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

CONTENTS

A. General description of project activity

B. Application of a baseline and monitoring methodology

C. Duration of the project activity / crediting period

D. Environmental impacts

E. Stakeholders' comments

Annexes

Annex 1: Contact information on participants in the project activity

Annex 2: Information regarding public funding

Annex 3: Baseline information

Annex 4: Monitoring plan

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Waste heat recovery based captive power project of RLUL in West Bengal
Version- 01
29th November 2006

A.2. Description of the project activity:

>>
Ramsarup Lohh Udyog Limited (RLUL) is in the process of setting up an integrated steel plant to produce semi-finished steel. Along with this, RLUL proposes to set up a 20MW captive power plant, at Kharagpur of West Bengal taking into account the availability of hot gas from the Direct Reduced Iron ("DRI") plant and excess gas from the MBF.

DRI Kiln is expected to emit around 93,300 (average) NM^3/hour of hot gas at a temperature of 950°C±50°C, containing heat energy to the tune of 0.38 kcal/NM^3/Deg K which, if not suitably utilized would be released in the atmosphere and thus be wasted. The projected availability of excess gas from Mini Blast Furnace ("MBF") is expected to be approximately 28,775 NM^3/hour with the heat energy of 764kcal/ NM^3. The steam from the BF gas boiler and the WHR boiler will be collected in a steam header and shall be expanded in a steam turbine coupled to a turbo-generator (TG) to produce power. The total heat energy available from the waste gas of DRI kilns and MBF, on conversion to electrical energy produces about 20MW of electrical power. Harnessing this power by establishing a suitably designed CPP at the tail end of the DRI Kilns and MBF will enable RLUL to reduce green gas emission by generating power from waste gas / heat.

The proposed plant shall be configured with the following:

- One Waste Heat Recovery Boiler (WHRB) of capacity 52.5TPH operating at 66ata and 490±5°C.
- One BF gas boiler of capacity 35TPH operating at 64ata and 485+5/-2°C.

The proposed project activity will not only provide a source of reliable green and environmentally benign power to DRI plant, MBF, EAF but also to achieve efficiency through waste heat recovery and significantly reduce the effect of thermal pollution to atmosphere, thus helping it to further establish its credentials as a concerned corporate citizen.

In the absence of the project, the RLUL would have either imported electricity from the state grid or set up a coal fired power plant of similar capacity for meeting the power requirement of the DRI plant, MBF, EAF, as is commonly being practiced in the region and in the sector. Thus, with the operation of the waste heat based CPP, the proposed project activity will displace an equal amount of imported electricity from the state grid (or coal fired power plant) and also save transmission and distribution (T&D) losses.

The GHG emission reductions due to the project activity arise from the replacement / displacement of equivalent amount of electricity from the state grid, which is comprised of a generation mix primarily from fossil fuel sources.
In summary, the main purpose of the project is:

- To utilize the waste gases to generate environmentally friendly power;

- Reduce green house gas emissions on account of its proposed project activity;
- Demonstrate its commitment towards the society and environment and thus reestablish its credentials as a concerned corporate citizen;
- To achieve energy efficiency by utilizing the available waste gases from DRI plant and excess gas from the MBF.
- Conservation of energy and natural resources, to reduce direct and indirect consumption of scarce resources

Project's Contribution to the Sustainable Development

Social well-being: The project is expected to create significant employment opportunities; directly, by way of manpower required to build / operate / maintain the unit and indirectly, by generating power and thus eliminating the need to draw power from an already deficit grid. Further, with growing technological advancement, the project activity will contribute to the capacity building in terms of technical knowledge and long-term skills. Such project, which involves energy efficiency, will certainly have long-term direct and indirect social benefits. The implementation of the project activity will bring about an increase in the business opportunities for contractors, suppliers, and erectors at different phases of its implementation.

Economic well-being: With project activity's ability to reduce an equivalent demand of electricity on the grid, there is an advantage to the regional grid in combating power shortage and making power available for other important purpose.

Environmental well-being: In India, a major share of the country's electricity is generated from fossil fuel sources such as coal, diesel, furnace oil etc. The proposed waste heat recovery CDM project will displace or replace the equivalent quantity of electricity generated in the grid. Furthermore, the project will relieve the burden on the depleting resources of conventional fuel thereby making coal available for other utilizations. Since the project is able to avoid all the associated pollution occurring related to extraction, processing and transportation of natural resources, it promotes an overall environmental well being. In India, coal is the most abundantly available fossil fuel, which is mainly used for power generation. Power plants run for supply of power to regional grid, contribute about 16477.78 MW[1] of which more than 84% is accounted for by coal, gas and diesel based thermal power plants. The waste heat recovery CPP in RLUL has been able to displace/ replace electricity generated by grid-connected power plants in an equivalent amount. Being able to do away with grid power, RLUL has indirectly saved further depletion of natural resources in the form of coal, thus increasing its availability to other important processes in future. Thus the implementation of project activity is a demonstration of a clean technology.

Technological well-being: Waste Heat Recovery based captive power plant is a cleaner technology that uses the waste flue gases of sponge iron kilns and MBF which otherwise would have been emitted to the atmosphere leading to its pollution. The electricity generated by the plant is consumed for both auxiliary and captive purposes. Hence, the project activity has contributed to a better quality environment to the employees and the surrounding community.

A.3. Project participants:

>>

---

[1] http://powermin.nic.in/generation/generation_state_wise.htm#estern

Name of Party involved (*) ((Host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ministry of Environment and Forest, Government of India (Host Country)	Ramsarup Lohh Udyog Limited (Project participant)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>
India

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

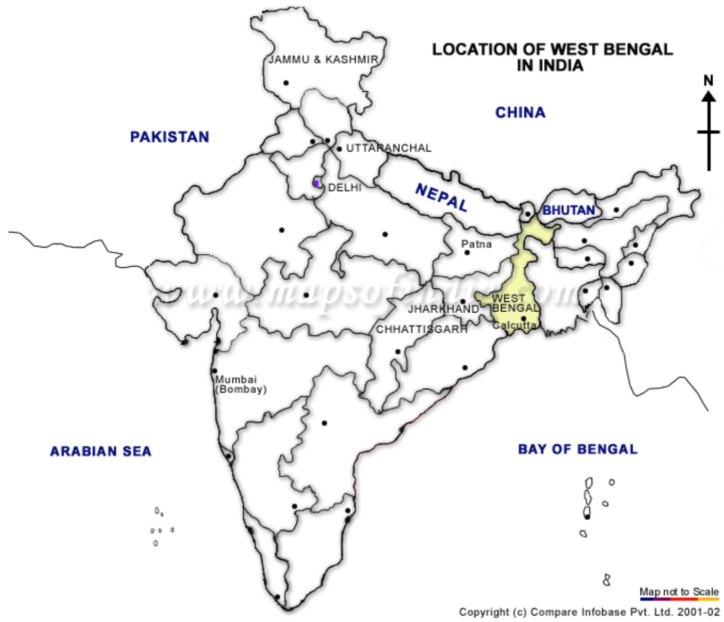
>>
West Bengal

A.4.1.3. City/Town/Community etc:

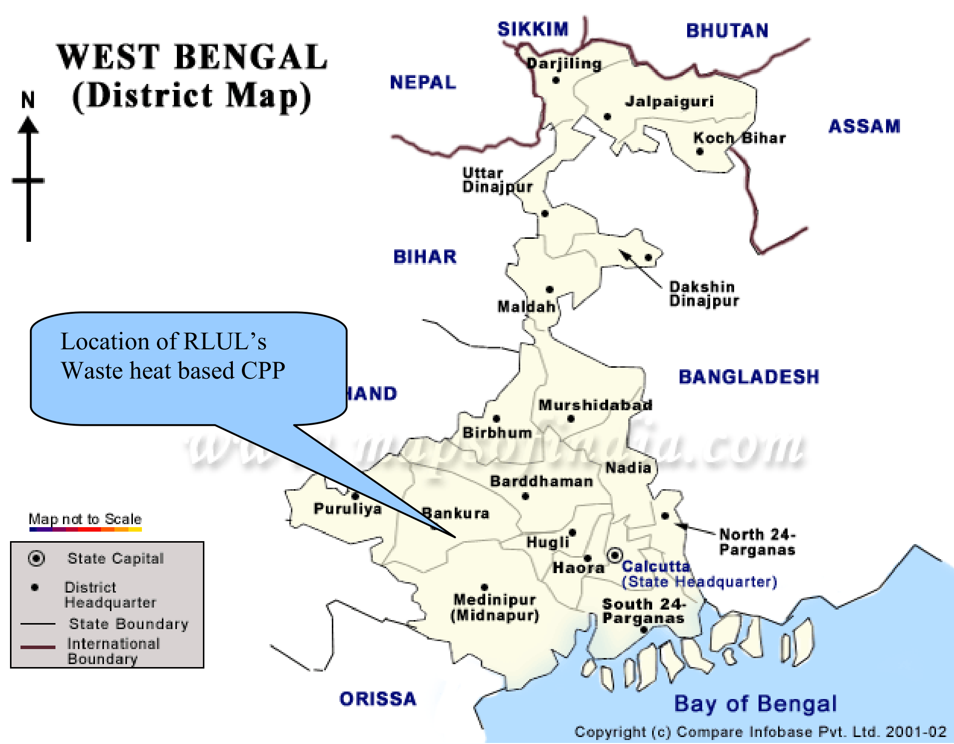
>>
Madinapur District at Shah Chowk

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

>>
The proposed plant is located near Kharagpur at Shah Chowk, District: Madinapur, West Bengal. The site is 200m away from Bombay road i.e., National Highway (NH) 6. The site is about 138km from Kolkata, about 18km from Midnapur, and 13km from Kharagpur. The site is well connected with Rail and Road. The nearest main Railway station is Gokulpur-Girimaidan station on the Kharagpur-Midnapur-Anra line. The nearest international Airport is located at Kolkata (Netaji International Air Port).



Location of West Bengal state in India



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

>>

The project activity is categorized under Sectoral Scope 01 "Energy Industries (renewable / non-renewable sources). The project will be generating electricity by utilizing the waste gases from the DRI kiln and MBF. Thus approved methodology ACM0004/Version 02 – "Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation", is applicable to the project.

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

>>

The waste heat recovery based captive power plant equipped with modern equipments, utilizes the heat content of the waste flue gas from Direct Reduced Iron (DRI) kilns of sponge iron unit and excess gases from the MBF to generate electricity for captive consumption.

The major equipment of the proposed 20MW captive power plant is:

- One waste heat recovery boiler (WHRB)
- One blast furnace gas fired boiler
- One steam turbine generator (STG) rating 20MW

Waste Heat Recovery Boiler

DRI Kiln emits around 93,300 (average) NM^3/hour of hot gas at a temperature of 950°C±50°C that contains heat energy to the tune of 0.38 kcal/NM^3/Deg K which if not suitably utilized goes to waste. The WHR boiler will be sized to extract the maximum of heat energy from the waste gases.

The major technical parameters of WHRB are given in table below:

Number of WHRBs	One
Steam Output Maximum Continuous Rating	52.5 TPH
Steam Pressure at superheater outlet	66 ata
Steam temperature at super heater outlet	490±5°C
Waste gas inlet conditions	
Gas flow	125000 Nm3/hr (max)
Gas temperature	950 to 1000°C

The WHRB proposed will be of unfired single drum, top supported natural circulation type. The boiler consists of economizer, evaporator, super heater, integral piping, flue gas ducting with expansion joints, supporting structures, platforms and walkways, soot blowers etc. the super heater will be arranged in two stages with spray type de-super heater in between to control the steam temperature. The boiler will be of 3-pass design. The boiler will be provided with a suitable control system to ensure maximum steam generation for different waste gas inlet conditions. The control system will be designed to ensure steady steam flow and temperature conditions. The boiler will also be provided with furnace pressure control system and feed water, flue gas and flow of steam and feed water, flue gas pressure and temperature at different sections, direct level gauges and level switches for steam etc. The flue gas from the boiler will be cleaned in high efficiency electrostatic precipitator (ESP). The particulate matter and flue gas existing from ESP will be dispersed into the atmosphere through a tall stack.

Blast Furnace gas fired boiler

The projected availability of excess gas from MBF and its composition is 28,775 NM^3/hour with the heat energy of 764 kcal/ NM^3. The major technical parameters of the blast furnace gas fired boiler are:

Number of BF gas boilers	One
Steam Output Maximum Continuous Rating	35 TPH
Steam Pressure at superheater outlet	64 ata
Steam temperature at super heater outlet	485+5/-2°C
Gas inlet conditions	
Gas flow	36,039 Nm3/hr (max)

The blast furnace gas fired boiler proposed will be of button supported, semi-outdoor type, natural, bi-drum and membrane wall construction. The burner will be of dual fuel type, i.e., blast furnace gas in combination with LDO and provided with flame monitoring systems. The feed systems shall comprise of de-aerator, boiler feed pumps and drives, feed control station and valves.

Turbo generator and auxiliaries

The steam from the BF gas boiler and the WHRB will be collected in a steam header and shall be expanded in a steam turbine coupled to turbo-generator (TG) to produce approximately 20MW power.

Multistage steam turbine directly coupled to an electric generator, main condenser, and air ejector system for main condenser condensate pumps. Condensate water heater, de-aerator, lubricating oil and governing oil system, controls and instrumentation will be provided for each of the above boilers.

Steam Turbine Driven Generator

Steam Pressure	61 ata
Steam Temperature	480±5°C
Numbers	1 No.
Type	Condensing

Generator Parameters

Capacity	20 MW
Voltage	6.6 kV
Frequency	50Hz
Numbers	1 No.
Installed Capacity	20 MW

The total heat energy as available from the DRI gas and MBF gas, on conversion to electrical energy produces about 20 MW of electrical power.

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

>>
The total emissions reductions throughout the first crediting period (7 years) from the project are expected to be as under:

Years	Annual estimation of emission reductions (tCO2e)
Feb 2007-Dec 2007	105,413
2008	114,996
2009	114,996
2010	114,996
2011	114,996
2012	114,996
2013	114,996
Jan 2014-Feb 2014	9,583
Total estimated reductions for the first crediting period of seven years	804,972
Total number of crediting years	21y-0m (3x7)
Annual average over the first crediting period of estimated reductions (t CO2 e)	114,996

A.4.5. Public funding of the project activity:

>>

No funding from the Annex I parties is available to the project activity

SECTION B. Application of a baseline and monitoring methodology

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

>>

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

Reference: Approved Consolidated baseline methodology ACM 0004/Version 02 – Sectoral Scope: 01, 03rd March 2006.

B.2 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 content of waste gases emitted from the DRI kilns in WHRB and MBF in BF gas fired boiler 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:"**

"That displace electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels,"- As per the Baseline Scenario analysis, conducted in Section B.4 of this PDD, the project activity displaces electricity generation with fossil fuels in the electricity grid (Eastern Regional Grid). Therefore the project activity meets this applicability criterion.

"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 and MBF. There is no fuel switch involved in process.

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

>>

	Source	Gas	Included?	Justification/Explanation
Baseline	Grid electricity generation	CO_2	Yes	Main Emission Source
		CH_4	No	Excluded for Simplification. This is conservative.
		N_2O	No	Excluded for Simplification. This is conservative.

Project Activity	Onsite fossil fuel consumption due to the project activity	CO_2	Yes	Main Emission Source
		CH_4	No	Excluded for Simplification. This is conservative.
		N_2O	No	Excluded for Simplification. This is conservative.

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

>>

The methodology has been applied to the project in following ways:

1. Identification of alternative baseline scenarios consistent with current laws and regulations
2. Additionality assessment
3. Determination of emission reductions from the project activity

Identification of alternative baseline scenarios consistent with current laws and regulations

As highlighted in the baseline methodology the determination of the baseline scenario requires consideration of the following potential alternatives:

(a) The proposed project activity not undertaken as a CDM project activity
(b) Import of electricity from the grid
(c) Existing or new captive power generation on-site using other energy sources other than waste heat and/or gas, such as coal, diesel, natural gas, hydro, wind etc
d) A mix of options (b) and (c), in which case the mix of grid and captive power should be specified.
(e) Other uses of waste heat and waste gases
(f) The continuation of the current situation, whether this is captive or grid-based power supply.

Analysis of the alternative scenarios:

The analysis of each of the above scenarios is done bearing in mind the factors considered by the promoters while making the investment decision, namely:

(i) The iron and steel industry is a highly cyclical industry and all industry indicators seem to suggest that the peak has been reached;
(ii) The generation of power by the system is completely dependent on the use of sponge iron unit, which in turn is dependent on the landed price of scrap metal which is also fluctuating and
(iii) The power plant cannot be technically operated if the PLF is below 50%.

Option a: The proposed project activity not undertaken as a CDM project activity

The promoters have gone on record with their reluctance to set up the waste heat recovery based power unit, primarily on account of the high capital cost and the risks involved. In fact it was only when the CDM related revenue was highlighted to the investor group and concrete offers were produced to the investors that they agreed to invest the equity component required to fund the power plant. Otherwise, the investors were of the opinion that the project was very risky and preferred to set up the project by drawing the required power from the state electricity grid. In addition, all (most) similar WHR projects being set-up in the country (in the SME segment) are being developed under the CDM. In view of the above, it may be concluded that at the point in time when the decision to proceed with the project was taken, the related CDM linked revenue were seriously considered and was a key factor responsible for the favorable decision (suitable documents will be provided to the DOE at the time of validation)

Thus the option to undertake this project as a non-CDM project was/is not a viable baseline scenario.

Option b: Import of electricity from the grid

In the absence of the project activity, import of electricity from the state grid, would perhaps have been the most economically feasible option. The key advantage with the state grid electricity is the fact that the upfront capital investment (and thus the related project risk) is very low and this was a key factor under consideration by the project developers.

Furthermore, the plant meets all the legal and regulatory requirements needed to be able to purchase electricity. In addition, the project had received an offer from the state government for supply of the entire power required by the project.

Option c: Existing or new captive power generation on-site using other energy sources other than waste heat and/or gas, such as coal, diesel, natural gas, hydro, wind etc .

In analyzing this option it is necessary to consider fuels, materials and technology available at the project site.

Natural gas as a possible fuel can be ruled out on account of lack of infrastructure for its supply to the project activity. In other words, supply constraints rules out natural gas as an option.

Wind & hydro: Renewable energy sources like wind and hydro are unreliable sources of power and are thus not serious contenders. In addition wind / hydro are very capital intensive and the state of West Bengal does not have too many suitable wind / hydro sites. The basic criterion for developing wind power project depends on the density of wind in the particular site. The state of West Bengal has not developed too many wind power projects. The total electricity generated from the wind power projects in West Bengal is only 1.08 MU[2] with 1.1 MW[3] of installed capacity. It is evident from these statistics that the region is not too favourable for switching over to a wind-based source for generation of electricity.

Coal and diesel (including other liquid fossil fuel) are therefore left as alternatives for power generation. Even though the sponge iron plant will be installing diesel generators as back up units, on account of the high cost of operation, they will not be used continuously. The power generated would partially meet RLUL's own demand and the remaining power would be wheeled through the SEB grid. An equivalent amount of CO_2 emissions would be released at the CPP end. This alternative is in

---

[2] http://mnes.nic.in/wp12.htm

[3] http://www.indianwindpower.com/potential.html

compliance with all applicable legal and regulatory requirements and can be a part of baseline option. But it should be noted that diesel based power generation is not an economically feasible option.

Of the potential options for captive units we are essentially limited to a small coal based electricity generation system as an alternative. Coal based boilers are installed in sponge iron plants to utilize the "char" (unburnt coal that exits the rotary kiln). The coal based generation plant, being cheaper in terms of up-front investment costs (estimates from manufacturers identified coal based boilers as 50% cheaper than waste heat recovery boilers), is generally a preferred option.

However the char must be mixed with coal in order to reduce the size of the boiler. The feasibility of generation from this set up depends on the access to coal over time and as coal is available in plenty in the eastern part of the country, this was an option that was under serious consideration by the project developers. Moreover in addition to the cost advantage, it did not suffer from the risks of under utilization that the WHR based power plant was faced with.
The coal-based power plant was thus a viable option that could also be considered to be the baseline scenario.

Option d: A mix of options (b) and (c), in which case the mix of grid and captive power should be specified.

In view of the issues mentioned above, option (d) is a possible baseline scenario. However in order to be conservative, the baseline emission has been computed considering a 100% power draw down from the eastern regional grid.

Option e :Other uses of waste heat and waste gases

In examining option (e), i.e. other uses of waste heat and waste gas, there have been no attempts to utilize the gases for other purposes in the region. The majority of plants have traditionally released the gas into the atmosphere and the installation of waste heat recovery boilers has only been considered recently. There are not too many sponge iron plants in West Bengal which has a Waste Heat Recovery Based Power Plant. Therefore it is plausible to rule out this option in cases where the waste gases are generated in a sponge iron plant.

Option f: The continuation of the current situation, whether this is captive or grid-based power supply.
Grid based power is available to projects in the state and there are no limitations on obtaining a grid connection either by the type of industry or region. A plausible alternative baseline scenario is that of the electricity being generated by the operation of grid-connected power plants and by the addition of new generation sources.

Therefore, through the examination of the alternatives available to the project promoter it can be demonstrated that the possible options were limited to three:

- Import of electricity from the grid;
- Setting up a coal based power plant;
- The project activity that involves investment in sponge iron waste heat recovery;

Of the three options, the most plausible (and reliable) option would have been a combination of coal-based power together with additional power being drawn from the grid. However, in order to be conservative, the baseline has been considered to be 100% grid based power. The project activity therefore gives rise to emission reductions through the displacement of grid based power generation sources in the supply of electricity to the sponge iron plant and to other third parties, both of which would have been satisfied by the grid under the baseline scenario.

Key methodological Steps followed in determining the baseline scenario:

1. The methodology requires RLUL to establish base line scenario by considering all possible options that provide or produce electricity for in house consumption and /or sale to grid and/or other consumers. The methodology also identifies six possible alternative scenarios.

Each of the alternatives have been discussed above and illustrated that the import of power from grid as the baseline scenario**.**

2. The methodology requires us to demonstrate the additionality of project activity using the " latest version of Tool for demonstration and assessment of additionality".

The additionality of project activity using the "Tool *for demonstration and assessment of additionality version 02 of 28 November 2005''* in Section B.5.

3. The methodology applies to electricity generation project activities; that displaces electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels, where no fuel switch is done in the process where the waste heat or pressure or the waste gas is produced after the implementation of project activity.

We have established that project activity generates electricity, which displaces grid power that is fossil fuel based and there is no fuel switch being done in the rotary kiln where the waste gases are produced in this project activity.

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

As per the proposed baseline methodology, the project proponent is required to establish that the GHG reductions due to the project activity are additional to those that would have occurred in the absence of the present project activity as per 'Tool for the demonstration and assessment of additionality'.

Additionality of the project as described in proposed baseline methodology is discussed further.

Step 0: Preliminary screening based on the starting date of the project activity.
As the project will not be registered before the project date of commissioning (February 2007), the crediting period is expected to start after the project starts generating power. Since the project participants do not wish to have crediting period starting prior to the registration of their project activity the Step 0 is satisfied.

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

The demonstration of the baseline scenarios incorporated the steps contained within this section and therefore to summarize the conclusions of the baseline scenario it was shown that the alternatives might be limited to the project activity not undertaken as a CDM and the supply of electricity from the grid.

Step 2 – Investment analysis

Step 3 -- Barrier analysis

That the project activity is additional can be established by carrying out a barrier analysis as envisaged in Step 3.

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

1. Investment barrier(s)
The key investment barriers are:
Availability of the equity required for the project: The principal investment barrier is the availability of equity for the project. The investors had made it absolutely clear that the project was too risky and was not a preferred option. It was only after the additional revenue from the sale of CERs was considered that one investor Mr. Radhe Shyam Saraf agreed to increase his contribution.

It should be highlighted that the investor (Mr. Radhe Shyam Saraf) had initially agreed to invest the additional amount required for the power project (after being 'educated' about the CDM process and related advantages) only in the form of Cumulative Convertible Preference Shares and it was much later when project was being developed under the CDM that he agreed to bring in his additional investments in the form of equity.

In view of the above, it may be concluded that the additional revenue from the sale of CERs played a very important role in facilitating the mobilizing of the required equity for the project.

2. Technological and Operational barrier(s)
With a flow rate of the order of around 93,300 (average) NM^3/hour of hot gas at a temperature of 950°C±50°C and the projected availability of excess gas from MBF and its composition is 28,775 NM^3/hour, the waste gas generated had a potential to generate net power of approximately 20 MW. With the present heat energy available in the waste gases from DRI kiln and MBF, the project activity boiler capacity was designed to operate at 61ata pressure and 480±5°C temperature. As the major activity of the proponent is steel manufacturing, operating power plants with such high configurations is not something that the management has experience in.

Besides all these risks and barriers regarding stand alone operations, the project activity had to face operations risks related to the waste gas generation and its heat content, which has a direct bearing on the successful implementation of the project activity.

- If the heat content of the waste gas is not sufficient, the project activity will directly be affected and be unable to generate power;

- Cumulative effect of sustained variable frequency operation due to fluctuations in waste gas supply (flow rate & temp) 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 ingot manufacturing 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. It has been further stated that resumption of production process takes a long time. Hence the power interruption even for a short spell destabilizes the manufacturing process, besides causing production loss and damage to the sophisticated equipments due to thermal shock.
- Moreover if the waste gas temperatures are greater than 1000^{o}C, the corrosive nature of the waste gases increase manifolds and it would have a detrimental effect on the boiler tubes designed for waste gases between 950-1000^{o}C. The project activity thus required the installation of expensive controls to ensure the waste gas temperatures does not exceed 1000^{o}C, however in case of any failure of such controls the DRI kilns and MBF would have to be shut down immediately; else the boiler would be damaged.
- The waste gases generated from MBF operations, have high quantity of inert materials and low calorific value, which makes stabilization of flame in the burner difficult and results in slow burning, this may finally leads to explosion from accumulated combustible components in the gases. This makes operation of the technology a risky proposition.
- The inert materials are generally cleaned in wet scrubbers; this reduces the gas temperature and results in carry-over of moisture, resulting in low flame temperature in the boiler and lower heat availability; the moisture also generates water vapor making the flame less reliable.
- Also, the flame is unstable due to wide fluctuations in gas supply pressure and flow and low calorific value.

Due to such inherent problems related to the use of waste gases from MBF operations, specially designed boiler with longer residence time and elongated shaft was required to be designed in the project activity; this also increased the cost of the new type of boiler compared to use of conventional boilers using any other gas.

The other major technical barrier is in the form of forward integration in the steel manufacturing process. Any fluctuations in the power output from the WHR will affect the production of steel to a larger extent as almost the entire production is based on power drawn from the WHR system with a contract maximum demand from the West Bengal State Electricity Board limited to just above 50% of the total plant's power requirement.

The technical and operational barriers mentioned above make the investment in the proposed project activity a very risky proposition, not only from the project activity's point of view but also from the larger steel manufacturing operations point of view as any mishap could adversely affect the steel manufacturing operations, leading to significant financial losses.

3. Other barrier(s) - Managerial resources barrier

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

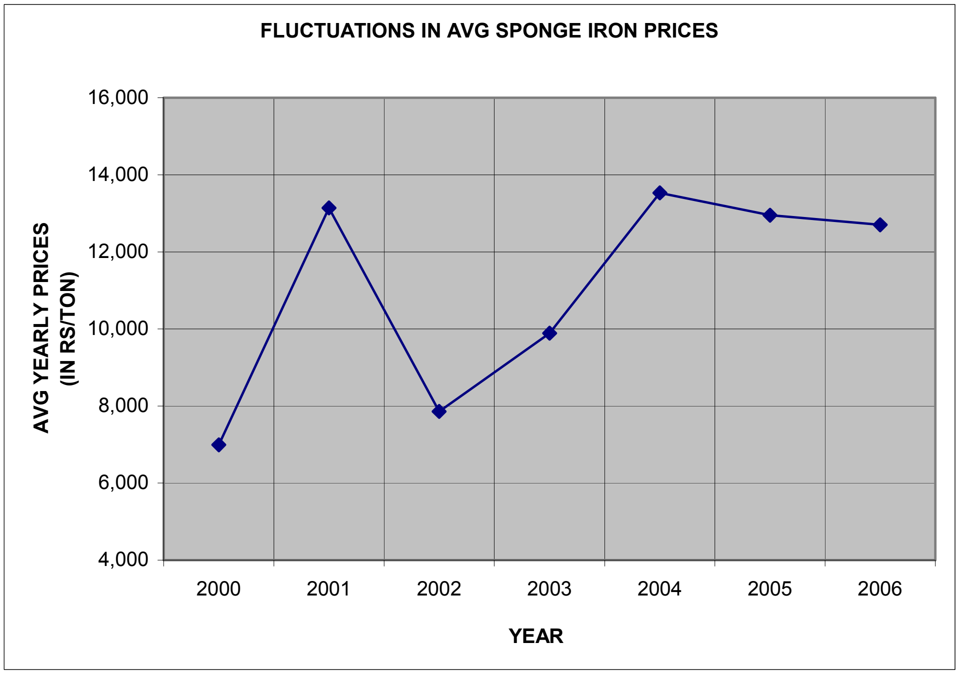
The domestic sponge iron and Ferro alloy industry in India is witnessing a downward trend in prices of sponge iron. This can directly lead to a drop in allocation of working capital requirements (i.e. budget) of none core activities like that of the CPP. RLUL is committed to the cause of green power produced by the waste heat recovery project and although it will continue to support the successful implementation and operation of the project, it may be constrained for funding further development/training for the CPP operations in the event of squeeze in working capital as forecasted.

The market scenario of the sponge iron in the country is volatile; the prices for the final product too have been fluctuating[4] as shown in the graph given below. The fluctuation in the price of the final product is significant as the project was conceptualized at a point in time when the steel prices had peaked and were showing a downward trend. The promoters, being aware of this, were very keen to limit their total project exposure.

The proposed project activity (waste heat based power plant) is totally dependent on the upstream sponge iron plant and also to a large extent on the prices of scrap (as below a level, it would make economic sense to shift partially / completely from sponge iron to scrap). Furthermore, the market conditions being volatile, there is the possibility of the project promoters having to discontinue the project activity and shift to alternative power sources. This may lead to either downscaling or shutting down the upstream sponge iron plant altogether and thus terminating the project activity (the project activity will cease to generate power at below ~ 35% PLF). Therefore there is a significant capital risk associated with the project.

---

[4] http://www.indiainfoline.com/sect/stee/db71.html



In spite of all these barriers and large financial risks, RLUL has decided to implement the waste heat recovery based power plant, in order to reduce GHG emissions thereby generating power from an environment friendly source.

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):

RLUL's project activity is a WHR based power project utilizing waste heat from sponge iron rotary kiln and MBF. RLUL would not have faced any regulatory or investment barrier in case it would opt for Alternative b i.e., Import of electricity from the grid (existing sponge iron units of RLUL had imported the power from the grid to meet their requirements). This alternative option was evaluated with respect to the above-mentioned barriers. So far as investment barrier is concerned, there is no high initial cost or high operational and maintenance cost required for this option. Further for import of power from grid, RLUL would not have to face any technological barriers as in the case of generation of waste heat based power. Therefore, it is most likely that in absence of the project activity RLUL would opt for the business-as-usual scenario, i.e. releasing the waste heat into the atmosphere and importing equivalent electricity from regional grid to cater to the need.

Step 4 – Common practice analysis

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

In the sponge iron sector of West Bengal with similar socio-economic environment, geographic conditions and technological circumstances, RLUL is one of the exceptions which is in the construction phase of the waste heat recovery based captive power plant in order to reduce GHG emissions and avail the revenues from sale of carbon emission reductions.

There are a total of 67 sponge iron plants already in operation in the state surrounding the proposed project activity. Of the 67 sponge iron plants, only four plants have Waste Heat Recovery plants and the same also applies to availing carbon credits. They are namely Jai Balaji Sponge Ltd, Sri Ramrupia Balaji, Electrosteel Castings Ltd and Vikash Metal & Power Ltd. This indicates a very low penetration of technology. The project activity occurs in 6% of the similar industries and therefore is not a common practice.

It may be concluded that the there are significant barriers (technical / investment / market related etc.) that has resulted in the low penetration level of the technology in the area and the proposed project activity is NOT a common practice.

Sub-step 4b. Discuss any similar options that are occurring:
From the above analysis the proposed project activity is not common practice amongst plants facing similar techno-economic circumstances.

Step 5 – Impact of CDM registration
The main benefits of CDM registration relate to the financial and investment impacts of the CDM revenue stream as highlighted in step 2. Furthermore, the inherent risks in undertaking the project are reduced through the increased return associated with registering the project under CDM, thereby specifically offering the plant greater leeway in its first two years of operation when the promoter is gaining experience of operating the plant efficiently and assisting the project in achieving financial closure. In addition, the registration of the project under the CDM would enhance RLUL's profile as a company that is concerned about the environment that it operates under.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
As per the methodology, the 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. Light Diesel Oil (LDO) forms one of the primary raw materials for the generation of power. The estimated gross requirement of LDO to be procured annually for production of 20MW power is 1890Metric tonnes.

The project proponent has identified all the possible sources, which could have directly or indirectly added to GHG emissions in the project activity:

- GHG emission due to heat energy extraction in the WHRB is zero, as there is no change in chemical composition of waste gases at the inlet and outlet of the boiler.
- No major on-site emissions for meeting the auxiliary consumption, since all the auxiliary of the power plant runs by the power that is generated by the project activity.

a) Project Emissions

$$PEy = \sum Q \times NCV \times EF \times OXID \times 44/12$$

Where:
PEy Project emissions in year y (tCO_2)

Qi Mass or volume unit of fuel *i* consumed (t or m3)
NCVi Net calorific value per mass or volume unit of fuel *i* (TJ/t or m3)
EFi Carbon emissions factor per unit of energy of the fuel *i* (tC/TJ)
OXIDi Oxidation factor of the fuel *i* (%)[5]

b) Baseline Emissions

$BE_{electicity,y} = EG_y * EF_{electricity,y}$
Where,
EG_y = Net quantity of electricity supplied to the manufacturing facility by the project during the year y in MWh, and
$EF_{electricity,y}$ = CO_2 baseline emission factor for the electricity displaced due to the project activity during the year y (tCO_2/MWh)

As per the methodology, if the project displaces the electricity generation by the fossil fuel for the captive purpose then the baseline scenario is **Option 2. if baseline scenario is grid power imports**

Please refer Annex 3 for the Baseline emission factor ($EF_{electricity,y}$)for the grid chosen

Net quantity of electricity supplied to the manufacturing facility by the project (EG_y)

Net units of electricity substituted in the grid (EGy) = (Total electricity generated-Auxiliary Consumption)
Net units of electricity substituted in the grid (EGy) = (EG_{total} - EG_a)

c) Leakage
No leakage is considered

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 emissions 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

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

(Copy this table for each data and parameter)

Data / Parameter:	**NCV_f**
Data unit:	Kcal/kg

[5] The oxidation factor of the fuel is taken from page 1.29 in the 1996 Revised IPCC Guidelines for default values

Description:	**Net Calorific Value of fuel LDO**
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual.
Value applied:	The data is used for calculations of emissions due to use LDO in the project activity.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Net Calorific Value of fuel LDO is obtained from revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. The value is monitored monthly and it is archived in paper for the credit period+2years.
Any comment:	The amount of the LDO used by the project activity will be measured continuously and recorded. The data is used for estimating the project emissions.

Data / Parameter:	EF_i
Data unit:	tC/TJ
Description:	**Carbon Emission Factor of LDO**
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual.
Value applied:	The data is used for calculations of emissions due to use LDO in the project activity.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Carbon Emission Factor of LDO is obtained from revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. The value is monitored monthly and it is archived in paper for the credit period+2years.
Any comment:	The default IPCC value of LDO is considered.

Data / Parameter:	EF_y
Data unit:	tCO_2e/GWh
Description:	**CO_2 Emission Factor of the grid**
Source of data used:	Calculated from the data obtained from CEA
Value applied:	The data is used for calculation of baseline emissions due to import of power from the grid.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The CO2 Emission Factor of the grid is calculated from the data obtained from CEA. This involves the use of official data released by the power generating company. Quality control of this data is beyond the control of the project operators. However, the data, if considered unreasonable, may be supplanted by more accurate data according to methods verified by the DOE. The data is recorded annually and it is archived in paper for credit period +2years.
Any comment:	Calculated as the weighted sum of OM and BM Emission Factor

B.6.3 Ex-ante calculation of emission reductions:

>>

a) Project Emissions

As per the methodology, the 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.

The estimated gross requirement of LDO to be procured annually for production of 6MW BF gas fired power is 1890Metric tonnes.

The project proponent has identified all the possible sources, which could have directly or indirectly added to GHG emissions in the project activity:

- GHG emission due to heat energy extraction in the WHRB is zero, as there is no change in chemical composition of waste gases at the inlet and outlet of the boiler.
- No major on-site emissions other than the emissions from LDO for meeting the auxiliary consumption are accounted, since all the auxiliary of the power plant runs by the power that is generated by the project activity.

Project Emissions are from 6MW BF gas fired boiler given as:

$PEy = \sum Q \times NCV \times EF \times OXID \times 44/12$

Where:
PEy Project emissions in year y (tCO2)
Qi Mass or volume unit of fuel i consumed (t or m3)
NCVi Net calorific value per mass or volume unit of fuel i (TJ/t or m3)
EFi Carbon emissions factor per unit of energy of the fuel i (tC/TJ)
OXIDi Oxidation factor of the fuel i (%)[6]

PEy = ∑ Q x NCV x EF x OXID x 44/12

Project Emissions = $1890 * 43.33 * 10^{-3} * 20.2 * 0.99 * 44/12$
Project Emissions = 6,005 tCO2e/yr

b) Baseline Emissions

Baseline Emissions are given as:

$BE_{electicity,y} = EG_y * EF_{electricity,y}$

Where,
EG_y = Net quantity of electricity supplied to the manufacturing facility by the project during the year y in MWh, and
$EF_{electricity,y}$ = CO_2 baseline emission factor for the electricity displaced due to the project activity during the year y (tCO_2/MWh)

---

[6] The oxidation factor of the fuel is taken from page 1.29 in the 1996 Revised IPCC Guidelines for default values

As per the methodology, if the project displaces the electricity generation by the fossil fuel for the captive purpose then the baseline scenario is **Option 2. if baseline scenario is grid power imports**

Emission Factor of the Grid (EFy)

Baseline emission factor of eastern region (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.

STEP 1. Calculate the Operating Margin emission factor
STEP 2. Calculate the Build Margin emission factor
STEP 3. Baseline Emission Factor

The baseline emission factor (EF*y*) of the chosen grid is calculated as combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors following the guidelines in the section "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM 0002).

Baseline emission factor ($EF_{,y}$)

The baseline emission factor $EF_{,y}$ is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM, simple,y}$) and the Build Margin emission factor (*EFBM,y*) , where the weights W_{OM} and W_{BM}, by default, are 50% and $EF_{OM,,y}$ and EF*BM,y* are calculated as described in steps 1 and 2 above and are expressed in tCO_2/MU.

$EF_{grid,,y} = 0.5(EF_{OM, y} + EF_{BM, y})$

Net quantity of electricity supplied to the manufacturing facility by the project (EG_y)

Net units of electricity substituted in the grid (EGy) = (Total electricity generated-Auxiliary Consumption)
Net units of electricity substituted in the grid (EGy) = (EG_{total} - EG_a)

Sl.No	14MW Waste Heat Recovery Boiler (WHRB)	6 MW BF gas fired boiler
Net quantity of electricity available after auxiliary consumption	87.8	37.63 MU
Type of fossil fuel used for power generation	No	LDO

c) Leakage
No leakage is considered

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 emissions 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

Emission Reductions by setting up the 14MW WHRB: 84,701 tCO2e/yr

Emission Reductions by setting up the 6MW BF gas fired boiler:
= 30,295 tCO2e/yr

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

>>

Emission Reductions from the project activity

Year	Baseline Emission (tCO2e)	Project Emissions (tCO2e)	Annual Emission Reductions (tCO2e)
Feb 2007-Dec 2007	110,917	5,505	105,413
2008	121,001	6,005	114,996
2009	121,001	6,005	114,996
2010	121,001	6,005	114,996
2011	121,001	6,005	114,996
2012	121,001	6,005	114,996
2013	121,001	6,005	114,996
Jan 2014 - Feb 2014	10,083	500	9,583
Total Emission Reductions throughout the first crediting period (tCO2e)			804,972

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	Qi
Data unit:	tonnes
Description:	Volume of Light Diesel Oil (LDO) as auxiliary fuel used by project.
Source of data to be used:	The data is obtained from project records.
Value of data applied for the purpose of calculating expected	The data is used for calculation of project emissions for use of LDO for auxiliary consumption.

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	This data would be measured and recorded in papers continuously. The data would be archived for credit period +2yrs.
QA/QC procedures to be applied:	QA/QC procedures have been planned. The level of uncertainty level of data is low. This data would be used for calculation of project emissions.
Any comment:	The amount of the LDO used by the project activity will be measured continuously and recorded. The data is used for estimating the project emissions.

Data / Parameter:	EG_y
Data unit:	MWh/yr
Description:	Net electricity generation available for captive purpose
Source of data to be used:	The data is obtained from project Records/Log Book.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The data is used for calculation of baseline emissions and emission reductions.
Description of measurement methods and procedures to be applied:	Meters at plant will automatically measure the data. The data will be recorded in project logbooks. The data would be archived in paper and electronic for credit period +2years.
QA/QC procedures to be applied:	QA/QC procedures have been planned. The level of uncertainty level of data is low. This data would be used for calculation of baseline emissions.
Any comment:	This data would be measured online and recorded in papers continuously

Data / Parameter:	EG_a
Data unit:	MWh/yr
Description:	Auxiliary consumption of the power plant
Source of data to be used:	The data is obtained from project Records/Log Book.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The data is used for calculation of baseline emissions and emission reductions.
Description of measurement methods and procedures to be applied:	Meters at plant will automatically measure the data. The data will be recorded in project logbooks. The data would be archived in paper and electronic for credit period +2years.
QA/QC procedures to be applied:	QA/QC procedures have been planned. The level of uncertainty level of data is low. This data would be used for calculation of baseline emissions.
Any comment:	This data would be measured online and recorded in papers continuously

Data / Parameter:	EG_{total}
Data unit:	MWh/yr
Description:	Total electricity generated from the project activity
Source of data to be used:	The data is obtained from project Records/Log Book.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The data is used for calculation of baseline emissions and emission reductions.
Description of measurement methods and procedures to be applied:	Meters at plant will automatically measure the data. The data will be recorded in project logbooks. The data would be archived in paper and electronic for credit period +2years.
QA/QC procedures to be applied:	QA/QC procedures have been planned. The level of uncertainty level of data is low. This data would be used for calculation of baseline emissions.
Any comment:	This data would be measured online and recorded in papers continuously

B.7.2 Description of the monitoring plan:

>>

RLUL has procedures for monitoring and recording data on operation & maintenance of the plant/ equipments. The equipments used for CDM project are part of these procedures and document on maintenance and rectification done on all the equipments are maintained. Unit Head is responsible for the overall functioning of the sponge iron plant & power plant. RLUL adopts following procedures to assure the completeness and correctness of the data needed to be monitored for CDM project activity.

Formation of CDM Team:

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

Checking data for its correctness and completeness:

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

Reliability of data collected-

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

Frequency-

The frequency for data monitoring shall be as per the monitoring details in Section D of this document.

Archiving of data-

Data shall be kept for two years after the crediting period.

B.8 Date of completion of the application of the baseline study and monitoring methodology and

the name of the responsible person(s)/entity(ies)
>>
Name of person/ entity determining the baseline: Ramsarup Lohh Udyog Limited
Date of completion of the baseline: 25/03/2006
Detailed contact information of the above is given in Annex 1.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:
>>
01/12/2005

C.1.2. Expected operational lifetime of the project activity:
>>
30y-0m

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

C.2.1. Renewable crediting period

Three crediting periods 3 X 7 = 21 years

C.2.1.1. Starting date of the first crediting period:
>>
01/02/2007

C.2.1.2. Length of the first crediting period:
>>
7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:
>>
Not applicable

C.2.2.2. Length:
>>
Not applicable

SECTION D. Environmental impacts

>>

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

>>

RLUL has conducted a Rapid Environment Impact assessment study for the project. This was done as per guidelines from Ministry of Environment & Forest (MoEF).For the study an area of 7 km radius was considered around the project site. Following areas were covered in the study –

1. Assessment of existing level of pollution on Air, water, noise, which included monitoring of ambient air quality for SPM, RSPM, NOx, SOx and CO
2. Collection of metrological data
3. Assessment of existing status of water, air, flora, fauna, demographic and socioeconomic factors
4. Assessment of impact of construction activities
5. Study of proposed pollution control equipments
6. Study of short term and long term impacts on endangered species and wild life, plants and economically important crop

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

>>

The Environmental Management Plan has been made for formulation, implementation and monitoring of environmental protection measures during and after commissioning of the project taking into consideration the following:

- Mitigation of Adverse Impacts
- Occupational safety and Health
- Regulatory compliance's etc

Green belt development:

Greenbelt is an important sink for air pollutants. By using suitable plant species, green belts can be developed in strategic zones to provide protection from fugitive pollutants and noise. In the proposed plant, green belt will be developed in vacant areas, around office building, stores, along the side of roads, plants boundaries and around the waste dump area.

It is proposed to have at least 5-7 meters wide green belt all around the plant site by planting suitable species of evergreen broad leaves type.

Pollution monitoring

Necessary provisions would be made for routine monitoring of stack emissions, quality noise level, and water quality as required by the regulations and for monitoring environment management as implemented.

Environmental Monitoring:

The emission levels from the stack and the ambient air quality around the power plant will be periodically monitored. Further, the effluent quality and noise levels will also be regularly monitored. The instruments and the equipment necessary for monitoring will be made available in the plant laboratory.

Plant Safety and Industrial Hygiene Measures:
The two aspects need to be given due attention at the time of detailed engineering, meeting all the prevalent regulations of Factory Act and recommendations made by the regulating authority. Fire protection systems by means of providing fire hydrants, fire extinguisher at vulnerable points within the plant boundary have been envisaged. No fire tender provisions have been considered, as this would be made available from local authorities. A first aid unit has to be considered for the operating and maintenance personnel. All the necessary safety kits like hand gloves, gumboots, aprons, helmets etc. need to be provided. Proper sanitation facilities, rest room, adequate plant lighting is also envisaged for the proposed project.

SECTION E. Stakeholders' comments

>>

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

>>

RLUL identifies the following as stakeholders to keep the transparency in the operational activity of the project promoter and thereby meeting local/ environmental regulations. The stakeholders identified are:

Name of the Stakeholder	Responsibilities
Ministry of Environment and Forest	The project participant has to avail environmental clearance to the proposed project activity under the provisions of the EIA notification dated 27th January 1994.The project activity has received it approval from the competent authorities on 3rd October 2006.
West Bengal Pollution Control Board (WBPCB)	Stakeholders appreciated efforts from RLUL and extended their support for future projects also. They told that the project activity would help in pollution reduction in the region. The project has acquired the necessary clearances from WBPCB and the authority has provided consent to establish dated 6th June 2006.
Gram Panchayat	Gram Panchayat Sarpanch applauded efforts from RLUL and expressed his pleasure for setting up waste heat recovery based power project. He admitted that project activity would help in environment conservation and he has provided NOC for the project on behalf of the local people.
Kharagpur Municipality	The kharagpur municipality has accorded it clearance for utilizing water for the said project activity by letter vide no:2657 .

E.2. Summary of the comments received:

>>

All the above identified stakeholders of the project has provided a positive response and appreciated the effort of the project participant.

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

>>

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

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Ramsarup Lohh Udhyog Limited
Street/P.O.Box:	Kiran Shankar Roy Road
Building:	7C, Hastings Chambers, First Floor
City:	Kolkata
State/Region:	West Bengal
Postfix/ZIP:	700 001
Country:	India
Telephone:	+91 033 2242 1200, 2242 1884
FAX:	+91 033 2242 1888
E-Mail:	naveen@ramsarup.com
URL:	www.ramsarup.com
Represented by:	
Title:	C.F.O
Salutation:	Mr.
Last Name:	Gupta
Middle Name:	
First Name:	Naveen
Department:	Finance
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project

Annex 3

BASELINE INFORMATION

The project activity would generate electricity by utilizing the heat content of the waste gas of the sponge iron kiln and MBF and displace an equivalent amount of electricity from the grid. The emission reduction resulting from the project activity would depend on the emission factor of the grid mix. Therefore it is required to select the appropriate grid where an equivalent amount of electricity would be displaced by the electricity generated from the project activity.

Choice of the Grid

Indian power grid system (or the National Grid) is divided into five regional grids namely Northern, North Eastern, Eastern, and Southern and Western Region Grids. The Eastern Regional Grid consists of Bihar, Jharkhand, Orissa, West Bengal and Sikkim sector grids. These states under the regional grid have their own power generating stations as well as centrally shared power-generating stations. While the power generated by own generating stations is fully owned and consumed through the respective state's grid systems, the power generated by central generating stations is shared by more than one state depending on their allocated share. Eastern Region Electricity grid facilitates the share of power generated by the central generating stations.

Eastern regional grid has a total generating capacity of 17909.27 MW[7] as on 31.12.2004, of which private and Central stations has a generating capacity of 9994.51 MW and the balance is being generated by power stations at state level. Thus more than 50% of the generation capacity is coming from the central and private generating stations. As all the states forming part of the Eastern grid are dependent on power allocation from Central generating stations, Eastern region regional grid is considered as the appropriate grid system for the project activity.

As per the methodology, if the project displaces the electricity generation by fossil fuel for the captive purpose then the baseline scenario is **Option 2. If baseline scenario is grid power import**

Emission Factor of the Grid (EFy)

Baseline emission factor of eastern region (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.

STEP 1. Calculate the Operating Margin emission factor
STEP 2. Calculate the Build Margin emission factor
STEP 3. Baseline Emission Factor

The baseline emission factor (EF*y*) of the chosen grid is calculated as combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors following the guidelines in the section "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM 0002).

---

[7] Ministry of Power-Annual Report 2004-2005

Step 1: Calculation of Operating Margin Emission Factor for the region based on Simple OM

As per ACM0002, the simple OM method can only be used where low-cost must run resources constitutes less then 50% of total grid generation of average of the five most recent years.

Fuel	GWh				
	2005	2004	2003	2002	2001
Hydro	8266.6	7297	4479	7828	5809
Thermal	76649.06	68558	59972	55748	53436
Total	84915.66	75855	64451	63576	59245
% of Low Cost must run projects	9.735071	9.619669	6.949465	12.31282	9.805047
Average of five most recent years of low cost/must run projects constitutes less than 50%					9.684415

Since the average of low cost must run resources in the five most recent years constitutes less then 50% of the total grid, the simple OM method is selected.

The simple OM emission factor ($EF_{OM, simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MU) of all generating sources serving the system, not including low-operating cost and must-run power plants. The detailed baseline information is given in Annex 3.

$$EF_{OM, y} = \frac{\Sigma\ F_{i,j,y} * COEF_{i,j\ y}}{\Sigma\ GEN_{j,y}}$$

where *Fi ,j, y* is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must run power plants, and including imports to the grid,
COEFi,j y is the CO2 emission coefficient of fuel *i* (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*, and
GENj,y is the electricity (MWh) delivered to the grid by source *j*.

The fuel consumption in individual plants as required by the above formula is not readily and correctly available. However, MNES published the Station Heat Rate (SHR), which is a measure of plant efficiency in Kcal/KWh. In order to calculate the emission factor by the simple OM method the formula in the numerator is expressed as:

$$\Sigma\ F_{i,j,y} * COEF_{i,j\ y} = \Sigma \frac{GEN_{j,y}.\ SHR_i}{NCV_i} X\ NCV_i\ X\ EF_{CO2i}\ X\ Oxid_i$$

Or $\Sigma\ GEN_{j,y}.\ (SHR_i\ X\ EF_{CO2i}\ X\ 44/12\ X\ Oxid_i)$

Where,
SHRi is the station heat rate with fuel i
EF_{CO2i} is the emission factor per unit of energy of fuel j and
Oxidi is the oxidation factor for fuel i

The values of SHRi are available from MNES baseline reports. Values of EF_{CO2i}, Oxidi are available from Revised 1996 IPCC guidelines for Greenhouse Gas Inventories Workbook and Reference Manual for various fuels used in Indian power plants.

The power generation mix of eastern region comprises of coal based thermal power generation, diesel based thermal power generation and hydropower generation. The actual generation data of entire eastern region was analysed for the years 2003, 2004 and 2005 to arrive at the contribution of the fossil based power plants in the grid.

Source of generation	MU		
	2005	2004	2003
Hydro power generation	8266.6	7297	4479
Coal power generation	76607.74	68552	59965
Diesel power generation	41.32	6	7
Total power generation in the grid	84915.66	75855	64451
% of Hydro power generation	9.74	9.62	6.95
% of thermal power generation	90.26	90.38	93.05
Average % of Hydro in the grid	8.77 % average of three years		

RLUL has therefore adopted the 'Simple OM' method, and the simple OM emission factor is calculated using "A 3-year average statistics"

Fuel	2005	Heat Rate	Carbon Emission Factor (tC/TJ)	Carbondioxide Emission Factor (tCO2e/GWh)	Carbondioxide Emissions (tCO2e)
	GWH	Kcal/KWh			
Hydro	8266.6	0	0	0	0
Coal	76607.74	2717	26.2	1069.214	81910083.39
Diesel	41.32	2062	20.2	632.0085	26114.5923
Total	84915.66				81936197.98

Fuel	2004	Heat Rate	Carbon Emission Factor (tC/TJ)	Carbondioxide Emission Factor (tCO2e/GWh)	Carbondioxide Emissions (tCO2e)
	GWH	Kcal/KWh			
Hydro	7297	0	0	0	0
Coal	68552	2717	26.2	1069.214	73296771.8
Diesel	6	2062	20.2	632.0085	3792.051157
Total	75855				73300563.85

Fuel	2003 GWH	Heat Rate Kcal/KWh	Carbon Emission Factor (tC/TJ)	Carbondioxide Emission Factor (tCO2e/GWh)	Carbondioxide Emissions (tCO2e)
Hydro	4479	0	0	0	0
Coal	59965	2717	26.2	1069.214	64115429.47
Diesel	7	2062	20.2	632.0085	4424.059683
Total	64451				64119853.53

Factor	2005	2004	2003
∑ Fi,,j,y x COEF i,,j (tons/year)	81936198	73300564	64119854
∑ GEN i,,j (MU)	76649	68558	59972
∑ EF OM,y (tCO2/yr)	1068.97	1069.176	1069.163
Average ∑ EF OM,y	1069.106 (tCO2/yr)		

Step 2: Calculation of Build Margin Emission Factor for the region (ex-ante):

The project developer has adopted option 1 (Ex-ante), which requires to calculate the Build Margin emission factor *EFBM,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 data used to determine the simple BM emission factor (*EFBM,y*)

$$EF_{BM,\,y} = \frac{\Sigma\, F_{i,m,\,y} * COEF_{i,m}}{\Sigma\, GEN_{m,y}}$$

where
Fi,m,y, *COEFi,m* Are analogous to the variables described for the simple OM method above for plants *m*.

A	20% of state grid (MU)	16983.13
B	Plants meeting 20% (MU)	17005.81
C	Last Five Plants Total (MU)	11075.3

For the RLUL project, the sample group m that consists of (b) the power plants capacity additions in the electricity system that comprise 20% of the system generation and that have built most recently is adopted. Below is a list of power plants that comprises 20% of the system generation and which are built most recently.

Power Stations	Installed capacity MW	Fuel	Generation GWh 2005	Emission factor IPCC tCO2/GWh	Emissions tCO2 2005	Year of Commission
Talcher STPS	500	Coal-3E	3317	1069	3546583	2003
Talcher STPS	500	Coal-3E	3317	1069	3546583	2003
Chandil	2 x 4	Hydro	0	0	0	2002

Bakreswar	210	Coal 1D	1590	1069	1700051	2001
Upper Indravati	150	Hydro	2851.3	0	0	2001
Upper Indravati	150	Hydro		0	0	2000
Upper Indravati	150	Hydro		0	0	1999
Upper Indravati	150	Hydro		0	0	1999
Bakreswar	210	Coal 1D	991	1069	1059591	2000
Teesta	7.5 x 3	Hydro	107.87	0	0	1999
Teesta	7.5 x 3	Hydro		0	0	1998
Teesta	7.5 x 3	Hydro		0	0	1997
Bakreswar	210	Coal 1D	1597	1069	1707535	1999
Mejia	210	Coal 3E	1583	1069	1692566	1999
Rangit	3 x 20	Hydro	369.64	0	0	1999
Tenguhat	210	Coal 1D	0	1069	0	1998
Mejia	210	Coal 3E	1282	1069	1370733	1998
E.G. canal	5	Hydro		0	0	1997
Budge Budge	500	Coal 1D	3784.46	1069	4046398	1997
Kahalgaon	210	Coal 4F	1454	1069	1554637	1996
Sone east canal	2 x 1.65	Hydro	10.75	0	0	1996
E.G. canal	5	Hydro		0	0	1996
Tenguhat	210	Coal 1D	1326	1069	1417778	1996

∑ Fi,,j,y x COEF i,,j (tons/year)	14623643
∑ GEN i,,j (MU)	17005.81
∑ EF BM,y (tCO2/yr)	859.92

Step 3 Baseline Emission Factor ($EF_{,y}$)

The baseline emission factor $EF_{,y}$ is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,\ y}$) and the Build Margin emission factor (*EFBM,y*) , where the weights W_{OM} and W_{BM}, by default, are 50% and $EF_{OM,,y}$ and EF*BM,y* are calculated as described in steps 1 and 2 above and are expressed in tCO_2/MU.

$EF_{grid,,y} = 0.5(EF_{OM,\ y} + EF_{BM,\ y})$

∑ EF BM,y	859.92 tCO2e/ GWh
∑ EF OM,y	1069.11 tCO2e/ GWh
∑ EFy (Avg of OM &BM)	**964.51 tCO2e/Gwh**

Annex 4

MONITORING INFORMATION

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

Data to be monitored:
1. Steam quantity from WHRB in project activity
2. Steam quantity from BFboiler
3. Steam quantity at turbine inlet
4. Gross power generation from turbine in power plant
5. Auxiliary power consumption in power plant

Calculation for net power generation from WHRB and BFboiler in project activity:

Net power generation from turbine in project activity

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