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

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Appendices

SECTION A. General description of project activity

A.1 Title of the project activity:

JBSL–Waste Heat Recovery Based Captive Power Project

Version – 01

Date of Document – 28th Aug 2005

A.2. Description of the project activity:

Brief Introduction

Jai Balaji Sponge Limited (JBSL) belongs to the Jai Balaji Group of Companies, one of the major groups among the secondary steel producers in Eastern India. The group has long experience of over 35 years in steel industry and has earned its name in the market for quality production of various steel products.

JBSL has a sponge iron-manufacturing unit with a capacity of 1,05,000 Metric Tonnes (MT) per annum that consists of seven Direct Reduction Iron (DRI) kilns of 50 MT per day (MTPD) capacity each. The manufacturing facility is located at Mangalpur Industrial Estate, Raniganj, District Burdwan, West Bengal. The sponge iron unit started commercial production from April 2000. The company proposes to set up a 1200 MTPD Ferro Alloy Plant (FAP) adjacent to the sponge iron (SI) plant premises. JBSL proposes to install a captive power plant (CPP) of 12 MW nominal capacity running primarily on waste heat energy with minor contribution from coal char, coal fines and coal washery rejects. The CPP will be partially meeting the electricity demand of JBSL's proposed FAP.

Project Activity

Of the 12 MW installed capacity of the CPP, about 9 MW of power will be generated by utilizing the sensible heat content of the waste gas from the DRI kilns (ie. from waste heat energy) for generating steam through Waste Heat Recovery Boilers (WHRBs). The power generated using waste heat comes under the scope of term **Project Activity** mentioned hereinafter.

Power supply planning through the CPP

The CPP will be operating in island mode, supplying power dedicatedly to proposed FAP and its auxiliaries. The existing sponge iron plant would continue to get power from electricity utility company Dishergarh Power Supply Company Limited (DPSCL) for its regular operation and no power will be supplied from the up-coming CPP to the sponge iron plant.

The proposed CPP will be catering to a major share of the power demand of FAP in island mode while the rest will be taken from the grid. The power generation in the CPP will be at 11 kV level. The internal consumption requirements for the auxiliaries and equipments for the proposed FAP and the CPP will be met by stepping down the voltage level to 440 V.

Gross power generation (kW)	12,000
Power generation from waste gases only (kW)	9,040
Turbogenerator capacity (kW)	12,000
Grid connection	The CPP would be solely supplying power to the Ferro Alloy Plant in island mode
Plant load factor	90%
Net Electricity Supply per annum from Waste Heat Recovery Steam Generation System [Million kWh or Million Units(MU)]	56.38

Purpose

The purpose of the project is to achieve the following objectives:

1. Primarily to recover the sensible heat content of the waste gases generated from DRI kiln through WHRB.
2. Utilize the recovered heat of the waste gas to generate power through a steam turbine generator (STG).
3. Use the generated electricity for the FAP and its auxiliaries.

This project taken up by JBSL to meet the power requirement of the proposed FAP would subsequently achieve three macro-objectives, viz.

- Positive contribution towards sustainable economic growth from both energy-economy as well as environmental point of view.
- Utilisation of a waste resource for electrical energy generation
- Conservation of natural resources by reducing the load on thermal power sources.
- Reduced GHG emission

Project's Contribution To Sustainable Development

The project will contribute to the 'Sustainable Development of India'. The sustainability aspects have been discussed below:

Socio-Economic well-being: In Ranigunj – Durgapur area the project will contribute to employment generation and abridging the gap of electricity demand and supply at local and national level. From the macro point of view since the grid electricity will be replaced the economy will be benefited by corresponding reductions in cost of coal mining and transportation and savings in fossil fuel.

Environmental well-being: The project activity, by eliminating the power demand will eliminate an equivalent amount of Carbon dioxide (CO_2) emission, which would have been generated to produce power from coal. Therefore the project activity will have excellent environmental benefits in terms of reduction in GHG emission due to substitution of electricity supplied by the grid to in-house generation by waste gas utilization and coal resource conservation. The same amount of coal conserved through the project activity will become available to be utilized for other industrial activities and manufacturing processes. Further implementation of air cooled condensing system instead of water-cooled condensing system will help to avoid the enormous amount of sludge generation and contribute to the minimization of water consumption in an area which suffers from the scarcity of water resources.

Technological well-being: Waste heat recovery (WHR) based captive power plant developed as a cleaner technology will utilize waste flue gases of sponge iron kilns which otherwise would have been emitted to the atmosphere leading to thermal pollution. The electricity generated from the system will partly substitute the power supplied from grid enabling project proponent to reduce carbon dioxide emission and other associated emission from the thermal power plants; equivalent of which would have been emitted in absence of the project. Moreover, the in-house generation of electricity will reduce transmission & distribution loss (T&D loss), which would have been occurred to supply the electricity to the proposed FAP of JBSL.

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)
Jai Balaji Sponge Limited	Private Entity	Yes
Ministry of Environment & Forests, Govt. of India	Public Entity	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.:

South Asia/ West Bengal

A.4.1.3. City/Town/Community etc:

Ranigunj

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

The proposed project activity is located in the same complex of JBSL's sponge iron and mini steel plant at Mangalpur Industrial Area, Ranigunj near Asansol in the Burdwan district of West Bengal state, India

The site is well connected by rail and road. The project site is located about 180 km away from the state capital Kolkata on the National Highway - 2. The nearest railway station is at Ranigunj, about 10 km from the plant site.

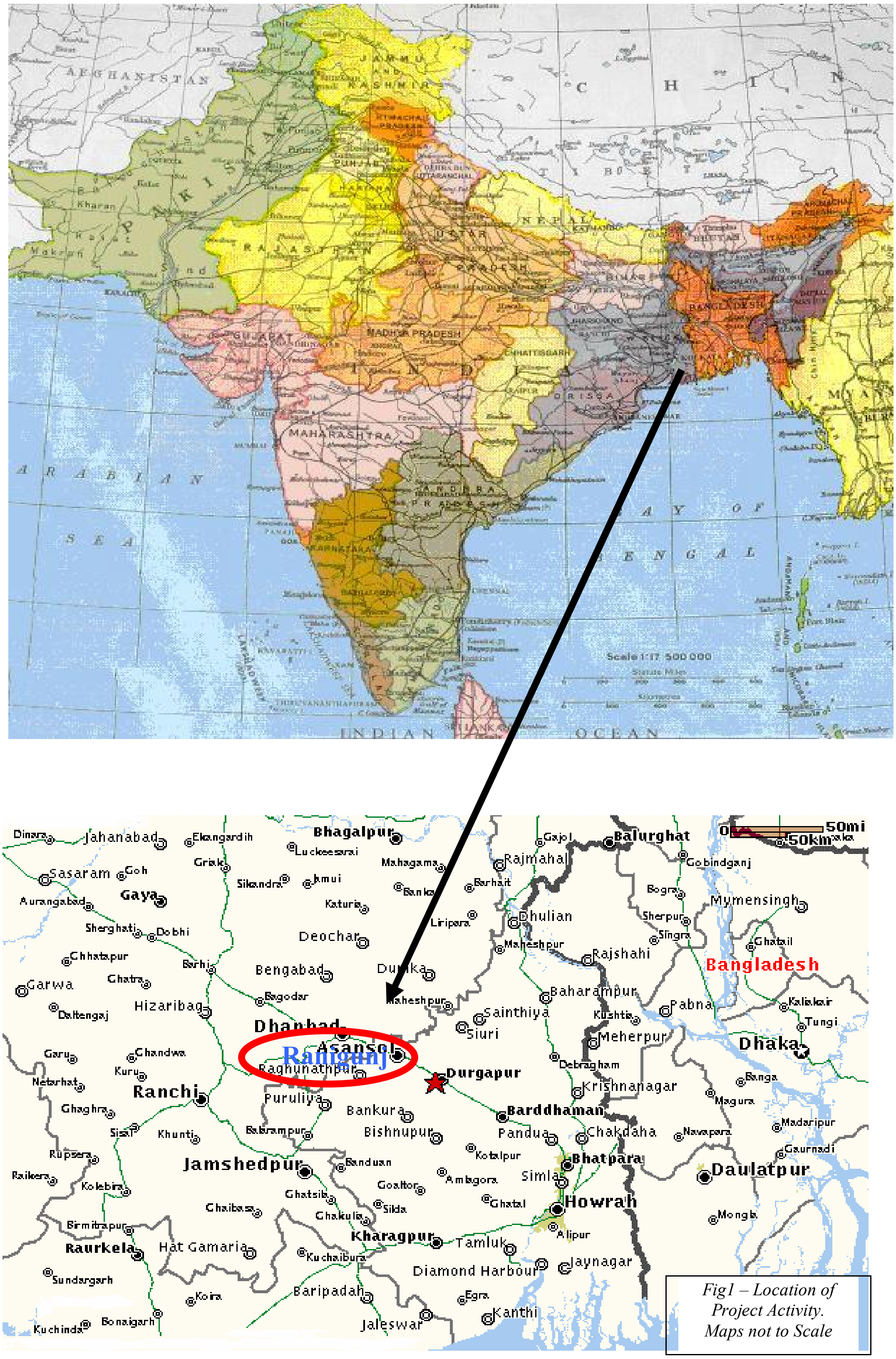

Fig1 – Location of Project Activity. Maps not to Scale

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

The project activity is an electricity generation project utilizing waste heat where aggregate electricity generation of the project exceeds the equivalent of 15 GWh per annum. The baseline and monitoring and methodology adopted as per ACM0004. The project activity may principally be categorized in Category 1- Energy Industries (Renewable/Non-Renewable sources) as per the scope of the project activities enlisted in the 'list of sectoral scopes and approved baseline and monitoring methodologies (version 3)' on the UNFCCC website for accreditation of Designated Operational Entities[1].

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

JBSL is implementing a modern WHR based captive power plant at their sponge iron cum mini steel unit at Ranigunj. The power generated by CPP will be completely utilized for supplying power to the FAP of JBSL.

The sponge iron unit of JBSL consists of seven DRI kilns, each of 50 MTPD capacity. The hot gases from each kiln are discharged to the After-Burning Chamber (ABC). Average flue gas availability from the sponge iron kilns of JBSL would be about 12,000 Nm^3/hr at 900^0C from each kiln. As the gases contain a small percentage of carbon monoxide (CO), the same will be burnt in ABC by admitting suitable quantity of combustion air. This will raise the gas temperature to around 950 to 1000^oC. Water will be sprayed to moderate the gas temperature to 950^0C after which it will be finally introduced to WHRBs through the hot gas duct.

The 7 WHRBs respectively connected to each of the DRI kilns are of 5 tph steam generation capacity. The combusted gas will be circulated through WHRB to transfer the sensible heat energy of the waste gas to water and generate steam. A substantial amount of heat shall be recovered at this point. Finally, the gas will pass through Economiser bundles for optimum recovery of heat from the hot exhaust. After final heat transfer at all heat recovery sections the gas will leave the WHR chamber at a temperature of around $170\text{-}180^o$C.

The WHRBs (67 kg/cm^2 and 490^0C) along with the high efficiency single extraction-cum-condensing type multistage Steam Turbine Generator (STG) set of 12MW rating shall be operated to generate power.

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[1] http://cdm.unfccc.int/DOE/scopes.html

The WHRBs will be single run, natural circulation radiant furnace type with water cooled membrane walls & bottom refractory furnace, bed tubes, two stage superheater with inter stage de-superheater and induced draft. The boilers will be top supported and shall be of semi-outdoor type. The WHRBs will consist of evaporator, superheater, economizer, recuperative type air heater, integral piping, flue gas ducting with expansion joints.

The turbine will be designed for the operation with the inlet steam parameters of 66 kg/cm^2 and 485^{0}C. The turbine shall be of horizontal, single cylinder, single extraction, and condensing type. There shall be one uncontrolled extraction from the turbine.

Combusted gas after maximum heat transfer in the boiler will lead to the exhaust stack through Electrostatic Precipitator (ESP), which will reduce the Suspended Particulate Matter (SPM) load to a large extent. The SPM will be collected in the hoppers of the ESP. The particulate matter collected in the hoppers will be conveyed to existing silo by totally enclosed pneumatic conveyors.

Other accessory systems include fuel handling system, ash handling system, vessels and heat exchangers, tanks, piping and electrical systems. Air-cooled condenser will be used to condense exhaust steam after passing through turbine rotor. Auxiliary cooling water enters the totally enclosed air-cooler where water is cooled by air only. Only treated water will be supplied to the boiler to avoid scale formation in boiler heat transfer tubes and for better performance. Blow down water can be used for other purposes like plantation.

Implementation Schedule

The project construction start date was July 2004 and the project is to be commissioned in September 2005. The expected year of first CER-delivery (post-certification) is 2006. The proposed crediting period for the project is 10 years and the total lifetime of the project is 20 years.

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:

JBSL has set-up the CPP with an objective to utilize waste resources available from manufacturing process and use it to generate electrical energy for utilization at its FAP.

The project has employed a non-GHG emitting technology - Waste Heat Recovery and Steam Generating System. In the absence of the project, the electricity requirements of equivalent amount would have been met by DPSCL grid supply resulting into an equivalent amount of CO_2 emission from the thermal power stations. More than 90% of DPSCL grid mix comprises of thermal power mix (coal, gas)[2]. However, due to project activity, the project proponent has been able to do away with equivalent amount of generation mix resulting in reduction of corresponding CO_2 emissions at the thermal power generation end.

The project does not contribute to any additional GHG emission. It utilizes heat content of the waste gases available at the outlet of sponge iron kiln located within the premises and well connected by hot gas duct. The chemical composition of the waste gas at the inlet and outlet of the boiler remain same and no other secondary fuel is fed to the boiler.

Furthermore, taking into consideration the power deficiency in India, future power demand rise in West Bengal (from 4236 MW in 2001-02 to 8173 MW in 2011-12)[3] and recent capacity built to meet the electricity demand in the state, the project activity contributes by reducing this demand by 9 MW (equivalent to **56.38 MU** per year). The project activity reduces anthropogenic emissions by sources that would have occurred (due to future generation mixes) or are occurring (due to present generation mixes) to cater to a certain proportion of the demand. The average estimated emission reduction to be achieved by the project is **52239.5** tonnes of CO_2/year and **522395** tonnes of CO_2 for the entire 10 year crediting period.

The Indian Government or Government of West Bengal does not require the sponge iron manufacturing units to utilize the heat content of the waste gases released during their production process. Hence the project proponents do not have any legal bindings to implement the proposed project activity. JBSL will be implementing the proposed project activity over and above the national or sectoral requirement. The resulting GHG emission reduction will be additional to those directed by the government policies and regulations.

The project faced a number of regulatory/institutional barriers during approval of the WHR based CPP. The decision to implement the project activity was taken in year 2002 when the rules related to captive power generation in India were not clear. Further, the project proponent

[2] DPSCL owns 40MW capacity coal based power plants that meet around 32% of its total requirement. Remaining power is drawn from West Bengal State Electricity Board and Damodar Valley Corporation (DVC) system.

faced a number of barriers for access to bank loans (investment barrier). When JBSL approached a number of financial institutions (FIs) for debt sourcing for the CPP, loans were offered at higher interest rates which posed an obstacle for implementation of project. Finally, a Government owned FI agreed to partially lend the project at competitive lending rates on the sole premise that the project activity had the potential to accrue potential revenues through CDM route. Based on the economic appraisal of the above FI alone, JBSL further managed to arrange for funding from a bank at comparable rates. Thus, CDM acted as a strong motivator for the implementation of the project activity. Moreover, although Electricity Act-2003 that has liberalised captive power generation since June 2003 in the country; the project proponent still faces numerous barriers on a continuous basis. The above mentioned 'additionality' factors are further dealt in detail in Section B3.

Hence, in absence of the CDM project activity the associated barriers would prevail and JBSL would eventually resort to business-as-usual scenario which is releasing the waste heat from sponge iron kilns into atmosphere and importing power from grid for the proposed FAP plant. The power plant is not only justified in view of its capability to affect the generation mix but also lead as an example of eco-friendly power from a sponge iron industry. The project meets the requirement of additionality tests as its existence and operation has the effect of reducing GHG emissions below the level that would have occurred in its absence (refer section B.3 for further details).

[3] Refer- http://www.saneinetwork.net/pdf/SANEI_II/Reforms_and_PowerSector_in_SouthAsia.pdf

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
2005-2006	52239.49
2006-2007	52239.49
2007-2008	52239.49
2008-2009	52239.49
2009-2010	52239.49
2010-2011	52239.49
2011-2012	52239.49
2012-2013	52239.49
2013-2014	52239.49
2014-2015	52239.49
Total estimated reductions CO_2 e	**522395**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**52239.5**

A.4.5. Public funding of the project activity:

There is no public funding available for 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[4]

Approach: Existing actual or historical emissions, as applicable.

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

Justification concerning selection of the approach

Project activity includes electricity generation by utilizing the heat energy of waste flue gas available from JBSL's Sponge Iron unit through waste heat recovery and steam generating system in its CPP. The project activity will generate electricity to meet the electricity requirement of proposed FAP of JBSL

In absence of the project (business-as-usual scenario) JBSL would have drawn equivalent amount of electricity from the utility grid supply (DPSCL) consisting of a generation mix from various sources mainly thermal (coal, gas), hydro and renewable resources (generation mix – 91.6% thermal and 7.9% hydro: refer Table 1). Also the waste heat energy in the flue gases would have been lost in the ambient air adding to thermal pollution of the area. Therefore with successful operation of captive power plant, the project is being able to displace/ substitute the equivalent power units from grid mix which has an emission factor of 0.927 kgCO_2/kWh (refer Chapter E).

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4 http://cdm.unfccc.int/EB/Meetings/020/eb20repan12.pdf

Table 1: Generation Mix of DPSCL, WBSEB and DVC based on power available (in MU) for 2003-04

Source	Power Available in MU for 2004-05 to DPSCL, DVC and WBSEB combined grid	%
Coal	24012.67	91.1
Gas	119.01	0.5
Hydro	2075.65	7.9
Other Grid	159.233	0.6
	26366.563	100.0

Source: DPSCL, WBSEB, DVC and CEA reports

However, since the project has a capacity of 9 MW, which is less then 1% of the DPSCL generation capacity (6370.51MW) we can assume a marginal effect on the operation of existing power plants. Also in view of the predicted power deficit status of the state in future, a delay effect in future power plants may creep in due to the occurrence of this project although to a limited extent. Thus the project has marginal affect on the operation of the existing power plants and future capacity additions and their associated actual emission. Hence it can be concluded that the most appropriate approach for baseline methodology would be “Existing actual and historical emission” of the power plants connected to the selected grid.

The selected baseline methodology is also based on “Existing actual and historical emission” established upon chosen or identified grid that is most realistic representation of the baseline scenario w.r.t. the project activity.

Justification concerning applicability conditions of the new methodology

The Consolidated baseline methodology ACM0004 for waste gas and/or heat for power generation applies to project activities that generate electricity from waste heat or the combustion of waste gases in industrial facilities. The methodology applies to electricity generation project activities:

A. that displace electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels,
B. where no fuel switch is done in the process where the waste heat or waste gas is produced after the implementation of project activity

JBSL’s project activity is a WHR based power generation project utilizing waste heat from DRI kilns that use coal as fuel. Before project activity JBSL was connected to the grid to meet its entire power requirement. Even after project implementation it still imports grid power to partially meet its demand. In the state of West Bengal there are about 27 sponge iron plants[5] producing similar products by using similar technology under the similar governed polices. Out of these 27 plants JBSL project is the first of its kind. In absence of the project activity JBSL would opt for the business-as-usual scenario, ie. releasing waste gas into atmosphere and importing of equivalent electricity from state grid to cater to the need. Moreover, the DRI kilns of JBSL continue to use coal as fuel and no fuel switch is planned during the crediting period. The project activity thus meets both the applicability criteria of the methodology.

The non-project option is "import of electricity from the grid". Since the baseline scenario (as established in Section B2) is grid connected and the selected approach is 'existing actual and historical emission", the data of actual emission of the power plants connected to the grid has been collected from DPSCL, WBSEB and Central Government information sources and used in calculation to determine the carbon intensity of the grid (emission factor). Data is generally available in the form of total fuel consumption, total electricity generated, plant load factor, CO_2 emission factor and total run time, etc of the individual units.

As per the Kyoto Protocol (KP) baseline should be in accordance with the additionality criteria of article 12, paragraph 5(c), which states that a CDM project activity must reduce anthropogenic emissions of greenhouse gases that are additional to any that would have occurred in the absence of the registered CDM project activity. The project additionality is established as per latest version of "Tool for the demonstration and assessment of additionality" which is described in Section B3.

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

The project activity involves setting up of 9 MW WHR based CPP by JBSL to meet a part of its total in-house power consumption. The methodology is applied in the context of the project activity as follows:

[5] Quarterly Bulletin, Vol. II, No. 4, dated March 2004 of Directorate of Industries, Govt of West Bengal

Identification of Alternative Baseline scenarios and selection of appropriate baseline scenario:

As per the methodology, the project proponent should include all possible options that provide or produce electricity (for in-house consumption and/or other consumers) as baseline scenario alternatives. These alternatives are to be verified for legal and regulatory compliance requirements and also for their dependence on key resources such as fuels, materials or technology that are not available at the project site. Further, among those alternatives that do not face any prohibitive barriers, the most economically attractive alternative is to be considered as the baseline scenario.

As mentioned above, the project activity requires supplying a total of 9 MW of power to JBSL. Five plausible alternative scenarios were available with the project proponent that was contemplated during project inception stage:

Alternative 1: Import of power from grid – continuation of current scenario

JBSL would continue to purchase required power from DPSCL grid. An equivalent amount of CO_2 emissions would take place at the thermal power generation end. This alternative is in compliance with all applicable legal and regulatory requirements and can be a part of baseline option.

Alternative 2: Coal based CPP at JBSL

The project proponent could set up a 9 MW coal based CPP at its existing sponge iron plant. The power generated would partially meet JBSL's own demand. An equivalent amount of CO_2 emissions would be released at the CPP end. However, for setting up a coal based CPP statutory requirements exist due to air pollution hazards and ash handling problems. Nevertheless, this alternative is in compliance with all applicable legal and regulatory requirements and can be a part of baseline option.

Alternative 3: Gas based CPP at JBSL

The project proponent could generate their own power using natural gas based captive power plant and an equivalent amount of carbon dioxide would be generated at the power plant end. Though this alternative is in compliance with all regulatory and legal requirements, it is not a realistic alternative due to non-availability of natural gas and its distribution network in the state[6]. Therefore, alternative 3 can be excluded from the baseline scenario.

Alternative 4: Light diesel oil or furnace oil based CPP at JBSL

The project proponent could set up 9 MW light diesel oil (LDO) or furnace oil (FO) based CPP at its existing sponge iron plant. The power generated would partially meet JBSL's own demand. An equivalent amount of CO_2 emissions would be released at the CPP end. This alternative is in compliance with all applicable legal and regulatory requirements and can be a part of baseline option.

Alternative 5: Implementation of project activity without CDM benefits

JBSL may set up a 9 MW waste heat recovery based CPP at its existing sponge iron plant to partially meet its demand. This alternative is in compliance with all applicable legal and regulatory requirements. The energy content of the flue gases from the kilns in this case would be fully utilized and JBSL would reduce an equivalent amount of CO_2 emissions at the thermal power plants feeding to DPSCL grid. However, for this option, the project proponent would face a number of regulatory, investment and technological barriers (as detailed in Section B3 below) making it predictably prohibitive. Hence this option is not a part of baseline scenario.

Evaluation of the alternatives on economic attractiveness:

From the discussion above it is found that alternatives 1, 2 and 4 can be a part of baseline scenario. Further, as per the methodology, the alternatives are to be evaluated on the basis of economic attractiveness to find the appropriate baseline scenario. The broad parameters used for the evaluation of sources of power are capital (installation) cost figures and the unit cost of electricity purchased or produced. Table 2 below shows the economic evaluation of the three options:

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

Table 2: Evaluation of Alternatives based on Economic Attractiveness

Alternative	Capital Cost Rs. Million / MW	Generation/ Purchase Cost Rs./kWh		Source of Information	Comments	Conclusion
1) Import of Power from Grid	Nil	Year 2000-2001	2.68	JBSL sources	Continuation of current situation, No additional investment, easy government approvals	An economically attractive option
		Year 2001-2002	2.80			
		Year 2002-2003	3.37			
2) Coal based CPP	42.5 - 45.0	1.78 - 1.92		Indicative prices available in India during project inception stage[7]	High Capital Cost - uneconomical for small sizes, difficulty in accessing bank loans. Government statutory approvals cumbersome because of Air pollution hazard and ash handling problems. Delay in obtaining approvals and regular permissions from the concerned authority will lead to cost overrun.	This option is economically unattractive
4) LDO/FO Based CPP	7.5 – 12.0	3.5-4.6		Indicative prices available in India during project inception stage[7]	Marginal Low capital cost but high variable cost mainly due to higher fuel prices. Generally used as backup for supplying power to essential equipments and not for complete grid displacement at such a scale. Moreover, JBSL anticipated further oil price increase in future.	This option is economically unattractive

[7] Captive Power Plants- Case study of Gujarat India - http://iis-db.stanford.edu/pubs/20454/wp22_cpp_5mar04.pdf

Thus in view of the above points, the Baseline Alternative 1: 'Import of electricity from the grid' is most likely baseline scenario and has been considered as business as usual scenario for the baseline emission calculations. Further, the following points corroborate that 'import of electricity from grid' is the baseline:

- This is a usual practice being followed by the other similar industries in the state (business-as-usual-scenario). Out of 27 sponge iron plants in the state, JBSL is the first plant to implement waste heat recovery for captive power generation.

- The grid's generation mix comprises of power generated through sources such as thermal (coal and gas), hydro and renewable energy. The project activity would therefore displace an equivalent amount of electricity the plants would have drawn from the grid. The Baseline Emission Factor for the grid is more conservative than that of the coal based CPP.

We may therefore conclude that in the absence of project activity, JBSL would draw power from DPSCL, and the system boundary would include the grid's generation mix. Thus the most appropriate baseline scenario would be 'Import of power from grid'.

Establishing the additionality for the project activity

This step is based on Annex I - "Tool for the demonstration and assessment of additionality" of the sixteenth meeting of Executive Board. Information/data related to preliminary screening, identifying alternatives, common industry practice and other financial, regulatory and technology related barriers were used to establish the additionality. Details of establishing additionality are explained in section B3.

Determining the baseline emissions

This step provides steps for analysis of the selected baseline scenario to calculate the baseline emission factor. Details of baseline data are shown in Annex 3. From the step 'Identification of alternative baseline scenarios' it is found that 'Import of Electricity from Grid' is the most appropriate baseline option. The project activity thus displaces equivalent amount of electricity from grid which is predominantly generated from thermal (fossil fuel based) power plants. Further, as per ACM0004 baseline methodology the Baseline Emission Factor (BEF) of chosen grid is calculated as per combined margin method of ACM0002 in Annex 3. Project emissions are zero as no auxiliary fuel is used for generation startup or supplementary fuel for WHRB. Finally, annual emission reductions are found as the difference of baseline emissions and project emissions during the given year in tons of CO_2 equivalent. This is shown in detail in Section E.

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 GHGs by sources are reduced below those that would have occurred in absence of registered CDM project activity. The methodology requires the project proponent to determine the additionality based on 'Tool for the demonstration and assessment of additionality' as per EB-16 meeting. The flowchart in Fig 2 below provides a step-wise approach to establish additionality of the project activity.

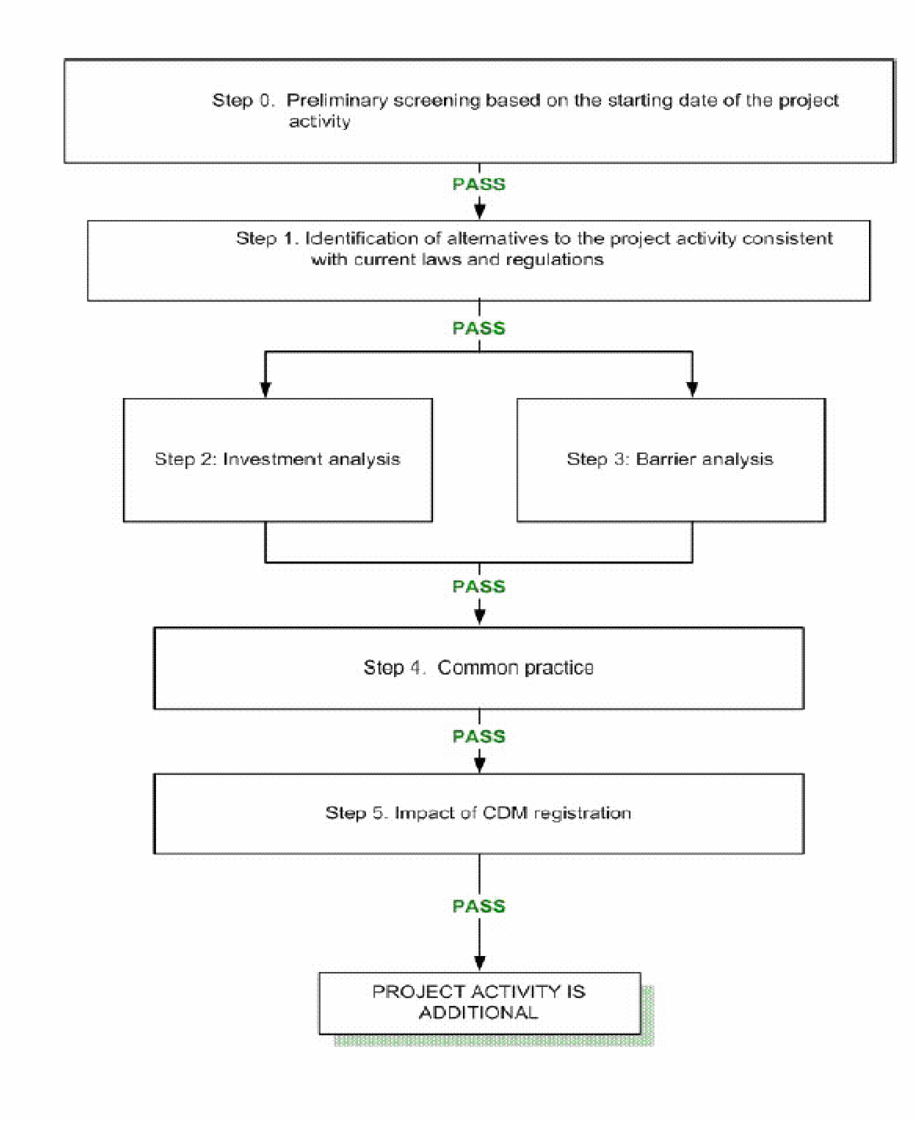

Fig 2: Flow chart for establishing additionality

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

1. If project participants wish to have the crediting period starting prior to the registration of their project activity, they shall:

(a) *Provide evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of a first CDM project activity, bearing in mind that only CDM project activities submitted for registration before 31 December 2005 may claim for a crediting period starting before the date of registration*:

The project proponent and sponsor Jai Balaji Sponge Limited launched the project on WHR based Captive Power generation in July 2004, with a consolidated project report. The CPP will start commercial operation in September 2005. Hence, the project activity lies between 1st January 2000 and the 18 November 2004 i.e. date of registration of first CDM project activity.
JBSL would provide sufficient evidences to establish the same. JBSL proposes to get the project activity registered with UNFCCC before December 31, 2005.

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

As a responsible corporate citizen, JBSL is committed for business growth keeping in mind the environmental protection aspects both locally as well as globally. JBSL is aware that the emergence of the concept of sustainable development in the recent years has brought in the general realization that environmental issues are intrinsically connected with the development objectives and polices. All activities undertaken by JBSL take into consideration the environmental, health and social assessment. Consequently, climate change issues are very much a part of JBSL decision making covering all its proposed activities. JBSL was aware of the number of investment and regulatory barriers it would face for entering into a domain of power generation which is not coming under its expertise. Despite these barriers, the Board Members of JBSL in its meeting in March 2003 decided to take up the project activity in view of the potential risk mitigation cover CDM would provide[8]. The Board also decided to bear the costs for CDM documentation, registration and for adhering with the M&V protocol. Adequate evidences are available which shows that CDM benefits was seriously considered to proceed with project activity.

[8] Minutes of Meeting of Board of Directors of JBSL held in March 2003

Following are the documents available that can be shown as evidence to support that incentive from CDM was seriously considered in the decision to proceed with the project activity:

1) Appraisal for project activity by IREDA where CDM benefits was considered in the project financial analysis.
2) Board Note submitted in the Board Meeting and Resolution of the Board Meeting showing the approval of the Board for the same.

These evidences will be made available to the Designated Operational Entity (DOE) during validation.

Sub-step 1a. Define alternatives to the project activity:
Sub-step 1b. Enforcement of applicable laws and regulations:

The project activity requires supplying a total of 9 MW of power to JBSL plant. As discussed in section B2 above, there were five plausible alternatives available with the project proponent to provide this service among which three were feasible. The feasible alternatives are:

Alternative 1: Import of power from grid by JBSL – continuation of current scenario

Alternative 2: Coal based CPP at JBSL

Alternative 4: Light diesel oil or furnace oil based CPP at JBSL

These alternatives are in compliance with all applicable legal and regulatory requirements. There is no legal binding on JBSL to implement the project activity. In India it is not mandatory for sponge iron units to implement waste heat recovery based power generation plants from waste gases of the kilns. Neither are there any planned regulations for sponge iron manufacturing industries that will enforce them to implement project activity in India. The pollution control board does require sponge iron units to operate such that the dust levels of the waste gases to be emitted into the atmosphere should be less than 150mg/Nm^3. These pollution control board norms were being met even in absence of the project. Though this alternative would bring down the SPM levels in the flue gas, there is no mandate by the West Bengal Pollution Control Board to implement the same. From the above we can conclude that the project activity is a voluntary activity on part of the project proponent and is no way mandated by the law or instigated by the promotional policies of the Government. It is a proactive endeavor to improve on energy efficiency by utilization of waste heat energy and reduce greenhouse gas emissions.

Next the project proponent is required to conduct

Step 2. Investment analysis OR

Step 3. Barrier analysis.

JBSL proceeds to establish project additionality by conducting the Step 3: Barrier Analysis.

The project proponent is required to determine whether the proposed project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and

(b) Do not prevent the implementation of at least one of the alternatives through the following sub-steps:

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

1. **Regulatory and Institutional Barriers:**

Macro Perspective: In India the power demand has always outstripped supply and the quality and reliability of power supply have not improved[9]. This has resulted in widespread power shortages throughout the country, wide fluctuations in supply voltage and frequency, frequent grid disturbances and general lack of system integrity. The deficit power situation has been exacerbated by the very high (and worsening) transmission and distribution (T&D) losses, which have increased from 18% in 1970 to around 32% in 2004[10], against an international average of less than 10%. This situation is largely a result of under-investment in T&D systems in comparison with investment in generation capacity addition, and is also strained by inadequate billing, improper metering and pilferage of power.

The Indian Power sector is constrained by:

- inadequate financial resources
- cumbersome project clearance procedures
- poor financial management of financial resources
- irrational tariff structure that is politically motivated,

During the start of the project in 2004 a number of difficulties were faced by the project proponent for obtaining approvals for the project activity. These barriers are mentioned below:

- The agricultural and domestic consumers are being heavily cross subsidized by the industrial and commercial consumers in India[11]. Billing and collection is much more efficient for High Tension (HT) industrial consumers[12]. The development of captive power stations would reduce the revenues of state utilities that could in turn lead to reduction in cross subsidy to the domestic and agricultural sector. With this trend the financial problems of the SEBs would continue to worsen. In fact, one of the major reasons SEBs have introduced policies which discourage setting up captive power plants was the fact that their

[9] 'Problems and prospects of privatisation and regulation in India's power sector' http://www.ieiglobal.org/ESDVol3No6/india.pdf

[10] http://www.cea.nic.in/ge_re/2004-05/chap-5.pdf

[11] Power Trading, http://www.electricityindia.com/powertrading.html

[12] Captive Power Scenario in India, Infrastructure Development Action Plan for Chattisgarh-Final Report, http://chhattisgarh.nic.in/opportunities/Annexure%203.2.pdf

most profitable and regular paying customer had moved away from them in the past. In view of the dismal financial state of most SEBs in India, the SEBs are unwilling to give up the industrial segment and hence have framed policies which do not encourage captive power plants. Such an approach (dissuading setting up of captive power plants by disallowing excess sale to the grid/ third party, making it mandatory for industries to buy from the SEB, very high wheeling charges, etc.) was inhibiting the introduction of new energy efficient technologies such as the waste heat recovery steam generation system in JBSL's case.

- Besides, another concern as mentioned by one of the state regulatory commissions of India in one of its orders was that the industrial consumers provide continuous high load factor and act as base loads during off peak hours for power plants feeding to the grid. Setting up of CPPs by HT consumers would affect the off peak operations of such thermal power plants[13]. This factor was also one of the reasons why SEBs in India dissuaded industrial consumers like JBSL from setting up their own CPP.
- As mentioned earlier the decision to go ahead with the project was taken in a Board meeting in 2003. During this period the prevailing law for setting up a CPP was governed by section 44 of Electricity Supply Act, 1948 read with Sub-section 3 of section 21 of WB electricity Act, 1995[14].This Act mandated the respective State Governments to frame rules with respect to industries setting up Captive Power plants. Under this notification any industry setting up a CPP had to obtain the clearance (No Objection Certificate) from the State Electricity Board (in this case WBSEB). Obtaining such clearances/approvals was cumbersome and caused considerable delay. Moreover, as per the rules of the notification industries setting up CPP would have to pay WBSEB electricity duty charges under the Bengal Electricity Duty Rules.

2. **Investment Barriers:** The total capital cost for the project was estimated at Rs. 519.69 million and Debt Equity ratio for the project activity was fixed at 70:30. Hence, the fund to be raised externally from banks/ FIs was around Rs. 363.78 million which was a heavy liability for a medium sized company like JBSL (turnover in 2003-04 was Rs. 1220 Million[15]). The project proponent approached a number of banks and FIs like Power Finance Corporation, Rural Electrification Corporation, UCO bank, Federal Bank, West Bengal Industrial Development Corporation and West Bengal Financial Corporation. These banks and FIs were offering loans at high lending rate in the range of 13.5 – 16.00% as compared to the prevailing Prime

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[13] 'OERC Orders', Section 6.40.10.2 - http://www.wescoorissa.com/cinfo/a39.htm#6.37

[14] See 'Initiatives –Policy for Captive Power plants' http://www.wbpower.nic.in/

[15] JBSL Annual Report 2003-04.

Lending Rate of 10.25 – 11.00%[16]. Typically, one of the factors that influence the determination of lending rate for such projects is based on the extent of penetration of technology. Unlike other CPPs, the waste heat recovery based CPP had very low penetration of technology in similar industry scenario of West Bengal (as shown in the Common Practice Analysis of section B3 of Tools for demonstration and assessment of Additionality). The banks viewed the project as high risk project and hence fixed the higher interest rate making the project unaffordable to the project proponent. Finally, project proponent approached Indian Renewable Energy Development Agency (IREDA) which undertook financial appraisal of the project as an energy efficiency project and considered potential CDM revenue that would make the project financially attractive for lending[17]. In its project appraisal IREDA also mentioned about the socio-economic and environmental benefits from gainful utilization of waste products and reduction of carbon emission by replacing grid power. IREDA agreed to partially fund (around Rs. 190 million) the debt portion at a comparatively attractive interest rate. UCO bank followed suit funding the remaining portion on the strength of the IREDA appraisal did UCO bank further agree to fund the remaining portion of the debt at comparable lending rates[18]. Thus from the above discussion we can conclude that CDM was the principal motivator for reducing the interest rates making the debt sourcing for the project affordable. This confirms that CDM played a major role in covering the investment risks for the project.

[16] http://indiabudget.nic.in/es2003-04/chapt2004/chap33.pdf

[17] Letter No.221/2230/EEC/2003/IREDA dated 24th December 2003 from IREDA to UCO bank.

[18] Letter from UCO bank dated 3rd June 2004 to JBSL.

3. Technological Barriers:

a. Operational risks: As mentioned earlier, JBSL's waste heat recovery based CPP will supply power to its Ferro Alloy Plant (FAP) in stand alone mode. The project activity faces operational risks related to the waste gas generation and its heat content, which effect the successful implementation of the project activity.

- The non-availability of waste gases due to any technical fault in the kilns will prevent power generation in the project activity. If the heat content of the waste gas is not sufficient, the project activity will directly be affected since there are no inbuilt provisions to increase waste gas temperatures through auxiliary fuel firing.
- Cumulative effect of sustained variable frequency operation due to fluctuations in waste gas supply (flow rate & temperature) may have substantial bearing in safe and sustained operation of assets like the power plant equipments.
- Quality of ferro alloys 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 from sponge iron at the required temperature can also result in a complete closure of the project activity and in effect will affect the FAP production. Further, 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 equipment.

b. Air cooled Condenser: In the proposed captive power plant JBSL is going to install air-cooled condensing system instead of water-cooled condensing system. Air-cooled condensing systems are least preferred in India as they have a much higher capital cost, higher operating temperatures, and lower efficiency than wet cooling systems[19]. Air-cooled condensers consist of one or more rectangular bundles of finned tubes arranged in staggered rows and suitably supported on a steel structure. Both ends of the tubes are fixed in tube sheets in channels that have holes opposite to the tubes, or removable covers, for tube rolling and cleaning. Apart from design complexity air-cooled condensing system involves huge space requirement (12m width x 16m length x 22m height) for JBSL and its weight is also quite substantial (415 MT). In spite of such technical barriers the project proponent is willing to continue with the proposed air-cooled condensing system because it is directly contributing to the reduction of water consumption (unlike water-cooled condensing system) in a region, which suffers from severe water crisis especially during summer. For this proposed installation of air-cooled condensing system the estimated amount of savings in make- up water consumption is going to be 70,000 lit/hr.

[19]'Closed Cycle Dry Cooling Systems' http://www.energymanagertraining.com/power_plants/condenser&cooling_sys.htm

4. **Other barrier(s) – due to lack of awareness about available technologies, products, financial support; limited dissemination of information on operation knowhow; limited managerial resources; organizational capacity**

a. Lack of information on operation know-how: The sponge-iron manufacturing sector belongs to steel industry sector with limited knowledge and exposure of complications associated with production of power. JBSL 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 JBSL 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.

b. Declining prices of sponge iron and ferro alloys: The domestic sponge iron and ferro alloy industry in India is witnessing a downward trend in prices of sponge iron in 2005-06[20]. In comparison to July 2004, the sponge iron prices for the same month in 2005 have declined by almost 15%. The major factors leading to the falling prices are attributed to lower demand of sponge iron due to increased supply of steel scrap at lower prices (sponge iron substitutes scrap in steel production through Electric Arc Furnace/Induction Furnace) and oversupply of sponge iron in the market due to additional capacities exceeding demand. As a result, the margins for sponge iron industries in 2005-06 are expected to shrink with respect to the previous year. High input costs (due to shortage of raw material - especially coal) add to the damper arising from declining prices.

This squeeze in operating margins will affect the working capital requirements of the sponge iron industry. 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. JBSL 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.

[20] Monthly Industry Review for Steel Intermediaries by CRIS INFAC– July 2005 report

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

This is demonstrated in Table 2 of Section B.2 above. JBSL's project activity is a WHR based power project utilizing waste heat from sponge iron rotary kiln that uses coal as fuel. JBSL would not have faced any regulatory or investment barrier in case it continued to import power from grid. In this scenario it would not have faced the investment barrier as no special investments are required to meet the demand. Further for import of power from grid, JBSL 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 JBSL would opt for the business-as-usual scenario, i.e. releasing the waste heat into the atmosphere and importing equivalent electricity from state grid to cater to the need.

Step 4: Common Practice analysis*:*

Based on the information about activities similar to the proposed project activity, the project proponent is supposed to carry out common practice analysis to complement and reinforce the barrier analysis. The project proponent is required to identify and discuss the existing common practice through the following sub-steps:
Step 4a: Analyze other activities similar to the proposed project activity
Step 4b: Discuss any similar options that are occurring

In the sponge iron sector of West Bengal with similar socio-economic environment, geographic conditions and technological circumstances, JBSL 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. As shown in Table – 3, there were 27 similar plants in West Bengal during start of project[21]. Out of the 27 plants, JBSL will be the first sponge iron manufacturer to implement the waste heat recovery based power plant. This indicates a very low penetration of technology. The project activity occurs in 4 % of the similar industries and therefore is not a common practice.

Table 3: Common practice analysis for sponge iron plants in West Bengal

Scenario	No. of Sponge iron plants in West Bengal
Scenario 1: Import of electricity from the grid	26
Scenario 2: Coal based captive power plant	0
Scenario 4: Diesel based captive power plant	0
Project Activity: Waste heat recovery based power plant	1
(Source: Directorate of Industries, Government of West Bengal)	

[21] Quarterly Bulletin, Vol. II, No. 4, dated March 2004 of Directorate of Industries, Govt of West Bengal

Step 5: Impact of CDM registration

The project activity was started in July 2004 and commissioned in September 2005. As mentioned in Step3, JBSL was the first waste heat recovery project in the state of West Bengal and minimize GHG emissions due to import of power. Though the Electricity Act 2003 provided for freeing of license to generate captive power and enable wheeling, a number of regulatory/institutional problems are still being faced by project proponent on a continuous basis. Project activity getting registered as CDM project would give instant visibility among the state utilities power ministries/departments, environment ministries/departments enabling JBSL to face lesser governmental hurdles thereafter.

Registering the project activity as CDM project would allow JBSL to make the project successful and sustainable which would lead to banks lowering interest rates for similar activities to sponge iron industries located in the state. This would act as a precursor for other industries to invest in waste heat recovery based power generation with wheeling facility leading to further reduction in GHG emission reduction.

Successful implementation and running of the project activity on a sustainable basis requires continuous investments in maintenance and technological up gradation. It also requires manpower training and skill development on a regular basis. The project proponent could get the necessary funding from selling the project related CERs. Apart from these, registration of the project under CDM would enhance the visibility and would enable West Bengal Government in appreciating the GHG emission reduction efforts of the project proponent. This could lead to smoother transactions in future between the project proponent and the utility. Further CDM fund will provide additional coverage to the risk due to failure of project activity; shut down of plant and loss of production in JBSL.

It is ascertained that the project activity would not have occurred in the absence of the CDM simply because no sufficient financial, policy, or other incentives exist locally to foster its development in West Bengal /India and without the proposed carbon financing for the project JBSL would not have taken the investment risks in order to implement the project activity. Therefore the project activity is additional. Also, the impact of CDM registration is significant with respect to continuity of the project activity on a sustainable basis.

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

The project boundary covers the point of fuel supply to the point of power generated for use of the JBSL's facility where the project proponent has a full control. Hence, project boundary is considered within these terminal points. However, for the purpose of calculation of baseline emissions the state grid is also included in the project boundary.

Thus, boundary covers ABC, Waste Heat Recovery Boilers, STG, all other power generating equipments, captive consumption units, the transport of the waste gases to boiler and the electricity generated to be supplied to JBSL's facility. The project boundary (as shown in Fig 3) starts from supply of waste flue gas at the boiler inlet to the point of electricity generated for end users.

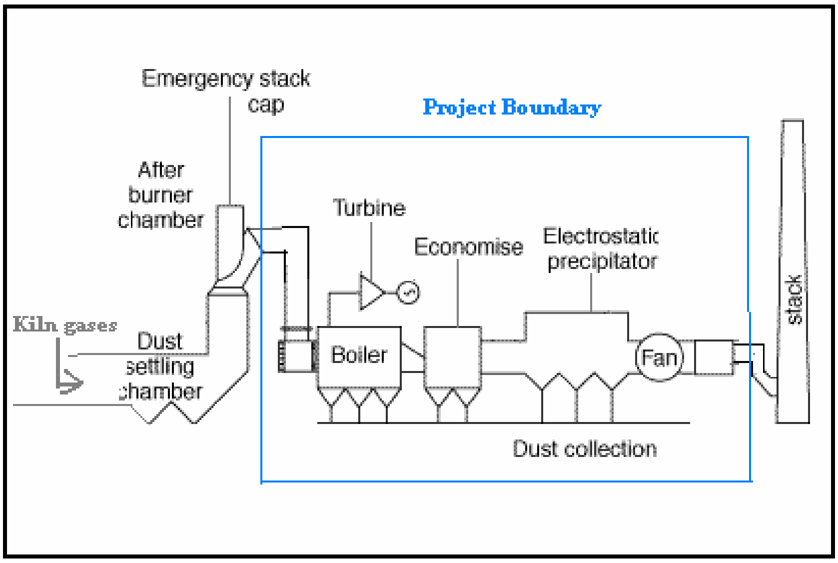

Fig 3: Project Boundary for JBSL's Waste Heat based Power Project.

Further, upstream emissions should be placed within the project boundary when the project developer can significantly influence these emissions. In principle this could mean that the waste gas emissions that are made available as input to the Waste Heat Recovery Boiler should be included within the system boundaries. Since there is no change in the chemical composition of the input waste gas & the waste gas output net GHG emissions are zero. The project boundary will therefore not include the upstream emissions.

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

As established in Section B2, the baseline scenario for the project activity is Import of Power from Grid. Hence, as required by ACM0004 baseline for the project activity is calculated as per ACM0002 for chosen grid. The approach used is exising actual or historical emissions. Net baseline emission factor for the grid was found to be 0.927 kg CO_2/ kWh. Please refer to details in Annex 3 of the PDD.

Date of completing the final draft of this baseline selection *(DD/MM/YYYY)*: 28/08/2005

Name of person/entity determining the baseline:

Jai Balaji Sponge Limited (the project participant as listed in Annex-1) and its associated consultants.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

July 2004: construction start date

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:

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C.2.1.2. Length of the first crediting period:

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C.2.2. Fixed crediting period:

C.2.2.1. Starting date(DD/MM/YYYY):

01/10/2005

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 monitoring plan has been prepared in accordance with in ACM0004.

The project activity being a waste heat recovery based power generation one, there are no/negligible project emissions generated during operation of the project activity.

The monitoring methodology will essentially aim at measuring and recording through devices, which will enable verification of the emission reductions achieved by the project activity that qualifies as Certified Emission Reductions (CERs). The generation of power units, auxiliary consumption, steam generation, steam characteristics [temperature and pressure], flue gas quantity and quality, are some of the essential parameters to be monitored. The methods of monitoring adopted should also qualify as economical, transparent, accurate and reliable.

Applicability Criteria:
This methodology applies to project activities that generate electricity from waste heat or the combustion of waste gases in industrial facilities.
The methodology applies to electricity generation project activities

- that displace electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels,
- Where no fuel switch is done in the process where the waste heat or waste gas is produced after the implementation of project activity

JBSL's project activity is a waste heat recovery based power project utilizing waste heat from DRI kilns. The project activity displaces electricity of equivalent amount from DPSCL grid having a generation mix of thermal (coal, gas) hydro and nuclear sources. Coal was used as fuel in the sponge iron kilns prior to project activity. The kilns will continue to use coal as fuel and no fuel switch is planned during the crediting period. The applicability criteria of ACM0004 meet the principle of the project activity and therefore the monitoring procedure for the project is developed as per that methodology.

Description of Monitoring Methodology

The methodology ACM004 requires monitoring of the following:

- *Net Electricity Generation from Project Activity* (MWh / year)– This is calculated as the difference of gross waste heat power generated for a year minus the auxiliary power consumption during that year. The project activity has employed state of the art monitoring and control equipments that will measure, record, report and control various key parameters like total power generated, power used for auxiliary consumption, steam flow rate, temperature and pressure parameters of the steam generated and steam fed to the common header of turbo-generator sets to generate power. The monitoring and controls is part of the Distributed Control System (DCS) of the entire plant. All instruments are calibrated and marked at regular interval to ensure accuracy.

- *Data needed to calculate carbon dioxide emissions from fossil fuel consumption due to project activity* – The project activity does not use any auxiliary fossil fuel, hence there is no carbon dioxide emissions due to fossil fuel consumption from project activity.

- *Data needed to recalculate the operating margin emission factor, if needed based on the choice of the method to determine the Operating Margin(OM), consistent with "Consolidated baseline methodology for grid connected electricity generation from renewable sources(ACM0002)"* – The Operating Margin Emission Factor for the chosen grid is calculated as per ACM0002 Data needed to calculate the emission factor are based on information available from authorised government agencies - Central Electricity Authority (**www.cea.nic.in**), WBSEB(www.wbseb.gov.in) and DVC (www.dvcindia.org) sources and also the private generation and distribution licensee DPSCL(www.dpscl.com) The government authorised agencies monitor power generated and supplied to the grid. The grid mix scenario through the entire crediting period will be based on records and reports with CEA, DPSCL, WBSEB and DVC. CEA monitors the performance of all power generation units connected to grid under their own monitoring schedule monthly/ annually. The Grid transmission and distribution network includes monitoring and control facilities at each generation unit level, as well as voltage, substation and consumer level. The power records from the above sources contain all information related to sources and origin of generation like thermal, hydro and renewable energy sources, installed and de-rated capacity, performance of generating unit like actual and expected generation, and planned capacity additions during the year, etc. Hence, the transparency of measurements, recording, monitoring and control of the generation mix of the DPSCL Grid is ensured all the time. These records can be used for verification of generation mix and emission factor (EF) for baseline calculation for a particular year.

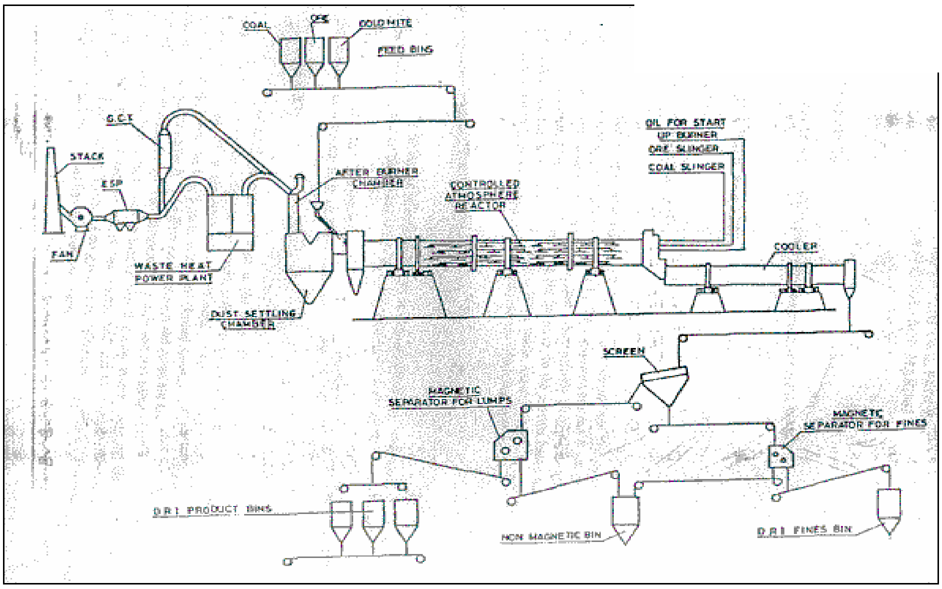
- *Data needed to calculate the build emission factor, if needed, consistent with"Consolidated baseline methodology for grid connected electricity generation from renewable sources(ACM0002)"* – Same as above.
- *Data needed to calculate emission factor for captive power generation* - Not applicable for the project activity

Further, within the JBSL facility there is no or negligible amount of T&D losses of electricity distributed and hence neglected.

<u>Project Boundary and GHG Sources</u>

To clarify the characteristics of the JBSL waste heat recovery based power project, a full flow diagram is presented below. The project system comprising of the ABC, waste heat recovery boiler (WHRB), steam turbine generator (STG), all other power generating equipments, captive consumption units, ESP, and the slurry removal system. The heat captured from the waste gas is transferred to the water to generate steam, which in turn generates power through a turbine. The waste gas after passing through ESP is released to the environment.

Figure 4: JBSL Process



The project boundary covers the point of supply of waste gas to WHRB inlet to the point of power generated for use of the JBSL's DRI Unit where the project proponent has a full control. Hence, project boundary is considered within these terminal points.

However, for the purpose of calculation of baseline emissions the state grid is also included in the project or system boundary as shown in Fig 3.

Further, upstream emissions should be placed within the project boundary when the project developer can significantly influence these emissions. In principle this could mean that the waste gas emissions that are made available from the ABC as input to the Waste Heat Recovery Boiler should be included within the system boundaries. These waste gas emissions were emitted in the atmosphere in the absence of the project activity. The project boundary will therefore not include the upstream emissions, which will any way be generated during production process.

The project is using the energy in the waste gas and therefore eliminating the need of grid electricity. It reduces the production of the same energy from generating stations connected to grid. The amount of electrical energy generated and thereby substituted in the grid, is directly controlled by the project proponents, and will be under the preview of monitoring and verification protocol. The actual amount of CO_2 reduction however depends on the generation mix and production scenario of the grid that is taken into consideration in the baseline factor. The project does not have a direct control on the baseline. But since the baseline parameters like actual generation mix in million units and efficiency of thermal power plants will affect the actual emission reduction units that are attained during verification, they too will be included in the Monitoring and Verification procedure. The verification methodology takes into account the methodology to estimate the CO_2 reduction.

Therefore, the direct project boundary includes the ABC, WHRBs and auxiliaries and STG (and its auxiliaries), whereas the system boundary extends to the thermal power plants.

GHG Emissions Sources of the Project

Direct on-site emissions

As power is generated from the waste gas, which was released to the environment earlier project extracts the heat energy through indirect physical contact (through boiler tube) there is no change in the composition of the waste gas at the boiler inlet and outlet.

The controlled combustion in ABC will ensure that there will be no on-site emission from the project activity. As all auxiliaries will be run by the power generated through the waste heat, no other major on-site emission will takes place within the project boundary.

Indirect on-site emissions

The indirect on site GHG source will be the consumption of energy and the emission of GHGs involved in the construction of waste heat recovery based power plant. Considering the life cycle of the total power generated and the emissions to be avoided in the life span of the project, emissions from the above-mentioned source will become too small and hence neglected. In comparison with the transportation and mining of equivalent coal/oil required for power generation at thermal power plant (of the grid) the one-time indirect on-site emissions will be negligible.

Direct off site emissions

There will be no direct off site emissions from the project activity.

In-Direct off-site emissions

This includes emissions during the manufacturing process of parts, supplies and machinery required for building the project (i.e. electromechanical equipment, etc.). But these emissions are outside the control of the project and excluded.

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

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data type	Data Variable	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)	For how long is archived data to be kept	Comment
1. Qi	*Quantitative*	*Volume of auxiliary fuel used by project*	*tonnes of* m^3	***Not applicable***					
2. NCV_f	*Quantitative*	*Net calorific Value of fuel*	*TJ per* m^3						
3.EF_i	*Quantitative*	*Carbon Emissions factor of fuel*	*tC/ TJ*						

As per the methodology, project emission is applicable only if any treatment is given to waste gases for additional heat gain and as a result there is additional emission of CO_2 due to project activity. The Additional Heat Gain can take place due to any of the two following reasons:

1. Auxiliary firing using other fuels in After Burning Chamber (ABC)
   There is no provision for auxiliary fuel firing in ABC. Hence, there are no project emissions due to auxiliary fuel firing.
2. Improved Technology which results in improved combustion and additional heat gain:
   No technological up-gradation has been implemented in ABC. Hence there are no associated project emissions.

Since project emissions in the project activity are almost negligible, no data needs to be monitored for this purpose.

For Electricity Generated by Project Activity

ID No.	Data type	Data variable	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)	For how long is archived data to be kept?	Comments
4. EG_{gen}	Quanti tative	Total Electricity Generated	MWh /year	Calculated[22]	Continuously	100%	Electronic/ paper	Credit Period + 2 years	MONITORING LOCATION: The data will be measured by meters at plant and DCS. Manager In-charge would be responsible for calibration of the meters. See Annexe 4 for details.
5. EG_{aux}	Quanti tative	Auxiliary consumption of Electricity	MWh /year	Calculated[23]	Continuously	100%	Electronic/paper	Credit period + 2 years	MONITORING LOCATION: The data will be measured by meters at plant and DCS. Manager In-charge would be responsible for regular calibration. See Annexe 4 for details
6. EG_y	Quanti tative	Net Electricity supplied	MWh /year	Calculated (EG_{gen}- EG_{aux})	Continuously	100%	Electronic/paper	Credit Period + 2 years	Calculated from the above measured parameters. Algorithm for project emissions given in baseline methodology

[22] Power generated due to waste heat recovery project will be calculated on the basis of total enthalpy of steam (enthalpy per unit steam x steam flow) from WHRBs as a percentage of total enthalpy of steam fed to common header of the CPP

[23] Auxiliary consumption of electricity due to the project activity will be calculated as percentage of total auxiliary consumption in the same manner as mentioned above.

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 No.	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	For how long is archived data to be kept?	Comments
7. EF_y	Emission factor	CO2 emission factor of the grid	tCO2/ MWh	Calculated	Simple OM, BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as weighted sum of OM and BM emission factors
8. $EF_{OM,y}$	Emission factor	CO2 operating margin emission factor of the grid	tCO2/ MWh	Calculated	Simple OM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as indicated in the relevant OM baseline method above
9. $EF_{BM,y}$	Emission factor	CO2 Build Margin emission factor of the grid	tCO2/ MWh	Calculated	BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as [∑I Fi,y*COEFi]/ [∑mGENm,y] over recently

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 No.	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	For how long is archived data to be kept?	Comments
										built power plants defined in the baseline methodology
10. $F_{i,j,y}$	Fuel Quantity	Amount of each fossil fuel consumed by each power source/ plant	t or m^3/year	Measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from authorised latest local statistics
11. $COEF_{i,k}$	Emission factor coefficient	CO2 emission coefficient of each fuel type and each power source/plant	tCO2/ t or m^3	Measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated based on the IPCC default value of the Emission Factor, Net Calorific Value and Oxidation Factor of the fuel used by the power plants feeding to DPSCL
12. $GEN_{j,y}$	Electricity quantity	Electricity generation of	MWh/ year	Measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from the authorised

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 No.	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	For how long is archived data to be kept?	Comments
		each power source/plant								latest local statictics

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

>>

Emission Factor of the Grid (EF_{Grid})

Electricity baseline emission factor (EF_y) of DPSCL Grid mix (i.e. DPSCL, DVC and WBSEB collective grid) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source (where available) and made publicly available.

STEP1: Calculate the Operating Margin emission factor

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

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

where

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

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

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

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

The Fuel Consumption $F_{i,j,y}$ is obtained as

$$\sum_i F_{i,j,y} = \left(\sum_j GEN_{j,y} \otimes 860 \Big/ NCV_i \otimes E_{i,j} \right)$$

where

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

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

$E_{i,j}$ is the efficiency (%) of the power plants by source j

The CO_2 emission coefficient $COEF_i$ is obtained as

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

where

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

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

$OXID_i$ is the oxidation factor of the fuel

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated separately for the most recent three years (2001-2002, 2002-2003 & 2003-2004) and an average value has been considered as the OM emission factor for the baseline ($EF_{OM,y}$).

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

where y represents the years 2001-2002, 2002-2003 and 2003-2004

STEP 2. Calculate the Build Margin emission factor

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

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

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

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

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

where

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

Considered calculations for the Build Margin emission factor $EF_{BM,y}$ is updated annually ex post for the year in which actual project generation and associated emissions reductions occur. The sample group m for the most recent year consists of the 6 (six) power plants that have been added to the grid most recently, since it comprises of larger annual power generation.

STEP 3. Calculate the Emission Factor of the Grid (EF_{Grid})

The electricity baseline emission factor of WBSEB, EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

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

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

(Please refer to "Annex 3: Baseline Information" for further details on grid analysis)

<u>Baseline Emission Calculations</u>

Net units of electricity substituted in the grid (EG_y) = (Total electricity generated-Auxiliary Consumption)$_{WHR}$

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

EG_y is calculated as mentioned above in the Table D.2.1.3

Therefore the Baseline Emission is calculated as,

$$BE_y = EG_y \otimes EF_y$$

where,

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

EG_y = Net units of electricity substituted in the grid during the year y (in MWh)

EF_y = Emission Factor of the grid (in tCO_2/ MWh) and

y is any year within the crediting period of the project activity

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

Not applicable

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

>>

D.2.3. Treatment of leakage in the monitoring plan

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

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

>>

CO_2 Emission Reduction Calculations				
Step 1	**:**	Baseline Emissions	-	Project Emissions

Please refer to Section E.5 of this document.

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

Data *(Indicate table and ID number e.g. 1. , -14.)*	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
1., -2.	Low	Yes	It is a critical parameter that would affect the GHG reductions claims.
4.,-6.	Low	Yes	This data will be used for calculation of project electricity generation.
7.,-9.	Low	No	This data is calculated, so does not need QA procedures
10., - 12.	Low	No	This data will be required for the calculation of baseline emissions (from grid electricity) and will be obtained through published and official sources.

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

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

The Plant Manager is responsible for monitoring and archiving of data required for estimating 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:

Experts and consultants of JBSL.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The project activity utilizes the heat content of the waste gas available from the Sponge Iron kilns as its fuel source. Since the composition of the waste gas at the boiler inlet and the boiler outlet is identical and there are no other fuel source within the project boundary the project activity itself leads to zero net GHG on-site emissions.

E.2. Estimated leakage:

There is no leakage activity, which contributes to the GHG emissions outside the project boundary.

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

A net emission by project activity (E1+E2) is zero tonnes of CO_2 per kWh of power generation.

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

Sl. No.	Operating Years	Baseline Emission Factor (kg CO_2 / kWh)	Baseline Emissions (tonnes of CO_2)
1.	Oct. 2005 – Mar.2006	0.927	26119.47
2.	2006-2007	0.927	52239.49
3.	2007-2008	0.927	52239.49
4.	2008-2009	0.927	52239.49
5.	2009-2010	0.927	52239.49
6.	2010-2011	0.927	52239.49
7.	2011-2012	0.927	52239.49
8.	2012-2013	0.927	52239.49
9.	2013-2014	0.927	52239.49
10.	2014-2015	0.927	52239.49
11.	Apr 2015 – Sep2015	0.927	26119.47

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

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.	Oct2005-Mar2006	26119.47	0	26119.47
2.	2006-2007	52239.49	0	52239.49
3.	2007-2008	52239.49	0	52239.49
4.	2008-2009	52239.49	0	52239.49
5.	2009-2010	52239.49	0	52239.49
6.	2010-2011	52239.49	0	52239.49
7.	2011-2012	52239.49	0	52239.49
8.	2012-2013	52239.49	0	52239.49
9.	2013-2014	52239.49	0	52239.49
10.	2014-2015	52239.49	0	52239.49
11.	Apr2015-Sep2015	26119.47	0	26119.47

Total tonnes of CO_2 Estimated Emission Reductions: **522395** over 10 year crediting period

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

Please refer to Appendix III 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. JBSL proposes to implement 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 has positive effects on local air and water quality. The new waste gas treatment technology adopted is better one.

By displacing electricity demand on the grid, the project will reduce emissions related to coal-fired power production, which include carbon dioxide, sulphur oxides, nitrogen oxides and particulates. It will also conserve the non-renewable natural resource – coal and reduced the adverse impacts related to transportation of coal and coal mining that would have been required to meet the additional capacity requirement of thermal power plants. These aspects contribute to the regional and global benefits.

Environmental Impact Analysis

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

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

The impacts envisaged during construction of the project activity were:

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

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

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

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
A	CATEGORY: ENVIRONMETAL – NATURAL RESOURCE CONSERVATION	
1.	Conservation of coal – A non-renewable natural resource: • By displacing JBSL Plant's electricity demand on the grid (which would otherwise been met from the grid), the project activity will reduce an equivalent amount of coal consumption that would have required meeting the future additional capacity requirements of thermal power plants • In absence of the project activity the hot and dust laden gas from the ABC would have been passed through a refractory lined duct to the Gas Cooling Tower (GCT is a power intensive pollution control equipment having high electrical load) where it would get cooled by spray water to about 200^0C. After the implementation of CPP the gas will be cooled in WHRB. The operation of CPP would reduce the energy consumption by decreasing the energy requirement of the gas-cooling tower. Reducing energy requirement the project is going to reduce an equivalent amount of coal consumption that would have been required to meet the future additional capacity requirement of thermal power plants.	The project activity is a step towards Coal Conservation.

SL. NO	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
B	CATEGORY: ENVIRONMETAL – AMBIENT AIR QUALITY	
1.	• JBSL being a Sponge Iron (DRI) making company generates hot dusty gas from rotary kiln. Company already had an elaborate gas-cleaning tower inclusive of multi field Electrostatic Precipitator (ESP), ID fan, Stack etc. The only change in the system during the project will be the replacement of Gas Conditioning Tower (GCT) to Waste heat recovery Boiler for generation of power. By the project activity exit gas temperature in atmosphere will be reduced without any change in the gas cleaning system. The project will not create any additional pollutant in the exit gas of the stack since it will be driven by an unfired Waste Heat Recovery Boiler. The ESP will be designed to limit the dust concentration below 150 mg/ Nm^3 at the outlet of ESP. • The ambient air quality in and around the JBSL factory will expected to be found well within the statutory limits. (as per the design). There will be no variations in the AAQ data after the project execution and the SPM values too will be well within the limits. All other ambient air quality parameters i.e. SO_2, NOx, CO, HC concentrations will also remain below the West Bengal Pollution Control Board standards. Therefore we can conclude the project activity will have no negative impacts on the ambient air quality of the area.	—

SL. NO	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS

SL. NO	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
C.	CATEGORY: ENVIRONMENTAL – AIR EMISSIONS	
	SUB CATEGORY: THERMAL POLLUTION	
1.	The project activity will utilize the heat content of the gases and thereby reduce heat energy release to atmosphere either as hot air emissions or as hot wastewater emissions from the Gas Cleaning Tower. Presently the temperature of the waste gas at the ABC out let is 950 – 1000^{0}C and then in the gas cleaning tower the spray water reduces the temperature of the waste flue gas before it enters the ESP. Presently i.e. in the absence of the project due to the absence of the implementation of WHRB the hot gases are released to atmosphere. Therefore the project activity will reduced thermal Pollution as well as the loss of heat energy to a great extent. The heat energy, which is currently get lost, will be converted to electrical energy in the after project scenario. The stack emission temperatures in the after project scenario will also found to be lower.	The WHRB will recover a part of the heat content of the waste gas to generate steam, which will further generate electricity. As the gas will come out from WHRB and finally pass through ESP the temperature of the outlet gas will fall to 175^{0}C from earlier 220^{0}C.
	SUB CATEGORY: SPM & DUST REDUCTION	
2.	As a result of the project activity, air pollution from JBSL will be reduced due to a better air pollution control mechanism. Therefore there has been a marked reduction in air pollution levels. However all the SPM emission values before and after the project execution would be well within the statutory limits of 150mg/Nm^3 (as given by West Bengal Pollution Control Board regulations).	Presently the waste gases coming out of the ABC are passed through the GCT followed by a multi-field ESP to meet the pollution control norms of SPM level of 150mg/Nm3. In terms of meeting the SPM standards the proposed project activity will be more efficient in the sense that the WHRB in CPP will reduce the temperature of the waste gas around 180 degree C at which the ESP operates with maximum efficiency. A high collection efficiency (99.714%) of ESP will ensure SPM levels less than 150 mg/ Nm3 in the stack. The stack height is 50 m, which will further help, in fast dispersion of pollutants into the atmosphere, thus, reducing their impacts in the vicinity of the project area.

SL. NO	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
3.	The impact due to construction will, however, be temporary. The impact will be confined to the project boundaries.	Sprinkling of water on roads and construction site, proper upkeep of and maintenance of vehicles, providing sufficient vegetation etc. are some of the measures, which would greatly reduce the impacts during the construction phase.
	SUB CATEGORY: CO_2 REDUCTION & OTHERS	
4.	By displacing electricity demand on the grid, the project will reduce emissions related to coal fired/ Thermal power production, which include carbon dioxide, sulphur di oxides and particulates. The total estimated amount of carbon-di-oxide reduction in the 10- year crediting period is 587720 tons.	—
5.	The project activity will also reduce the adverse impacts on air quality related to transportation of coal and coal mining that would have been required to meet the additional capacity requirement of thermal power plants.	—
6.	During the shutdown period of the plant an **auxiliary stack** on top of After Burning Chamber (ABC) will be provided for diverting the flue gas from ABC to atmosphere. The flue gas from the kilns will be directly routed to the ESP before discharging into environment.	During the maintenance phase of the waste heat recovery power plant a Gas Conditioning Tower (GCT) will cool the flue gas before passing through ESP.

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
D	CATEGORY: WASTE WATER GENERATION	

1.	(i) Water for power plant will be mostly used for: • As coolant for condensing the bulk of steam collected. • For slurry making in dust disposal system. • Demineralized water for boiler make-up, drinking, sanitary, fire fighting etc. (ii) There will be a Reverse Osmosis (RO) based water treatment plant to cater to make-up water requirement of steam generator turbine cycle. In the water treatment plant, acidic and alkaline effluents will be generated: • During regeneration of the cation/ anion and the mixed bed exchangers. • In the demineralised water treatment plant (DM plant) acidic and alkaline effluents will be generated during the regeneration of cation /anion and mixed bed exchangers. The effluent from wastewater treatment plant will be led into a properly sized impervious, neutralization pit. Normally these effluents are self-neutralizing but provision has been made in the design for dosing lime/acid into the neutralization pit to ensure proper pH value before it is being sent to the effluent treatment pond which forms a part of the power plant effluent disposal system. (iii) **Waste Water Treatment:** Wastewater will be generated from the effluents of water treatment plant, steam generator blow down and sewages from various buildings in the plant.	(i) In the after project scenario the water cooled condensing system will be removed by air cooled condensing system to reduce the generation of waste water. (ii) The effluents from the RO water treatment plant will be led into a properly sized impervious, neutralization pit of 15-cu.m capacity. Normally these effluents are self neutralizing but provision will be made for dosing lime into the neutralization pit to ensure a sufficiently high PH value before these effluents get disposed. (iii) Waste water treatment for the plant will be based on discharge of various wastewaters to ponds for clarification and filtration. Oily water will be treated separately to remove oil/ grease before discharge into effluent ponds.
SL. NO.	**ENVIRONMENTAL IMPACTS & BENEFITS**	**MITIGATION MEASURES/ REMARKS**
D	CATEGORY: WASTE WATER GENERATION	

2.	Additional manpower for the project activity will contribute to organic pollution load but the quantity addition is going to be very low.	This is taken care of by well-designed toilets and soak pit facilities available.

SL. NO.	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
E	CATEGORY: ENVIRONMENTAL – GROUND WATER STATUS	
1.	The primary source of water for the plant will be bore well water and DVC river water brought by tanker lorries. However, there will not be any significant change in the physico-chemical parameters regarding the ground water quality of the region.	—

SL. NO	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
F	CATEGORY: ENVIRONMENTAL – SOIL	
1.	The impacts on soil due to the project are negligible and were restricted to the construction phase. During site preparation, negligible amount of soil movement was involved due to site leveling operation and construction of the facility. The soil analysis reports after project execution too indicate that there has been no soil contamination due to the project activity.	These impacts have been stabilized during the operational phase.

SL. NO	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
G.	CATEGORY: ENVIRONMENTAL – SOLID WASTE GENERATION	
1.	1. The bulk of the solid wastes is generated from dusts containing unreacted iron ore and coal ash. There is no additional solid waste generation from the project activity. There is no problem associated so far with the collection, handling and transportation of solid wastes. Also there is no further pollution risk of air, water or soil at the place of disposal of solid wastes. 2. Presently i.e. in the before project scenario the gas after getting cooled at GCT is allowed to enter to the ESP for cleaning before discharging to atmosphere and the waste ESP dust is having approximately 15% fixed carbon. However, in the after project scenario the gas will pass through WHRB followed by ESP and carbon content in the ESP discharge dust drastically will be reduced to 3% (max). This reduction in the carbon content will enable to use the ESP dust to make fly ash brick. 3. The fly ash in a coal based sponge iron plant & thermal power plant is a common problem since it creates air pollution, water pollution and land contamination and this fly ash coming out of ESP does not have any market value.	There is a dump yard within the plant boundary meant for proposed disposal & treatment of plant sludge. Fly ash collected from the ESP hoppers and the air heater hoppers and the ash collected from the furnace bottom hoppers, which is also dry, can be used for land filling, cement or brick manufacturing. The estimated amount of ash quantity generated from all the boilers will be 42,000 MT/annum.

SL. NO	ENVIRONMENTAL IMPACTS & BENEFITS	MITIGATION MEASURES/ REMARKS
H.	CATEGORY: ENVIRONMENTAL – NOISE GENERATION	
1.	The equipments used in the project will be designed and other noise abatement measures will seriously be taken in such a way so as to keep the noise level below 85 to 90 db(A) as per the requirement of Occupational Safety and Health Administration (OSHA) Standards.	• The plant and equipment used will be designed and specified with a view to minimize noise pollution. • Employees in high noise areas will be provided with ear protection devices.

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. This project activity in turn has positive environmental impacts and the environmental clearance has been received. The Heat Recovery Based Power Plant with ESP is a cleaner and more energy efficient air pollution control measure as compared to the Gas Conditioning Tower technology. The project activity is not polluting and the impacts associated with the project activity are insignificant. Environmental Clearance documents from relevant Government Departments are available with the project proponent and can be shown on request.

SECTION G. Stakeholders' comments

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

JBSL's corporate policy incorporates the following stakeholder consultation aspects:

- Information will be provided to stakeholders in such a way that they clearly understand who is consulting and why, the way in which decisions will be made (and by whom) and the type of consultation to be undertaken in particular cases.
- JBSL prefers open consultation with relevant stakeholders
- Targeted consultation is conducted as felt appropriate
- Comments from stakeholders are taken into consideration and is given due weightage in the company's course of action
- JBSL holds an annual consultative stakeholder forum to gather issues that may need to be addressed by a socially responsible corporate citizen like JBSL.

Identification of stakeholders:

JBSL proposes to implement a 9 MW waste heat recovery power plant at their sponge iron factory premise. The project will use the heat content of the waste gases as a fuel. The GHG emissions of the combustion process, mainly CO_2, will be sequestered representing a cyclic process. So the project leads to zero net GHG on-site emissions. The stakeholders identified for the project are as under from among government and non-government parties involved at various stages.

- Elected body of representatives administering the local area (village *Panchayat*)
- West Bengal Electricity Regulatory Commission (WBERC)
- West Bengal Renewable Energy Development Agency (WBREDA)
- Indian Renewable Energy Development Agency (IREDA)
- UCO Bank
- Dishergarh Power Supply Company Limited(DPSCL)
- West Bengal Pollution Control Board (WBPCB)
- Environment Department, Government of West Bengal
- Ministry of Non Conventional Energy Sources (MNES)
- Non-Governmental Organisations (NGOs)
- Consultants

G.2. Summary of the comments received:

Stakeholders Involvement

The village Panchayat /local elected body of representatives administering the local area is a true representative of the local population in a democracy like India. Hence, their comments on the project activity are necessary. JBSL has received their opinions for the project. Local population comprises of the local people in and around the project area. The roles of the local people are as the beneficiary of the project. In addition to this, it will also include local manpower working at the plant site. Since, the project results in environmental benefits and will provide good direct employment opportunities the local populace holds positive opinion about the project.

The project will not cause any major displacement of the local population. The project will be set up on a barren land inside the factory premises. Thus, the project will not cause any adverse social impacts on local population rather will help in improvising their quality of life.

West Bengal Pollution Control Board (WBPCB) and Environment Department of Government of West Bengal have prescribed standards of environmental compliance and monitor the adherence to the standards. The project has received the Consent to Establish (or No Objection Certificate (NOC) from WBPCB before the commissioning of the plant.
Indian Renewable Energy Development Agency (IREDA – A Government of India Enterprises) has done the financial appraisal of the of the project activity. IREDA invited the industries, which have waste sources, to utilise the same for power generation by availing IREDA's financial assistance. The Government of India, through Ministry of Non-conventional Energy Sources (MNES), has been promoting energy conservation, demand side management and viable renewable energy projects including wind, small hydro and bagasse cogeneration / bio-mass power.

Project consultants were involved in the project 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, one of the stakeholders have supplied the equipments as per the specifications finalized for the project and are responsible for successful erection & commissioning of the same at the site.

Stakeholders' Comments

JBSL has already received the major necessary approvals and consents from various authorities, required for project implementation like West Bengal Electricity Regulatory Commission and West Bengal Pollution Control Board. They have also received a positive response from the Village Panchayat and other stakeholders for the project activity.

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

The relevant comments and important clauses mentioned in the project documents/clearances like Detailed Project Report (DPR), environmental clearances, local clearance etc. were considered while preparation of CDM project development document.

The JBSL representatives met with the various stakeholders for appraisal and support. They were commended for their voluntary action toward environmental development and energy efficient measures undertaken in this project involving generation of electricity by utilising process waste gases with associated energy efficiency and positive environmental effects.

As per UNFCCC requirement this Project Design Document (PDD) will be published at the validator's web site for public comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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URL:	-
Represented by:	Mr. A. K. Gulati
Title:	Director (Technical)
Salutation:	Mr.
Last Name:	Gulati
Middle Name:	K
First Name:	A
Department:	Technical
Mobile:	-
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Personal E-Mail:	-

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Till now funding from any Annex I country is not available.

Annex3

BASELINE INFORMATION

Determination of Carbon Intensity of Chosen Grid

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

The Current Delivery System in India and West Bengal were studied for selection of a realistic grid representing the factual scenario associated with the project activity. Relevant information/data are provided herein.

CURRENT DELIVERY SYSTEM

Indian power grid system (or the National Grid) is divided into five regional grids namely Northern, North Eastern, Eastern, Southern and Western Region Grids. The Eastern Regional Grid consists of Bihar, Jharkhand, Orissa, West Bengal, Damodar Valley Corporation (DVC) and Sikkim state sector grids. These regional grids have independent Load Dispatch Centres (LDCs) that manage the flow of power in their jurisdiction. Power generated by state owned generation units and private owned generation units would be consumed totally by respective states. However there is a deviation in the case of West Bengal Grid. The deviation has been dealt with in the following section. The power generated by central sector generation plants will be shared by all states forming part of the grid in fixed proportion. This central share amount has been allocated for the West Bengal State.

GRID SELECTION

Dishergarh Power Supply Company Limited (DPSCL) system: The project activity draws power from DPSCL grid which is a private Generation cum Distribution Company operating in the area. The DPSCL generation system consists mainly of two coal based generating stations at Chinakuri (30MW) and Dishergarh (10MW). The present peak load of the company is 122 MW. Around 32% of the load is met from own generation, while the balance is met through imports of power from DVC and WBSEB. Imports of power take place from DVC at four points spread over its licensed area and from WBSEB at one point. The Company is involved in supply of power to WBSEB consumers at 18 different points in its licensed area spread over nearby Asansol / Raniganj Coal & Industrial belts. ***For calculations of emission factor, the***

power drawn from own generating stations of DPSCL alone is considered and not the import of power from WBSEB or DVC to avoid double counting.

WBSEB system:

The WBSEB has the primary responsibility for the supply of electricity that may be required within the state and for transmission and distribution of the same in most efficient manner.

The transmission and distribution system in West Bengal has access to electricity generated from:

- WestBengal's share from generating stations set up by the Central Government ["Central Sector Plants"]

The central government (Government of India) owns power generation plants managed by Government of India Enterprises like National Thermal Power Corporation Ltd (NTPC), National Hydroelectric Power Corporation Ltd (NHPC), Damodar Valley Corporation (DVC) and Power Grid Corporation of India (PGCIL) Chukka. ***However, power drawn from DVC system is excluded in the generation mix of WBSEB to avoid double counting.***

Power generated by the central sector is being fed to the grid, which is accessible to all states in the region. The power generated by central sector generation plants is shared by all states forming part of the grid in fixed proportion as mentioned above. As per the Availability Based Tariff (ABT) Notification the central sector power generating units would operate at a plant load factor of 80% and West Bengal state has to make payments for its total share in the central sector. Therefore West Bengal would have to draw its allocated share from the central sector generating stations.. In India, nuclear power generation is allowed only by Central Sector Organisations. However West Bengal has no share in the nuclear power generating stations. Therefore the power mix may be thermal, hydro and wind.

- West Bengal's State owned generation[24]

The state sector in West Bengal comprises of three entities namely West Bengal State Electricity Board (WBSEB), West Bengal Power Development Corporation Limited (WBPDCL) and Durgapur Projects Limited (DPL). WBSEB currently has a total generating capacity of 264.01 MW (100 MW-Gas and 164.01MW Hydro) and is primarily into

[24] Refer WBSEB Annual Report 2003-04 and http://cea.nic.in/ge_re/2004-05/contents.pdf

transmission and distribution. WBPDCL is in the business of electric power generation and supply and has a total generating capacity of 2910 MW.

DPL operates a power plant with a capacity of 395 MW and is engaged in all the three functional areas of a power utility – the generation, transmission and distribution. The company is generating power from its six power units and distributing power at 11KV in its licensed area at Durgapur and the surplus power transmitted to WBSEB Grid.

- West Bengal's Private owned generation

In addition to the State Sector, the other entities operating in West Bengal as Private Companies are CESC Limited (with a generating capacity of 1155 MW) and Dishergarh Power Supply Company Limited (with a generating capacity of 40MW). ***However, power drawn from DPS system is excluded in the generation mix of WBSEB to avoid double counting.***

Also Power generated from CESC is not dispatched into the WBSEB transmission systems. They have separate jurisdiction of operation and therefore do not contribute to the grid mix of the WBSEB. Therefore CESC has not been considered for estimation of the baseline carbon intensity of the grid mix of WBSEB.

Damodar Valley Corporation (DVC):

DVC, jointly owned by Government of India, Government of West Bengal and Government of Bihar is a multipurpose river valley project set up under Act No. XIV of 1948, for the unified development of Damodar valley area. The generation mix of DVC consists of 2535 MW-coal, 82.5MW – gas and 144 MW-hydro as on 2003-04. DVC supplies bulk power at 33 KV, 132 KV and 220 KV at 122 different locations to a number of industries and distributing licensees[25].

[25] http://www.dvcindia.org/power/plants.htm

Choice of Grid

The present Generation mix statistics for DPSCL, DVC and WBSEB collective grid is given in Table 4 below.

Table 4 – Generation Statistics for DPSCL, WBSEB and DVC for the year 2003-04.

Name of generating Company	Installed Capacity (MW)	Total Power Generated/ Available in 2003-04 (MU)
Dishergarh Power Supply Company	40	220.80
WBSEB*	3569.01	16069.04
DVC	2761.5	10076.72
Total	6370.51	26366.56

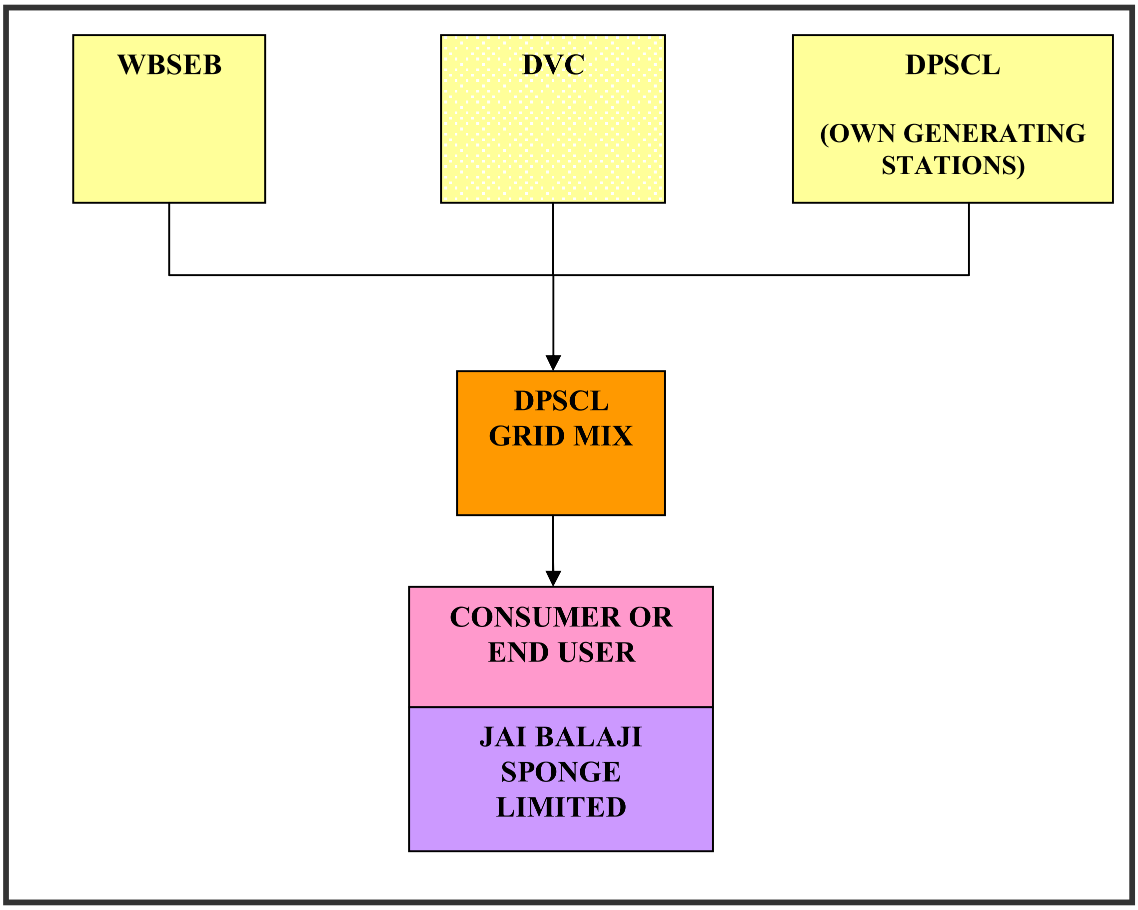
* *WBSEB is the state owned Transmission and Distribution Company. Installed Capacity figures include capacities of WBSEB and other state generating companies- WBPDCL and DPL. The power available figure in WBSEB excludes power drawn from DVC.*

The appropriate grid level for the project activity's affect on the emissions caused at the thermal power plants has been assessed based on the 'Size of the project activity'. The project activity would be saving on an average 9 MW of power and the reduced power is 0.143% of DPSCL, WBSEB and DVC grid capacity. It is too small to have a significant impact on the national grid(112,684MW) or regional grid (17249.58)[26] in terms of marginally effecting changes in the generation and dispatch system (operating margin) or delay future power projects that may be commissioned during the crediting period (build margin) in the national or eastern regional grid. Therefore, the principal effect of the project activity would be on the lowest level of the grid i.e. the carbon intensity of the DPSCL, WBSEB and DVC grid (see Figure 5 below).

We would therefore determine the carbon intensity of the grid mix which is governed by DPSCL, WBSEB and DVC in Step B below to arrive at the baseline emission factor for baseline emission calculations for the project activity's crediting period.

Figure 5: Flow Chart of Current Delivery system of DPSCL Grid Mix

[26] http://www.cea.nic.in/ge_re/2004-05/chap-2.pdf



B) Determination of the Carbon Intensity of the chosen Grid

Complete analysis of the system boundary's electricity generation mix has been carried out for calculating the emission factor of DPSCL, WBSEB and DVC collective grid as follows:

Combined Margin

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

Step 1: Calculation of Operating Margin

As mentioned above the project activity would have some effect on the Operating Margin (OM) of DPSCL, WBSEB and DVC combined Grid. The approved consolidated baseline methodology-ACM0004 requires the project proponent to calculate the Operating Margin (OM) emission factor following the guidelines in ACM0002 (Consolidated methodology for grid-connected electricity generation from renewable sources).

As per Step 1 of ACM0002, the Operating Margin emission factor(s) ($EF_{OM,y}$) is calculated based on one of the four following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch Data Analysis OM, or

(d) Average OM.

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

'Simple OM' (1a) method is applicable to project activity connected to the project electricity system (grid) where the low-cost/must run[27] resources constitute less than 50% of the total grid generation in

1) average of the five most recent years, or

2) based on long-term normal for hydroelectricity production.

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

To select the appropriate methodology for determining the Operating Margin emission factor ($EF_{OM,y}$) for the project activity, JBSL conducted a baseline study wherein the power generation data for all power sources in the project electricity system (i.e. DPSCL,WBSEB and DVC combined grid) were collected from government/non-government organisations and authentic sources. The power generation mix of combined comprises of coal based thermal power generation, gas based thermal power generation and hydro power generation. The actual generation data of combined grid was analysed for the years 1999-2000, 2000-2001, 2001-2002, 2002-2003 and 2003-2004 to arrive at the contribution of the coal, gas and hydro based power plants in the grid mix. (Refer to Table 5 given below). It was found that the average share of the hydro-based power projects over the five most recent years was lower than 50% of the total electricity generation in the grid.

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

Table 5: Power Generation Mix of DPSCL,WBSEB and DVC combined grid for five most recent years

Energy Source	1999-00*	2000-01	2001-02	2002-03	2003-04
Total Power Generation (MU)	21791.715	22681.031	23770.066	23496.835	26366.563
Total Hydro Power Generation (MU)	1284.155	1419.82375	1873.534	1830.722	2075.65
Total Thermal Power Generation(MU)	20507.36	21064.5293	21727.162	21527.043	24131.68
Other Grids(MU)	N/A	196.678	169.37	139.07	159.233
Hydro % of Total grid generation	5.8929	6.25996124	7.88190491	7.7913557	7.8722813
Thermal % of Total grid generation	94.107	92.8728912	91.4055603	91.616777	91.523799
% Other Grids of Total generation	N/A	0.86714753	0.71253483	0.5918669	0.6039202
Hydro % of Total grid generation - Average of the five most recent years – 7.13 %					
Source: DPSCL, DVC, WBSEB and CEA information					

** Data for 1999-2000 excludes power from Jaldhaka and Teesta (WBSEB Hydro), DVC Purchase and DPSCL figures since data was not available (N/A) at the time of PDD submission.*

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

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

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) *y*:

- A 3-year average, based on the most recent statistics available at the time of PDD submission, or
- The year in which project generation occurs, if $EF_{OM,y}$ is updated based on ex post monitoring.

JBSL has calculated the OM emission factor as per the 3-year average of Simple OM calculated based on the most recent statistics available at the time of PDD submission.

Table 6 gives the detail of power generation mix of DPSCL for 2001-02, 2002-03 and 2003-2004.

Table 6– Power Generation Mix of DPSCL own generating stations for 2001-02, 2002-03 and 2003-04			
Source	**Generation (MU)**		
	2001-02	**2002-03**	**2003-04**
Coal (Chinakuri TPS and Dishergarh TPS)	224.87	216.63	220.8
Total	**224.87**	**216.63**	**220.8**
Source: http://www.dpscl.com/Supply_of_Powers.htm			

Table 7 gives the detail of power generation mix of WBSEB grid for 2001-02, 2002-03 and 2003-04 under State jurisdiction (excluding power drawn from DPSCL). The identified plants have been categorically differentiated on the basis of their fuel source used for generation.

Table 7 – Power Generation Mix of WBSEB grid from the Own Generating Stations, purchase from other State and Private Generating Stations (2001-02, 2002-03 and 2003-04)					
Sl. No.	**Energy Source**		**Own Generation/ Purchase in MU (2001-2002)**	**Own Generation/Purchase in MU (2002-2003)**	**Own Generation/Purchase in MU (2003-2004)**
I.	**West Bengal State Sector**				
1	Thermal (Coal Based)				
	WBPDCL	Kola ghat	10334.67	12411.8	10264.81
		Bakereswar			
		Bandel			
		Santhandih			
2	DPL		350.08	344.38	499.11
A	**Subtotal – Thermal Coal Based**		**10684.75**	**12756.18**	**10763.92**
	Thermal (Gas Based)				
1	WBSEB	Kasbha GTPS	0.629	0.163	0
		Haldia GTPS	0	0.024	0
		Siliguri GTPS	0	0	0
B.	**Subtotal-Thermal Gas Based**		**0.629**	**0.187**	**0**
	Hydro				
1	WBSEB	Jaldhaka	137.273	124.09	160
		Rammam	239.275	221.348	240
		Teesta Canal Falls	169.37	163.979	93
C.	**Subtotal-Hydro Based**		**545.918**	**509.417**	**493**

II.	**West Bengal Private Sector**			
1	CESC	0	0	0
2	DPSCL (coal)	Excluded		
D.	**Subtotal-Private Sector**	**0**	**0**	**0**
E.	**State Sector Total**	**11231.297**	**13265.784**	**11257.107**
Source: WBSEB Annual Report 2001-02,2002-03 and CEA General Review 2003-04				

Table 8 gives the detail of power generation mix of WBSEB grid for 2001-02, 2002-03 and 2003-04 under Central jurisdiction (excluding power drawn from DVC). The identified plants have been categorically differentiated on the basis of their fuel source used for generation.

Table 8 – Power Generation Mix of WBSEB grid from the Central Generating Stations (2001-2002,2002-03 and 2003-04)

Sl. No.	**Energy Source**		**Purchase in MU (2001-2002)**	**Purchase in MU (2002-2003)**	**Purchase in MU (2003-2004)**
I.	**West Bengal's Share in Central Sector Schemes**				
A.	**Thermal Coal Based**				
1	NTPC Thermal (Coal Based)				
	NTPC	Farakka T.P.S	1875.82	516.75	3764.46
		Kahalgaon T.P.S			
		Talcher T.P.S			
A.	**Subtotal-Thermal (Coal) Based**		**1875.82**	**516.75**	**3764.46**
	Thermal Gas Based				
1	NEEPCO	Assam GBPP	148.86	173.157	113.34
2		Agartala GBPP			
B.	**Subtotal Thermal (Gas) Based**		**148.86**	**173.157**	**113.34**
C	**Hydro Based**				
1	PGCIL Hydro				
	PGCIL/ PTC	Chukha H.P.S.	525.89	486.59	695.21
		Kurichhu H.P.S.	29.04	99.81	
2	NHPC	Rangit H.P.S.	139.48	127.47	133.45
3	NEEPCO	Kopili H.P.S	70.136	45.838	105.66
		Doyang H.P.S			
		Ranganadi H.P.S			

C	**Subtotal - Hydro Based**	**764.546**	**760.185**	**934.32**
D.	**Central Sector Total**	**2789.226**	**1450.092**	**4812.12**
Source: WBSEB Annual Report 2001-02,2002-03 and CEA General Review 2003-04				

The generation figures for DVC from own generating stations under different sources of fuel are shown in Table below.

Table 9– Power Generation Mix of DVC from own generating stations (2001-02, 2002-03 and 2003-04)			
Source	**Generation (MU)**		
	2001-02	**2002-03**	**2003-04**
Coal	7529.104	7425.82	8428.74
Gas	17.720	7.33	5.67
Hydro	288.206	291.12	300.86
Total	**7835.03**	**7724.27**	**8735.27**
Source: DVC Annual Report 2001-02; CEA General Review 2002-03 and 2003-04			

Power generation Mix of DVC due to purchase of power from other generating stations or grids is shown in Table 10.

Table 10– Power Generation Mix of DVC grid due to Purchase of Power - excluding WBSEB (2001-02,2002-03 and 2003-04)					
Sl. No.	**Energy Source**		**Purchase in MU (2001-2002)**	**Purchase in MU (2002-2003)**	**Purchase in MU (2003-2004)**
A.	**Thermal Coal Based**				
1	NTPC Thermal (Coal Based)				
	NTPC	Farakka T.P.S	1245.369	414	763.8
		Kahalgaon T.P.S			
		Talcher T.P.S			
2	Private Thermal (Coal Based)				
	Tata Power	Jojobera T.P.S	0.04	16.989	70.95
A.	**Subtotal-Thermal (Coal) Based**		**1245.409**	**430.989**	**834.75**
B	**Hydro Based**				
1	PGCIL Hydro				
	PGCIL /	Chukha H.P.S.	174.131	116.6	155.4

	PTC	Kurichhu H.P.S.	31.413	96.7	127
2	NHPC	Rangit H.P.S.	69.32	56.7	65.07
B	**Subtotal-Hydro Based**		**274.864**	**270**	**347.47**
C	Other Grids				
1	JSEB		113.817	136.563	146.965
2	GRIDCO		55.553	2.507	12.268
C	**Subtotal - Other Grids**		**169.37**	**139.07**	**159.233**
D.	**DVC Purchase Total**		**1689.643**	**840.059**	**1341.453**
Source: DVC Annual Report 2001-02, CEA General Review2002-03 and 2003-04					

Calculation of Operating Margin Emission Factor

The following table gives a step by step approach for calculating the Simple Operating Margin emission factor for DPSCL, DVC and WBSEB for the most recent 3 years at the time of PDD submission i.e.2001-2002, 2002-2003 & 2003-2004.

Table 11: Calculation of Simple Operating Margin

Parameter	2001-2002		2002-03		2003-04	
Generation Mix					BASE-YEAR	
Sector	MU	%	MU	%	MU	%
DPSCL						
DPSCL own generation (coal)	224.870	0.946	216.630	0.922	220.800	0.837
WBSEB						
Coal Based (Central) excluding DVC	1875.820	7.892	516.750	2.199	3764.460	14.277
Coal Based (State)	10684.750	44.950	12756.180	54.289	10763.920	40.824
Coal Based (Private) excluding DPSCL	0.000	0.000	0.000	0.000	0.000	0.000
Gas Based (Central) excluding DVC	148.860	0.626	173.157	0.737	113.340	0.430
Gas Based (State)	0.629	0.003	0.187	0.001	0.000	0.000
Hydro (Central) excluding DVC	764.546	3.216	760.185	3.235	934.320	3.544
Hydro (State)	545.918	2.297	509.417	2.168	493.000	1.870
DVC						
Coal based(Own Generation)	7529.104	31.675	7425.820	31.603	8428.740	31.968

Coal based(Purchase)	1245.409	5.239	430.989	1.834	834.750	3.166
Gas Based(Own Generation)	17.720	0.075	7.330	0.031	5.670	0.022
Hydro(Own Generation)	288.206	1.212	291.120	1.239	300.860	1.141
Hydro(Purchase)	274.864	1.156	270.000	1.149	347.470	1.318
Import from EREB(JSEB,GRIDCO excluding WBSEB)	169.370	0.713	139.070	0.592	159.233	0.604
Total generation	23770.066	100.000	23496.835	100.000	26366.563	100.000
Net generation excluding Hydro, Nuclear, CPP & RE plants	21727.162	91.406	21527.043	91.617	24131.680	91.524
% of generation by coal out of total gen.excl. Hydro, Nuclear,CPP & RE plants	21559.953	99.230	21346.369	99.161	24012.670	99.507
% of generation by gas out of total gen.exl. Hydro, Nuclear, CPP & RE plants	167.209	0.770	180.674	0.839	119.010	0.493
Estimation of Baseline Emission Factor (t CO2/MU)						
Simple Operating Margin	_	_	_	_	_	_
Fuel 1: Coal	_	_	_	_	_	_
Avg. efficiency of power generation with coal as a fuel, %	36.081		36.317		36.228	
Avg. calorific value of coal used, kcal/kg	3820.000		4171.000		3820.000	
Estimated coal consumption, tons/yr		13452541.250		12119154.104		14922142.458
Emission factor for Coal (IPCC),tonne CO2/TJ	96.100		96.100	35.007	96.100	
Oxidation factor of coal (IPCC standard value)	0.980		0.980		0.980	

COEF of coal (tonneCO2/ton of coal)		1.503		1.642		1.503
Fuel 2: Gas						
Avg. efficiency of power generation with gas as a fuel, %	45.000		45.000		45.000	
Avg. calorific value of gas used, kcal/kg	10000.000		10000.000		10000.000	
Estimated gas consumption, tons/yr		31955.498		34528.809		22744.133
Emission factor for Gas (as per standard IPCC value)	56.100		56.100		56.100	
Oxidation factor of gas (IPCC standard value)	0.995		0.995		0.995	
COEF of gas(tonneCO2/ton of gas)		2.333		2.333		2.333
EF (OM Simple, excluding imports from other grids), tCO2/MU		934.295		927.908		931.869
EF (EREB) tCO2/MU	1190.000		1190.000		1190.000	
EF (OM Simple), tCO2/MU		936.273		929.590		933.561
Average Simple OM, tCO2/MU	**931.357**					
Simple OM, kg CO2 / kWh	**0.9313**					

Step 2: Calculation of Build Margin

The project activity would have some effect on the Build Margin (BM) of the DPSCL, WBSEB and DVC combined grid. The approved consolidated baseline methodology-ACM0004 requires the project proponent to calculate the Build Margin (BM) emission factor following the guidelines in ACM0002 (Consolidated methodology for grid-connected electricity generation from renewable sources).

As per Step 2 of ACM0002, the Build Margin emission factor ($EF_{BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2/MU) of a sample of power plants. The methodology suggests the project proponent to choose one of the two options available to calculate the Build Margin emission factor $EF_{BM,y}$

Option 1:

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

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

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

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

Option 2:

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

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

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

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

JBSL has adopted Option 1, which requires the project participant to calculate the Build Margin emission factor $EF_{BM,y}$ ex ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m should consist of either (a) the five power plants that have been built most recently or (b) the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MU) and that have been built most recently. Project participants are required to use from these two options that sample group that comprises the larger annual generation. As per the baseline information data the option (b) comprises the larger annual generation. Therefore for JBSL project activity the sample group m consists of (b) the power plants capacity additions in the electricity system for 2003-04 that comprise 20% of the system generation (in MU) and that have been built most recently.

The following Table presents the selection of most recent plants used to determine the BM emission factor for the most recent year 2003-04.

Table 12: Power Plants considered for BM calculation

Sl. No.	Year	Plant	MW	Own Generation/Purchase for 2002-03 (MU)
1	2001	Bakreswar U-2	210	4311
2	2001	Bakreswar U-3	210	
3	2000	Bakreswar U-1	210	
4	2000	NEEPCO(hydro)	730	105.66
5	2000	NEEPCO(gas)	375	113.34
6	1999	PGCIL Chukha(hydro)	336	745.27
Total				**5275.275152**
20% of Gross Generation- MU				**5273.31**
Coal based				**4311**
Gas Based				**113.34**
Hydro based				**850.9351515**
% of generation by coal out of total				**81.72085581**
% of generation by gas out of total				**2.148513523**
% of generation by hydro out of total				**16.13063067**

Built Margin Emission Factor is calculated for most recent year (2003-04) as shown in Table 13.

Table 13: Built Margin Emission Factor Calculation

Built Margin Factor 2003-04	MU	%
Gross Generation for 2003-04	**26366.563**	**100**
Considering 20% of Gross Generation	**5273.313**	**20**
Sector		
Total Coal Based	4311.000	81.721
Total Gas Based	113.340	2.149
Total Hydro Based	850.935	16.131
Total generation	**5275.275**	100.000
Net generation excluding Hydro, Nuclear, other grid & RE plants	4424.340	83.869
Net generation by coal out of total gen.excl. Hydro, Nuclear,other grid & RE plants	4311.000	97.438
Net generation by gas out of total gen.exl. Hydro, Nuclear, other grid & RE plants	113.340	2.562
Built Margin		
Fuel 1 : Coal		
Avg. efficiency of power generation with coal as a fuel, %	36.228	
Avg. calorific value of coal used in kcal/kg	3820.000	
Estimated coal consumption, tons/yr		2678975.563
Emission factor for Coal (IPCC),tonne CO2/TJ	96.100	
Oxidation factor of coal (IPCC standard value)	0.980	
COEF of coal (tonneCO2/ton of coal)		1.503
Fuel 2: Gas		
Avg. efficiency of power generation with gas as a fuel, %	45.000	
Avg. calorific value of gas used, kcal/kg	10000.000	
Estimated gas consumption, tons/yr		21660.533
Emission factor for Gas (IPCC value) tonne CO2/TJ	56.100	
Oxidation factor of gas (IPCC standard value)	0.995	
COEF of gas(tonneCO2/ton of gas)		2.333
EF(Built Margin), tCO2/MU		**921.764**
EF(BM) kg CO2 / kWh		**0.9217**

Step 3: Combined Margin

Therefore the NET BASELINE EMISSION FACTOR as per COMBINED MARGIN = (OM + BM)/2 = (0.9313+0.9217) / 2 = 0. 927 kg CO_2 / kWh

C) Leakage

There is no considerable leakage potential identified from the project activity. There is no requirement to procure additional fuel and therefore no transportation liabilities faced. The project operates solely on waste heat recovery from the sponge kiln flue gases. Indirect GHG emissions outside the project boundary only arise from transportation related to operation of the project. The same is negligible compared to the emission reductions that accrue from the project activity. Waste heat energy of flue gas available from Sponge Iron kiln of JBSL facility situated beside the project unit is utilized. Other infrastructure requirements for the project are also met from the JBSL facility.

D) Emission Reductions

Based on the Combined Margin Method detailed above, (see section E and Appendix III for calculations) the project activity will reduce **522395** tonnes of CO_2 in 10 year of credit period. Since, the project activity is not a baseline scenario, without project activity there will be emission as per the carbon intensity of the grid (**0.927 kgCO_2/kWh**). Therefore the project activity implementation reduces the energy requirement of the devices in the project boundary and its associated emission reductions.

Annex 4 – MONITORING PLAN

Introduction: JBSL's 12 MW Captive Power Plant consists of 7 nos. of 5 TPH Waste Heat Recovery Boilers which utilize waste heat from the seven sponge iron kilns as energy source, a 30 TPH Fluidised Bed Combustion Boiler that uses coal rejects (coal char and coal fines) from sponge iron process as fuel, a common steam header and 12MW turbo generator (TG) set as shown in Fig.6 below. WHRB was installed by JBSL to improve the energy efficiency of the manufacturing process and FBC was installed to avoid pollution problems associated with disposal of coal rejects as required by pollution control norms. The entire CPP will be commissioned in September 2005.

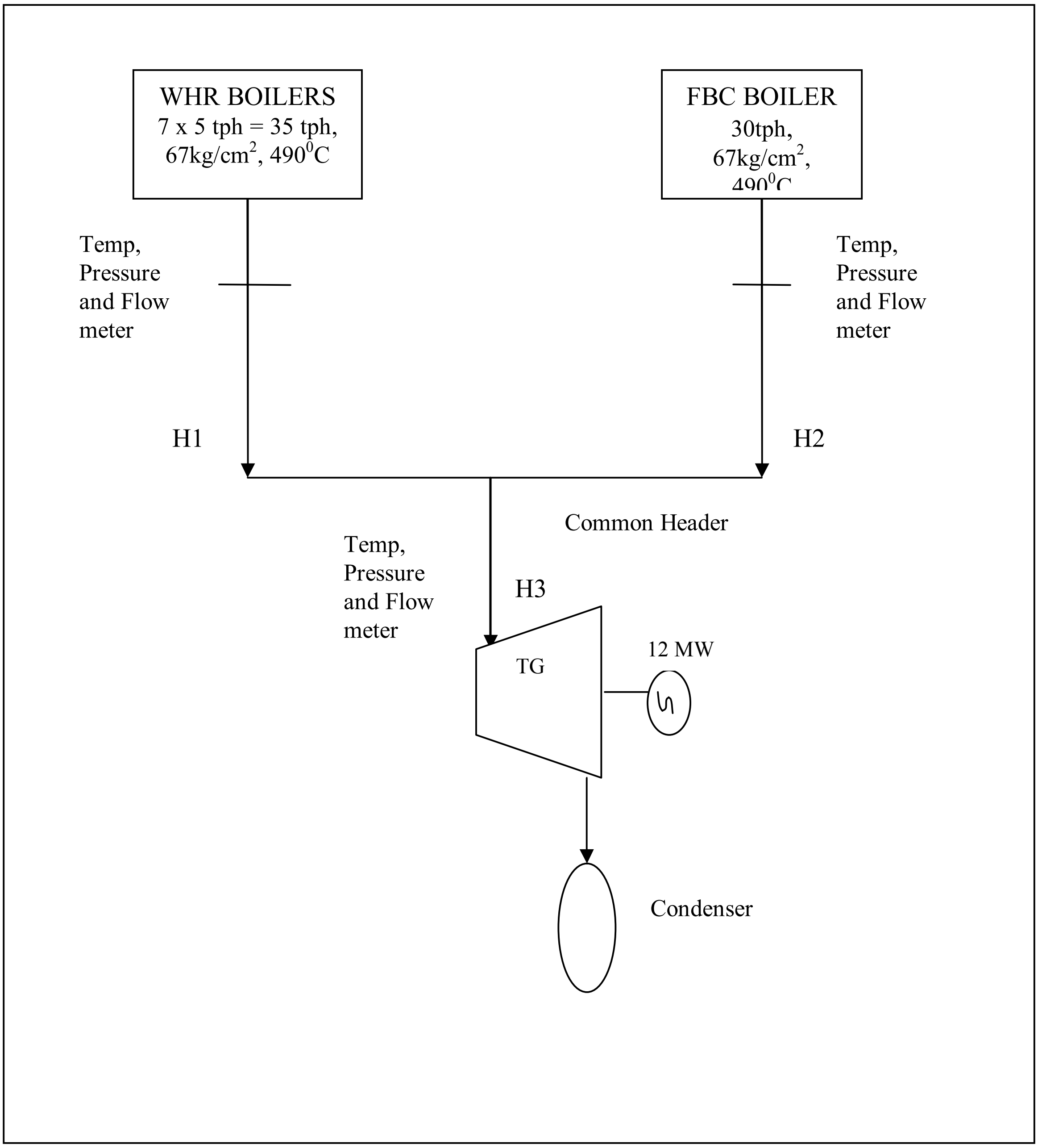


Fig 6: Schematic Diagram of JBSL's CPP

The working parameters of various equipments and location of Steam Flow meters, pressure and temperature gauges are as indicated in the diagram. The pressure and temperature parameters for both WHR and FBC steam are the same i.e. 67 kg/cm^2 and 490±5^{0}C. As working steam parameters of pressure and temperature are identical for both the boilers, the only dependent variable for calculation of waste heat power would be the steam flow from respective boilers. However, to maintain transparency in calculating WHR power following monitoring methodology is used.

Calculation of Waste Heat Power: The waste heat power generated is calculated thermodynamically on the basis of Total Enthalpy (steam enthalpy per unit x steam flow) of

WHR steam as a percentage of Total Enthalpy of Steam fed to the common header from both WHR and FBC.

The calculation is shown as follows:

A.) Total Enthalpy of Steam from WHRB in kCal (H_1)

= (Enthalpy of steam at boiler outlet in kCal/kg) x (WHRB steam flow in tonnes per day)

= h_1 x S_1

The enthalpy of steam is calculated based on average temperature and pressure readings for the day and WHR steam flow per day is measured by flow meter.

B) Similarly Total Enthalpy of Steam from FBC in kCal (H_2)

= Enthalpy of steam at boiler outlet in kCal/kg x steam flow in tonnes per day

= h_2 x S_2

The enthalpy of steam is calculated based on average temperature and pressure readings for the day and steam flow from the FBC steam flow meter.

C) If $EG_{GEN\ CPP}$ is the Total Power generated by the CPP per day (in MWh) then Power Generated by Waste heat Recovery Boiler (EG_{GEN}) would be calculated as

$$EG_{GEN}\ (MWh) = \frac{EG_{GEN\ CPP} \times (H_1)}{(H_1 + H_2)} \qquad \ldots\ldots\ldots\ldots 1$$

Again, if Auxiliary Consumption for the CPP per day is $EG_{AUX\ CPP}$ (in MWh), then WHRB Auxiliary Consumption (EG_{AUX}) will calculated in the same ratio as

$$EG_{AUX}\ (MWh) = \frac{EG_{AUX\ CPP} \times (H_1)}{(H_1 + H_2)} \qquad \ldots\ldots\ldots\ldots 2$$

Therefore Net Generation from Waste heat Recovery ie. project activity (1 – 2)

$$EG_y\ (MWh) = (EG_{GEN} - EG_{AUX}) \qquad \ldots\ldots\ldots\ldots 3$$

An. D1 – Total Enthalpy from WHRB steam									
ID No.	Data type	Data variable	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)	For how long is archived data to be kept?	Comments
1. T_1	Quantitative	Avg. Temperature of WHR steam before Common header	^0C	Online Measurement	Continuously	100%	Electronic/ paper	Credit Period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be responsible for calibration of the meters
2. P_1	Quantitative	Avg. Pressure of WHR steam before Common header	kg/ cm^2	Online measurement	Continuously	100%	Electronic/paper	Credit period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be responsible for regular calibration
3. h_1	Quantitative	Enthalpy	kCal/kg	Calculated	Daily	100%	Electronic/ paper	Credit period + 2 years	Noted from standard Steam table/ Mollier Diagram as per the avg. temperature and pressure for the day.
4. S_1	Quantitative	Flow of WHR Steam to Common header	tonnes per day	Calculated	Daily	100%	Electronic /paper	Credit period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be responsible for regular calibration
5. H_1	Quanti	Enthalpy of	kCal	Calculated	Daily	100%	Electronic/paper	Credit	Calculated on a daily basis

An. D1 – Total Enthalpy from WHRB steam									
ID No.	Data type	Data variable	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)	For how long is archived data to be kept?	Comments
	tative	WHR Steam		(h_1 x S_1)				Period + 2 years	

An. D2 – Total Enthalpy of Steam from FBC Boiler									
ID No.	Data type	Data variable	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)	For how long is archived data to be kept?	Comments
6. T_2	Quantitative	Avg. Temperature of WHR steam before Common header	^{0}C	Online measurement	Continuously	100%	Electronic/ paper	Credit Period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be responsible for calibration of the meters
7. P_2	Quantitative	Avg. Pressure of WHR steam before Common header	kg/ cm^2	Online measurement	Continuously	100%	Electronic/paper	Credit period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be responsible for regular calibration
8. h_2	Quantitative	Enthalpy	kCal/ kg	Calculated	Daily	100%	Electronic/ paper	Credit period + 2 years	Noted from standard Steam table/ Mollier Diagram as per the avg. temperature and pressure for the

An. D2 – Total Enthalpy of Steam from FBC Boiler									
ID No.	Data type	Data variable	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)	For how long is archived data to be kept?	Comments
									day
9. S_2	Quantitative	Flow of Steam to Common header	tonnes per day	Online measurement	Continuously	100%	Electronic /paper	Credit period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be responsible for regular calibration
10. H_2	Quantitative	Enthalpy of WHR Steam	kCal	Calculated (h_1 x S_1)	Daily	100%	Electronic/paper	Credit Period + 2 years	Calculated on a daily basis

An.D3 – WHR Power generated									
ID No.	Data type	Data variable	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)	For how long is archived data to be kept?	Comments
11. $EG_{GEN\ CPP}$	Quantitative	Total Electricity Generated by the CPP	MWh / day	Online measurement	Continuously	100%	Electronic/ paper	Credit Period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be

An.D3 – WHR Power generated									
ID No.	Data type	Data variable	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)	For how long is archived data to be kept?	Comments
									responsible for calibration of the meters
12 $EG_{AUX\ CPP}$	Quantitaive	Total Auxiliary Consumption of the CPP	MWh /day	Online measurement	Continuously	100%	Electronic / paper	Credit Period + 2 years	MONITORING LOCATION: The data will be monitored from meters at plant and DCS. Manager In-charge would be responsible for calibration of the meters
13. EG_{GEN}	Quantitative	Waste Heat Recovery Based Power	MWh /day	Calculated	Continuously	100%	Electronic/paper	Credit period + 2 years	Calculated based on the Enthalpy Ratio H1/ (H1+H2)
14. EG_{AUX}	Quantitative	Auxiliary Electric Consumption	MWh /day	Calculated	Continuously	100%	Electronic/ paper	Credit period + 2 years	Calculated based on the Enthalpy Ratio H1/ (H1+H2)

An. D4.	**Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored**

Data *(Indicate table and ID number e.g. 1. , -14.)*	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
1., -5.	Low	Yes	This data will be used for calculation of WHR steam parameters.
6.,-10.	Low	Yes	This data will be used for calculation of FBC steam parameters.
11,-14.	Low	Yes	This data is used for calculating power contributed from waste heat recovery steam generation system.

Appendix I: Abbreviations

1 Lakh	1,00,000
ABC	After Burning Chamber
BAU	Business as Usual
BEF	Baseline Emission Factor
BM	Built Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reductions
CM	Combined Margin
CO_2	Carbon di-oxide
CPP	Captive Power Plant
DCS	Distributed Control System
DPL	Durgapur Projects Limited
DPSCL	Dishergarh Power Supply Company Limited
DRI	Direct Reduction Iron
DVC	Damodar Valley Corporation
EIA	Environmental Impact Assessment
ESP	Electro Static Precipitator
FAP	Ferro Alloy Plant
FBC	Fluidized Bed Combustion
GCT	Gas cooling tower
GHG	Greenhouse Gas
GOI	Government of India
GWh	Giga Watt hour
IPCC	Intra-governmental Panel for Climate Change
IPP	Independent Power Producers
IREDA	Indian Renewable Energy Development Agency
JBSL	Jai Balaji Sponge Limited

km	Kilo metres
KP	Kyoto Protocol
KV	Kilo Voltage
KW	Kilo Watt
KWh	Kilo Watt hour
M&V	Monitoring and Verification
MkWh	Million Kilo Watt hour
MU	Million Units (1 MU = 1 Million kWh)
MNES	Ministry of Non-conventional Energy Sources
MoP	Ministry of Power
MoU	Memorandum of Understanding
MT	Metric Ton
MU	Million units
MW	Mega Watt
NOC	No Objection Certificate
OM	Operating Margin
p.a	per annum
PLF	Plant Load Factor
PLR	Prime Lending Rate
SEB	State Electricity Board
SI	Sponge Iron
SPM	Suspended Particulate Matters
STG	Steam Turbine Generator
TJ	Trillion Joules
tph	tonnes per hour
TPD	Tonnes Per Day
UNFCCC	United Nations Framework Convention on Climate Change
WBSEB	West Bengal State Electricity Board
WBPCB	West Bengal Pollution Control Board
WHR	Waste Heat Recovery
WHRSGS	Waste heat Recovery Steam Generating System

Appendix II: List of References

Sl.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, Guidelines for completing the Clean Development Mechanism-Project Design Document Form (CDM-PDD) Version 03.
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, IPCC and IEA Information
7	Detailed project report for JBSL waste heat recovery system and captive power plant.
8	Various project related information / documents / correspondences/ data available with JBSL
9	Annual Reports of WBSEB, DVC and DPSCL and for the years 2000-2001, 2001-2002 & 2002-2003 and 2003-04.
10	Dishergarh Power Supply Company Limited – www.dpscl.com
11	Damodar Valley Corporation – www.dvcindia.org
12	Quarterly Bulletin- Investment, Industry & Trade in West Bengal, Directorate of Industries, Govt. of West Bengal.
13	http://www.worldbank.org/html/fpd/energy/subenergy/energyissues 20.pdf
14	Website of Ministry of Power (MoP), Govt. of India **www.powermin.nic.in**
15	A paper on Anthropogenic Emissions from Energy Activities in India: Generation and Source Characterisation by Moti L. Mittal and C. Sharma.
16	Website of Indian Renewable Energy Development Agency (IREDA), **www.ireda.nic.in**
17	Central Electricity Authority (CEA) General Review, Performance of Thermal Power plants (2001-02, 2002-03 and 2003-04) – www.cea.nic.in
18	Captive Power Scenario in India, Infrastructure Development Action Plan for Chattisgarh-Final Report, http://chhattisgarh.nic.in/opportunities/Annexure%203.2.pdf
19	'Captive Power Plants- Case study of Gujarat India'

Sl.No	Particulars of the references
	Source : http://iis-db.stanford.edu/pubs/20454/wp22_cpp_5mar04.pdf
20	Electricity Act 2003, Ministry of Power , Govt. of India http://www.powermin.nic.in/JSP_SERVLETS/internal.jsp
21	Monetary and Credit Policy - http://indiabudget.nic.in/es2003-04/chapt2004/chap33.pdf
22	'OERC Orders', Section 6.40.10.2 – http://www.wescoorissa.com/cinfo/a39.htm#6.37
23	'Closed Cycle Dry Cooling Systems' http://www.energymanagertraining.com/power_plants/condenser&cooling_sys.htm

Appendix III: Baseline and CER calculations

The calculation sheet is enclosed along with this document.

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