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:

Usha Martin Limited - Waste Heat Recovery Based Captive Power Project activity

Version 01; Date: 24/10/2005

A.2. Description of the project activity:

Usha Martin Limited started its Mini Steel Plant in the year 1974 in the Adityapur Industrial Area near the steel city of Jamshedpur in the state of Jharkhand, India. Over the years, much backward and forward integration have been made. Today, it is a fully integrated mini steel plant with latest manufacturing facilities for producing engineering steels. Its major raw materials consist of iron ore, coke, scrap steel, fluxing materials and DRI etc. Out of these, the DRI forms the largest single variable, which fluctuates both in terms of quality, availability and cost, thereby affecting the quality and cost of the existing operation. Usha Martin Limited installed a DRI plant with an average sponge iron production of 100,000tonnes/annum along with the project activity under consideration. The waste heat recovery based captive power project activity (hereafter referred to as project activity) recovers the heat energy of the waste gas of the Direct Reduction Iron (DRI) kiln to generate electricity for in house consumption.

In absence of the project activity, significant amount of waste gases would have been exhausted from the DRI kiln and the temperature of the gas would be of the order of 1000°C. The sensible heat of the waste gases would have gone un-utilised. The project activity has therefore utilized the waste gases of the DRI kiln as heat source to operate a modern waste heat recovery (WHR) based captive power plant (CPP).

The purpose of the project activity is to

- meet the partial power requirement of Usha Martin Limited (UML) plant from the year 2004-2005 onwards

- result in environmental improvements, energy efficiency improvements

- result in sustainable economic growth,

- conserve natural resources and

- reduce Green House Gas (GHG) emissions

The project activity has a significant contribution towards the sustainable development of the host country India. The sustainable development issues are as follows:

Conservation of Energy & Natural Resources- Coal:

It was known that in the DRI process a large percentage of the energy is lost in the waste gas as sensible heat. This waste heat in the gases has been tapped to generate steam, which is further used to generate electricity. In absence of project activity, a coal based captive power plant would meet the power requirements of UML plant.[1]

Indian economy is highly dependent on coal as fuel to generate energy and for production processes. Thermal power plants are one of the major consumers of coal in India, and yet the basic electricity needs of a large section of humanity are not being met. Changing coal consumption patterns will require a multi-pronged strategy focusing on energy demand, reducing wastage of energy and proper use of coal in the metallurgical and production process.

Since this project activity utilizes waste heat energy and generates electricity to cater to UML plant's partial power demand, it has positively contributed towards the reduction of energy wastage (in the form of heat energy from waste gases) along with reduction in power demand and its associated use of finite natural resource coal.

Global Pollution Abatement

The project activity, by reducing UML plant's partial power demand has also avoided an equivalent amount of carbon dioxide (CO_2) that would be emitted due to combustion of coal in the captive power plant in order to produce electricity for UML operations.

Therefore this project activity has excellent environment benefits in terms of coal resource conservation and in terms of carbon emission reductions due to substitution of electricity supplied by the captive generation from fossil fuel.

Local Pollution Abatement

In the absence of the project activity, the coal based power plant would be under operation with fly ash disposal as one of the major environmental concerns. The project activity implementation has avoided fly ash generation and its associated environmental concerns like

- land pollution due to the burden of the ever-increasing volume of waste in landfills
- air pollution caused due to fugitive emissions from flyash dumped in the vicinity of the thermal power plants
- water contamination problems arising from landfill leaching

Further the DRI plant would have to adopt some Air Pollution Control measures like ESP or Venturi Scrubber to remove dust particles from the gas in order to meet the statutory requirements.
The ESP would yield poor results, due to very high corrosive nature and high temperature of the exit waste gases. The Venturi Scrubber operations would have generated higher quantity of wastewater and the SPM levels in the flue gases too would be comparatively higher.

UML as its commitment to the environment has set up the WHR based CPP that has reduced the waste gas temperature levels to 160^{o}C and the Electrostatic Precipitator operates at the highest efficiency at such low temperatures as a result of which SPM levels are brought down to <100mg/Nm^3 thereby reducing adverse effects on the atmosphere.
The choice of a CPP along with an ESP over a venturi scrubber will at the same time eliminate the electrical energy component that would be consumed by the venturi scrubber. Venturi scrubber is a power-intensive pollution control equipment with electrical loads in the range of 400KW – 500KW.

This project activity will therefore contribute to the environmental & social issues locally and globally by

- Reducing heat energy release to atmosphere and recovery of waste heat to generate steam
- Generation of 10MW electricity with the above for own consumption and thereby eliminating the power generation from a coal based power plant.
- Conserving coal, a non-renewable natural resource
- Making coal available for other important applications
- Reducing GHG (Carbon Dioxide)
- Reducing dust emission level <100mg/Nm^3
- Eliminating electricity consumption that would be required if the Air Pollution Control Devices (Venturi Scrubber Plant) would be installed to meet statutory norms.
- Reducing liquid effluents that would have been generated from the Venturi Scrubber Plant
- Contributing to a small increase in the local employment in the area of skilled jobs for operation and maintenance of the equipment.

[1] This is further substantiated in the Section B2.

The detailed references of the above mentioned contributions are also provided in Chapter F – Environmental Impacts.

A.3. Project participants:

Name of the 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 - Ministry of Environment and Forests (MoEF)	Usha Martin 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.:

Jharkhand

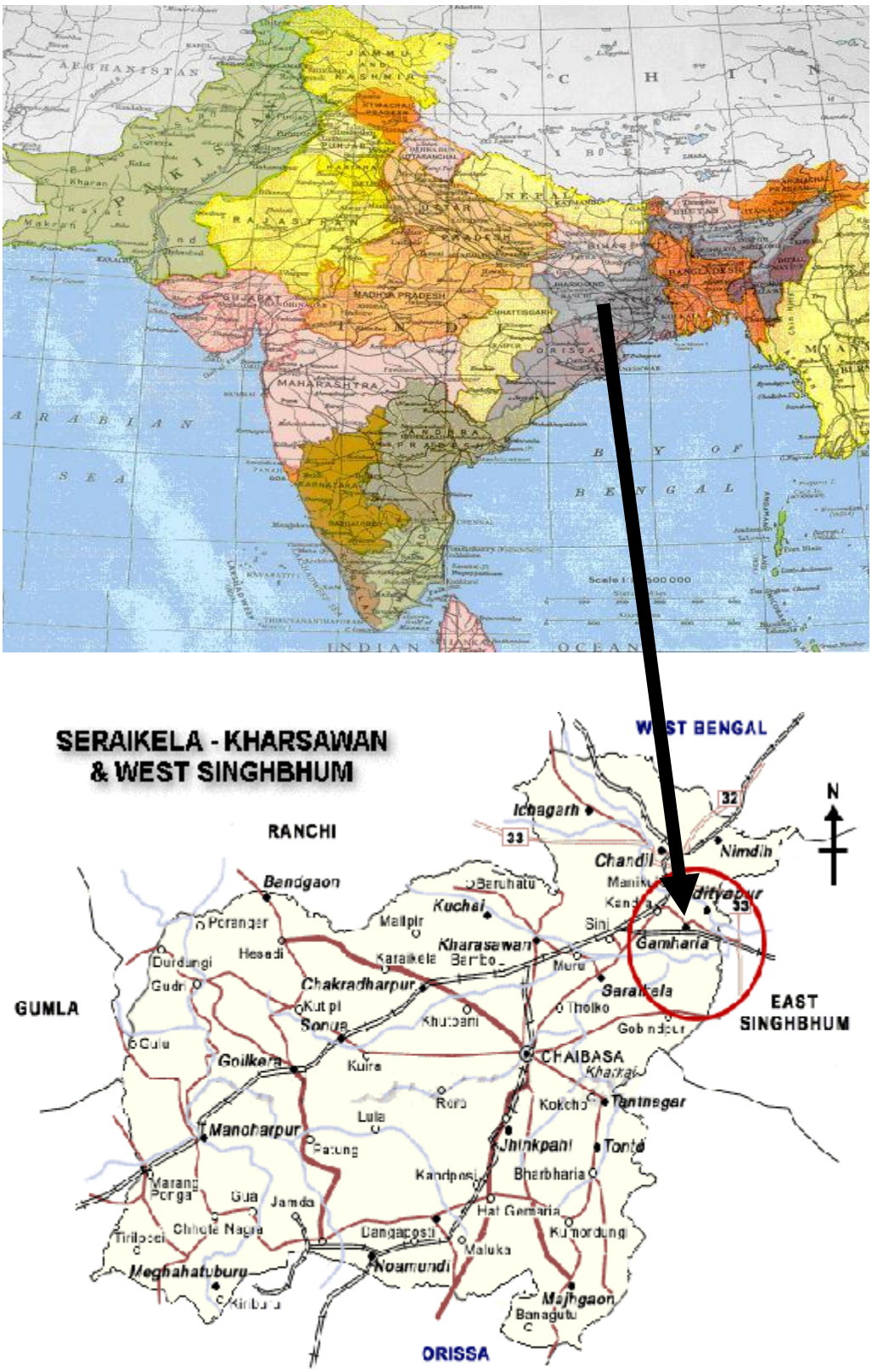
A.4.1.3. City/Town/Community etc:

Jamshedpur

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

The project activity is implemented in UML's factory premise at P.O. Gamharia, Dist. Saraikela-Kharsawan, Jamshedpur, India. It is situated in the UML's factory premise, behind the Rotary Kiln. This location is chosen to facilitate placement and operations of the waste heat recovery boiler, adjoining After Burning Chamber (ABC) and the Rotary Kiln of the proposed DRI Unit. The waste gases generated from the ABC would be channelised through the hot gas duct into the Waste Heat Recovery Boiler for extraction of heat.

Other requirements of the project including water requirement, infrastructure facilities etc. will also be available at site.



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

As per the "Sectoral scopes related approved methodologies and DOEs (Version: July 05)", the recommended sectoral scope of the project activity is

(1) Energy industries (renewable - / non-renewable sources)

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

The project activity is generating electricity to meet the UML plant's partial power requirements, using the kiln's waste gases as heat source. The DRI kiln's exhausted gases are received in the modernised After Burning Chamber (ABC) and the exit at around 1000^{o}C. The ABC is connected in series with a 45.6 TPH Waste Heat Recovery Boiler (WHRB) to recover the sensible heat energy of the waste gases and generate steam at 46 kg/cm^2 pressure and 460^{o}C temperature along with a high efficiency Extraction-Condensing condensor, a multistage steam turbine and generator set to generate power.

The waste gases after maximum heat recovery in the boiler are directed to the exhaust stack through ESP. Suspended particles in the exhaust gases are removed to the maximum extent in the Electrostatic Precipitator. The particulate matter collected in the hoppers is transported for disposal.

Other systems required for project activity include Circulating cooling water system, DM Plant, Instrument air compressor system etc. Circulating water system is used to condense exhaust steam after passing through turbine rotor. Cooling water enters the condenser and extracts the heat available in the exhaust steam. Only treated water is supplied for better performance of the boiler and to avoid scale formation in boiler heat transfer tubes. Makeup water is regulated to the De-aerator through de-aerator level controller.

The electricity requirements of the project activity and its associated systems are met by the project activity itself.

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 primary objective of the project activity is to generate electricity from waste gas of DRI kiln for UML plant operations and thereby displace captive electricity generation from fossil fuel – coal.

The project activity generates 10 MW power from the waste gases of the DRI kiln and utilizes the electricity for in-house consumption. The quantum of electricity that is generated in the CPP is a function of the quantum of hot metal production and the raw material quality used for the production of hot metal.

Further the non availability of waste gases will result in consequent shut down of the CPP. Therefore an annual operation of 300 days is envisaged for the CPP. With these 300 days of annual operation and a Plant Load Factor of 60%, the project activity is designed to generate gross electricity of 43.2 million kWh per annum. With 15% auxiliary consumption, net electricity generated for in-house consumption is of the order of 36.72 million kWh per annum.

Emissions due to combustion of waste gas for electricity generation are excluded since this gas would have been burned in the baseline scenario.

The project activity itself will not produce any additional on-site emissions related to auxiliary firing. There is no change in the composition of the waste gases at the WHRB inlet and outlet indicating no additional emission of GHG due to extraction of thermal energy from the waste gases in the WHRB.

In the absence of the project activity, 367.2 million kWh of energy load contributed by the project activity over a period of 10 years would have been taken-up by UML's coal based captive power plant and 5,44,913 tonnes of CO_2 emissions would have resulted due to coal combustion over the crediting period. Therefore there is an additional reduction of GHG emissions (CO_2) that would not occur in absence of the project activity, with the UML plant drawing electricity from coal based CPP.

The Jharkhand Power Department does not require sponge iron and steel industries to utilize the heat content of the waste gases generated from the reduction kilns and generate electricity for their own consumption. 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.

The project activity is not only justified in view of its capability to cancel the planned construction of another coal based captive power plant and contribute to the green house gas reductions but also due to its eco-friendly mechanism of power generation.

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

Years	Annual estimation of emission reductions in tonnes of CO_2 e
Dec, 2004 – Jan, 2005	54491.3
Dec, 2005 – Jan, 2006	54491.3
Dec, 2006 – Jan, 2007	54491.3
Dec, 2007 – Jan, 2008	54491.3
Dec, 2008 – Jan, 2009	54491.3
Dec, 2009 – Jan, 2010	54491.3
Dec, 2010 – Jan, 2011	54491.3
Dec, 2011 – Jan, 2012	54491.3
Dec, 2012 – Jan, 2013	54491.3
Dec, 2013 – Jan, 2014	54491.3
Total estimated reductions (tonnes of CO_2 e)	544913
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	54491.3

A.4.5. Public funding of the project activity:

No public funding from parties included in Annex – I is available to 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:

Title: Consolidated baseline methodology for waste gas and/or heat for power generation.

Reference: 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:

As stated in the "Consolidated baseline methodology for waste gas and/or heat for power generation"-

"*This methodology applies to project activities that generate electricity from waste heat or the combustion of waste gases in industrial facilities".*- The project activity under consideration recovers the heat energy of waste gases of the DRI kiln in the WHRB and utilizes the same to produce steam which is further used to generate electricity.

Apart from the key applicability criteria, the project activity is required to meet the following conditions in order to apply the baseline methodology-

"*The methodology applies to electricity generation project activities:"*

1. *"that displace electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels, electricity"*-As per the Baseline Scenario analysis, conducted in Section B.2 of this PDD, the project activity displaces captive electricity generation with fossil fuel coal. Therefore the project activity meets this applicability criterion.
2. *"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 project activity involves utilization of the heat content of waste gases of the sponge iron kiln, which would be dissipated into the atmosphere in absence of project activity, for power generation. There is no fuel switch involved in the sponge iron kiln operation.

Furthermore, since "*The methodology covers both new and existing facilities*" and the project activity is based on the waste gases emitted from the new sponge iron kiln of UML, the methodology can be applied for the project activity.

As stated above, the project activity under consideration meets all the applicability conditions of the baseline methodology. This justifies the appropriateness of the choice of the methodology in view of the project activity.

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

UML assessed their electrical energy requirements for all operations at their Jamshedpur Plant. The Table B-1 provides the unit wise electrical energy requirements.

Annual Electrical Energy Requirement (in MU) for UML operations from 2004-2005 onwards	
UML operations	2004-05
MBF	24.4375
DRI	7.1565
SMS	159.8
WRM	53.016
OXYGEN PLANT	7.52596
VPSA	8.946432
LIME KILN PLANT	0.8825
ANNEALING	0.45
Total Energy Required	**262.2149**

The existing captive power generation system at UML can generate and supply 191.434 MU per annum. The demand supply gap of 68.22 MU per annum was required to be met through other possible alternatives.

All possible alternative scenarios that were available to UML were assessed to determine the most appropriate business-as-usual baseline scenario in order to meet the UML's electricity demand gap.

Identification of possible alternative baseline scenarios

UML identified the following plausible alternatives to meet their in-house electricity requirements:

Alternative 1- Import of electricity from the grid

UML may import electricity from Jharkhand State Electricity Board grid to meet the in-house electrical energy requirement of 68.22 MU. This would result in an equivalent amount of CO_2 emissions corresponding to the power generation in the grid connected thermal power plants.

The waste gas of the DRI kiln may be flared with its thermal energy being dissipated into the atmosphere since there are no other uses of waste gas in the UML plant operations.

This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline.

Therefore the Alternative 1 is considered further for arriving at the baseline scenario.

Alternative 2- Fossil fuel (coal) based captive power plant

UML may generate electricity (equivalent to 10 MW of gross power) from a fossil fuel (coal) based captive power plant to meet the in-house electrical energy requirement of 68.22 MU. This would result in an equivalent amount of CO_2 emissions corresponding to the power generation in the captive power plant of UML.

The waste gas of the DRI kiln may be flared with its thermal energy being dissipated into the atmosphere since there are no other uses of waste gas in the UML plant operations.

This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline.

Therefore the Alternative 2 is considered further for arriving at the baseline scenario.

Alternative 3- Fossil fuel (gas) based captive power plant

UML may generate electricity (equivalent to 10 MW of gross power) in a fossil fuel (gas) based captive power plant to meet the in-house electrical energy requirement of 68.22 MU. This would result in an equivalent amount of CO_2 emissions corresponding to the power generation in the captive power plant of UML.

The waste gas of the DRI kiln may be flared with its thermal energy being dissipated into the atmosphere since there are no other uses of waste gas in the UML plant operations.

This alternative is in compliance with all applicable legal and regulatory requirements.

However this alternative would not be a credible and realistic alternative available with UML in absence of project activity due to non-availability of gas fuel for power generation to the plant for its locational disadvantage[2].

Therefore the Alternative 3 may be excluded from further consideration.

Alternative 4- Fossil fuel (diesel) based captive power plant

UML may generate electricity (equivalent to 10MW of gross power) in a fossil fuel (diesel) based captive power plant to meet the in-house electrical energy requirement of 68.22 MU. This would result in an equivalent amount of CO_2 emissions corresponding to the power generation in the captive power plant of UML.

The waste gas of the DRI kiln may be flared with its thermal energy being dissipated into the atmosphere since there are no other uses of waste gas in the UML plant operations.

This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline.

However this alternative would not be a credible and realistic alternative available with UML in absence of project activity. Diesel based captive power plants have very high operating costs. The power generation costs per unit of electricity are found to be very high mainly due to higher fuel prices. Therefore this alternative is used by Indian industries only as backup/alternate source for supplying electricity under emergency situations.

Therefore the Alternative 4 is not considered further for arriving at the baseline scenario.

Alternative 5- Waste Heat recovery based power plant without CDM benefits along with import of electricity from the grid

UML may generate electricity (equivalent to 10 MW of gross power) in waste heat recovery based power plant which is a function of the DRI kiln's waste gas parameters to meet the in-house electrical energy requirement of 36.72 MU. The remaining 31.50 MU may be imported from the JSEB grid.

This alternative is in compliance with all applicable legal and regulatory requirements. However, this alternative has associated financial and technical barriers to its implementation which prevented UML to implement this alternative in absence of CDM incentives for the project activity. (Please refer to Step 2: Investment Analysis and Step 3: Barrier Analysis in Section B.3 below for details).

[2] Source: Statewise/ Sectorwise Allocations of Natural Gas- http://petroleum.nic.in/ngbody.htm

UML took the CDM benefits into consideration before taking the decision of undertaking necessary measures to overcome all the barriers to project implementation thereby commissioning and further improving the sustainability of the project activity. Therefore this alternative of implementing a 'Waste Heat recovery based power plant without CDM benefits along with import of electricity from the grid' would not be a credible and realistic alternative option for UML to implement.

Therefore the Alternative 5 may be excluded from further consideration.

The above discussion clearly establishes that Alternative 1 and 2 were the only two credible and realistic alternatives, available to UML in absence of the CDM project activity, which could be a part of the baseline.

UML conducted an analysis based on the economic attractiveness of these alternatives to arrive at the business–as-usual baseline scenario.

Evaluation of the Alternatives based on their economic attractiveness

The economic attractiveness of the two credible and realistic alternatives is based on the comparison of the unit cost of service provided by both.

Table B-2: Economic analysis of all the realistic and credible alternatives available with UML in absence of the project activity

Parameters	Generation/ Purchase Cost[3]	Comments on the Financial aspects	Other Considerations
Alternative 1. Import of electricity from the grid	4 INR/kWh	1. UML is connected to the grid. No capital investment (i.e. Fixed cost is nil) required. Electricity could be procured immediately. 2. The Purchase Cost (i.e. Operating cost) is very high	3. No clearances/ approvals required. 4. In house expertise available to implement this alternative.
Alternative 2. Fossil fuel (coal) based captive power plant	1.96 INR/kWh[4]	1. Higher capital investment, (i.e. Fixed cost is higher) hence some financial assistance would have been required from banks/ financial institutions. 2. The Generation Cost (i.e. Operating cost) is low.	3. Some clearances/ approvals required from the regulatory bodies. 4. In house expertise available to implement this alternative. UML has an existing 25MW coal based power plant in operation.

[3] The unit cost of service calculated for both the alternatives factor both fixed and operating costs incurred for the alternatives.

[4] The power generation cost in Alternative 2 is expected to reduce to 1.59 INR/kWh in the year 2007-2008 if coal is made available from UML's own mines.

Conclusion	Considering all the points mentioned above, "Alternative 2: Fossil fuel (coal) based captive power plant" was found to be the most economically attractive option available to UML in absence of the project activity and therefore, as per the methodology, this alternative option is the baseline scenario. This is further substantiated by the following facts: • This alternative has been opted for in the earlier considerations to meet plant's power requirements. As stated above UML meets its current electricity requirements mainly from the existing 25MW coal based power plant. • Furthermore, after acquiring coal mines the power generation cost would drop further which makes the alternative even more economically attractive.

Establishing Additionality of the Project Activity

The methodology requires the project proponent to establish the additionality as per the "Tool for the demonstration and assessment of additionality" as provided in Annex I: to the Executive Board – 16 meeting report. Information/data related to industry practice and other regulatory and project activity related documents were used to establish the additionality of the project activity. Details of demonstration of additionality are a part of Section B.3.

Estimation of emission reductions resulting from the project activity[5]

As per the methodology, the emission reductions resulting from the project activity is calculated as a difference between the baseline emissions and the project emissions. The methodology does not require the project proponent to consider any emission due to leakage.

Baseline Emissions

The UML project activity would displace an equivalent quantum of electricity the UML plant otherwise would have drawn from a new coal based captive power generation in absence of the project activity.

Therefore since "Alternative 2: Fossil fuel (coal) based captive power plant" is the most appropriate baseline scenario, the baseline emissions are determined as per Option 1[6] of the methodology wherein the Emissions Factor for displaced electricity is calculated as per Equation 3 of ACM0004.

Emissions Factor for captive power generation

The CO_2 emission factor for captive power generation has been calculated based on the emission factor of coal which would be used in the captive power generation and the 100% boiler efficiency (as per Option B) for the reference plant. The emission factor for captive power generation was found to be 1.48 t CO_2/ MWh. Please refer to "Annex 3: Baseline Information" and Enclosure-I for detailed calculation of the CO_2 emission factor for the captive power generation.

[5] The emission reductions calculated herein are attributed only to the quantum of electricity the project activity would displace in a coal based captive power generation. Further the grid emission factor of JSEB (1.04 tCO_2/MWh) was found to be lower than the emission factor for coal based captive generation (1.48tCO_2/MWh). The emission reductions attributed to the quantum of electricity imported from grid which would displace the coal based captive power generation has not been considered to be on the conservative side.

[6] Option1. If baseline scenario is captive power generation

Net Electricity supplied to UML facilities by the project activity

The project activity would generate a net electricity of 36.72 Million Units per annum (and 367.2 million kWh for a period of 10 years) to meet the partial in-house power requirement of UML. This electrical energy would displace the captive electricity generation from coal. Without the project activity, the same energy load would have been taken up by coal based captive power plant and CO_2 emissions would have occurred due to fossil fuel combustion.

Therefore baseline emissions are calculated as the product of the CO_2 emission factor for captive power generation and the net quantity of electricity supplied to the UML facilities by the project activity.[7]

Further as per the methodology, since the waste gas is combusted in both the baseline and the project scenario, its associated CO_2 emissions have been excluded from the project boundary.

Project Emissions

As per the methodology, project emissions are applicable only if auxiliary fuels are fired for generation start up, in emergencies, or to provide additional heat gain to waste gases before entering the WHRB.

However there is no provision of auxiliary fuel firing for generation start up or for additional heat gain of the waste gases in the project activity. Therefore there is no project emission resulting from the project activity.

Further there is no change in the composition of the waste gases at the WHRB inlet and outlet indicating no additional emission of GHG during extraction of thermal energy from the waste gases in the WHRB.

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 CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

The methodology requires the project activity to determine its additionality based on the "Tool for the demonstration and assessment of additionality", agreed by the CDM Executive Board at its sixteenth meeting.

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

The project proponent is required to provide evidence

(a) 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 in order to claim for a crediting period starting before the date of registration

(b) that the incentive from the CDM was seriously considered in the decision to proceed with the project activity.

The project activity received Finance Committee's approval on 5th June 2002. Therefore project activity's start date falls between 1 January 2000 and the date of the registration of a first CDM project activity which is18th November 2004[8]. UML would provide evidences to establish the same.

UML proposes to get the project activity registered with UNFCCC before December 31, 2005. One of the primary guiding factors governing UML management's decision to proceed with the project activity was the consideration of the project activity's potential to avail revenue under CDM.

The 'Alternative 5: Waste Heat recovery based power plant without CDM benefits along with import of electricity from the grid' proposal was presented in the "Proceeding of the meeting of the Board of Directors (Finance Committee) of the company held on 5th June 2002 by the Joint Managing Director. All aspects related to the project activity were discussed. The discussions revolved around the issues related to the financial non-viability and other technical and operational limitations of the Alternative 5.

The Chief Financial Officer briefed the Board about the Kyoto Protocol and the financial benefits the project activity could receive under the Clean Development Mechanism and advised the Board that the

[8] Reference: http://cdm.unfccc.int/Projects/registered.html

company could avail CDM revenue from the project activity which would make the Alternative 5 financially viable.

After discussions, it was unanimously

(a) Resolved that the company do go ahead with Alternative 5 and

(b) Resolved further that any one of its Directors or any one of the Company Secretary & Chief Finance Officer and Joint Managing Director were advised to execute all activities in connection with CDM.

Therefore the UML's management decided to recommend the project activity implementation with the intent to pursue the CDM benefits once the CDM modalities were in place.

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:

There were five alternatives available to UML that could provide 68.22 MU of electricity for in-house consumption out of which two alternatives are realistic and credible alternatives to the CDM project activity that can be (part of) the baseline scenario. The two alternatives were analysed to determine the most probable baseline scenario. Among the alternatives that do not face any prohibitive barriers, the most economically attractive alternative was considered as the baseline scenario.

Please refer to Section B.2 above for further details on all the possible alternative(s) available to UML in absence of the project activity and for the choice of the baseline scenario. "Alternative 2: Fossil fuel (coal) based captive power plant" was found to be the baseline scenario.

Step 2. Investment analysis OR

Step 3. Barrier analysis.

The Finance Committee took into consideration both quantitative (Investment analysis) and qualitative (Barrier Analysis) assessments before approving the project activity.

Step 2. Investment analysis

As per the investment analysis the project proponent is required to determine whether the project activity is the economically or financially less attractive than other alternatives without the revenue from the sale of

certified emission reductions (CERs). To conduct the investment analysis, UML is required to use the following sub-steps:

Sub-step 2a Determine appropriate analysis method

The project activity generates electricity for in-house consumption and has financial implications other than those related to CDM. Therefore Option-I – Simple cost analysis would not be an appropriate analysis method.

Amongst the other two options – investment comparison analysis (Option II) and benchmark analysis (Option III) UML has adopted the investment comparison analysis wherein the financial indicator(s) of the Alternative 5: Waste Heat recovery based power plant without CDM benefits along with import of electricity from the grid is compared with the two other plausible alternatives. If one of the plausible alternatives has the best indicator (e.g. highest Project IRR / lowest unit cost of service), then the project activity can not be considered as the most financially attractive;

Sub-step 2b – Option II. Investment Comparison analysis

UML conducted an investment analysis for the following three alternatives available with UML to meet their in-house power generation requirement. The three alternatives under consideration were

Alternative1. Import of electricity from the grid

Alternative 2: Fossil fuel (coal) based captive power plant and

Alternative 5: Waste Heat recovery based power plant without CDM benefits along with import of electricity from the grid

The unit cost of service was used as the financial indicators for the investment comparison analysis.The unit cost of service is calculated taking into consideration both fixed and variable cost

Sub-step 2c – Calculation and comparison of financial indicators

Alternative 1: Import from the grid

The unit cost of service is based on the following aspects

1. JSEB Power Purchase cost – INR 4.0/kWh
2. No capital investment

Unit cost of service (electricity generation in kWh) for the Alternative 1 is INR 4.0

Alternative 2: Fossil fuel (coal) based captive power plant

The unit cost of service is computed based on the following aspects

1. Capital investment of 450 Million INR

2. Annual net electricity generated by coal based captive power plant and sent to UML plant – 68.22 MU
3. Coal specific consumption - 1.2 kg/kWh
4. Coal Price - INR 975/MT
5. Conversion Cost - INR 0.20/kWh
6. Depreciation Rate - 5.5%

Unit cost of service (electricity generation in kWh) for the Alternative 2 is INR 1.96

Alternative 5: Waste Heat recovery based power plant without CDM benefits along with import of electricity from the grid

The unit cost of service are computed based on the following aspects

1. Capital investment of 400 Million INR
2. Annual net electricity generated by waste heat recovery based power plant and sent to UML plant – 36.72 MU
3. Annual electricity imports drawn from JSEB grid and sent to UML plant – 31.50 MU
4. JSEB Power Purchase cost – INR 4.0/kWh
5. Conversion Cost - INR 0.27/kWh
6. Depreciation Rate - 5.5%

Unit cost of service (electricity generation in kWh) for the Alternative 5 is INR 2.38

Since the unit cost of service for the Alternative 2: has the best financial indicator i.e. it has the lowest unit cost of service and is therefore found to be most financially attractive it may be concluded that Alternative 5 can not be considered as the most financially attractive proposition.

All financial data used to arrive at the unit cost of service for the alternatives would be provided to the DOE during Validation.

Sub-step 2d. Sensitivity analysis :

The value of the unit cost of service for the alternatives' were found to be sensitive to the following factors –

1. Coal price and
2. Specific Consumption of coal

The sensitivity analysis was conducted for scenarios with variations in each one of the above-mentioned factors and for scenarios with variations in both the above-mentioned factors simultaneously in order to assess the financial attractiveness of the alternatives under such circumstances.

Sl. No.	Parameters	Variation	Unit Cost of Service			Comment
			Alternative-1	Alternative-2	Alternative-5	
1.	Coal price	+10%	INR 4.0[9]	INR 2.10	INR 2.38[10]	The Unit Cost of Service for Alternative-5 is higher than that for Alternative-2.
		-10%	INR 4.0	INR 1.83	INR 2.38	The Unit Cost of Service for Alternative-5 is higher than that for Alternative-2.
2.	Specific Consumption of coal	+ 10%	INR 4.0	INR 2.10	INR 2.38	The Unit Cost of Service for Alternative-5 is higher than that for Alternative-2.
		-10%	INR 4.0	INR 1.83	INR 2.38	The Unit Cost of Service for Alternative-5 is higher than that for Alternative-2.
3.	Combination of Parameters 1 & 2	1→+10% 2→+10%	INR 4.0	INR 2.24	INR 2.38	The Unit Cost of Service for Alternative-5 is still lower than that for Alternative-2.
		1→-10% 2→-10%	INR 4.0	INR 1.71	INR 2.38	The Unit Cost of Service for Alternative-5 is still lower than that for Alternative-2.

[9] The Grid's Power Purchase cost would possibly increase however it is not possible to predict the increase.

[10] The Unit Cost of Service would possibly increase due to the increased cost of the component from grid's power purchase however it is not possible to predict the increase.

The results of the sensitivity analysis conducted confirm that the unit cost of service of Alternative 2 is lowest and is therefore found to be more financially attractive than Alternative 5.

Hence, it may be concluded that

(a) the 'Alternative 5 is not the most financially attractive option' is robust to reasonable variations in the critical assumptions and that

(b) the CDM revenue the project activity would obtain through sale of the emission reductions has been one of the most important determinants for UML to opt for Alternative 5, which is financially less attractive than Alternative 2.

Step 3. Barrier analysis

The realistic and credible alternatives 1 & 2 available to UML were evaluated with respect to the risks that would be faced by the project activity. These barriers have been dealt with in Sub-Step 3a and the evaluation of the alternatives has been done in Sub-Step 3b.

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 are being overcome by UML to bring about additional green house gas emission reductions. The barriers are detailed below:

Technical (Operational) Barrier due

Inconsistent power generation

Waste gas availability and consistency of waste gas parameters[11] are the most important aspects that can affect the performance of the project activity. Any non-availability of waste gas or inconsistency of key waste gas parameters and WHRB failure[12] will result in inadequate steam and power generation. Waste gas from the DRI kiln was the only major source of heat energy for the project activity and its insufficiency would completely hamper the steam and power generation. Non-availability of Waste gas may occur due to DRI kiln shut downs, functional disturbances in the DRI kiln or due to any kind of network failure. And since UML plant operations would be significantly dependent on the project activity for electricity, disruption in steam and power generation would have a detrimental effect on UML's entire plant operations. Under such situations UML would need to meet its electricity requirements through imports from the grid.

[11] Waste gas parameters include temperature, pressure and flow rate.

[12] The waste gases entering the WHRB are abrasive in nature and the boiler tubes are highly susceptible to damage

Other barrier(s) – Managerial Resources barrier - limited dissemination of information on operation know how; limited managerial resources; organizational capacity

The sponge-iron manufacturing sector belongs to steel industry sector with limited knowledge and exposure of complications associated with production of power.

The UML personnel lacked the necessary technical background to develop and implement a waste heat recovery based power plant with technological innovation. They had to strengthen their internal capacity by inviting external expertise to implement the project activity. The UML personnel at various levels lacked relevant managerial background for project activity implementation, operation and maintenance. They were provided with training to ensure smooth operation. They had no background strength in the power sector economics and power generation sector.

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

These barriers do not exist for the alternative 1 & 2 and they do not prevent the wide spread implementation of these alternatives.

It has been observed in Sub-step 3a that the project activity has its associated barriers to successful implementation. In a broader sense, these barriers can be categorised as below:

- Technical barrier
- Managerial Resources barrier

These barriers had to be overcome in order to implement the project and reduce additional green house gas emissions.

The two realistic and credible alternatives - alternative 1: Import of power from the grid and alternative 2: Fossil fuel (coal) based captive power plant available to UML were also evaluated.

These alternatives do not face any impediments the project activity faced.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Sub-step 4b. Discuss any similar options that are occurring:

The common practice scenario discussed below further substantiates that the project activity faces barriers to implementation and is therefore not a widespread proposition for sponge iron manufacturing sectors under similar socio-economic environment in Jharkhand.

In the similar project sector, socio-economic environment, geographic conditions and technological circumstances there are 10 similar sponge iron plants operating in Jharkhand and only one of them has a waste heat recovery based power plant which is now non-operational. There are 21 similar proposed plants, which were expected to start operation in the next few years. UML's DRI plant project is one of the 21 proposed plants of Jharkhand and the only one, which implemented the project activity in order to reduce GHG emissions and avail the revenues from sale of carbon emission reductions.

Thus in absence of the project activity there would be no waste heat recovery based power project in Jharkhand. This shows that there is no (poor) penetration of this technology in Jharkhand. The above discussion clearly establishes that the project activity is not the common practice for the sponge iron plants in Jharkhand and would not have taken place in absence of CDM revenue.

Step 5. Impact of CDM registration

The alternative 5 has been rendered financially unattractive as compared to alternative 2 for UML with out the consideration of CDM incentives. (Refer to Investment Analysis). However with CDM revenue as one of the annual cash flows, expected after approval and registration, the project activity's financial viability would improve. Therefore UML management took the decision of taking the investment risks and secure financing partially from bank funding and partially through internal accruals so as to invest in the CDM project activity after computing the proposed carbon financing.

Besides the direct financing risk, UML is also shouldering the additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining Monitoring methodology to fulfill CDM requirements.

UML's decision to opt for the Alternative 5 and incur additional transaction costs related to execution of activities like PDD preparation, validation, developing and maintaining robust operating and monitoring systems to fulfil CDM requirements was guided solely by the carbon financing the project activity would receive through sale of Certified Emission Reductions under CDM. The revenue from the CDM funds proves to be vital to project's feasibility and significantly improve the sustainability of the project activity.

As stated above before implementation of the project activity UML considered all the barriers mentioned above. Each of them especially financial barriers could result in project failure resulting in huge financial losses.

The above steps have established that the initiative taken by UML is additional and the anthropogenic emissions of GHG by sources will be reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity would achieve 5,44,913 tonnes of CO_2 reductions in a 10 year credit period.

Further with CDM project activity registration many more sponge iron manufacturing industries in Jharkhand would take up similar initiatives under CDM by overcoming the barriers to project activity implementation resulting in higher quantum of anthropogenic greenhouse gas emissions reduction.

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

The project boundary covers the point of fuel supply to the point of power generated for use of the UML's plant where the project proponent has a full control. Hence, project boundary is considered within these terminal points.

Thus, boundary covers ABC, Waste Heat Recovery Boiler, STG and all other power generating equipments, captive consumption units, the transport of the waste gases to boiler, the electricity generated that is supplied to UML Jamshedpur plant.

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:

Date of completing the final draft of this baseline selection: October 2005

Name of person/ entity determining the baseline: UML along with their 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:

June 2002

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

20y

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:

>> Not Applicable

C.2.1.2. Length of the first crediting period:

>> Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

December, 2005

C.2.2.2. Length:

10y

SECTION D. Application of a monitoring methodology and plan

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

Title: Consolidated monitoring methodology for waste gas and/ or heat for power generation

Reference: 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 approved consolidated monitoring methodology is designed to be used in conjunction with the approved consolidated baseline methodology. The applicability conditions of the monitoring methodology are identical with those for the baseline methodology. The project activity under consideration meets all the applicability conditions of the approved consolidated baseline methodology (please refer to Section B.1.1 for details).Hence it is justified to adopt the approved consolidated monitoring methodology for the project activity.

The monitoring methodology requires the project proponent to determine the electricity generated using the waste gases of the DRI kiln in the WHR based power plant. The project activity's financial benefits under CDM are based on this parameter. The amount of electrical energy generated by the project activity and thereby displacing coal based captive electricity generation of the 'coal based captive reference plant' is directly controlled by the project proponent and will be under the purview of monitoring plan. Further, the actual amount of CO_2 reductions depend on the emission factor of coal based captive reference plant. Thus a detailed monitoring plan (as described in Annex 4: Monitoring Plan) is developed by UML in line with the approved consolidated monitoring methodology.

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

As per the methodology, 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 WHRB. However auxiliary fuel firing would not be required for start up and there is no provision for auxiliary fuel firing in the ABC for additional heat gain of the waste gases in the project activity. The project proponent has identified all

possible sources which could have directly or indirectly added to GHG emissions in the project activity. All these sources and the emissions from them are discussed below:

Overview on emission sources included in or excluded from the project boundary		
Emission Sources	**Analysis**	**Conclusion**
Direct on-site emissions	1. No change in chemical composition of waste gases at the inlet and outlet of the boiler since the heat energy of waste gases is extracted through indirect physical contact (through boiler tube). 2. All auxiliaries of the power plant are run by the power that is generated by the project activity.	1. GHG emission due to heat energy extraction in the WHRB is zero. 2. No major on-site emissions for meeting the auxiliary consumption.
Indirect on-site emissions	Energy consumption due to construction of waste heat recovery based power plant would lead to GHG emissions. However this onetime indirect on-site emission is negligible as compared to the emission from transportation and mining of equivalent coal required for power generation at coal based captive reference plant.	Considering the life cycle assessment of the total power generated and the emissions to be avoided in the life span of 25 years, this emission is too small and hence neglected. Furthermore the methodology also does not require the project proponent to consider the same.
Direct off-site emissions	No source has been identified.	No direct off-site emission from the project activity. Furthermore the methodology also does not require the project proponent to consider the same.
Indirect off-site emissions	Includes emissions from manufacturing process of parts, supplies and machinery required for building the project (i.e. electrochemical equipment, etc.).	These emissions are outside the control of the project proponent and hence excluded. Furthermore the methodology also does not require the project proponent to consider the same.

D.2.1.1. 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.

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
For electricity generation by the project activity								
1. EG_{GEN}	Total Electricity generated from the project activity	LOG BOOK	MWh/ yr	Measured online	Continuously	100%	Paper	-
2. EG_{AUX}	Auxiliary Electricity for the project activity	LOG BOOK	MWh/ yr	Calculated	Continuously	100%	Electronic	-
3. EG_y	Net Electricity generated by the project activity which is supplied to UML	LOG BOOK	MWh/ yr	Measured online	Continuously	100%	Paper	-
For calculation of emission factor for captive power generation								
4. $EF_{CO2,i}$	CO_2 emission factor of fuel used for captive power generation in the reference plant	LOG BOOK	tC/TJ	Calculated	Randomly	100%	Paper	The $EF_{CO2,i}$ is calculated based on the GCV value and the carbon content of fuel used

5. $Eff_{captive}$	Energy efficiency of the captive reference plant	-	%	Estimate	-	100%	Paper	

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

Baseline Emission Calculations

Baseline Emission is calculated as,

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

where,

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

EF_y = CO_2 baseline emission factor for the electricity displace due to the project activity during the year y (in tCO_2/ MWh)

Since the project activity displaces the coal based captive reference plant CO_2 baseline emission factor (EF_y) is calculated as

$$EF_{captive,y} = \frac{EF_{CO2,i}}{Eff_{captive}} \times \frac{44}{12} \times \frac{3.6TJ}{1000MWh}$$

where:

$EF_{captive,y}$ – Emission Factor for captive power generation (tCO_2/MWh)

$EF_{CO2,i}$ - CO_2 emission factor of fuel used in captive power generation (tC/TJ)

$Eff_{captive}$ – Efficiency of captive power generation (%)

44/12 – Carbon to Carbon dioxide conversion factor

3.6/1000 – TJ to MWh conversion factor.

(Please refer to "Annex 3: Baseline Information" for further detailed calculation)

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

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
There are no potential sources of leakage which can be attributed to the project activity. Hence no data is required to be monitored for this purpose.								

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 resulting from the project activity is calculated as

$$ER_y = BE_y - PE_y$$

Where,

ER_y = are the emissions reductions of the project activity during the year *y* in tons of CO_2

BE_y = are the baseline emissions due to 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

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.
Parameters for calculation of Baseline Emissions		
For calculation net electricity generated from project activity		
1,2& 3	Low	These data would be measured online, so do not require any QA procedure.
For calculation of emission factor for captive power generation		
4	Low	The data is based on the report of the recognized laboratory of Central Fuel Research Institue Unit, Ranchi and doesnot require Quality Assurance Procedure.

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 would be responsible for monitoring and archiving of data required to estimate the emission reductions. He would be supported by the shift in-charge who would continuously monitor the data logging and would generate daily, monthly reports.

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

UML along with guidance from consultants

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

There is no project emission associated with the project activity as described in Section D.2.1.1 of this PDD. Hence

PEy=0

Where

PEy = Total project emissions during the year y (any year within the crediting period of the project activity) (in tons of CO_2)

E.2. Estimated leakage:

As described in Section D.2.3.1 of this PDD, there are no sources of leakage which can be attributed to the project activity. Hence there will be no emission due to leakage in the project activity.

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

Since there will be no emission of GHG from any source in the project scenario and no leakage which can be attributed to the project activity, it will be a zero net GHG emitting project

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

The project activity would displace the captive electricity generation from coal. The baseline emission is calculated as per formulae described in Section D.2.1.4 of this PDD. The baseline emission figures are tabulated below:

Sl. No.	Operating Years	Baseline Emission Factor (tonnes of CO_2 / GWh)	Baseline Emissions (tones of CO_2)
1.	Dec 2004- Nov 2005	1.48	54491.3
2	2005-2006	1.48	54491.3
3	2006-2007	1.48	54491.3
4	2007-2008	1.48	54491.3
5	2008-2009	1.48	54491.3
6	2009-2010	1.48	54491.3
7	2010-2011	1.48	54491.3
8	2011-2012	1.48	54491.3
9	2012-2013	1.48	54491.3
10	2013-2014	1.48	54491.3
Total			544913

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

The emission reduction resulting from the project activity is calculated as per formulae described in Section D.2.4 of this PDD. The emission reduction values are tabulated below:

Sl. No.	Operating Years	Baseline Emissions (tonnes of CO_2)	Project Emission (tonnes of CO_2)	CO_2 Emission Reductions (tonnes of CO_2)
1.	Dec 2004- Nov 2005	54491.3	0	54491.3
2.	2005-2006	54491.3	0	54491.3
3.	2006-2007	54491.3	0	54491.3
4.	2007-2008	54491.3	0	54491.3
5.	2008-2009	54491.3	0	54491.3
6.	2009-2010	54491.3	0	54491.3
7.	2010-2011	54491.3	0	54491.3
8.	2011-2012	54491.3	0	54491.3
9.	2012-2013	54491.3	0	54491.3
10.	2013-2014	54491.3	0	54491.3
	Total	544913	0	544913

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

Please refer to Enclosure – I for details.

SECTION F. Environmental impacts

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

Article 12 of the Kyoto Protocol requires that a CDM project activity contribute to the sustainable development of the host country. Assessing the project's positive and negative impacts on the local environment and on society is thus a key element for each CDM project.

UML implemented the CDM project activity because of their commitment to ensure maximum global and local benefits in relation to certain environmental and social issues and was a major step towards sustainable development.

With regard to the local environment the project activity has positive effects on local air quality. By displacing electricity demand on the captive generation from fossil fuel, the project activity reduces emissions related to coal-fired power production, which include carbon dioxide, sulphur oxides, nitrogen oxides and particulates. It also conserves the non-renewable natural resource – coal and reduces the adverse impacts related to transportation of coal and coal mining that would have been required to meet the additional power capacity requirement of UML plant. These aspects contribute to the regional and global benefits.

Environmental Impact Analysis of the project activity :

During Construction Phase

During Operational Phase and

Maintenance Phase

The impacts envisaged during construction of the project activity are as follows:

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 are discussed in detail in the tables given below. All possible environmental aspects for the project activity have been identified and discussed for their impacts on the baseline environment before project activity implementation. The following table summarizes the environmental scenario in the baseline and project, project's possible local and environmental, social and other impacts, benefits and the mitigation measures UML has adopted to reduce/minimize negative impacts if any and enhance the positive impacts.

SL.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
A	CATEGORY: ENVIRONMENTAL – NATURAL RESOURCE CONSERVATION	
1	By eliminating the electricity requirement of the UML's plant operation and the electricity necessary to operate the Air Pollution Control devices like Venturi Scrubber in absence of project activity, on the captive power generation from fossil fuel, the project activity reduces an equivalent amount of coal combustion that would have been required to meet the plant's requirements. IMPACT/BENEFIT: The project activity is a step towards Coal Conservation.	
B	CATEGORY: ENVIRONMENTAL – AIR EMISSIONS	
1.	The project activity utilizes the heat content of the gases and reduces heat energy release to atmosphere either as hot air emissions or as hot wastewater emissions from venturi scrubber. IMPACT/BENEFIT: The heat energy, which would have been lost to the atmosphere in absence of project activity, is converted to electrical energy.	The WHRB recovers a part of the heat content of the waste gas to generate steam, which generates electricity.

SL.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
B	CATEGORY: ENVIRONMENTAL – AIR EMISSIONS	
	STACK EMISSIONS: The project activity itself doesnot contribute to air pollution. The air contaminants in the waste gases are generated from the DRI Kiln at UML. Some quantum of emissions is generated due to combustion of waste gases in the ABC. It may however be noted that the waste gas combustion in the ABC is mandatory. The CO content in the waste gases cannot be released to the environment without combustion. An auxiliary stack on top of After Burning Chamber (ABC) is provided for diverting the flue gas from ABC to atmosphere when the WHRB is shut down for maintenance. The air polluting contaminant in the waste gases generated from the kiln is routed through the ESP before discharging into the environment. IMPACT/BENEFIT: The project activity has no negative impact on the ambient air quality. In absence of the project activity the waste gases would be passed through the Venturi scrubber to meet the pollution control norms of SPM level of 150mg/Nm^3. The new waste gas treatment technology adopted is more efficient.	The waste gas after heat recovery in the WHRB passes through an Electrostatic Precipitator (ESP) with a design efficiency of 99.9% and finally discharged into the atmosphere through a stack of 63metre height. A high collection efficiency (99.9 %) of ESP ensures SPM levels less than 100 mg/Nm^3 in the stack which falls well within the Indian Regulatory Standard of 150mg/NM^3. Further, periodical monitoring is undertaken to ensure compliance. Although, there are no emission standards for SO_2 and NOx, a stack of 63-meter height for DRI plant is provided for the wide dispersal of the gaseous emissions thus, reducing their impact in the vicinity of the project area. During maintenance in waste heat power plant a Gas Conditioning Tower (GCT) cools the gas before passing through ESP. The Consent to Establish (NOC) under Section 21 of Air (Prevention & Control of Pollution) Act, 1981 for setting of Plant for manufacturing of DRI (Sponge Iron) at Plot No. Existing premises, Mauza: Adityapur Industrial Area, P.O. Gamharia and Consent to Operate under Air Act, 1981 have been received. The project activity included as a part of the plant for manufacturing of DRI.

SL.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
C	CATEGORY: ENVIRONMENTAL – AIR EMISSIONS	
1	FUGITIVE EMISSIONS: The particulate and ash material collected in the ESP is one of the generation points of the fugitive emissions. However this environmental aspect would have had a much higher detrimental effect on the environment if UML proposed to implement a coal based captive power plant. IMPACT/BENEFIT: The project activity results in some fugitive emissions after waste gas cleaning at the ESP end.	There is adequate provision to contain the fugitive dust in this area. Further, there is a plan to dump the ash in a low-lying area within the plant premises and develop it in the form of ash mound, with topsoil covered with grass and the trees. A plantation of grass and suitable green cover shall be raised upon the said ash mound. This will ensure no fugitive emission from the ash mound.
2	By displacing captive electricity generation from coal, the project activity has reduced global and local air pollution (due carbon dioxide, sulphur oxides, nitrogen oxides and particulates) related to coal-fired thermal power production. IMPACT/BENEFIT: The project activity has ensured there is no detrimental impacts on the air quality by preventing coal based captive power plant operations.	-
3	The project activity has avoided 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 coal based captive power plant. IMPACT/BENEFIT: The project activity has prevented local air quality deterioration.	

SL.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/REMARKS
D	CATEGORY: ENVIRONMENTAL – SOLID WASTE GENERATION	
1	The particulate and ash material in the waste gases is collected in the ESP. The project activity itself does not contribute to the solid waste generation. IMPACT/BENEFIT: The mixing of ash material collected at the ESP end of the project activity with soil in low proportion is reported to improve the soil condition for plant growth. Further since these solid wastes are confined within the factory premises, there is no impact on the outside land environment.	This shall be disposed off as ash mounds.
2.	In the CPP maintenance phase some boiler soot is generated after cleaning but it does not cause any adverse impact on the environment IMPACT/BENEFIT: These solid wastes would be confined within the factory premises; there is no impact on the outside land environment.	

SL.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
E	CATEGORY: ENVIRONMENTAL – WASTEWATER GENERATION	
1	In absence of the project activity UML would have adopted the Venturi Scrubber/Gas Cleaning Plant to clean the waste gases from the ABC. With project activity in operation there is no wastewater generation. IMPACT/BENEFIT: With project implementation, no wastewater is discharged, therefore there is no adverse impact envisaged from wastewater generation.	UML has opted for dry disposal of waste dust generated from dust settling chambers, ESP, and ABC. Hence, thickner and muddy water handling system and settling pond will not be necessary. The water of the Tailing Pond is pumped and used for dust suppression and irrigation.
2	Some amount of wastewater is generated from RO and blow down containing TDS. IMPACT/BENEFIT: There is no adverse impact envisaged from wastewater generation since it is reused for irrigation.	This water flows to the Tailing Pond. From there it is pumped and used for dust suppression and irrigation.
3	Additional manpower for the project activity has contributed to organic pollution load but the quantity addition is very low. IMPACT/BENEFIT: There is no adverse impact envisaged from wastewater generation.	This is taken care of by well-designed toilets and soak pit facilities available.

SL.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
F	CATEGORY: ENVIRONMENTAL – GROUND WATER / HYDROLOGY	
1	The water requirement of the project activity is met from the existing reservoir of the existing plant of UML, which ultimately receives the water from Subarnarekha Multipurpose Project. IMPACT/BENEFIT: Since availability of required water for the project activity was demarcated and ascertained, it is not expected to have any tangible impact on the surrounding users as far as water use is concerned. As no water is extracted from ground water resources, there is no impact on ground water use.	-

G	CATEGORY: ENVIRONMENTAL – SOIL	
1	During site preparation, negligible amount of soil movement is involved due to site leveling operation and construction of the facility. IMPACT/BENEFIT: The impacts on soil due to the project activity are negligible and restricted to the construction phase.	However, in order to minimize such impacts, appropriate soil conservation measures have been undertaken by UML to appease the chances of soil erosion. The soil conditions of the project site were allowed to stabilize during this period after the impacts of the construction phase. The topsoil in the non-built up areas was restored and such portions of the site were subjected to plantations which has helped in bonding together of the soil, thus increasing its strength.

SL.	**ENVIRONMENTAL IMPACTS & BENEFITS**	**MITIGATION MEASURES/REMARKS**
I	CATEGORY: ENVIRONMENTAL – NOISE GENERATION	
1	The equipment used in the project activity are designed for noise levels between 85 to 90 dB(A). IMPACT/BENEFIT: The project activity itself has no adverse affect.	Provisions of protective personnel equipment have further reduced the impact of noise level. Hence these noise levels may not be of much concern from occupational health point of view. Warning signs indicating noise area are posted.

J	CATEGORY: SOCIAL	
1	The occupational structure for the area is mainly in reference to main workers and marginal workers. The region facing a slow economic growth due to lack of industrialization. Since the project size is not so big, this has not had any major influence on the socio economic fabric of the region. The project activity site is within the premises of UML and there is no human displacement. Therefore no rehabilitation programme was needed. IMPACT/BENEFIT: The project activity has offered some employment during the construction as well as the operational phase, which has had a beneficial impact.	

SL.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/REMARKS
K	CATEGORY: GREEN BELT	
1	Green Belt is considered as one of the major aspects in maintaining the stability of the environment of the area. There were no endangered species located in and around the plant area. Therefore, there needn't be any concern for loss of important greenery that needs conservation. IMPACT/BENEFIT: The impact on the green environment is of no concern, rather it is observed that the green belt developed by the UML seems to have reversed the tendency of deterioration in flora and fauna due to any expansions.	In order to improve the aesthetic look of the area and enhance the land use as well as to compensate for any loss in ecology during construction, adequate plantation programmes around the project site have been adopted. The plantations consist of a mixture of carefully chosen locally available species of trees, shrubs and herbs, preferably evergreen and resistant to adverse environmental conditions.
L	CATEGORY: CAPACITY BUILDING	
1	IMPACT/BENEFIT: The Project activity has contributed to the Power Sector by replacing future thermal generation with clean energy.	-
2	IMPACT/BENEFIT: This is one of the largest demonstration of a Captive Power Plant based on the waste heat gases in India and has had a catalyzing effect for further development of energy projects. Successful implementation of this project has opened new avenues for other sponge iron and steel industries to available this technology.	

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 do not require an Environmental Impact Assessment for the project activity. However, a combined EIA study has been conducted for the DRI plant along with the WHR based CPP. The same may be provided on request.

This project activity has positive environmental impacts and the environmental clearance have been received.

The project activity 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.

SECTION G. Stakeholders' comments

>>

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

UML identified the major stakeholders involved with the project activity in order to get their views and concerns on the implementation of the project activity. UML consulted them at various stages of project implementation. The major stakeholders include both government & non-government organisations.

The stakeholders identified for the project are as under.

Government Parties

The stakeholders identified for the project are as under.

- Jharkhand State Electricity Board
- Ministry of Environment & Forest
- Jharkhand Pollution Control Board (JPCB)

Non-Government Parties

- Employees
- Elected body of representatives administering the local area (village *Panchayat*)
- Non-Governmental Organisations (NGOs)
- Consultants
- Equipment Suppliers

UML shared the project activity's salient features, which includes the project activity's objective to utilize waste heat of the waste gases of the DRI Kiln and its environmental impacts which include GHG reductions with all the stakeholders enlisted above.

UML sent applications / letters to all the government parties to get their opinions on the project activity and attain the necessary approvals and clearances for project implementation.

UML representative met the local stakeholders and apprised them about the project activity's environmental benefits to the locality and sought their support.

G.2. Summary of the comments received:

Non-Government Parties

The project activity did not result in any major displacement of any local population. The project activity was set up on a barren land inside the factory premises. Therefore the project activity was not going to cause any adverse social impacts on local population rather it would help in improvising their quality of life. The project activity was going to provide good direct employment opportunities to the local populace therefore UML got full co-operation from the local populace.

The village Panchayat /local elected body of representatives administering the local area are a true representative of the local population in a democracy like India. Since the project has both social and environmental benefits the village Panchayat representatives welcomed it. UML has received their positive opinions for the project activity.

The employees of UML too have extended their full support and co-operation to UML in order to implement the project activity.

The project activity also provided direct employment to the project consultants and the equipment suppliers.

Project consultants were involved in the project activity to take care of various pre contract and post contract project activities like preparation of Detailed Project Report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project implementation, successful commissioning and trial runs.

Equipment suppliers, have supplied the equipments as per the specifications finalized for the project activity and were responsible for successful erection & commissioning of the same at the site.

UML has received complete cooperation from the Project consultants and equipment supplies in all stages of project implementation.

Government Parties

As stated above the UML sent applications to all the government parties associated to the project activity providing with them all necessary project related information and to seek their approvals. The applications were submitted to the following government parties:

Jharkhand Pollution Control Board (JPCB) has 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 JPCB.

The project activity has received the Host Country Approval from the Indian Designated National Authority Ministry of Environment & Forest (MoE&F).

UML has also received the clearance of Jharkhand State Electricity Board to which the UML plant is connected for import of electricity.

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

The comments received by the non government and government parties are primarily focused on encouraging UML in its environmental initiative.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Usha Martin Limited
Street/P.O.Box:	P.O. Gamharia, Dist. Saraikela-Kharsawan,
Building:	
City:	Jamshedpur
State/Region:	Jharkhand
Postfix/ZIP:	832108
Country:	India
Telephone:	0657 2408908
FAX:	0657 2200504
E-Mail:	-
URL:	www.ushamartin.com
Represented by: Sr. Vice President – Commercial and Shared Services	
Title:	Mr.
Salutation:	Dear
Last Name:	Basak
Middle Name:	-
First Name:	Arun
Department:	Alloy & Steel Division
Mobile:	
Direct FAX:	0657 2200504
Direct tel:	0657 3982368
Personal E-Mail:	arunbasak@ushamartin.co.in

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding for this project.

Annex 3

BASELINE INFORMATION

The project activity generates electricity by utilising the heat content of the waste gas of the sponge iron kiln and displaces an equivalent amount of captive electricity generation from the coal. The emission reduction resulting from the project activity would depend on the net quantity of electricity supplied to the manufacturing facility by the project during the year and the CO_2 baseline emission factor of the coal based captive reference plant.

CALCULATION OF EMISSION REDUCTIONS OF 10 MW WASTE HEAT RECOVERY PROJECT				
Baseline Emissions (tCO_2/MWh)				
CO2 emission factor of coal used in captive power generation, tC/TJ	26.27			
Efficiency of captive power generation,%	0.23			
Emission factor for captive power generation, tCO2/Mwh	1.48			
Year of offer	Net quantity of electricity supplied to the manufacturing facility by project activity, MWh	Baseline Emissions, tCO2	Project Emissions, tCO2	Carbon emission reductions, tCO2
Dec, 2004 - Nov,2005	36720.00	54491.3487	0.0000	54491.3487
Dec, 2005 - Nov,2006	36720.00	54491.3487	0.0000	54491.3487
Dec, 2006 - Nov,2007	36720.00	54491.3487	0.0000	54491.3487
Dec, 2007 - Nov,2008	36720.00	54491.3487	0.0000	54491.3487
Dec, 2008 - Nov,2009	36720.00	54491.3487	0.0000	54491.3487
Dec, 2009 - Nov,2010	36720.00	54491.3487	0.0000	54491.3487
Dec, 2010 - Nov,2011	36720.00	54491.3487	0.0000	54491.3487
Dec, 2011 - Nov,2012	36720.00	54491.3487	0.0000	54491.3487
Dec, 2012 - Nov,2013	36720.00	54491.3487	0.0000	54491.3487
Dec, 2013 - Nov,2014	36720.00	54491.3487	0.0000	54491.3487
Total number of CERs over the 10 year crediting period	544913.4870			

Annex 4

MONITORING PLAN

The monitoring plan for the CDM project activity has been developed in order to determine the baseline emissions over the entire credit period. The net units of electricity generated by the project activity are to be determined through a robust monitoring system which comprises mainly of the power meters

As stated above the project activity is a part of the UML Power System. The instrumentation and control system for the Power System is designed with adequate instruments to control and monitor the various other operating parameters for safe and efficient operation of the WHRB and the turbo generator unit.

The actual amount of CO_2 reduction however also depends on the CO_2 emission factor of coal that would have been used in the captive power generation in the baseline scenario to determine the emission factor for captive power generation calculation. Therefore it is also included in the Monitoring system.

Serial No.	Activity
1.0	**GHG Performance Parameter**
1.1	UML is required to determine the following GHG Performance parameter with regards to the project activity: • Net electricity generated from the project activity which is supplied to the UML plant • CO_2 emission factor of coal
2.0	**Metering System**
2.1	The Power Metering System consists of two metering units at key locations on the electricity network - Power Meter for monitoring total electricity generation from project activity - Power Meter for monitoring electricity sent to UML plant The instrumentation system comprises of microprocessor-based instruments of reputed make with the best accuracy available. All instruments are calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time. The calibration frequency is once in a year by third party.
	According to the state electricity board's (grid operator) regulations also, the annual calibration and verification of electricity meters is mandatory for all power generating units. We may therefore conclude that the reliability of the results would be ensured by

Serial No.	Activity
	the UML both as a statutory requirement and for the project activity.
2.2	Reporting for Power Metering: Registration of data would be on-line in the control cabin through a microprocessor. However, hourly data logging would be there in addition to software memory. The shift-in-charge of the project activity shall take eight hourly reading of the data and shall keep the complete and accurate records in the Plant Log Book for proper administration. The readings will be verified by the Plant Manager on a daily basis. The daily and monthly reports would be prepared.
3.0	CO_2 emission factor of coal
3.1	CO_2 emission factor of coal is calculated based on the GCV value and Total Carbon Content Value of coal used for 25MW existing captive power plant. The GCV value and Total Carbon Content Value is reported both in-house and by third party.
4.0	**Experience and Training**
4.1	The plant in-charge will be qualified engineer degree/diploma holder with prior work experience. All the Shift in-charges will be degree/diploma holders and will undergo an exhaustive on-the-job training programme, including plant operations, data monitoring and report generation.
5.0	**Records**
	1. Plant Log Book for Power Generation maintained at site 2. Coal Analysis Report maintained at site 3. Calibration Certificates for the Meters of the Power Metering system maintained at site

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Appendix I : Abbreviations

UML	Usha Martin Limited
WHR	Waste Heat Recovery

CCP	Captive Power Plant
CC	Climate Change
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CO_2	Carbon di-oxide
CPU	Central Power Units
DCS	Distributed Control System
DPR	Detailed Project Report
DRI	Direct Reduction of Iron
ESP	Electro Static Precipitator
EIA	Environmental Impact Assessment
FYP	Five Year Plan
GHG	Greenhouse Gas
GOI	Government of India
GWh	Gega Watt hour
IPCC	Intra-governmental Panel for Climate Change
IPP	Independent Power Producers
ISPLAN	Integrated System Plan
KP	Kyoto Protocol
km	Kilo metres
KV	Kilo Voltage
KW	Kilo Watt
KWh	Kilo Watt hour
1 Lakh	1,00,000
MkWh	Million Kilo Watt hour
MU	Million units

ABBREVIATIONS (Contd… …)

MoP	Ministry of Power
MoU	Memorandum of Understanding
MT	Metric Ton

MW	Mega Watt
NEDA	Non conventional Energy Development Agency
NOC	No Objection Certificate
p.a	Per annum
PLF	Plant Load Factor
PPA	Power Purchase Agreement
PIN	Project Idea Note
SEB	State Electricity Board
STG	Steam Turbine Generator
TJ	Trillion Joules
TPH	Tones Per Hour
TERI	Tata Energy Research Institute
UNFCCC	United Nations Framework Convention on Climate Change
JPCB	Jharkhand Pollution Control Board
JSEB	Jharkhand State Electricity Board

Sr.No	Particulars of the references
1.	Kyoto Protocol to the United Nations Framework Convention on Climate Change
2.	Website of United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int
3.	UNFCCC Decision 17/CP.7 : Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol.
4.	UNFCCC , Clean Development Mechanism-Project Design Document (CDM-PDD) version 01(in effect as of: August 29, 2002)
5.	UNFCCC document : Annex B to attachment 3 Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories
6.	Practical Baseline Recommendations for Green House Gas Mitigation Projects in the Electric Power Sector, OECD and IEA Information
7.	Various project related information / documents / data received from Usha Martin Limited, Jamshedpur during the site visits.