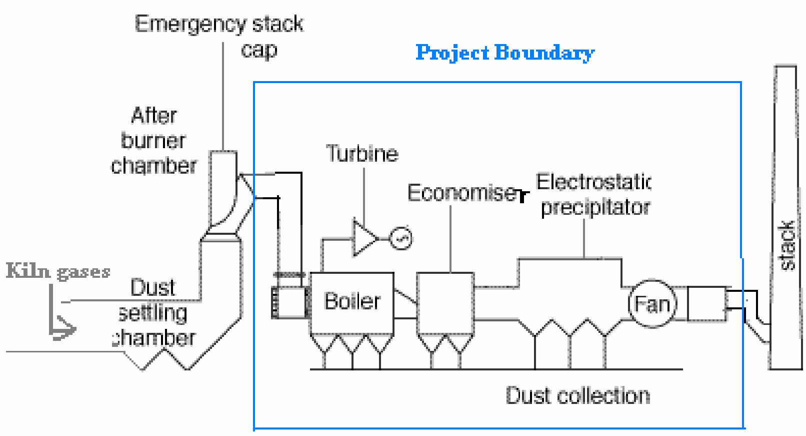
additional coverage to the risk due to failure of project activity; shut down of plant and loss of production. In such an event the BAU baseline option is continued with release of CO_2 emissions.
It is ascertained that the project activity would not have occurred in the absence of the CDM simply because no sufficient financial, policy, or other significant incentives exist locally to foster its development in Chattisgarh/India and without the proposed carbon financing for the project MIL would not have taken the investment risks in order to implement the project activity. Therefore the project activity is additional. Also, the impact of CDM registration is significant with respect to continuity of the project activity on a sustainable basis.

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

>>
The definition of the project boundary states that the project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases (GHG) under the control of the project participants that are significant and reasonably attributable to the CDM project activity.
As per ACM0004, for the purpose of determining GHG emissions of the project activity, project participants need to include:

- CO_2 emissions from combustion from auxiliary fossil fuels

As discussed earlier that there is no provision of auxiliary fossil fuel firing in the project activity so there are no project activity related emissions. The project boundary related to ACM0004 as applied to the project activity comprises of the WHRBs, turbo-generators, and the ESP as shown in the figure below:



The project boundary starts from supply of waste flue gas at the boiler inlet to the point of electricity generated for Monnet.
Further, for the purpose of calculation of baseline emissions Western regional grid has been considered within the system boundary. Estimation of baseline emissions has been done based on data and information available from Western Region Electricity Board (WREB) sources and Central Electricity Authority (CEA) sources as applicable.

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:

>>

As required by ACM0004 methodology, baseline is calculated as per ACM0002 and the net baseline emission factor was found to be 0.759 kg CO_2/ kWh. Please refer to details in Annex 3 of the PDD.

Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:
24/11/2005

Name of person/entity determining the baseline:
Monnet Ispat Limited and its associated consultants

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:

>>
January 2000

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

>>
25 years

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

The project activity will be using a fixed crediting period.

C.2.1. Renewable crediting period

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

>>
Not selected.

C.2.1.2. Length of the first crediting period:

>>
Not selected.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
July 2004

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:

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Title: “Consolidated monitoring methodology for waste gas and/or heat for power generation”
Reference: UNFCCC Approved consolidated monitoring methodology **ACM0004 / Version 01**, Sectoral Scope: 01, 8 July 2005.

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

>>

The monitoring methodology is used in conjunction with the approved baseline methodology ACM0004 – “Consolidated baseline methodology for waste gas and/or heat for power generation”. The applicability criteria for the approved baseline methodology ACM0004 and approved monitoring methodology ACM0004 are identical and have been justified in section B.1.1. Thus the said methodology is applicable to the project activity.
The methodology requires the project participant to monitor 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.

The project activity will have the monitoring of the generation of the total electricity generated and the auxiliary electricity thereby enabling the calculation of the net electricity supplied to the facility. As there will be no fossil fuel consumption in the project activity so monitoring of the same would not be required.

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

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

Not applicable. As per the methodology ACM0004 project emissions are applicable only if auxiliary fuels are fired for generation start-up, in emergencies, or to provide additional heat gain before entering the waste heat recovery boiler. Since in the project activity there will be no auxiliary fossil fuel firing / consumption involved, thence no project emissions.

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

>>

Not applicable

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

1. EG_{GEN}	Total Electricity Generated	On-site instrumentation	MWh/yr	m	Continuously	100%	Electronic	Monitoring location: meters at plant and DCS will measure the data. Manager In-charge would be responsible for regular calibration of the meter.
2. EG_{AUX}	Auxiliary Electricity	On-site instrumentation	MWh/yr	m	Continuously	100%	Electronic	Monitoring location: meters at plant and DCS will measure the data. Manager In-charge would be responsible for regular calibration of the meter.
3. EG_y	Net Electricity supplied to facility	On-site instrumentation	MWh/yr	c (EG_{GEN} - EG_{AUX})	Continuously	100%	Electronic	Calculated from the above measured parameters.
4. EF_y	CO_2 Emission factor of the grid	Grid reports and CEA reports	tCO_2/MWh	c	Once at the start of the crediting period	100%	Electronic	Calculated as a weighted sum of the OM and BM emission factors
5. $EF_{OM,y}$	CO_2 Operating Margin emission factor of the grid	Grid reports and CEA reports	tCO_2/MWh	c	Once at the start of the crediting period	100%	Electronic	Calculated as Step 1 of ACM0002
6. $EF_{BM,y}$	CO_2 Build Margin emission factor of the grid	Grid reports and CEA reports	tCO_2/MWh	c	Once at the start of the crediting period	100%	Electronic	Calculated as Step 2 of ACM0002

7. $F_{i,j,y}$	Amount of each fossil fuel consumed by each power source / plant	Grid reports and CEA reports	t or m^3/yr	m	Once at the start of the crediting period	100%	Electronic	Obtained from the power producers, dispatch centers or latest local statistics
8. $COEF_{i,k}$	CO_2 emission coefficient of each fuel type and each power source / plant	Grid reports and CEA reports, IPCC guidelines	tCO_2/ t or m^3	c	Once at the start of the crediting period	100%	Electronic	Plant or country specific values to calculate COEF are preferred to IPCC default values
9. $GEN_{j,y}$	Electricity generatio n of each power source / plant	Grid reports	MWh/yr	M	Once at the start of the crediting period	100%	Electronic	Obtained from the power producers, dispatch centers or latest local statistics.

As per the methodology the archive data will be kept during the crediting period and two years after.

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

>>

Emission Factor of the Grid (EF_{Grid})

Electricity baseline emission factor of Western Regional Grid (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin is based on data from official sources (where available) which is publicly available.

STEP 1. Calculation of the Operating Margin emission factor

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the weighted average emissions (in t CO_2equ/MWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

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

where

$COEF_{i,j}$ is the CO_2 emission coefficient of fuel i (t CO_2 / mass or volume unit of the fuel), calculated as given below and

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

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y , calculated as given 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 other grid

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO2,i} \otimes OXID_i$$

where

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i

$OXID_i$ is the oxidation factor of the fuel

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated separately for the most recent three years (2002-03, 2003-04 and 2004-05) and an average value has been considered as the OM emission factor for the baseline ($EF_{OM,y}$).

$$EF_{OM,y} = \sum_{y} EF_{OM,simple,y} / 3$$

where y represents the years.

STEP 2. Calculation of the Build Margin emission factor

The Build Margin emission factor ($EF_{BM,y}$) has been calculated as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of WREB. The sample group *m* consists of either

• the five power plants that have been built most recently, or

• 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. Project proponent should use from these two options that sample group that comprises the larger annual generation. The calculation for Build Margin emission factor is furnished below:

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

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.

STEP 3. Calculation of the Emission Factor of the Grid (EF_{Grid})
The electricity baseline emission factor of Western Regonal Grid, EF_y is calculated 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 $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.
(Please refer to "Annex 3: Baseline Information" for further details on grid analysis)

Baseline Emission Calculations

Net units of electricity substituted due to waste heat recovery based power in the grid (EG_y)
= (Electricity generated -Auxiliary Consumption)

$$= (EG_{GEN} - EG_{AUX})$$

Therefore the Baseline Emission is calculated as,

$$BE_y = EG_y \otimes EF_y$$

where,
BE_y = Baseline Emissions due to displacement of electricity during the year y (in tons of CO_2)

EG_y = Net units of electricity due to WHR substituted in the grid during the year y (in MWh)
EF_y = Emission Factor of the grid (in tCO_2/ MWh) and
y is any year within the crediting period of the project activity

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

Not applicable

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

Not applicable

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

>>
Not applicable

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

Not applicable

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

>>
Not applicable

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.)

>>
The emission reduction ER_y by the project activity during a given year y is the difference between the baseline emissions through substitution of electricity generation with fossil fuels (BE_y) and project emissions (PE_y), as follows:

$$ER_y = BE_y - PE_y$$

Where:
ER_y are the emission reductions of the project activity during the year y in tons of CO_2
BE_y are the baseline emissions due to the displacement of electricity during the year y in tons of CO_2
PE_y are the project emissions during the year y in tons of CO_2

Now, since the project emissions are non-existent in the project activity so the emission reductions (ER_y) equal the substitution of electricity generation with fossil fuels (BE_y)

$ER_y = BE_y$

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.
D.2.1.3 – 1	Low	This will be cross-checked with the quantity of flue gas generated and thereby the amount of steam generated in the WHRBs. The calibrated equipments can be checked by the verifier.
D.2.1.3 – 2	Low	The auxiliary consumptions are usually fixed but still the calibrated meters can be checked by the verifier
D.2.1.3 – 3	Low	This is a calculated value
D.2.1.3 – 4 - 9	Low	Latest data from local statistics, Grid reports, CEA reports. IPCC data will be checked against recent IPCC publications.

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

>>

The Plant Manager is responsible for monitoring and archiving of data required for estimating emission reductions. He would be supported by the shift in-charge who would continuously monitor the data logging and would generate daily, monthly reports. Any discrepancy observed in the readings would be promptly addressed by the plant manager. The calibration of the equipments would be carried out as per the guidelines provided by the equipment supplier to ensure correct monitoring.

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

>>

Monnet Ispat Limited

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

Not applicable. The waste heat recovery boilers of the project activity are unfired type, thus there will be no auxiliary fossil fuel consumption. Thence there will be no greenhouse gas emissions occurring due to the project activity, since there is no such source.

E.2. Estimated leakage:

>>

Not applicable as per the methodology ACM0004

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

>>

There are no project activity emissions.

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

>>

Baseline emissions (BE_y) are calculated using the formula:

$BE_y = EF_y \times EG_y$

Where,

EG_y Net electricity supplied to the facility

EF_y Baseline emission factor

Year	Estimation of Net Electricity supplied to the facility, EG_y (million kWh/annum)	Estimation of Emission factor, tCO2/ million kWh	Estimation of baseline emissions (tonnes of CO_2e)
2004-05	156.05	758.61	118,383
2005-06	156.05	758.61	118,383
2006-07	156.05	758.61	118,383
2007-08	156.05	758.61	118,383
2008-09	156.05	758.61	118,383
2009-10	156.05	758.61	118,383
2010-11	156.05	758.61	118,383
2011-12	156.05	758.61	118,383
2012-13	156.05	758.61	118,383
2013-14	156.05	758.61	118,383
Total (tonnes of CO_2e)	**1560.54**	**758.61**	**1,183,835**

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

>>

Emissions reductions (ER_y) are calculated using formula:

$ER_y = BE_y - PE_y$
Since project emissions (PE_y) are zero, the emission reductions are equal to baseline emissions as given in table below.

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

>>

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2004-05	0	118,383	0	118,383
2005-06	0	118,383	0	118,383
2006-07	0	118,383	0	118,383
2007-08	0	118,383	0	118,383
2008-09	0	118,383	0	118,383
2009-10	0	118,383	0	118,383
2010-11	0	118,383	0	118,383
2011-12	0	118,383	0	118,383
2012-13	0	118,383	0	118,383
2013-14	0	118,383	0	118,383
Total (tonnes of CO_2e)	**0**	**1,183,835**	**0**	**1,183,835**

SECTION F. Environmental impacts

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

>>

The heat recovery based captive power project would cause an impact on Environment in three distinct phases:

- During Construction Phase
- During Operational Phase and
- Maintenance Phase

The impacts envisaged during construction of the project activity were:

- Impact on Soil Quality
- Impact on Air quality
- Impact on Noise Levels

The environmental impact during the construction phase is regarded as temporary or short term and hence does not affect the environment significantly.

The nature of the impacts that are evident during the operational and maintenance phase is discussed in detail below. All possible environmental aspects for the various project activities have been identified and discussed for their impacts on the baseline environment that prevailed before the project was executed. The following table summarizes the project's local and environmental, social and other impacts, benefits and the mitigation measures taken by MIL to reduce/minimise negative impacts if any and enhance the positive impacts.

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
A	CATEGORY: ENVIRONMENTAL – NATURAL RESOURCE CONSERVATION	
1	Coal Conservation: By displacing MIL's electricity demand on the grid, the project activity reduces an equivalent amount of coal consumption that would have been required to meet the additional capacity requirements the plant. The project activity has also reduced the transmission and distribution losses of the grid as power is being consumed at the same place where it is getting generated. In addition, the power consumption for the venturi scrubber has also been avoided leading to more savings in the power. Water Conservation: Demineralised water, used to produce high pressure steam and auxiliary cooling water are closed loop system which reduces water consumption and effluent discharge to the environment.	The project activity is a step towards Coal and Water Conservation.
B	CATEGORY: ENVIRONMENTAL – AMBIENT AIR QUALITY	
1	MIL has an in-house monitoring capability and conducts ambient air quality monitoring at a regular basis. Based on theoretical GLC calculations of SPM, SO_2 and NO_x from all stacks in the plant, it has been observed that the maximum	-

	composite GLC, under stability class B from the combined stack of Sponge Iron Unit and Power Plant is quite low as compared to ambient air quality standards.	
C	CATEGORY: ENVIRONMENTAL – AIR EMISSIONS	
1	The project utilizes the heat content of the gases and thereby reduces heat energy release to atmosphere either as hot air emissions or as hot wastewater emissions from venturi scrubber. Most of the heat was lost in the wastewater generated while scrubbing. Therefore the project has reduced thermal Pollution and heat energy loss. The heat energy lost earlier has been converted to electrical energy. The present stack emission temperatures are found to be lower.	The WHRB recovers a part of the heat content of the waste gas to generate steam, which further generates electricity.
2	By displacing electricity demand on the grid, the project reduces emissions related to coal-fired/thermal power production, which include carbon dioxide, sulphur oxides, nitrogen oxides and particulates.	
3	The project activity has also reduced the adverse impacts on air quality related to transportation of coal and coal-mining that would have been required to meet the additional capacity requirement of thermal power plants.	
D	CATEGORY: ENVIRONMENTAL – HYDROLOGY	
1	The source of water for the plant is canal running adjacent to the plant site. The analysis results of water of this main canal show that water quality is within the limits.	
E	CATEGORY: ENVIRONMENTAL – WASTEWATER GENERATION	
1	The plant is designed on a 'zero discharge' concept.	During the process the dissolved solid concentration of water increases. In order to maintain the quality of water blow down is required. All the wastewater generated is recycled within the plant after treatment for; cooling water, dust suppression at ash dump area and horticulture purposes.
2	Effluents generated from the D.M. water plant will be neutralised before discharge.	These effluents will be suitably used for dust suppression at ash silos
3	Additional manpower for the project activity has contributed to organic pollution load but the quantity addition is very low.	This is taken care of by well-designed Septic tanks followed by soak pits.
F	CATEGORY: ENVIRONMENTAL – LAND	
1	At present, industry has efficient pollution control devices at all the units. Industry has also developed Green Belt in and around the plant premises. All the solid waste generated by the plant is safely collected, scientifically managed and is fully utilised.	There is no possibility of any negative impact on Land environment by existing or proposed units

G	CATEGORY: ENVIRONMENTAL – SOLID WASTE GENERATION	
1	The dust generated from the boilers will be utilised for dumping in low lying areas, filling of abandoned mines and as filling material for road making. This ash will also be utilised by bricks manufacturing units.	To prevent any adverse impacts, 100 mm thick PCC lining should be provided before filling the abandoned mines. The entire ash dump should not be used at a time for dumping in an unplanned manner rather it should be done in small sectors. The filled up sector should be covered with a layer of atleast 15 cm deep top soil over which, quick growing grass and other bushy shrubs should be grown.
H	CATEGORY: ENVIRONMENTAL – NOISE GENERATION	
1	Insulated working areas especially in turbine floors, compressed air station will be provided. Noisy machinery will be put on vibratory isolators surrounded by sound absorbing barriers.	The workers working in the areas of high noise level should use ear plugs or ear muffs to protect their ears.
I	CATEGORY: SOCIAL-ECONOMIC	
1	The project is not going to cause any damage to present traditional agriculture prevailing in that area. Moreover, it may directly help the agriculture to improve by way of providing additional income from supplementary sources expected to be generated. The project activity site is within the premises and there is no human displacement. Therefore no rehabilitation programme was needed.	The project is expected to bring positive changes in the life style and quality of life.
J	CATEGORY: OCCUPATIONAL HEALTH	
1	MIL has an Occupational Health Centre which runs round the clock. The dispensary is fully equipped with latest medicine and basic medicinal facilities. Safety of employees during operation and maintenance is taken care off as per factory rules and regulations.	Workers should be trained on sanitation, cleanliness, hygiene and health care. Values of different factors which lead to occupational health hazards should be monitored and control measures should be specified.
K	CATEGORY: GREEN BELT	
1	MIL has started the green belt development program simultaneously with the commissioning of its first unit. The same green belt is fully developed and gives a pleasant scenario. Industry has not only developed a green belt inside and outside the premises but also has taken up the work of green belt development in Raipur city. An elaborate green belt development plan has been drawn up for existing and proposed plant.	The green belt should be planted close to the area to be protected to optimise attenuation within physical limitations.

L	CATEGORY: ECOLOGY	
1	The study area is on the outer skirts of Raipur city and there are no forests. Consequently the bio-diversity is not high. The area is rural type and several types of flora and fauna is found in the study area. The air emissions and effluent of the proposed unit, being within prescribed norms, are not having any impact on any of the environmental parameters.	-

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:

>>

Host party regulations require MIL to obtain environmental clearance from Chhattisgarh pollution Control Board. . Environmental Impact Assessment has been conducted and the environmental clearance has been received. This project activity has positive environmental impacts. The Heat Recovery Based Power Plant with ESP is a cleaner and more energy efficient air pollution control measure as compared to the Venturi Scrubber. The project activity is not polluting and the impacts associated with the project activity are insignificant.

Environmental Clearance Documents are available with the company and can be inspected on request.

SECTION G. Stakeholders' comments

>>

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

>>

The stakeholders identified for the project are as under.

- Elected body of representatives administering the local area (village *Panchayat*)
- CSEB
- Chhattisgarh Pollution Control Board (CPCB)
- Non-Governmental Organisations (NGOs)

Stakeholders list includes the government and non-government parties, which are involved in the project at various stages. MIL has applied / communicated to the relevant stakeholders to get the necessary clearances. Notification through regional and national newspapers for public hearing was brought out requesting the stakeholders to participate and communicate any suggestions/objections regarding the project activity in writing. On the day of hearing, MIL representatives presented the salient features of the project activity to the stakeholders and requested their suggestions/objections. The opinions expressed by the stakeholders were recorded and are available on request.

No NGO involvement is there in the project as the waste heat recovery plant has been installed inside the plant premises and there has been no disturbance to the local community or people outside the plant boundary on account of this measure.

G.2. Summary of the comments received:

>>

The village Panchayat/Local elected body of representatives administering the local area is a true representative of the local population in a democracy like India. Hence, their comments on the project activity are necessary. Since the project has environmental additionality the local populace welcomed it. MIL has received their opinions for the project.

The project has not resulted in any displacement of any local population. The project was set up on land available inside the factory premises. Thus, the project will not cause any adverse social impacts on local population rather will help in improvising their quality of life.

State Pollution Control Board and Environment Department have prescribed standards of environmental compliance and monitor the adherence to the standards. The project has received the Consent to Establish (or No Objection Certificate (NOC)) and the Consent to operate from the board.

MIL has already received the major necessary approvals and consents from various authorities, required for project implementation. They have also received a positive response from the people living nearby for the project activity.

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

>>

- In view of various direct and indirect benefits (social, economical, and environmental), no concerns or comments were raised during the consultation with stakeholders. The conditions laid by the various Government bodies while giving the NOC will be faithfully complied with.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public Funding is available to the project.

Annex 3

BASELINE INFORMATION

For the project activity the baseline scenario was determined as equivalent electricity generation from the grid as shown in Section B2 earlier. As per ACM0004 methodology, if the baseline scenario is grid power supply then the Emission Factor for the displaced electricity is calculated according to ACM0002 baseline methodology.

A) Choice of the grid that will be affected by the project activity

In India, power is a concurrent subject between the state and the central governments therefore there are state utilities and central utilities. The electricity system in India is divided into five regions – Northern, Eastern, Western, Southern and North-Eastern Electricity Boards. The management of generation and supply of power within the regional grid is undertaken by the load dispatch centers (LDC). Different states within the regional grids meet the demand from their own generation facilities plus generation by power plants owned by the central sector i.e., National Thermal Power Corporation (NTPC) and National Hydro Power Corporation (NHPC) etc. Specific quota is allocated to different states from the central sector power plants. Depending on the demand and generation there are exports and imports of power within different states in the regional grid. The choice of a regional grid minimizes the effect of inter state power transactions which are dynamic and vary widely. The regional grids have minimal interchange of electricity between themselves therefore a regional grid can be safely considered as the relevant electricity grid rather than going for the state grid.

National grid has not been chosen due to the lack of infrastructure and low inter-regional energy exchanges. The formation of the National Power Grid has been envisaged in a phased manner as follows[4]:

Phase – 1: HVDC interconnections between regions. This phase was completed in the year 2002.

Phase – 2: Strengthening of inter-regional connectivity with hybrid system consisting of high capacity AC (765 kV & 400 kV) and HVDC lines. This phase is likely to be completed by the end of year 2007.

Phase – 3: Further , strengthening of National Grid is envisaged through 765 kV AC lines / HVDC lines to Southern region and linking North Eastern Region with rest of the National Grid through high capacity transmission system. This phase is planned to be implemented by 2012.

The status of inter-regional energy exchange for the past decade has been as follows[5]:

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[4] http://powermin.nic.in/JSP_SERVLETS/internal.jsp

[5] http://cea.nic.in/gmd/IRExchanges.pdf

INTER-REGIONAL ENERGY EXCHANGES

(All figures in MU)

REGION From	To	1997-98	1998 - 99	1999 - 00	2000-01	2001-02	2002-03	2003-04	2004-05
Northern	Western	1154.2	1060.1	700.2	984.7	975.4	1631.1	1036.2	257.8
	Eastern	5.1	14.9	29.4	16.8	22.0	1.6	9.0	0.0
	Southern	0.0	184.1	70.8	83.8	0.0	0.0	13.1	0.0
	Sub-total	**1159.3**	**1259.1**	**800.4**	**1085.3**	**997.4**	**1632.7**	**1058.3**	**257.8**
Western	Northern	377.3	376.4	599.6	573.5	299.1	104.0	411.4	1623.0
	Southern	520.9	1499.8	1067.1	323.9	798.9	169.6	299.1	162.8
	Eastern	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Sub-total	**899.3**	**1876.2**	**1666.7**	**897.4**	**1098.0**	**273.6**	**710.5**	**1785.8**
Southern	Northen	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.3
	Western	536.6	522.7	518.1	658.5	621.7	748.9	823.1	1771.7
	Eastern	0.0	0.0	0.0	0.0	0.0	0.0	46.4	26.1
	Sub-total	**536.6**	**522.7**	**518.1**	**658.5**	**621.7**	**748.9**	**869.5**	**1908.1**
Eastern	Northern	0.0	88.3	394.4	455.4	1768.8	1637.5	2086.5	3943.4
	Western	1200.0	1461.6	2772.9	2471.4	2380.9	2810.0	8500.5	9361.5
	Southern	820.2	1682.8	2492.1	3812.6	4742.6	4697.5	4437.4	3441.2
	N.Eastern	454.4	395.4	397.2	493.6	665.8	846.5	268.8	87.5
	Sub-total	**2474.6**	**3628.1**	**6056.6**	**7233.0**	**9558.1**	**9991.5**	**15293.2**	**16833.6**
N.Eastern	Northern	0.0	0.0	0.0	0.0	0.0	0.0	38.5	182.8
	Western	0.0	0.0	0.0	0.0	0.0	0.0	155.3	229.5
	Eastern	23.2	11.0	0.0	0.0	0.0	0.0	208.2	728.9
	Sub-total	**23.2**	**11.0**	**0.0**	**0.0**	**0.0**	**0.0**	**402.0**	**1141.2**
TOTAL		5093.0	7297.1	9041.8	9874.2	12275.2	12646.7	18333.5	21926.5

As can be seen the inter-regional exchange is presently too low due to the lack of infrastructure at present. Thus for the project activity National grid system is not being considered for the estimation of emission coefficient. Western Region grid which comprises of Madhya Pradesh, Chhattisgarh, Maharashtra, Gujarat, Goa, Daman & Diu and Dadar & Nagar Haveli, is chosen as the grid system for the project activity, since the project activity is coming up in Chhattisgarh.

B) Determination of the carbon intensity of the chosen grid

Complete analysis of the system boundary's electricity generation mix has been carried out for calculating the emission factor of Western Region electricity grid is as follows:

Combined Margin

The approved consolidated baseline methodology ACM0002 suggests that the project activity would have an effect on both the operating margin (*i.e.* the present power generation sources of the grid, weighted according to the actual participation in the state grid mix) and the build margin (*i.e.* weighted average emissions of recent capacity additions) of the selected grid and the net baseline emission factor would therefore incorporate an average of both these elements.

Step 1: Calculation of Operating Margin

As mentioned above the project activity would have some effect on the Operating Margin (OM) of the Regional Grid. The Operating Margin emission factor(s) ($EF_{OM,y}$) is calculated based on one of the four following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

As per the methodology 'Dispatch Data Analysis' (1c) should be the first methodological choice. However, this method is not selected for OM emission factor calculations due to non-availability of activity data.

'Simple OM' (1a) method is applicable to project activity connected to the project electricity system (grid) where the low-cost/must run[6] resources constitute less than 50% of the total grid generation in
1) average of the five most recent years, or
2) based on long-term normal for hydroelectricity production.

The Simple adjusted OM (1b) and Average OM (1d) methods are applicable to project activity connected to the project electricity system (grid) where the low-cost/must run resources constitute more than 50% of the total grid generation.

To select the appropriate methodology for determining the Operating Margin emission factor ($EF_{OM,y}$) for the project activity, MIL conducted a baseline study wherein the power generation data for all power sources in the project electricity system were collected from government/non-government organisations and authentic sources. The power generation mix of Western Regional electricity grid comprises of coal, gas, nuclear and hydro power generation as well as some imports from other regional grids as shown in Table B3 below.

Table B3 - Power generation Mix of Western Regional Grid for last five years

Energy Source	2000-01[7]	2001-02[8]	2002-03[9]	2003-04[10]	2004-05[11]
Total Power Generation (MU)	164428.5	164310.5	164710.1	169119.2	171732.6
Total Thermal Power Generation	151373.8	---	147642.0	149868.5	155734.2
Total Low Cost Power Generation	13054.7	---	17068.15	19250.73	15998.41
Thermal % of Total grid generation	92.06	---	89.64	88.62	90.68
Low Cost % of Total grid generation	7.94	---	10.36	11.38	9.32

[6] The low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

[7] CEA Report 2000-01

[8] Data not available

[9] CEA Report 2002-03

[10] CEA Report 2004-05

[11] WREB Report 2004-05

% of Low Cost generation out of Total grid generation – (Average of the four most recent years)	**9.75**

MIL has therefore adopted the 'Simple OM' (1a) method, amongst the 'Simple OM' (1a), 'Simple adjusted OM' (1b) and 'Average OM' (1d) methods to calculate the Baseline Emission Factor of the chosen grid.

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MU) taking into consideration the present power generation mix excluding low cost must run hydro-power projects of the selected grid, the design efficiency of the thermal power plants in the grid mix and the IPCC emission factors.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) *y*:
• A 3-year average, based on the most recent statistics available at the time of PDD submission, or
• The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex post monitoring.

MIL has calculated the OM emission factor as per the 3-year average of Simple OM calculated based on the most recent statistics available at the time of PDD submission.
Table B4 shows the power generation mix of Western Regional electricity grid under different jurisdiction such as State, Central and Private power plants respectively. The identified plants have been categorically differentiated on the basis of their fuel source used for generation.

Table B4: Power Generation Mix of Western Regional electricity grid

Year of offer	**2002-03**		**2003-04**		**2004-05**	
Generation Mix					**Base Year**	
Sector	**MU**	**%**	**MU**	**%**	**MU**	**%**
Thermal Coal Based-Western Region	129253	78.47	128817	76.17	130462	75.97
Thermal Gas Based-Western Region	18389	11.16	21051	12.45	25272	14.72
Hydro-Western Region	8122	4.93	9226	5.46	10524	6.13
Wind-Western Region	879	0.53	1522	0.90	0	0.00
Nuclear-Western Region	5600	3.40	5306	3.14	4497	2.62
Import from Self Generating Industries	2468	1.50	3197	1.89	978	0.57
Total	**164710**	**100.0**	**169119**	**100.0**	**171733**	**100.0**
Total generation excluding Low-cost power generation	147642		149869		155734	
Generation by Coal out of Total Generation excluding Low-cost power generation	129253	87.54	128817	85.95	130462	83.77
Generation by Gas out of Total Generation excluding Low-cost power generation	18389	12.46	21051	14.05	25272	16.23
Imports from others						
Imports from NREB	1124		1137		1093	
Imports from SREB	467		0		1767	
Imports from EREB	257		1450		9095	
Total including imports	166559		171707		183687	

Calculation of Operating Margin Emission Factor

The following table gives a step by step approach for calculating the Simple Operating Margin emission factor for Western Regional electricity grid for the most recent 3 years at the time of PDD submission i.e.2002-2003, 2003-2004 & 2004-2005.

Table B5: Calculation of Simple Operating Margin

Estimation of Baseline Emission Factor (tCO_2/MU)	-	-	-
Simple Operating Margin	-	-	-
Fuel 1 : Coal			
Avg. Efficiency of power generation with coal as a fuel, %	36.732	36.576	36.487
Avg. Calorific Value of Coal used (kcal/kg)	4171	3820	3820
Estimated Coal consumption (tons/yr)	72552891	79288901	80497035
Emission Factor for Coal-IPCC standard value (tonne CO2/TJ)	96.1	96.1	96.1
Oxidation Factor of Coal-IPCC standard value	0.98	0.98	0.98
COEF of Coal (tonneCO2/ton of coal)	1.645	1.506	1.506
Fuel 2 : Gas			
Avg. Efficiency of power generation with gas as a fuel, %	45	45	45
Avg. Calorific Value of Gas used (kcal/kg)	11942	11942	11942
Estimated Gas consumption (tons/yr)	2942817	3368913	4044423
Emission Factor for Gas- IPCC standard value(tonne CO2/TJ)	56.1	56.1	56.1
Oxidation Factor of Gas-IPCC standard value	0.995	0.995	0.995
COEF of Gas(tonneCO2/ton of gas)	2.791	2.791	2.791
EF (OM Simple, excluding imports from other grids), tCO2/MU	863.87	859.67	851.08
EF (NREB), tCO2/MU	790.00	740.00	730.00
EF (SREB), tCO2/MU	770	760	740
EF (EREB), tCO2/MU	1190.00	1190.00	1180.00
EF (OM Simple), tCO2/MU	**863.58**	**861.92**	**866.96**
Average EF (OM Simple), tCO2/MU		**864.15**	

Step 2: Calculation of Build Margin

The project activity would have some effect on the Build Margin (BM) of the Western Regional Electricity Board. The Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2/MU) of a sample of power plants. The methodology suggests the project proponent to choose one of the two options available to calculate the Build Margin emission factor $EF_{BM,y}$

Option 1:

Calculate the Build Margin emission factor $EF_{BM,y}$ *ex ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either:

(a) The five power plants that have been built most recently, or
(b) The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MU) and that have been built most recently.

Project participants should use from these two options that sample group that comprises the larger annual generation.

Option 2:

For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually ex post for the year in which actual project generation and associated emission reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in Option 1 above. The sample group m consists of either

(a) the five power plants that have been built most recently, or

(b) the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MU) and that have been built most recently.

Project participants should use from these two options that sample group that comprises the larger annual generation.

MIL has adopted Option 1, which requires the project participant to calculate the Build Margin emission factor $EF_{BM,y}$ ex ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m should consist of either (a) the five power plants that have been built most recently, or (b) the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MU) and that have been built most recently. Project participants are required to use from these two options that sample group that comprises the larger annual generation. As per the baseline information data the option (b) comprises the larger annual generation. Therefore for the project activity the sample group m consists of (b) the power plants capacity additions in the electricity system for 2004-05 that comprise 20% of the system generation (in MU) and that have been built most recently.

The following Table presents the key information and data used to determine the BM emission factor for the most recent year 2004-05.

Table B6: Most recent capacity additions in Western Regional Electricity Grid for 2004-05 that comprise 20% of gross generation

Sample of Power Plants for BM Calculation								
Sr.No.	Power plant name / location	State	Year of commissioning	Fuel Type	Capacity of the new addition	Total Capacity	Generation of the Unit in 2004-2005	Comments
					(MW)	(MW)	(MU)	
1	R.P.Sagar	Madhya Pradesh		Hydro	172 (50%)		188.64	Year of commissioning for these power plants are not available. But being low-cost power generation sources, all of them are considered for BM calculation to arrive at a conservative value of BM.
2	Jawahar Sagar	Madhya Pradesh		Hydro	99 (50%)		140.52	
3	Yeoteshwar	Maharashtra		Hydro	0.08		0.00	
4	Aravelam	Goa		Hydro	0.05		0.00	
5	Akrimota Lignite	Gujarat	31/3/2005	Lignite	125		0.00	
6	Indira Sagar Unit-8	Madhya Pradesh	23/3/2005	Hydro	125	1000	0.80	
7	Sardar Sarovar RBPH Unit-1	Gujarat	1/2/2005	Hydro	200		42.13	Generation from Sardar Sarovar RBPH Unit-1 & Sardar Sarovar CHPH Unit-1 to 5
8	Sardar Sarovar RBPH Unit-1	Madhya Pradesh	1/2/2005	Hydro	200		149.65	
9	Sardar Sarovar RBPH Unit-1	Maharashtra	1/2/2005	Hydro	200		71.09	
10	Indira Sagar Unit-6	Madhya Pradesh	29/12/2004	Hydro	125	1000	41.74	
11	Gangrel Unit-4	Chattisgarh	5/11/2004	Hydro	2.5		7.52	Generation from Gangrel Unit-1 to 4
12	Indira Sagar Unit-7	Madhya Pradesh	27/10/2004	Hydro	125	1000	25.16	
13	Gangrel Unit-3	Chattisgarh	17/10/2004	Hydro	2.5		0.00	Generation already considered in Gangrel Unit-4

14	Sardar Sarovar CHPH Unit-1	Gujarat	4/10/2004	Hydro	50		0.00	Generation already considered in Sardar Sarovar RBPH Unit-1
15	Sardar Sarovar CHPH Unit-1	Madhya Pradesh	4/10/2004	Hydro	50		0.00	
16	Sardar Sarovar CHPH Unit-1	Maharashtra	4/10/2004	Hydro	50		0.00	
17	Sardar Sarovar CHPH Unit-3	Gujarat	31/8/2004	Hydro	50		0.00	
18	Sardar Sarovar CHPH Unit-3	Madhya Pradesh	31/8/2004	Hydro	50		0.00	
19	Sardar Sarovar CHPH Unit-3	Maharashtra	31/8/2004	Hydro	50		0.00	
20	Sardar Sarovar CHPH Unit-2	Gujarat	16/8/2004	Hydro	50		0.00	
21	Sardar Sarovar CHPH Unit-2	Madhya Pradesh	16/8/2004	Hydro	50		0.00	
22	Sardar Sarovar CHPH Unit-2	Maharashtra	16/8/2004	Hydro	50		0.00	
23	Indira Sagar Unit-5	Madhya Pradesh	23/7/2004	Hydro	125	1000	120.09	
24	Gangrel Unit-2	Chattisgarh	29/6/2004	Hydro	2.5		0.00	Generation already considered in Gangrel Unit-4
25	Sardar Sarovar CHPH Unit-4	Gujarat	3/5/2004	Hydro	50		0.00	Generation already considered in Sardar Sarovar RBPH Unit-1
26	Sardar Sarovar CHPH Unit-4	Madhya Pradesh	3/5/2004	Hydro	50		0.00	
27	Sardar Sarovar CHPH Unit-4	Maharashtra	3/5/2004	Hydro	50		0.00	
28	Gangrel Unit-1	Chattisgarh	2/4/2004	Hydro	2.5		0.00	Generation already considered in Gangrel Unit-4
29	Indira Sagar Unit-4	Madhya Pradesh	28/3/2004	Hydro	125	1000	138.18	

30	Indira Sagar Unit-3	Madhya Pradesh	27/2/2004	Hydro	125	1000	314.87	
31	Sardar Sarovar CHPH Unit-5	Gujarat	15/2/2004	Hydro	50		0.00	Generation already considered in Sardar Sarovar RBPH Unit-1
32	Sardar Sarovar CHPH Unit-5	Madhya Pradesh	15/2/2004	Hydro	50		0.00	
33	Sardar Sarovar CHPH Unit-5	Maharashtra	15/2/2004	Hydro	50		0.00	
34	Indira Sagar Unit-2	Madhya Pradesh	18/1/2004	Hydro	125	1000	390.83	
35	Indira Sagar Unit-1	Madhya Pradesh	1/1/2004	Hydro	125	1000	300.20	
36	Dhuvaran CCCP ST	Gujarat	22/9/2003	Gas	38.77	133.6	194.42	
37	Dhuvaran CCCP GT	Gujarat	4/6/2003	Gas	67.85	133.6	340.25	
38	Bansagar (Stage-III) Unit-3	Madhya Pradesh	2/9/2002	Hydro	20	60	26.47	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
39	Bansagar (Stage-II) Unit-2	Madhya Pradesh	1/9/2002	Hydro	15	30	34.77	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
40	Bansagar (Stage-II) Unit-1	Madhya Pradesh	28/8/2002	Hydro	15	30	33.33	
41	Hazira CCGP-GSEL Surat	Gujarat	31/3/2002	Gas	52.1	156.1	386.23	
42	Majalgaon Unit-1	Maharashtra	1/1/2002	Hydro	0.75	2.25	0.00	Assumed as no generation data is provided in WREB Annual Report (2004-2005): Annex-X
43	Majalgaon Unit-2	Maharashtra	1/1/2002	Hydro	0.75	2.25	0.00	
44	Majalgaon Unit-3	Maharashtra	1/1/2002	Hydro	0.75	2.25	0.00	
45	Karanjavan	Maharashtra	26/10/2001	Hydro	3	3	0.00	
46	Hazira CCGP-GSEL Surat	Gujarat	16/10/2001	Gas	52	156.1	377.78	
47	Hazira CCGP-GSEL	Gujarat	30/9/2001	Gas	52	156.1	387.36	

	Surat							
48	Bansagar (Stage-III) Unit-2	Madhya Pradesh	25/8/2001	Hydro	20	60	24.68	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
49	Bansagar (Stage-III) Unit-1	Madhya Pradesh	18/7/2001	Hydro	20	60	24.51	
50	Dudhganga Unit-1	Maharashtr a	27/2/2001	Hydro	12	24	62.03	Includes generation from both Dudhganga Unit-1 & 2
51	Khaparkheda Unit-4	Maharashtr a	7/1/2001	Coal	210	840	1354.05	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
52	Khaparkheda Unit-3	Maharashtr a	31/5/2000	Coal	210	840	1463.92	
53	Koyna (Stage-IV) Unit-4	Maharashtr a	3/5/2000	Hydro	250	1000	223.01	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
54	Dudhganga Unit-2	Maharashtr a	31/3/2001	Hydro	12	24	0.00	Generation already considered in Dudhganga Unit-1
55	Koyna (Stage-IV) Unit-3	Maharashtr a	3/3/2000	Hydro	250	1000	718.46	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
56	Vindhyachal STPS Unit-VIII	Central Share	February'2000	Coal	500	2260	3586.90	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units

57	Koyna (Stage-IV) Unit-2	Maharashtra	25/11/1999	Hydro	250	1000	265.68	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
58	Sanjay Gandhi Unit-IV	Madhya Pradesh	23/11/1999	Coal	210	840	1332.96	Station auxiliary consumption from all the four Units is distributed in the ratio of installed capacity of the Units
59	Rajghat Unit-3	Madhya Pradesh	3/11/1999	Hydro	7.5	22.5	13.71	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
60	GIPCL-Surat Lignite	Gujarat	November'1999	Lignite	250	250	1627.53	
61	Rajghat Unit-1	Madhya Pradesh	15/10/1999	Hydro	7.5	22.5	18.75	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
62	Rajghat Unit-2	Madhya Pradesh	29/9/1999	Hydro	7.5	22.5	10.89	
63	Warna Unit-2	Maharashtra	1/9/1999	Hydro	8	16	28.34	Net generation is distributed as per the installed capacity of the Units.
64	Reliance Salgaonkar	Goa	14/8/1999	Gas	48	48	138.36	
65	Koyna (Stage-IV) Unit-1	Maharashtra	20/6/1999	Hydro	250	1000	526.76	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units

66	Surya CDPH	Maharashtra	4/6/1999	Hydro	0.75	0.75	0.00	
67	Bhandardara Stage-II	Maharashtra	19/5/1999	Hydro	34	44	36.71	
68	Dhabol	Maharashtra	13/5/1999	Gas	740	740	0.00	
69	Terwanmedhe	Maharashtra	31/3/1999	Hydro	0.2	0.2	0.09	
70	Vindhyachal STPS Unit-VII	Central Share	March'1999	Coal	500	2260	3560.31	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
71	Sanjay Gandhi Unit-III	Madhya Pradesh	28/2/1999	Coal	210	840	1412.06	Station auxiliary consumption from all the four Units is distributed in the ratio of installed capacity of the Units
72	Surya	Maharashtra	1/1/1999	Hydro	6	6	13.88	
73	Dimbhe	Maharashtra	17/10/1998	Hydro	5	5	9.02	
74	Warna Unit-1	Maharashtra	16/9/1998	Hydro	8	16	28.34	Net generation is distributed as per the installed capacity of the Units.
75	Kadana Unit-IV	Gujarat	27/5/1998	Hydro	60	240	96.71	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
76	Gandhinagar Unit-5	Gujarat	17/3/1998	Coal	210	210	1423.01	
77	Bhimgarh Unit-2	Madhya Pradesh	10/3/1998	Hydro	1.2		0.00	Included in Mini-Micro Hydro Power Plants wherefrom the generation is
78	Bhimgarh Unit-1	Madhya Pradesh	17/2/1998	Hydro	1.2		0.00	

								zero in 2004-2005
79	Manikodh	Maharashtra	9/2/1998	Hydro	6	6	4.08	
80	Kadana Unit-III	Gujarat	1/2/1998	Hydro	60	240	94.74	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
81	GPEC	Gujarat	1998	Gas	655		3565.16	
82	GIPCL	Gujarat	Nov-97	Gas	160		1098.91	
83	Chandrapur Unit-7	Maharashtra	1/10/1997	Coal	500	2340	3113.62	Station auxiliary consumption is distributed in the ratio of installed capacity of the Units
84	Kutch Lignite Unit-3	Gujarat	31/3/1997	Lignite	75	215	423.25	
85	Satpura Unit-2	Madhya Pradesh	9/2/1997	Hydro	0.5		0.00	Included in Mini-Micro Hydro Power Plants wherefrom the generation is zero in 2004-2005
86	Chargaon	Madhya Pradesh	7/2/1997	Hydro	0.8		0.00	
87	Tilwara	Madhya Pradesh	2/1/1997	Hydro	0.25		0.00	
88	Tata (H) Bhira PSU	Maharashtra	1997	Hydro	150		577.93	
89	Essar Gas	Gujarat	1997	Gas	515 (300MW to GEB)		3327.73	
90	Satpura Unit-1	Madhya Pradesh	9/2/1996	Hydro	0.5		0.00	Included in Mini-Micro Hydro Power Plants wherefrom the generation is zero in 2004-2005
91	Kakrapar Unit-2	Central Share	1995	Nuclear	220	440	1106.27	
92	Dahanu (BSES) Unit-2	Maharashtra	29/3/1995	Coal	250		2001.27	
Total							37025.64	

20% of Gross generation in the most recent year i.e. 2004-2005			36655.77	
Coal			21298.88	
Gas			9816.20	
Hydro			4804.29	
Nuclear			1106.27	

Built Margin Emission Factor is calculated as shown in Table B7.

Table B7: Built Margin Emission Factor Calculation

Built Margin	-
Fuel 1 : Coal	
Avg. efficiency of power generation with coal as a fuel, %	36.487
Avg. calorific value of coal used in Western Grid, kcal/kg	3820
Estimated coal consumption, tons/yr	13141763
Emission factor for Coal (IPCC),tonne CO2/TJ	96.1
Oxidation factor of coal (IPCC standard value)	0.98
COEF of coal (tonneCO2/ton of coal)	1.506
Fuel 2 : Gas	
Avg. efficiency of power generation with gas as a fuel, %	45
Avg. calorific value of gas used, kcal/kg	11942
Estimated gas consumption, tons/yr	1570914
Emission factor for Gas (as per standard IPCC value)	56.1
Oxidation factor of gas (IPCC standard value)	0.995
COEF of gas(tonneCO2/ton of gas)	2.791
EF (BM), tCO2/MU	**653.06**

Step 3: Combined Margin

Therefore the net baseline emission factor as per combined margin **(OM + BM)/2 = 758.61 tCO_2/MU**

Annex 4

MONITORING PLAN

The monitoring plan has been prepared in accordance with in ACM0004.
The project activity being a waste heat recovery based power generation one, there are no/negligible project emissions generated during operation of the project activity.
The monitoring methodology will essentially aim at measuring and recording through devices, which will enable verification of the emission reductions achieved by the project activity that qualifies as Certified Emission Reductions (CERs). The methods of monitoring adopted should also qualify as economical, transparent, accurate and reliable.
The project activity will employ state of the art monitoring and control equipments that will measure, record, report and control various key parameters like total power generated, power used for auxiliary consumption, flow rate, temperature and pressure parameters of the steam generated and steam sent to turbine for generation of power. The monitoring and controls will be part of the Distributed Control System (DCS) of the entire plant. All instruments will be calibrated and marked at regular interval to ensure accuracy.

Project factors affecting emission reduction claims

The potential factors that may affect the emission reduction claims are: -

Frequency of monitoring: -

The emission reduction generated by the project is calculated by multiplying the total unit electricity generated by the appropriate Emission Factor calculated on the basis of current baseline scenario. Therefore it important to meter the net generation of power produced on real time basis. Thus such parameters that directly influence the total revenue generated from the emission reduction calculation by the project will be monitored on continuous basis through online monitoring system in place.

Reliability: -

The amount of emission reductions achieved by the project is dependent on the net energy generated from the project as well as baseline emission factor. Therefore meter readings calculating the final value of total electricity produced from the project side will be monitored with calibrated instruments. Calibration as per instrument specifications shall ensure reliability of measures. All power-measuring instruments will be calibrated once a year for ensuring reliability of the system.
For baseline emission factor calculation, data will be collected from the reliable sources such as CEA reports, Western regional electricity board reports etc.

Registration and Reporting: -

Registration of data will be online in the control cabin through a microprocessor. Hourly data logging in log sheets in hard copies will be there in addition to software memory. Daily, weekly and monthly reports will be prepared stating the generation.

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