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

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SECTION A. General description of project activity

A.1 Title of the project activity:

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Title of project activity : SMC WHRB 1&2

CDM document version No : 6

Date of the CDM document : 03/03/2008

A.2. Description of the project activity:

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Purpose of project activity

The purpose of the proposed project activity is to generate electricity by generating steam using waste heat contained in the waste flue gases released from two numbers of ABC (After Burning Chamber) from two numbers of 300 TPD/each DRI (Direct Reduced Iron)sponge iron kiln. The heat contained in waste gases will be transferred to Water which converts water in to steam in two numbers of WHRB (Waste Heat Recovery Boiler) each producing 38 tph of steam at 65 kg/cm^2 pressure and 485^{0}C temperature. The steam produced will be fed into STGs (Steam Turbine Generators) to generate 16 MW electricity from Waste Heat.

The purpose of the project activity is to achieve better energy efficiency, achieve sustainable development in the industry and improve the working environment of Sponge Iron-making process. The power so generated shall mainly be used to meet the captive power requirement of SMC sponge iron Plant itself.

The net result is reduction in the demand of electricity from coal based captive power generation and resultant reduction in GHG emission.

Background of the company

SMC is putting up integrated steel complex to produce Sponge Iron, Steel billets, Wire rods; Coal Washerey etc. The company is implementing the project in 3 phases. In phase -1, the company has installed 1 No. DRI sponge iron rotary kiln with 300 tonnes / day (100000 tonnes/annum) capacity using Coal as fuel, 5 numbers induction furnaces to produce steel each having six tonnes crucible capacity along with 8 MW WHRB CPP which is the part of the present project activity. The company is installing another TG set with 25 MW capacities to generate 8 MW power from waste heat through WHRB and 17 MW from coal based boiler, in the next phase of expansion in its capacity. Thus the company is implementing the total 16 MW WHRB power plant as CDM Project activity which includes the existing 8MW WHRB & the second 8 MW WHRB as a CDM project activity and will be following CDM registration procedures for the entire capacity.

The 33 MW captive power plants shall comprise of 8 MW and a 25MW STG to generate total 33 MW Captive power. Out of which 16 MW power will be generated from waste heat recovery boiler steam, by setting up two nos. of 38 tonnes/h each capacity WHRB to produce total 76 tph steam and the remaining steam (about 80 tph) will be generated from Coal Based Fluidised Bed Boiler. The generated power will meet its present and future requirement of power. The balance back up or standby support power required to meet the fluctuating power generation from WHRB, would be drawn from WESCO which is the local grid and which is part of eastern regional grid. In case of Surplus the unit will wheel the surplus power to the Grid.

The main carbon benefit from the facility of the project arises from the replacement / displacement of an equivalent amount of electricity to the extent of 16 MW electricity generated from steam which is produced from waste heat recovered from waste gases in two WHRBs, which would have been otherwise generated by increasing the import from grid.

The total CO_2 emission reduction for the entire crediting period of 10 years have been calculated as 915020 Tonne CO_2 –equivalent. The other benefits being reduction of CO_2 emissions considering global scenario, Sustainable development through better energy efficiency and it also leads to the improvement of local environment.

SMC will have proper monitoring system to calculate the power generated out of the CPP and accurately record the reduction in CO_2 emissions. SMC will follow monitoring plan to achieve complete transparency in monitoring, recording and calculating reduction in CO_2 emissions.

The Project activity achieves the following goals.

- Utilisation of heat energy of waste gas.
- Meet the power requirement without any T & D losses.
- Helps to become self reliant and less dependant on grid supply of electricity.
- Upgraded technology to achieve sustainable Industrial growth in State.
- Conserve natural resources and environment.
- Promotes the sustainable development.

The project activity will lead to sustainable development and promote sustainable Industrial growth by conserving natural resources and preventing the thermal even though no such statutory requirement exists.

Social benefit to state

The project activity increases the direct employment within the company for skilled manpower and Professionals as well as indirect employment opportunities out side the company, due to the project activity

Economical Benefits to State

The state will generate revenue out of the manufacturing activities supported by the captive power generation and due to purchase of equipment for execution of project by way of Sales Tax; Excise Duty; Entry Tax etc.

Environmental Benefit

The Project activity uses waste heat recovery based Power Plant by utilizing waste heat from flue gases coming from process and thus effectively saving environment of thermal pollution. The project activity displaces power from fossil fuel based Captive power of the company and hence reduces CO_2 emission The adoption of new air cooling technology for cooling and condensing of turbine exhaust steam will help to save water resource.

Reduction of T & D Losses of Power

The Power generated by the project activity will be used for in house requirement and consumption without any significant T&D losses. This is significant as grid has more losses in T&D.

Reduction in SPM level in the Atmosphere and other additional Economic benefits

The proposed ESP shall remove the ash and dust from hot and dust laden Flue Gases which will be collected in ash hopper. This ash will be given free of cost to cement plants & brick manufactures for further Economic benefit and use. The ash used for production of bricks saves the valuable productive soil; also it reduces the air pollution caused by the conventional brick kilns due to the coal burning. The surplus has will be used for back filling of mines out areas or low lying areas.

A.3. Project participants:

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Name of the Party Involved (host) host party-	Private and/or Public entity (ies) Project Participant as applicable	Kindly indicate if the party involved wishes to be Considered as project participant (Yes/ No)
India (host) **Ministry of Environment and Forest**	**SMC Power Generation Ltd--** Private entity	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>> India

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

>> Orissa,

A.4.1.3. City/Town/Community etc:

>> Village:Hirma, District:Jharsuguda

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

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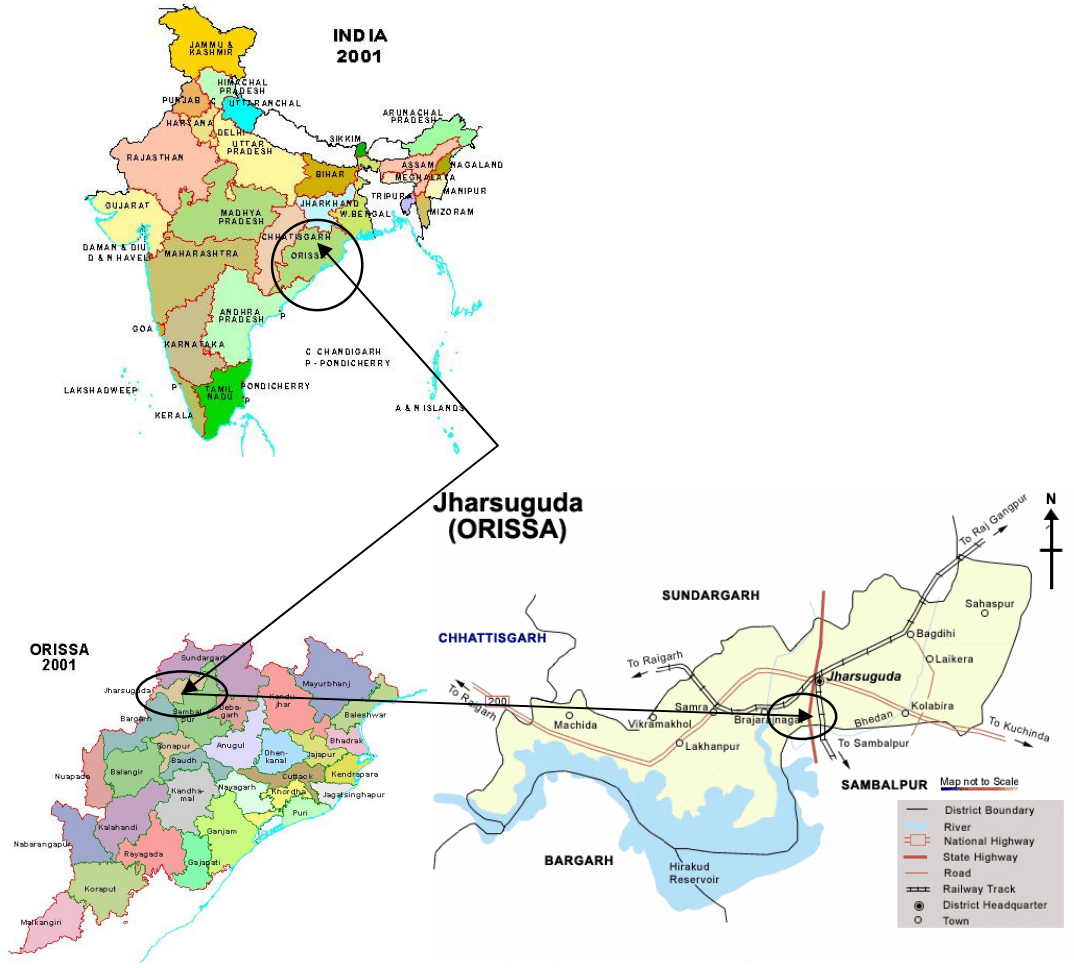
Physical Location:

The company is located at village Hirma about 10 KM from Jharsuguda town. Located on right side of Rourkela-Sambalpur state highway at Longitute $83^0$59'27"E and Latitude $21^0$47'42"N a distance of 3 km.



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

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The project activity is an captive electric power generation project utilising waste heat where aggregate electricity generation savings is equivalent to 100662.968 MWh per year. The project activity may be principally categorised in category –1 Energy Industries (Renewable /non renewable) as per Scope of Projects activities enlisted in the "list of sectoral scopes and approved base line and monitoring "methodologies" on the website for accreditation of "Designated operational Entities".

The CDM PDD is based on approved methodology ACM0004 version 02 and sectoral scope; 01 03 March 2006 "Consolidated Baseline methodology for waste gas and/or heat and/or pressure for power generation" of 03 March 2006"

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

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WHRB based captive Power Plant at SMC is proposed to utilise the heat content of flue gases coming out of ABC of sponge iron kiln.

The Exhausted flue gases from rotary kilns shall be received at their respective ABC for further incineration where the waste gas temperature likely to reach up-to 950-1000 ^{0}C. No auxiliary fuel is fired in ABC. The generated quantity and the temperature of flue gases are influenced by a number of operating parameters of the sponge iron plant. At the best operating levels this waste heat shall produce 38 tph of steam from each boiler at 65 kg/cm2 pressure at 485±5^{0}C temperature in WHRB. The WHRBs will be of single drum water tube with radiant chamber, along with convective super heater, radiant super heater, economiser, de-super heater and hoppers for ash collection as ash comes with flue gases.

The outlet boxes of the WHRB, leads to ESP to remove SPM from exhaust gases. The exhaust gas temperature shall be kept at 170^{0}C. The feed water temperature will be maintained at the inlet to economiser 126^{0}C.

The medium pressure steam from WHRB (76 tonnes/hr) will be used to operate high efficiency extraction cum condensing multi stage STGs to generate 16 MW Electricity from WHRB.

Ash collected from both WHRB hoppers & ESP will be conveyed pneumatically to ash silo.

Other systems required are circulating water, Demineralised water plant, Instrument Air Compressor and Exhaust Steam Condenser.

Steam from exhaust of STG rotor will be condensed in water cooled condenser.

Only DM (De Mineralised) water will be used in boiler to avoid scale formation on boiler tubes.

Total Waste water is recycled and reused after treatment.

The generated power shall be used to meet the captive power requirement of the company.

The technology is environmentally safe and abides all legal norms and standards for SPM, emissions.

The project activity is likely to operate maximum for 350 days in a year. No supplementary fuel is used in WHRB.

The project activity was started with board resolution dated 18th May 2003 subsequently followed with equipment selection and ordering process in July 2003..

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

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Years	Annual estimation of emission reductions in tonnes of CO_2eq
2008-09	91502
2009-10	91502
2010-11	91502
2011-12	91502
2012-13	91502
2013-14	91502
2014-15	91502
2015-16	91502
2016-17	91502
2017-18	91502
Total for credit period (tonnes of CO_2e)	915020
Total number of crediting years	10
Annual average over the crediting period of estimated reduction (tonnes of CO_2e)	91502

A.4.5. Public funding of the project activity:

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No public funding from parties included in Annex-I is available for the project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation.ACM0004/ Version 02, Sectoral scope:01, 3rd March 2006 and ACM0002 Sectoral scope : 01 of EB-36.

Version -04 of "tools for demonstration and assessment of additionality, along with "combined tool for identification of baseline scenario and demonstration of additionality" Version 2.1 EB-28 to identify and justify the selection of baseline scenario.

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

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The methodology applies to electricity generation project activities;

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

The methodology covers both new and existing facilities.

The project activity meets the applicability as it meets the above conditions set out in approved methodology

1. WHRB produces steam by recovering waste heat from flue gases coming out of DRI sponge iron kiln and this steam is used to generate electricity in STG. This displace the electricity generation from captive power plant based on fossil fuel.
2. In the absence of the Project activity, the electricity requirement would have been met by coal based captive power generation. The CO_2 emission reduction will be achieved by reduction of corresponding CO_2 emissions in fossil fuel based captive power plants of the company/ the eastern regional grid.
3. There will be no fuel switch in sponge iron manufacturing process after the implementation of the project activity.
4. By successful operation of project activity, the project activity will be able to displace/ substitute equivalent to 16 MW power from Coal based captive power plant of the company / the eastern regional grid., with an average emission reduction of 91502 tCO_2/annum
5. The project activity adds no additional GHG emission.

Since the project activity meets the eligibility criteria as specified in methodology ACM0004, version-2 hence the same is applied.

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

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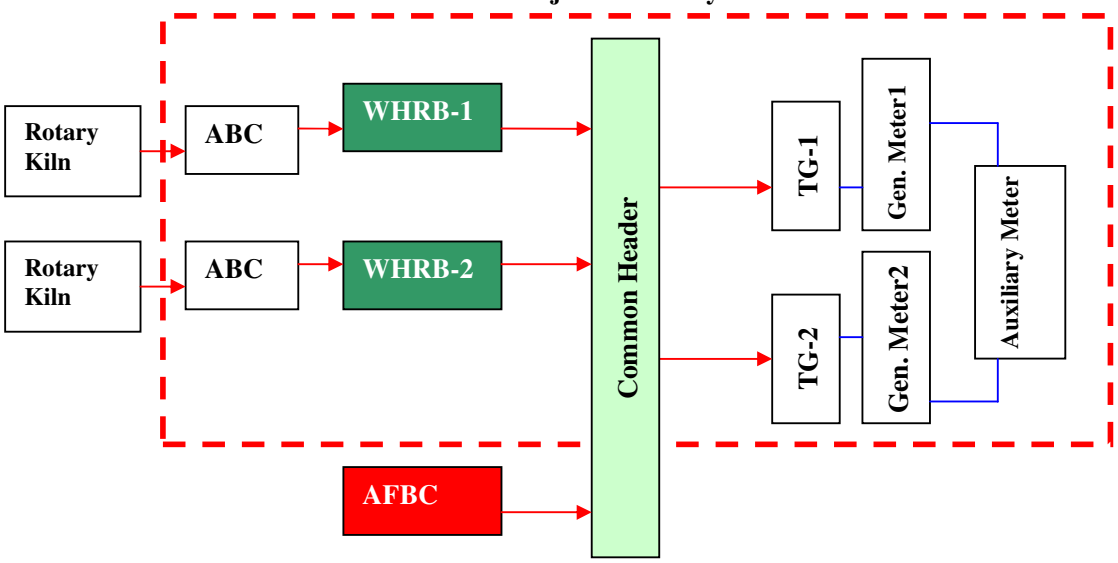
In line with methodology, the project activity is for the recovery of waste heat from flue gases for generation of steam for the electricity to be generated from CPP.

In the base line scenario, the electricity would have other wise been generated by fossil fuel based captive power plants of the company which has higher emission factor than the Regional Grid.

In line with methodology the project boundary comprises of the ABC(waste gas sources containing waste heat), and WHRBs (waste heat recovery equipments), steam flow piping, flue gas duct, and STGs, Auxiliary equipment, Power synchronising system, where project participant has full Control and the spatial extent of project boundary extends up to the grid to which it is connected physically and which is affected by the proposed project activity.

Project Boundary



Overview on emission sources included in or excluded from the project boundary

	Source	*Gas*		*Justification / Explanation*
Baseline	*Grid Electricity generation*	CO_2	*Included*	*Main emission source*
		CH_4	*Excluded*	*Excluded for simplification. This is conservative.*
		N_2O	*Excluded*	*Excluded for simplification. This is conservative.*
	Captive Electricity generation	CO_2	*Included*	*Main emission source*
		CH_4	*Excluded*	*Excluded for simplification. This is conservative.*
		N_2O	*Excluded*	*Excluded for simplification. This is conservative.*
Project	*On-site fossil fuel combustion due to the project activity*	CO_2	*Excluded*	*There is no fossil fuel used due to project activity*
		CH_4	*Excluded*	*Excluded for simplification*
		N_2O	*Excluded*	*Excluded for simplification*

	Combustion of waste gas for electricity generation	CO_2	*Excluded*	*There is no combustion of waste gas for electricity generation*
		CH_4	*Excluded*	*Excluded for simplification*
		N_2O	*Excluded*	*Excluded for simplification*

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

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The ACM0004 requires that the additionality of the project activity shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board, available at the UNFCCC CDM web site.

Whereas the tool for demonstration of assessment of additionality version-04, EB-36 para 3 (http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf) provides that; this tool to assess and determine additionality, does not replace the need for the baseline methodology to provide for a step wise approach, justifying the selection and determination of the most plausible baseline scenario alternatives. It is further stated that project participants can use the "tool for identification of baseline scenario and demonstration of additionality"(http://cdm.unfccc.int/Reference/Guidclarif/EB28_repan14_Combined_tool_ver02.pdf), which provides a procedure for baseline scenario identification as well as additionality demonstration.

In view of above provisions project proponent have adopted to use "combined tool for identification of baseline scenario and demonstration of additionality" Version 2.1 EB-28 to identify and justify the selection of baseline scenario. As per above; step to step identification of baseline scenario is given as below:

Methodology requires adopting procedure as given below:

STEP 1. Identification of alternative scenarios
STEP 2. Barrier Analysis
STEP 3. Investment Analysis (if applicable)
STEP 4. Common Practice Analysis.

The procedure is although summarized in the indicative flow chart given in the above tool, but for more specific details regarding the flow chart, project proponent have referred to the text and have proceeded as per the text given in the above tool to identify the baseline scenario.

STEP 1. Identification of alternative scenario

Project proponent have identified all alternative scenarios to the proposed CDM project activity that can be the baseline scenario and for identifying the baseline scenario project proponent have adopted following sub-steps as per the above combined tool.

STEP 1a. Define alternatives scenarios to the proposed CDM project activity

Since the proposed CDM project activity includes the facility to utilize waste heat to give output as power, therefore project proponent have identified all plausible alternative

scenarios which can generate power in the given geographical conditions. In addition to this project proponent have also considered the alternative use of heat and realistic combination of these alternative scenarios, in the identified alternative scenarios which can be implemented in the relevant geographical area.

Project proponent have considered the state of Orissa as the region for the relevant geographical area for the purpose of this section, because the frame work condition for the state of Orissa are substantially different than other states of India with reference to the proposed project activity, mainly for the reason that a number of private iron ore mines as well as state government owned company OMC Ltd. are supplying iron ore to the industries as well as coal is available from government owned coal mines. The state is quite backward in infrastructure as compared to many other states of India. The private sector steel industry's growth in the state is a recent development. These parameters provide a completely different framework for the state of Orissa therefore project proponent have considered this as a separate region within the host country India. There are more than ten facilities (WHRB Power Plant based on Sponge Iron Kiln) in the state of Orissa which provide similar output or service with comparable quality, properties and application areas as the proposed CDM project activity (refer to Appendix-III).

Out come of Step 1a:

As required in the above tool for identification of baseline scenario, we consider the following plausible alternatives

1. Proposed project activity undertaken without being registered as a CDM project activity
2. Import of electricity from grid
3. New CPP based on Diesel oil as alternative fuel
4. New CPP based on Gas as alternative fuel
5. New CPP based on Coal, Char/Dolochar, Washery reject as other alternative fuels
6. A combination of 2 and 5
7. Alternative use of waste heat from flue gases
8. The continuation of the current situation (same as 2)

STEP 1b: Consistency with mandatory applicable law and regulations:

All the above alternatives are in compliance to mandatory laws and regulations applicable in the host country; and a region.

Out come of Step 1b:

List of alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations taking in to account the enforcement in the region, and EB decisions on national and sectoral policies and regulations; are as follows:

1. Proposed project activity undertaken without being registered as a CDM project activity
2. Import of electricity from grid
3. New CPP based on Diesel oil as alternative fuel
4. New CPP based on Gas as alternative fuel

5. New CPP based on Coal, Char/Dolochar, Washery reject as other alternative fuels
6. A combination of 2 and 5
7. Alternative use of waste heat from flue gases
8. The continuation of the current situation(same as 2)

STEP 2. Barrier Analysis

Project proponent have identified the following barriers to assess which alternatives are prevented by these barriers through the following sub-steps:

STEP 2a. Identify barriers that would prevent the implementation of alternative scenarios:

List of realistic and credible barriers that may prevent alternative scenario to occur are given below:

i) Investment Barrier:
ii) Technology Barriers:
iii) Lack of prevailing practice
iv) Other barriers

Out come of Step 2a:

All the above identified barrier may prevent one or more alternative scenarios to occur; an analysis is given at step 2 b, how these barriers would prevent an alternative to occur.

STEP 2b. Eliminate alternative scenarios which are prevented by the identified barriers:

S.No.	Alternative Scenario	Barriers faced	Remarks
1	Proposed project activity undertaken without being registered as a CDM project activity	Investment Barrier (defined in Section B.5, Sub-step 3.a.a), Technology Barrier (defined in Section B.5, Sub-step 3.a.b), Lack of prevailing Practice as well as lack of proper infrastructure and proper government policy (other barriers) will prevent this alternative scenario to occur.	All these barriers will prevent the implementation of the project activity without CDM support. Hence not considered as a plausible alternative scenario.
2	Import of electricity from grid	No barriers	Considered as a plausible alternative scenario for baseline.
3	New CPP based on Diesel oil as alternative fuels	The cost of generating power through Diesel or other alternative liquid fuels will be prohibitive. Faces investment barrier	Hence not considered as a plausible alternative scenario.

		and not a prevailing practice.	
4	New CPP based on Gas alternative fuels	Since the availability of natural gas in the region is not there (other barrier). Faces investment barrier, not a prevailing practice.	Hence not considered as a plausible alternative scenario.
5	New CPP based on Coal, Char/Dolochar, Washery reject as other alternative fuels	No barrier	Considered as a plausible alternative for baseline scenario.
6	A Combination of 2 and 5	The industry would be required to pay line lying charges to secure power from the grid as well as also pay minimum demand charges to grid as well as incur investment in setting up a thermal power plant which would ultimately increase the cost of power to the industry. Therefore a combination of these will face investment barrier.	Hence not considered as a plausible alternative scenario.
7	Alternative use of waste heat from flue gases	There is no other use of waste heat in any form in industry (technology and other barrier).	Hence not considered as a plausible alternative scenario.
8	The continuation of the current situation	The grid would have no objection in providing the additional power, however the industry has to incur the cost for line lying and pay security deposit to obtain additional power as well as the industry has to pay higher cost for obtaining power. There are no identified barriers to this alternative. (same as alternative 2)	Considered as a plausible alternative for baseline scenario.

Out come of Step 2b :

The above analysis reveals that only the following alternative scenarios to the project activity are not prevented by any barrier:

Alternative 2	Import of electricity from grid
Alternative 5	New CPP based on Coal, Char/Dolochar, Washery reject as other alternative fuels
Alternative 8	The continuation of the current situation

Since alternative 8 is same as alternative 2 hence only two alternatives i.e. "alternative 2 and 5" are considered as alternative for baseline scenario to project activity. The State Electricity supply grid i.e. WESCO (Western Electricity Supply Company Of Orissa Ltd.) will have no objection in supplying the additional power to the industry as it already has provided supply of power to the industry. Similarly there is no restriction to setup a coal based captive power plant, as the industry itself has setup a coal based power plant. The industry would have implemented a coal fired boiler in place of waste heat recovery boiler.

The out come of the above analysis as per combined tool to identify the baseline scenario is applied with respect to the following text, which reads as below:

"

- ***If there is only <u>one alternative</u> scenario that is not prevented by any barrier, and if this alternative is the proposed project activity undertaken without being registered as a CDM project activity, then the project activity is not additional.***
  - Since there are two alternative scenarios that are not prevented by any barrier, as well as the identified alternative scenarios do no include the project activity undertaken without being registered as a CDM project activity, hence above option is not applicable hence proceeded to next step.
  - .
- ***If there is only <u>one alternative scenario</u> that is not prevented by any barrier, and if this alternative is <u>not</u> the proposed activity undertaken without being registered as a CDM project activity, then quantitative arguments- how the registration of CDM project activity will alleviate the barriers that prevent the proposed project activity from occurring in the absence of the CDM. If the CDM alleviates the identified barriers that prevent the proposed project activity from occurring, proceed to Step 4, otherwise the project activity is not additional.***
  - Since there are more than one alternative scenarios that are not prevented by any barrier, and none of these alternative scenarios include the project activity undertaken without being registered as a CDM project activity, hence this provision is not applied, thus proceeded to next step.
- ***If there are still <u>several alternative scenario</u> remaining, <u>including</u> proposed project activity undertaken without being registered as a CDM project activity, proceed to Step 3 (investment analysis).***
  - Since the remaining several alternative scenarios do not include the proposed project activity undertaken without being registered as a CDM project activity, hence project proponent have not proceeded to Step 3 (investment analysis for the sake of baseline determination); however the Step 3 is applied in determination of additionality at Section B.5.

- ***If there are still <u>several alternative scenarios</u> remaining, but which do <u>not include</u> the proposed project activity undertaken without being registered as a CDM project activity, explain- using qualitative or quantitative arguments- how the registration of the CDM project activity will alleviate the barriers that prevent the proposed project activity from occurring in the absence of the CDM. If the CDM alleviates the identified barriers that prevent the proposed project activity from occurring, project participants may choose to either:***
  - ***Option 1 : go to step 3 (investment analysis), or***
  - ***Option 2: identify the alternative with the lowest emission (i.e. the most conservative) as the baseline scenario, and proceed to step 4."***

  - Since the several alternative scenarios remaining do not include the proposed project activity undertaken without being registered as a CDM project activity project proponent have chosen this provision to determine the baseline scenario, as per the above project proponent have selected "Option 2" which requires to identify the alternative with the lowest emission as the baseline scenario. Since the comparative emission factor as analyzed between the Eastern Regional Grid and the Coal based captive power plant reveals that the Grid emission factor i.e. 1.01 tCO_2e/MWh (source: CEA official website) is most conservative and lowest as compare to coal based captive power plant i.e. 1.293 tCO_2e/MWh (source: as per calculation attached) hence Eastern Regional Grid (with emission factor 1.01 tCO_2e/MWh) is identified as baseline scenario. Now we proceed to "Step 4 for Common Practice Analysis". The additionality for the project activity is also determined as per "tool for demonstration and assessment of additionality (Version 04) EB 36" Report Annex 13, at Section B.5.

It is required to explain using qualitative or quantitative arguments how the registration of CDM project activity will alleviate the barriers that prevent the proposed project activity from occurring in the absence of the CDM support.

We herewith explain that the revenue generated out of CDM support will help to overcome the identified barriers. As most of the identified barriers ultimately have the financial significance and financial impact, in this case the levelized unit cost of power generation from WHRB captive power plant will become lower due to CDM revenue; hence will help the project proponent have to overcome all these barriers.

A comparative cost of levelized unit cost of generation with CDM support and without CDM support is given in Appendix-II, which reveals that with CDM support the unit cost of power becomes more attractive than coal based captive power generation. On carrying out sensitivity analysis at higher plant load factor at 71% and 76% also the cost of power to the industry with the project activity without CDM support is less attractive which is revealed in the comparative cost analysis and sensitivity analysis enclosed as Appendix-II. This analysis also reveals that with CDM support even at 66% Plant load factor the project activity becomes economically better attractive.

STEP 4. Common Practice Analysis

Since the above analysis up to Step 2 is carried out only for determination of baseline scenario. The common practice is also analyzed at section B.5 to demonstrate the additionality of the project activity.

We herewith give the common practice analysis prevailing in the region as follows:

1) The project type is a waste heat recovery boiler installed with two numbers of 300 TPD each capacity Sponge Iron Plant to generate up to 16 MW power from recovered waste heat of flue gases.
2) In the region there are no other WHRB power plant installed without the consideration of CDM.
3) In the region there were no other 16 MW WHRB power plant installed up to the date of considering to setup the project activity i.e. dated 18/05/2003
4) The methodology asks to exclude registered CDM project activity in this analysis however on going through the data available from UNFCCC CDM website it is revealed that M/s. Action Ispat & Power Ltd. is only one project which is seeking CDM registration with almost similar capacity. There are no other project activities in the region with similar activities. (refer to appendix-III)

It would be evident from the above, that there are no similar activities implemented in the region without CDM consideration, hence the project is additional for the purpose of identification of baseline scenario.

Description of identified baseline scenario:
As per above analysis Eastern Regional Grid has been identified as baseline scenario taking lowest emission option and most conservative approach. The data for Eastern Regional Grid baseline emission has been obtained from Central Electricity Authority's official website (http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm).

Summary of the baseline selection -

1	Initial investment cost:	That, it would have required much less initial investment cost and much less time to seek the additional power from the grid as in comparison to setting up its own captive power plant.
2	Common practice in the state of Orissa	That, it is a normal practice for the industries in the region to obtain start-up power and industrial power from the grid to operate their plants.
3	Power supply agreement with WESCO	That the company had already obtained power supply connection from the Grid and was running the Sponge Iron Plant from this power.
4	Conservativeness of Baseline Emission factor	That, as per the comparative $EFCO_2$ emission factor calculation between grid power and coal based captive power plant, it was found that the grid emission factor was much lower than coal based captive power plant.

All the above are in accordance with methodology ACM004 version -02, dated 3rd March, 2006. The methodology talks about the economic feasibility and conservativeness of Emission factor**.**

Hence, as a conservative approach SMC has selected eastern regional grid as baseline.

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

Explanation of how and why the project activity is additional in accordance with the baseline methodology

It is required to describe how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity. The proposed CDM project activity is designed to generate power from the waste heat only contained in the flue gases emitting out of an established industrial manufacturing process i.e. ABC of Sponge Iron Kilns, only the waste heat in the flue gases will be utilized to generate power without adding any GHG emission whereas in the absence of the proposed project activity power requirement would have been met by the unit by generating power from Coal based captive power plant at the same time the waste heat contained in the flue gases would have been emitted to the atmosphere.

Hence the project activity achieves reduction in CO_2 emission by displacing the fossil fuel based captive power of the company by WHRB based captive power which does not generate any CO_2 (or other GHG gases).

It is required to explain how and why the proposed project activity is additional and therefore not the baseline scenario in accordance to the selected baseline methodology.

As per the decision 17 / CP.7 AND 18/CP.9 a CDM activity is additional, if anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of registered project activity. The tool for the demonstrations and assessment of additionality version-04 of 36th meeting of CDM executive board requires the project participant to demonstrate and assess additionality, as per the steps given below:

1) Identification of alternative to project activity.
2) Investment analysis to determine that the project activity is not the most or financially attractive.
3) Barrier analysis.
4) Common practice analysis.

Project proponent have discussed realistic and credible alternatives available to project activity in B.4 and have come to conclusion that due to the conservative approach import of electricity from grid is the baseline scenario. We hereby proceed to establish the additionality of proposed project activity using “the tool for the demonstration and assessment of additionality” (version 04) of 36th meeting of CDM executive board.

We show that the project activity faces significant Technological, financial and investment barriers and in the absence of CDM finance these barriers would prevent the project activity from being implemented.

The tool for the demonstration and assessment of Additionality outlines four steps to demonstrate Additionality.

STEP 1 - Identification of the alternatives to the project activity considered with current law and regulations

Step 1.a Define alternatives to the project activity

	Identify realistic and credible alternatives including - Proposed activity undertaken without being registered as a CDM project activity. - All other plausible and credible alternative - Continuation of current situation	In section B.4 all the possible alternatives have been discussed, and the identified alternatives recognized were as below: 1) Project activity undertaken without being registered as a CDM project activity. 2) Import from Grid. 3) Alternative fuel HSD. 4) Alternative fuel Gas. 5) Alternative fuel Coal + Dolochar + Washery reject. 6) Combination of grid and coal power. 7) Alternative use of Waste heat. 8) Continuation of current situation.
	Out come of Step 1a. Identified realistic and credible alternative scenarios to the project activity	As discussed in B.4 out of the above eight alternative scenario we identified the following alternatives as realistic and credible alternative scenarios to the project activity: 1) Project activity undertaken without being registered as a CDM project activity 2) Import from Grid. 3) Alternative fuel Coal + Dolochar + Washery reject. 4) Combination of grid and coal power. 5) Continuation of current situation. As per ACM 0004, SMC has concluded that use of fossil fuel like coal, char/Dolochar, Washery reject as fuel is the most attractive economic option to generate captive power. The grid power is being used by the company at the moment and company is also installing a coal based CPP. As per the financial calculations, the coal, char/dolochar, washerey reject based thermal power plant is found to be financially most

		attractive which faces no barriers, and which is being implemented by the project proponent have as captive power plant also along with the WHRB power. Therefore, the coal based thermal power plant also qualifies for baseline emission calculations, however as per the methodology the choice to use the combined tool for assessment of baseline and demonstration of additionality provides an option to choose the lowest emission factor option. Hence as a conservative approach the grid emission factor has been considered as baseline, to arrive at the emission reduction due to the project activity.

Step 1.b Consistency with mandatory laws and regulations:

1	Alternative shall be in compliance with legal and regularly requirements.	**Out come of Step 1.b:** All the identified realistic and credible alternative scenarios are in compliance with current legal and regulatory requirements of the region, country and EB decision on national and / or sectoral Policies and regulation.

STEP 2 - Investment Analysis

It is required to determine whether the proposed project activity is economically or financially less attractive than at least one other alternative, identified in Step-1 without the revenue from the sell of certified emission reductions (CERs). To conduct the invest analysis project proponent have used the following sub-steps:

Sub-Step 2.a Determine appropriate analysis method

Project proponents have determined to apply investment comparison analysis as per sub-step -2b Option-II. SMC identifies unit cost of service (e.g. levelized cost of electricity production in Rs./MWh) as the most important financial indicator being most suitable for the project being a captive power plant for decision making context, in terms of Rs./kWh as first preference to make the investment comparison; because the choice of the project proponent setting up a captive power plant would always be to select a route through which cost of captive power is minimum. Therefore this option for investment comparison analysis is most suitable for the project type being a captive power plant for decision making context. However for further credible comparison in investment analysis project proponents have also analyzed project IRR by taking in to consideration the best price for power which would have been available to the project proponent if the same was exported to the grid in place of consuming it for captive purpose. Although the Orissa state electricity regulatory commission has awarded only Rs1.9287 per kWh or per unit (192.87 paisa/unit) tariff only for sale of power to grid by generating utilities, and has also allowed NALCO to sell part of power up-to Rs2.20/kWh, hence project proponents have considered a higher estimated rate of Rs 2.20/ kWh at which the project proponent could possibly be able to negotiate to export it's generated power, for exports to grid.

(http://www.orierc.org/new1/Orders/2006/GRIDCOORDER2007-08_55.pdf Page8, Table 9, pricing option for2007-2008 in Paise / unit and page 36, Table 14 Power Procurement Cost for 2007-2008, Page 46 Table 20 rates for NALCO)

Sub-Step 2b. (Option –I): Not considered for the purpose.

Sub-Step 2b. (Option –II): Investment comparison analysis:

We have identified unit cost of service (i.e. levelized cost of power in Rs./kWh) as most suitable financial indicator for the project type and decision making context.

Sub-Step 2b. (Option –III): Apply bench mark analysis.

The comparative unit cost of service as provided in Option-II is selected for the purpose hence the bench mark comparison is not given.

Step 2c : Calculation and comparison of financial indicators:

As per the calculations provided in Appendix -II. Levelized cost of services per unit is found as below:

	Captive power cost with Coal, Char/Dolochar, Washery rejects based captive power plant of 16 MW	Captive power cost with WHRB (without CDM)	Grid based power import or purchase cost
Cost of power /kWh in Rs.	1.45	1.83	3.25 (Source : Electricity Bill)
Capital Cost (Million Rs./ MW)	35.00	45.00	Cost of line laying and Fixed deposits
IRR	21.91%	10.20%	Not calculated.

(Refer to Appendix-II for more details)

The above investment analysis clearly establishes that cost of power through WHRB without CDM benefit is at Rs.1.83/kWh where as the cost of power from coal based captive power plant is only Rs.1.45/kWh, also the capital cost for installation of the project on per MW basis is Rs.45.00 Million for WHRB power plant where as it is only Rs.35.00 Million for coal based captive power plant. With this comparison we establish that coal based captive power plant is financially more attractive in the entire lifetime of the plant, which is expected to be 15 years. Subsequent to this on comparing the project IRR, it is established that project IRR is only 10.20% for WHRB power plant and 21.91% for coal based captive power plant. This establishes that coal based captive power plant is financially more attractive.

The above financial indicators have not been calculated for the grid based power supply because the project proponent receive the power at much higher cost from grid than WHRB power as well as coal based captive power. The Grid power cost is found to be Rs.3.25/kWh, hence the related parameters are not calculated.

Step 2d : Sensitivity analysis

The basic plant load factor considered for the project activity is at 66%. In the prevailing situation the most sensitive parameter which can improve is Plant Load Factor (PLF) hence project proponent have

done the sensitivity analysis on increasing the PLF by 5% up to 2 steps, and have thus calculated the parameters at 71% and 76% PLF, the results are as below:

Cost of WHRB based power (Without CDM)at 66% PLF : Rs.1.83 /kWh
Cost of WHRB based power (Without CDM) at 71% PLF : Rs.1.70 /kWh
Cost of WHRB based power (Without CDM) at 76% PLF : Rs.1.59 /kWh
(Refer to Appendix-II for more details)

With the above it is found that even at 76% PLF (without CDM benefit) through WHRB, the cost of power (Rs.1.59/kWh.) from WHRB is higher than the power cost from coal based captive power plant (Rs.1.45/kWh)..

This sensitivity analysis conclusively establishes that the coal based captive power plant is financial more attractive than WHRB based power (without CDM) and Grid Power. Therefore the project is found to be additional.

It is evident with the above that the cost of power to the project on annualized basis is lowest from coal based captive power plant hence the coal based captive power is economically most attractive.

Outcome of Step 2
With the sensitivity analysis it is comprehensively concluded that proposed CDM project activity i.e. WHRB based captive power plant without CDM support is financially not attractive as per compared to Coal based captive power, hence as per methodology we are required to proceed to Step 4 (common practice analysis) however the methodology also allows to carry out barrier analysis as per Step 3. Hence we proceed to Step 3 (barrier analysis) to establish that the project faces significant barriers which would prevent the project to be implemented without CDM support.

STEP-3 SMC selects step 3(barrier analysis) to show additionality
STEP –3 Barrier analysis to show additionality
Sub-Step 3.a Identification of barriers that would prevent the implementation of the type of the project *activity*.

3.a.1	**Investment barriers**	

	Implementation of similar activities by private entities which are broadly on a similar technology in a similar scale which take place in a comparable environment with respect to regulatory frame work have been implemented with grants or other non-commercial finance terms.	In the state of Orissa implementation of similar activities are done only on the strength of CDM support. As per the available information in the state of Orissa no other WHRB power generation units are using waste gases from 300 X 2 Nos. DRI Kiln to produce 16 MW WHRB power except AIPL who has 350 TPD X 2 Nos. DRI Kilns proposed to generate 16 MW WHRB power with CDM support. All other sponge iron plants which are putting up WHRB power are in the process of CDM validation or PDD preparation stage to seek the CDM support. (refer to Appendix-III)
	No private capital is available from domestic and international market due to real or perceived risk associated with investment in the country where the proposed CDM project activity is to be implemented as demonstrated by the credit rating of the country or other country investments report of reputed origin.	No private capital is available from domestic and international market due to the perceived risk associated with the fluctuating power generation from a sponge iron based WHRB captive power plant.
3.a.b	**Technological barrier**	
	Skilled and or properly trained labor not available	Due to sudden and tremendous increase in number of similar capacities of power plants based on coal or waste heat in the region availability of skilled and trained labour to operate and maintain the technology has become scarce. A high turn over of the employed skilled labours due to ever increasing demand for skilled man power also leads to unacceptably high risk of under performance and malfunctioning of the equipments. This is evident with the JPC Report as well as evident from the UNFCCC CDM website where in the number of power projects being established in India with CDM support give evidence that the number have suddenly increased several times than existed during last 50 years.
	Lack of infrastructure for implementation of the technology	The most essential infrastructure required for a power plant is evacuation of power to the grid in case of failure of captive power demand. In the state of Orissa the required logistics are not

		made available by the Government to evacuate the surplus power in such situation.
	Risk of Technology failure	The generation of power from waste heat of sponge iron plant is solely dependent on the performance of sponge iron kiln. The risk of process technology failure in the local circumstances is significantly greater than the coal based power plant as any crisis in the sponge iron market would lead to reduced production which will directly affect the power generation from waste heat recovery boiler. There exists no other remedial technology or process to continue generation of power from waste heat recovery boiler in case of any failure in the sponge iron plant. Whereas in case of a coal based power plant no such associated risk exist with the market.
	Particular technology used in the proposed project activity is not available in the relevant region.	The technology used in the proposed project activity is not available in the region i.e. in the state of Orissa, and is procured from Tamilnadu. 1) As per Joint Plant Committee report "Survey of Sponge Iron Industry 2005-06". A. 77 units out of 147 coal based unit are going in for expansion in capacity. B. Jharkhand, Chhatisagarh and Orissa are states where majority of expansion activities will be installed. C. Constraints faced by sponge iron industry are: a) Raw Material b) Power c) Finance d) Labor Company has to procure iron ore from the market from various sources. Due to change of sources the iron ore quality is not consistent. The company is required to use coal of Grade "A" to achieve better efficiency. As the availability of grade "A" coal is problematic. Hence Coal of various

		grades such as "B", "C", "D", "E" or "F" as per availability is used. The variation in quality of coal also creates operational problem. All the above pose technological problem as the variations in iron ore and coal quality lead to variations in flue gas temperature and quantity. This has impact on WHRB power generation. As so many units are expanding in the area, the availability of skilled technical personnel is a problem. Company has to hire the untrained personnel and impart the training as per training schedule. 2) Company has to procure all the necessary equipment required for proper implementation of the project. Extra synchronization infrastructure is also required to remain connected to WESCO grid. So when 16 MW WHRB power has to be synchronized with grid power, company has to install grid synchronization system resulting in additional cost. 3) Company has started venture in integrated steel project as a green field project. They did not have any previous experience in manufacturing of sponge iron or power. Hence having no previous experience neither in sponge iron making and power generation, acts as technical barrier 4) The Sponge Iron Rotary Kiln operation is dependant on many factors such are Iron Ore quality, Coal quality, formation of accretion, etc., the flue gas temperature and quantity variations result in lowered steam generation and hence reduced power generation. Due to the variations observed, the PLF of WHRB is low and is around 66%

		only. 5) The Sponge Iron Kiln has to take frequent shut down due to the raw material quality problem and due to accretion. These results in about 3 or more shut down in a year and this result in WHRB shut down also and hence the power generation loss. Due to the inconsistency of WHRB power generation, company has to maintain the agreement with WESCO for supply of backup power. The documentation in the form of WESCO agreement is available. 6) If the temperature of flue gas exceeds 1000^0C, then the boiler is in danger as the higher temperatures are damaging to the boiler tubes. As no control is there on exit temperatures of kiln, this acts as technical barriers. The company has procedures laid out to encounter flue gas high temperatures where in DCS instructs for carrying out remedial measures like water spraying, opening steam drains and finally opening of stack cap to release hot gases to atmosphere; bypassing WHRB. This leads to loss of power generation. 7) The inlet temperature to ESP has to be maintained at about 160^0C, as the higher or much lower temperature of flue gas will damage ESP. Hence the boiler has to many times work away from its designed parameters as any disturbance in performance of boiler due to any reasons affects the ESP and also power generation. This acts as a technological barrier.
	Barriers due to prevailing practice.	As per the available information, in the state of Orissa almost every WHRB power plant has been established due to CDM strength, which is evidenced with UNFCCC website and Appendix-III.
	Regulatory Barriers	1) The provision to export surplus power

		for sale to the grid is not available. 2) The demand charges payable even if WESCO is not in a position to supply power for any reason. Hence these act as regulatory barrier

Sub-Step –3.b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity).

As above the identified barriers are:

1) 3.a.a. investment barrier
2) 3.a.b technological barrier
3) 3.a.c prevailing practice barrier
4) 3.a.d operational barrier
5) 3.a.e regulatory barrier.

The identified other alternatives are:

1) **Drawing power from existing WESCO grid (Alternative-2)**
   None of the above barriers act as barriers in this alternative and WESCO would be having no objections to continue to supply the additional demand of power as already and presently the required power is being provided by WESCO. But the grid power is costlier than coal based captive power. As well as the grid infrastructure being poor results into frequent tripping.
2) **CPP based on HSD/Gas (alternatives 3 and 4)**
   None of the above acts as a barrier to this alternative. However CPP based on HSD will have additional GHG emissions from the plant. Availability of Gas is not there in the region.

3) **Alternative 5 CPP based on coal, char/dolochar, washery reject**
   None of the above barriers act as barriers in this alternative. This option is economically most attractive as increasing the capacity of coal based boiler to meet the entire steam requirement can be achieved with minimum cost to meet the total steam requirement of the 33 MW CPP.
4) Alternative use of Waste Heat from Flue Gases: There is no use of waste heat from flue gas, as SMC has no such heat requirement in the plant. No other beneficial use of the Waste Heat is in practice in the region.
5) Continuation of the current situation, as shown above the continuation of current situation is to draw more power from grid. Same as alternative 2.

None of the above barriers would prevent in implementing **Alternative 2** (drawing power from the grid) and **Alternative 5** (Coal, char/Dolochar, Washery reject based captive power plant).

STEP-4 Common practice analysis

We identify and discuss the existing Common practice through the following sub-steps which Complements additionality tests.

Sub-Step-4.a Analyze other activities similar to project activity.

	Provide an analysis of any	In Orissa state Tata Steel, Orissa Sponge, Orissa

1.	other activity implemented	Cement are a few pioneers which have gone ahead to establish WHRB power plant based on CDM strength, to the best of information available there is no sponge iron plant in the state which has implemented waste heat recovery boiler based power plant without the CDM support. The list of the similar project activities in the region is given in Appendix-III. All these activities are in the process of seeking CDM support.
2	Activities in similar scale.	The project activity is 16 MW WHRB based on 300 TPD X 2 Nos. Sponge Iron capacity plant. As per the available information in the state of Orissa (except Action Ispat & Power Ltd.) no other WHRB power generation units are using waste gases from 300 X 2 Nos. DRI Kiln to produce 16 MW WHRB power. Only Action Ispat which has little similar capacity of 350 TPD x 2 numbers sponge iron kiln is putting up 16 MW WHRB power plant under CDM support. All the other sponge iron plants which are putting up WHRB power plant, are in the process of CDM validation or PDD preparation stage to seek the CDM support The essential distinctions which include a serious change in circumstances due to which the new proposed CDM project activity in sponge iron plant with waste heat recovery boilers may not be implemented due to few of the following reasons as compared to the early birds: a) In the initial stage the market for sponge iron was very good as well as the prices of iron ore and coal were quite reasonable. b) A good quality Iron Ore and stable quality of iron ore and coal was available. c) The Grid was prepared to pay attractive price for the generated surplus power. d) The crisis of man power was not as serious as today. e) The state electricity board alone was the regulatory authority and also the grid owner. Whereas now the grid has been divided in to several grids and a separate regulatory commission has been established. f) The cost of equipments and land building, civil works as well as man power has substantially gone up which seriously affects the viability of new CDM project activities

		being planned. All these changes in circumstances lead to a condition due to which project activity faces additional barrier than the previously implemented projects.

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

1.	Discussion of similar activities	As per the available information in the state of Orissa no other project activity is using waste gases from 300 X 2 Nos. DRI Kiln to produce 16 MW WHRB power (except Action Ispat & Power Ltd. which has 350 TPD X 2 Numbers Sponge Iron Kilns is putting up 16 MW WHRB with CDM support). All the other sponge iron plants which are putting up WHRB power, are in the process of CDM validation or PDD preparation stage to seek the CDM support

SMC in its board meeting dated 18/05/2003 discussed about the available options to generate captive power for the industry, wherein coal based captive power plant was found to be financially most attractive and more reliable as compared to waste heat recovery based power plant. The possible benefits from CDM support were considered, therefore in spite of several barriers to implement the WHRB power plant, it was decided to implement WHRB power plant with consideration of CDM support.

JOINT PLANT COMMITTEE REPORT ON "SURVEY OF INDIAN SPONGE IRON INDUSTRY 2005-06"

Under the aegis of the Ministry of steel "joint plant committee (JPC)" was constituted by Government of India; which is the sole custodian of authentic database on the Indian iron and steel industry. The following are major findings:

Report in the "Survey of Indian Sponge Iron Industry 2005-06" has the following statement on Page-3 of 11.

"growth of domestic steel demand, vigorous growth in domestic steel production in secondary steel making sector, techno economic like relative low cost of investment, ease of setting of sponge iron plant, clear cut technology of direct reduction, better quality in end product, availability of mineral resources, abundant labor as well as professional/ technical expertise, frequent problem of scrap, all operating in the facilitating backdrop provided by a free market economy have boosted the growth of the industry"

Indian sponge iron industry summarized table given in JPC report

Table 1	**Indian Sponge Iron Industry : Both Coal & Gas Segments**		
	Data Collected	**Additional / Industry/ Field sources^**	**Total**

	No of units	Capacity (Unit :mt)	No. of units	Capacity# (unit:mt)	No. of units	Capacity (unit:mt)
Operating						
Coal	147	11	56	2	203	13
Gas	3	6	-	-	3	6
Total	150	17	56	2	206	19
Under commissioning (Coal)	58	6	167	12*	225	18
Brownfield Expansion : 77 out of 147 working coal based unit	-	7	-	-	-	7
^=State DI Offices; #=Estimated, *=included units in proposal/ planning stage						

Raw materials:
JPC survey list the following the main constraints faced by sponge iron industry, on Page 7 of 11.

"Analysis of the data shows that out of 147 units surveyed, raw material (availability and prices), accounts for the largest(96%) amongst the nature of constrains faced by a coal based sponge iron unit today, followed by power (cost), and to lesser extent finance (availability), and labor negligible".

JPC survey on page 5 & 6 of 11 :
"**Coal Linkage**: Analysis of the data shows that out of the 147 units surveyed, 60% has their own coal linkage. The state wise picture shows Orissa and Chhattisgarh tops the list with West Bengal close behind. But the scenario in the other states is not much encouraging, indicating the Indian coal based sponge iron producers are dependent on market sources for procuring this key raw material.

Iron Ore: Analysis of thee data shows that out of 147 units surveyed, iron ore from mines, be it captive (virtually nil) or leased (minimal), plays a significant part in meeting iron ore requirements of the domestic coal based sponge iron segment. In other words, this indicates that in case of iron ore also, Indian coal based sponge iron producers are dependent on market sources"

Captive power generation
On page-7 of 11 of JPC report under the heading "captive generation facility"

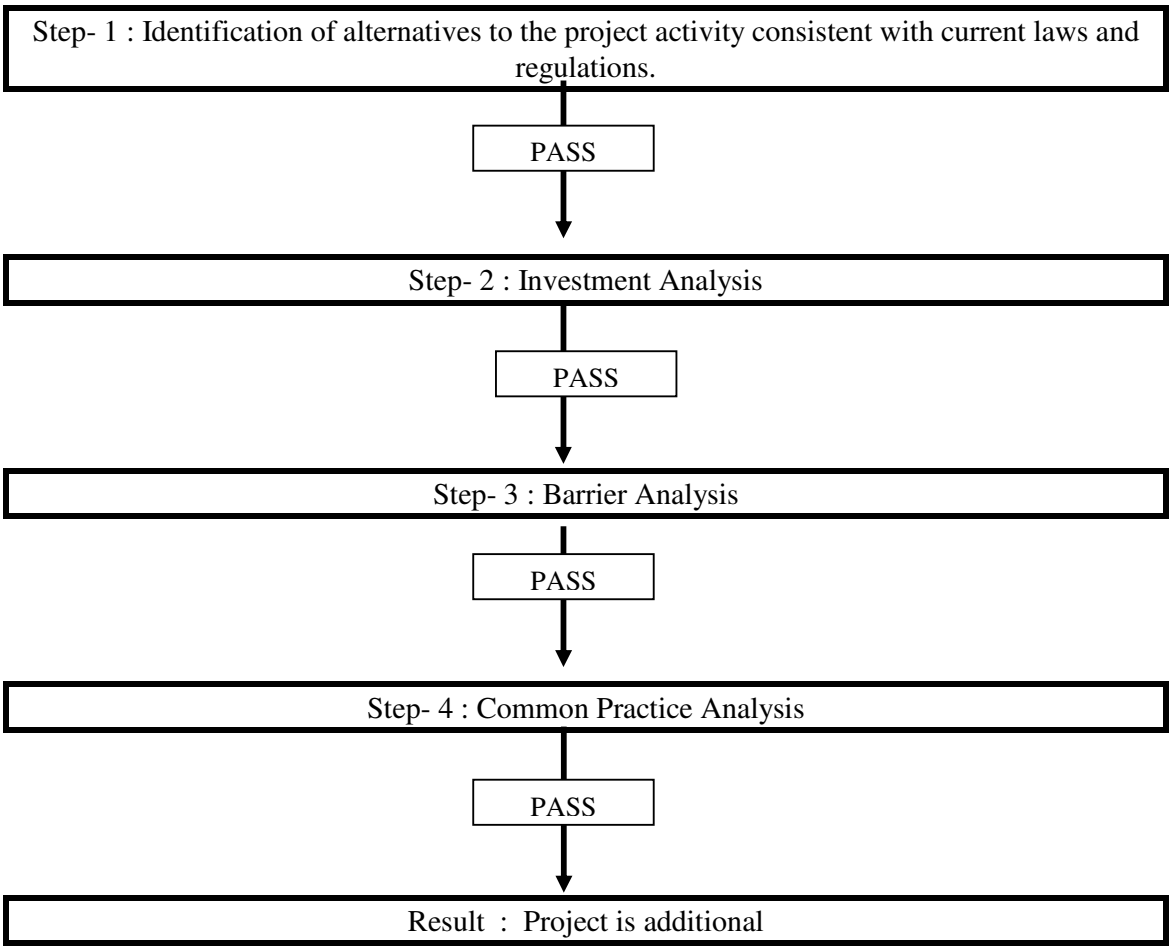
"Analysis of the data shows that out of the 147 units surveyed, the number of units with captive power generation facility is quite low; total of such units being only 16, with maximum concentration occurring in Chhattisgarh (8 units)"

Expansion
"77 out of 147 coal based units are going in for expansion of existing capacity."
Jharakhand, Chattisgarh and Orissa are states where majority of this fresh capacity will be installed

JPC report is enclosed as part of proof for the following barriers

1. Investment barrier due to shortage of iron ore and coal and market variation
2. Common practice analysis/prevailing practice.
3. Technological barrier due to shortage of technical manpower due to heavy expansion in sponge iron industry

Flow Chart : Additionality Scheme



B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Selected methodology is ACM 0004 Version 02 03 March 2006.

The project activity meets the applicability conditions of baseline methodology, namely.

1. Project activity generates 16 MW electricity from waste heat in waste gases, without adding any GHG emission.
2. The project activity displaces CO_2 emissions from the fossil fuel based power and hence achieves reduction of CO_2 emissions.
3. There will be no fuel switch in rotary kiln that produces flue gases with waste heat after completion of project activity.

Project Emission

Project emissions are applicable only if auxiliary fuels are fired for generation start up, in emergencies, or to provide additional heat gain before entering the Waste Heat Recovery Boiler.

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

Where,

PE_y = Project Emission in year y (tCO_2)
Q_i = Mass or volume unit of fuel consumed (t or m^3 or KL) = 0 (no fuel is used)
NCV_i = Net calorific value per mass or volume unit of fuel I (TJ/t or m^3 or KL)
EF_i = Carbon emission factors per unit of energy of the fuel I (tC/TJ)
$OXID_i$ = Oxidation factor of the fuel I (%)

No fuel is used for start up in WHRB power project hence PE_y becomes Zero (0)

Baseline Emissions

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

Where,

EG_y = Net quantity of electricity supplied to manufacturing facility by the project during the year y, MWh
EF_y = CO_2 baseline emission factor for the electricity displace due to the project activity during the year t; tCO_2/MWh
$BE_{electricity, y}$ = Baseline Emission for the year y.

CO_2 baseline emission factor in the baseline scenario is determined to be grid power supply, the emission factor for displaced electricity is calculated as in ACM0002

Leakage

There is no leakage in the project activity, hence Ly becomes Zero (0)

Emission Reductions

Project activity mainly reduces CO_2 through substitution of coal based captive electricity generation.

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

$$ER\ y = BE\ y - PE\ y - L_y$$

Where,

ER y = are the emission reduction of the project activity during the year y in tons of CO_2.

BE y = are the baseline emissions due to displacement of electricity during the year y in tons of CO_2,

PE y = are the project emission during the year y in tons of CO_2

L y = are the project leakage during the year y in tons of CO_2

Emission Factor

Grid emission factor has been considered as baseline, to arrive at the emission reduction due the project activity, which is 1.01 tCO_2/MWh for Eastern Region Grid as per the data of Central Electricity Authority (CEA), Government of India, Ministry of Power (available with CEA's official website (http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm).

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

(Copy this table for each data and parameter)

Data / Parameter:	OM
Data unit:	tCO2/MWh
Description:	Operating Margin for Eastern Region Grid
Source of data used:	"CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE" (http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	1.09
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is considered from Official website of Central Electricity Authority of India, which is a Government of India's authority to deal with Power Sector.
Any comment:	Nil

Data / Parameter:	BM
Data unit:	tCO2/MWh
Description:	Build Margin for Eastern Region Grid
Source of data used:	"CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE" (http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	0.93
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is considered from Official website of Central Electricity Authority of India, which is a Government of India's authority to deal with Power Sector.
Any comment:	Nil

Data / Parameter:	CM
Data unit:	tCO_2/MWh
Description:	Combined Margin for Eastern Region Grid
Source of data used:	"CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE" (http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm)
Value applied:	1.01
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data is considered from Official website of Central Electricity Authority of India, which is a Government of India's authority to deal with Power Sector.
Any comment:	Nil

B.6.3 Ex-ante calculation of emission reductions:

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Project proponent have followed the approved baseline methodology ACM0004 for formulas used in estimating base line emissions:

The baseline scenario is determined to be Grid Power Generation. The emissions reduction is calculated as follows;

Project Emission :

Considered Zero (0) because no fuel is combusted during start up in waste heat recovery boiler.
Hence,
PE_y = 0.0 tCO_2e/annum.

Leakage (L_y):

$L_y = 0$ (There is no leakage in the project activity)

Emission Reduction

Project activity mainly reduces CO_2 through substitution of coal based electricity generation.

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

$$ER\ y = BE\ y - PE\ y - Ly$$

Where,

ER y = are the emission reduction of the project activity during the year y in tons of CO_2.

BE y = are the baseline emissions due to displacement of electricity during the year y in tons of CO_2,

PE y = are the project emission during the year y in tons of CO_2

L y = are the project Leakage during the year y in tons of CO_2

No project emission is considered and no leakage is considered

We have followed the Central Electricity Authority: CO_2 Baseline Database version 03, dated 15 December 2007, which is using ACM002/ version 07 for calculating base line emission factor (http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm) .

.

Calculation of Baseline Emission Factor

Base line emission factor will be constant as ex-ante based and fixed for the entire credit period.

Calculation of Electricity Generated in units supplied by waste gas and other fuels:
The methodology requires to calculate the relative share of total electricity generated in units where direct measurement of electricity generated by using the waste gas is not possible as other fossil fuel along with waste gas are used for electricity generation. The electricity generated by supplied waste gas and other fuels will be calculated as below:

The procedure specified below is required to be applied as direct measurement of the electricity generated by using the waste gas is not possible because an other boiler fired with other fossil fuels such as Coal, Char-Dolochar, Washery reject is supplying steam to a common header along with the project activity boilers which generate steam from waste gases to generate electricity. The relative share of total generation from waste gas will be calculated by considering the total electricity produced, the amount and calorific values of other fuels and of the waste gas used, and the average efficiency of the plant where the electricity will be produced.

The average efficiency is given as :
Formula ;

$$H_r = \frac{\sum_{h=1}^{8760} \sum_{i=1}^{I} Q_{i,h} * NCV_i}{EG_{total,year}}$$

Where,

Hr	=	Average power plants efficiency (TJ/MWh)
$Q_{i,h}$	=	Amount of the individual fuel (waste gas and other fuel(s)) i consumed at the power plant during the hours h (Nm^3/h)
NCV_i	=	Net Calorific Value annual average for each individual consumed and the waste gas (TJ/Nm^3)
$EG_{Total, year}$	=	Total annual energy produced at the power plant (MWh/year)

The electricity produced by the project activity is calculated as follows:

$$EG_{year} = \frac{\sum_{h=1}^{8760} Q_{WG,h} * NCV_{WG}}{Hr}$$

Where

Q_{WG}	=	Amount of WG recovered (Nm^3/h)
NCV_{WG}	=	Net Calorific Value of Waste Gas (TJ/Nm^3)
Hr	=	Average Power Plant Efficiency (TJ/MWh)

Calculation of Net Emission Reduction:

a)	Total Power generated by entire CPP during a year including coal based boiler and waste gas based boiler ($EG_{total,year}$) in MWh	237804
b)	Total NCV of all fuels consumed in entire CPP (NCV_i) in TJ	3758.67395
c)	Total NCV consumed from waste gases ($NCV_{WG} * Q_{WG, year}$) in TJ	1591.055138
d)	Average Power Plant efficiency (TJ/MWh) (Hr)	0.015805764
e)	Electricity produced by the project activity (EG_{GEN}) in MWh	100662.96
f)	Auxiliary consumption considered (EG_{AUX}) in MWh	10% = 100662.96 X 10% = 10066.29
g)	Net Power Generation (EG_y) in MWh	Gross Power Generation – Auxiliary Consumption = 100662.96 MWh – 10066.29 MWh = 90596.67 MWh
h)	Emission factor of Eastern Region Grid	1.01 tCo_2/MWh
i)	BE_y (Baseline Emission)	= 90596.67 MWh X 1.01 tCO_2/MWh = 91502.63805 tCO_2 or Say 91502 tCO_2

As per the formulae=

ER_y = BE_y - PEy - Ly

= 91502 - 0 – 0

= 91502

hence, ERy = 91502 tCO_2/annum

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

>>

Year	Estimation of project activity emission (tonnes of CO2e)	Estimation of baseline emission (tonnes of CO2e)	Estimate of leakage (tonnes of CO2e)	Estimation of overall emission reduction (tonnes of CO2e)
2008-09	0	91502	0	91502
2009-10	0	91502	0	91502
2010-11	0	91502	0	91502
2011-12	0	91502	0	91502
2012-13	0	91502	0	91502
2013-14	0	91502	0	91502
2014-15	0	91502	0	91502
2015-16	0	91502	0	91502
2016-17	0	91502	0	91502
2017-18	0	91502	0	91502
Total ::	0	915020	0	915020

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	$Q_{WG\ WHRB1}$
Data unit:	Nm^3/hr
Description:	Flow rate of waste gases at WHRB1
Source of data to be used:	Flow measuring instrument at plant will measure the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	75000
Description of measurement methods and procedures to be applied:	Monitored continuously and hourly data are entered in to Log book maintained for data available from meters.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Archived data will be kept for crediting period + 2 years. The boiler is designed for 90000 Nm^3 with excess air. However for the sake of estimated power generation and estimated emission reduction 75000 Nm^3 flue gas volume has been considered.

Data / Parameter:	$Q_{WG\ WHRB2}$
Data unit:	Nm^3/hr
Description:	Flow rate of waste gases at WHRB2
Source of data to be used:	Flow measuring instrument at plant will measure the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	75000
Description of measurement methods and procedures to be applied:	Monitored continuously and hourly data are entered in to Log book maintained for data available from meters.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Archived data will be kept for crediting period + 2 years. The boiler is designed for 90000 Nm^3 with excess air. However for the sake of estimated power

	generation and estimated emission reduction 75000 Nm^3 flue gas volume has been considered.

Data / Parameter:	$T_{WG\ WHRB1}$
Data unit:	^0C
Description:	Temperature of waste gases at WHRB1
Source of data to be used:	Temperature measuring instrument at plant will measure the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	950
Description of measurement methods and procedures to be applied:	Monitored continuously and hourly data are entered in to Log book maintained for data available from meters.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Average temperature during a day will be considered. Archived data will be kept for crediting period + 2 years.

Data / Parameter:	$T_{WG\ WHRB2}$
Data unit:	^0C
Description:	Temperature of waste gases at WHRB2
Source of data to be used:	Temperature measuring instrument at plant will measure the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	950
Description of measurement methods and procedures to be applied:	Monitored continuously and hourly data are entered in to Log book maintained for data available from meters.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Average temperature during a day will be considered. Archived data will be kept for crediting period + 2 years.

Data / Parameter:	$NCV_{WG\ WHRB1}$
Data unit:	TJ/Nm^3
Description:	NCV of waste gases at WHRB1
Source of data to be used:	Measured Temperature and standard density of flue gases considered 1.303 KG/Nm^3 specified by the manufacturer. The standard NCV of flue gases is

	derived from BHEL handbook
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0000016615029
Description of measurement methods and procedures to be applied:	The temperature of waste gases will be measured continuously and NCV will be Calculated from Monitored Temperature Data continuously and Calculated data will be entered in to Log book maintained
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Archived data will be kept for crediting period + 2 years. The gas NCV has been considered on conservative basis for the sake of estimate of emission reduction calculation. Actual NCV will be calculated based on actual temperature of flue gases.

Data / Parameter:	$NCV_{WG\ WHRB2}$
Data unit:	TJ/Nm^3
Description:	NCV of waste gases at WHRB2
Source of data to be used:	Measured Temperature and standard density of flue gases considered 1.303 KG/Nm^3 specified by the manufacturer. The standard NCV of flue gases is derived from BHEL handbook.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0000016615029
Description of measurement methods and procedures to be applied:	The temperature of waste gases will be measured continuously and NCV will be Calculated from Monitored Temperature Data continuously and Calculated data will be entered in to Log book maintained
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Archived data will be kept for crediting period + 2 years. The gas NCV has been considered on conservative basis for the sake of estimate of emission reduction calculation. Actual NCV will be calculated based on actual temperature of flue gases.

Parameter:	$Q_{COAL\ AFBC}$
Data unit:	Tonnes
Description:	Quantity of coal fed to AFBC
Source of data to be used:	Quantity measuring instrument at plant will measure the data.
Value of data applied for the purpose of	17.073

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Monitored continuously and hourly data are entered in to Log book maintained for data available from meters.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Volume of auxiliary fuel i.e. Coal fed has been considered on 100% coal feed basis, however the actual coal feed rate has recorded shall be taken in to account. Archived data will be kept for crediting period + 2 years.

Data / Parameter:	$Q_{WR\ AFBC}$
Data unit:	Tonnes
Description:	Quantity of washery reject fed to AFBC
Source of data to be used:	Quantity measuring instrument at plant will measure the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	22.117
Description of measurement methods and procedures to be applied:	Monitored continuously and hourly data are entered in to Log book maintained for data available from meters.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Volume of auxiliary fuel i.e. Washery reject fed has been considered on 75% Washery reject feed basis, however the actual coal feed rate has recorded shall be taken in to account. Archived data will be kept for crediting period + 2 years.

Data / Parameter:	$Q_{CHAR\ AFBC}$
Data unit:	Tonnes
Description:	Quantity of char/dolochar fed to AFBC
Source of data to be used:	Quantity measuring instrument at plant will measure the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	18.022
Description of measurement methods and procedures to be	Monitored continuously and hourly data are entered in to Log book maintained for data available from meters.

applied:	
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calibration of the meters.
Any comment:	Volume of auxiliary fuel i.e. Char/ dolochar fed has been considered on 50% char/ dolochar feed basis, however the actual coal feed rate has recorded shall be taken in to account. Archived data will be kept for crediting period + 2 years.

Data / Parameter:	$NCV_{COAL\ AFBC}$
Data unit:	TJ/t
Description:	NCV of coal at AFBC
Source of data to be used:	The NCV of the fuel for the purpose of calculating emission reduction will be based on the actual analysis of continuously drawn sample's calorific value to be done at the plant laboratory. The data for calculation of expected emission reduction are based on the NCV of coal prescribed by the manufacturer..
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.015910
Description of measurement methods and procedures to be applied:	The calorific value of the fuel shall be analysed from continuously drawn samples.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular analysis of fuel.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	$NCV_{WR\ AFBC}$
Data unit:	TJ/t
Description:	NCV of Washery reject at AFBC
Source of data to be used:	The NCV of the fuel for the purpose of calculating emission reduction will be based on the actual analysis of continuously drawn sample's calorific value to be done at the plant laboratory. The data for calculation of expected emission reduction are based on the NCV of washery reject available in region.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.009211
Description of measurement methods and procedures to be applied:	The calorific value of the fuel shall be analysed from continuously drawn samples.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular analysis of fuel.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	NCV_{CHAR_AFBC}
Data unit:	TJ/t
Description:	NCV of Char/dolochar at AFBC
Source of data to be used:	The NCV of the fuel for the purpose of calculating emission reduction will be based on the actual analysis of continuously drawn sample's calorific value to be done at the plant laboratory. The data for calculation of expected emission reduction are based on the NCV of char/ dolochar generated in region..
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.007537
Description of measurement methods and procedures to be applied:	The calorific value of the fuel shall be analysed from continuously drawn samples.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular analysis of fuel.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	Hr
Data unit:	TJ/MWh
Description:	Average Plant efficiency.
Source of data to be used:	Calculated from the recorded NCV of total fuel and waste gases fired in the CPP and by dividing total power generated by CPP during a year
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.015805764
Description of measurement methods and procedures to be applied:	Calculated once in a year or earlier, as per the verification period proposed to be verified.
QA/QC procedures to be applied:	In-charge (O&M) would be responsible for regular calculation of Hr.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	Me_1
Data unit:	kWh
Description:	Electricity generated from TG1
Source of data to be used:	Meter at plant and DCS will measure the data.
Value of data applied	8000

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Log book maintained for data available from meter
QA/QC procedures to be applied:	Meters are sealed by Orissa government 's Deputy Electrical Inspector as company has to pay cess on any power generated in CPP. Manager-In-Charge would be responsible for regular calibration of the meters.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	Me_2
Data unit:	kWh
Description:	Electricity generated from TG2
Source of data to be used:	Meter at plant and DCS will measure the data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	25000
Description of measurement methods and procedures to be applied:	Log book maintained for data available from meter
QA/QC procedures to be applied:	Meters are sealed by Orissa government's Deputy Electrical Inspector as company has to pay cess on any power generated in CPP. Manager-In-Charge would be responsible for regular calibration of the meters.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	Me_3
Data unit:	kWh
Description:	Auxiliary consumption for entire CPP (including WHRB and coal based AFBC).
Source of data to be used:	The auxiliary loads are being monitored through Electrical Energy meters installed at auxiliary consumption sources. The summed up of all these meters is considered as total Auxiliary consumption normally termed as Me_3.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3300
Description of measurement methods and procedures to be	Log book maintained for data available from meter

applied:	
QA/QC procedures to be applied:	Meters are regularly calibrated and Manager-In-Charge would be responsible for regular calibration of the meters.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	$EG_{total, year}$
Data unit:	MWh
Description:	Gross electricity generated by CPP (total electricity generated including electricity generated due to WHRB and Coal based AFBC)
Source of data to be used:	The continuously measured data through electronic meter provided at the output of the TGs, same will be summed up. The meter reading will be used from DCS continuously and same will be transferred to log book to be maintained by shift engineer , approved by shift-in- charge as the daily report Meters are sealed by Orissa government 's Deputy Electrical Inspector as company has to pay cess on any power generated in CPP.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	237804
Description of measurement methods and procedures to be applied:	Log book maintained based on DCS data which receive data from meters
QA/QC procedures to be applied:	Log book signed by plant manager daily. Meters calibrated regularly. As Orissa Government 's Deputy Electrical Inspector sealed meter is provided the meters are regularly under QC/QA procedure for any variation. If variation is noticed recalibration will be done immediately.
Any comment:	Archived data will be kept for crediting period + 2 years. This data includes the total power generation including steam from WHRBs and Coal based AFBC.

Data / Parameter:	$EG_{AUX\ CPP}$
Data unit:	MWh
Description:	Auxiliary electricity consumption in CPP (total auxiliary consumption including auxiliary for WHRB power generation and coal based AFBC power generation).
Source of data to be used:	The data will be continuously measured through the electronic meter provided at the feed to auxiliary consumption sources. The meters readings will be available and same will be summed up to arrive total auxiliary consumption. This data is transferred to log book to be maintained by shift engineer , approved by shift-in-charge as the daily report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	23780.40
Description of	Log book maintained based on DCS data which receive data from meters

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Log book signed by plant manager daily. Meters calibrated regularly.
Any comment:	Archived data will be kept for crediting period + 2 years. Archived data will be kept for crediting period + 2 years. This data includes the total power generation including steam from WHRBs and Coal based AFBC.

Data / Parameter:	EG y_{CPP}
Data unit:	MWh
Description:	Net electricity generated from CPP (Net electricity generation including WHRB and Coal based AFBC power generation)
Source of data to be used:	Calculated as per formulae EG $y_{CPP} = EG_{total, year} - EG_{AUX CPP}$
Value of data applied for the purpose of calculating expected emission reductions in section B.5	214023.6
Description of measurement methods and procedures to be applied:	Log book maintained based on DCS data which receive data from meters
QA/QC procedures to be applied:	Calculated based on measured data.
Any comment:	Archived data will be kept for crediting period + 2 years. Archived data will be kept for crediting period + 2 years. This data includes the total power generation including steam from WHRBs and Coal based AFBC.

Data / Parameter:	EG_{GEN} / EG year
Data unit:	MWh/Annum
Description:	Electricity generation due to WHRBs
Source of data to be used:	This data is arrived by dividing the average efficiency of the plant (Hr) with total NCV of waste gases consumed in the CPP.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100662.96
Description of measurement methods and procedures to be applied:	power generation will be continuously monitored and recorded data will be used for arriving at the required data parameter.
QA/QC procedures to be applied:	Based on continuously measured and recorded data, through calibrated meters

Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	EG_{AUX}
Data unit:	MWh / Annum
Description:	Auxiliary electricity consumption for WHRB power generation
Source of data to be used:	Proportionate Auxiliary consumption for electricity generation in TG due to WHRB..
Value of data applied for the purpose of calculating expected emission reductions in section B.5	10066.29
Description of measurement methods and procedures to be applied:	power consumption will be continuously monitored and recorded data will be used for arriving at the required data parameter.
QA/QC procedures to be applied:	Based on continuously measured and recorded data, through calibrated meters.
Any comment:	Archived data will be kept for crediting period + 2 years.

Data / Parameter:	EG y
Data unit:	MWh/ Annum
Description:	Net electricity generated due to WHRBs.
Source of data to be used:	calculated $EG\ y = EG_{GEN} - EG_{AUX}$ (or $EG_{year} - EG_{AUX}$)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	90596.67
Description of measurement methods and procedures to be applied:	Continuously monitored power generation and auxiliary consumption data will be used for this parameter.Calculated value will be used.
QA/QC procedures to be applied:	Calculation will be done based on continuously recorded data on yearly basis or earlier, as per verification plan of the project proponent.
Any comment:	Archived data will be kept for crediting period + 2 years.

B.7.2 Description of the monitoring plan:

>>

(A) Purpose

To define the procedures and responsibilities for GHG Performance, monitoring, measurement, reporting of data, dealing with uncertainties, and covers the responsibilities regarding plant operation and maintenance.

(B) Scope

This procedure is applicable to 16 MW waste heat based WHRB power project of SMC

(C) Responsibilities

Shift Incharge (Operations): Responsible for proper operation of the mechanical equipments, reporting daily data of waste gas fed to WHRB, coal fed to the AFBC of captive power plant. The report is then sent to the Incharge (O & M) for his review.

Shift Incharge (Electrical): Responsible for proper operation of electrical equipment and taking meter reading for electricity generation

Shift Incharge (maintenance): Responsible for proper maintenance management.

Incharge (O&M): Responsible for operation, maintenance and management of plant will be reviewing the monitored parameters shift-wise and presenting a daily executive summary report, duly signed by himself, to the General Manager (Power Plant)/ CDM Officer.

General Manager/Vice President (Power Plant) : Responsible and In- charge of complete operation, maintenance and management of all plant and CDM related matters

He will be In- charge of all CDM related matters he will be responsible for preparing required documentation and reviewing the accuracy of various reports with counter checks along with project developer. He will be responsible for internal audit regarding CDM project matters.,

Details of monitoring plan is provided in Annexure 4

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

Date of Completion of application and baseline study : 20 August 2007

Preparation of this document has been done by "Indus Technical and Financial Consultants Ltd.", whose address is :

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Shri Vikas Thakur
Indus Technical and Financial Consultants Ltd.
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Raipur City , Chhattisgarh State . 492001. INDIA
Phone : 0771-2255186 Fax : 0771-2254188, Email : indusryp@satyam.net.in ,
Mobile: 094252-08189, 093011-93400

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:

>> 18/05/2003

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

>> 15 Years

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

Project activity will use a fixed crediting period of 10 years.

C.2.1. Renewable crediting period

Not applicable

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

>> Not applicable

C.2.1.2. Length of the first crediting period:

>> Not applicable

C.2.2. Fixed crediting period:

Project activity will use a fixed crediting period of 10 years.

C.2.2.1. Starting date:

>> 01/05/2008 or from the date of registration, which ever is later.

C.2.2.2. Length:

>> 10 Years 0 Month

SECTION D. Environmental impacts

>>

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

>>

The Project activity is to produce 16 MW power based on waste heat recovery based steam generation (WHRB) and steam turbines. There are no additional GHG emissions other than the existing GHG emissions in the absence of project activity.

The installation of WHRB and CPP requires approvals of IBR (Indian Boiler Regulation) and Orissa State Pollution Control Board (OSPCB) and both the approvals have been received before the Commissioning of project activity.

Environmental impact is negligible as the project activity benefits the local, regional and global environment by,

1. Reducing the thermal pollution which could have been caused by emitting waste gases at 950^0C into atmosphere. Project activity recovers the waste heat and save; energy and reduces thermal emission by controlling gas temperature below 200^0C.
   i) Generates electricity without adding any additional GHG emissions.
   ii) The power generated by the project activity will be used for in house activity will be used for in house requirement and consumption without any T&D losses as the location of power generation is in the same premises.
2. Noise level from equipments shall be kept within legal limits.
3. The project will not generate on its own any Fly Ash due to Power generation from the project activity. But ash contained in flue gases will be collected in ash hoppers provided in WHR boiler.
4. The proposed ESP shall remove the ash from flue gases which will be collected in Ash Hopper. This ash will be given free of cost to cement plants and brick manufacturers for further Economics benefits and use. The ash used for production of bricks saves the valuable productive soil; also it reduces the Air Pollution caused by the conventional brick kilns, due to the coal burning. The Ash consumed in Cement making reduces the limestone and coal consumption, thus natural resources are saved.

SMC have carried out EIA Study.

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

>>

Environmental impact are considered in-significant as enumerated in D1, No adverse impact on environment will be there due to project activity.

Noise Pollution

Equipments like Boiler and STGs shall be provided with noise depressing facilities to dampen and to reduce the noise level to permissible levels at the nearest village. In the plant the noise level will be kept below 90dB.

Thermal Pollution:

In current situation the hot flue gases will be let out causing considerable thermal pollution.

The heat shall be recovered in the boiler and the flue gases be let out by stack of 70 m height below 200^0C and hence thermal pollution shall be reduced considerably.

Air emission:

An ESP provided at the outlet of boiler effectively reduces the flue dust level below to 100 mg/Nm^3 while acceptable legal standard is 150 mg/Nm^3 .

Impact on Water environment

Blow down water shall be used for plantation. Sources of waste water are DM Plant and Blow down.

All the waste water will be neutralized before using for plantation.

Monitoring of waste water will be done to limit pH, BOD and COD levels within the stipulated levels.

No discharge will be there outside the premises. Hence due to the zero discharge condition, no adverse impact will be there in the water regime.

Solid waste management

Ash collected from bottom of hopper of ESP shall be transported to Ash Silo equipped with bag filters to ensure clean air.

Ash collected shall be supplied to cement manufacturing/ brick manufacturing units and as back fill material for filling of the low lying area.

Safety Management

To ensure safe working conditions:

1) All moving parts shall be provided with guards/ hoods.
2) Insulation of all hot parts shall be done.
3) Full fledged maintenance department shall ensure the healthy condition of equipments.
4) A disaster management plan already exists to handle crisis situation.

All efforts will be done to create clean environment.

Parameters like Noise, Fugitive Emission as well as point source emissions will be monitored regularly.

Conclusion:

Project activity is environment friendly and creates employment and other benefits and promotes sustainable developments.

SECTION E. Stakeholders' comments

>>

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

>>

SMC identifies the following as stake holders to keep the transparency in the operational activity of the project promoter and thereby meeting local/ environmental regulations

1) Local Authority (Member of Legislative Assembly of Orissa)
2) Local authority of Village –Hirma Gram Panchayat (Village level local body)
3) Western Electricity Supply Company of Orissa ltd (WESCO)
4) State Pollution Control Board, Orissa (OSPCB)
5) Ministry of Commerce and Industry.

SMC management invited comments on the project activity by advertisement in daily newspaper "SAMBAD" on dated.16.03.2007.

Local stake holders appreciated the energy efficient environment friendly project activity which has sustainable contribution to the development.

E.2. Summary of the comments received:

>> SMC management apprised the representatives of village Panchayat (Village level local body)of village-Hirma about the project activity. The members of Panchayat appreciated and had expressed their no objection for project activity. Hirma Gram Panchayat (Village level local body) have issued no objection certificate.

Similarly SMC management apprised MLA regarding the project activity who also appreciated and expressed no objection for the project activity.

Permission have been sought from the State agencies like WESCO,OSPCB, etc. wherever required legally and have been received and other State agencies have been apprised of the project activity

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

>>

The relevant comments and important clauses mentioned in the project documents/ Detailed project report, clearance from OSPCB (State Pollution Control Board) were considered while preparation of CDM Project Design Document. SMC management representatives met various stake holders for appraisal regarding project activity and sought the support.

The peripheral development has been undertaken by the company in line with Sarpanch comments. In addition company has planted a number of trees and plans to plant 5000 more trees.

No adverse comments were received on project activity, stake holders were appreciated the project activity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	SMC POWER GENERATION LTD
Street/P.O.Box:	-------
Building:	-------
City:	Village:Hirma, distt: Jharsuguda
State/Region:	Orissa
Postfix/ZIP:	768202
Country:	India
Telephone:	91-6645-227089
FAX:	91-6645-227073
E-Mail:	works@smcpgl.com
URL:	-----
Represented by:	Mool Chand Aggarwal
Title:	Managing director
Salutation:	Mr.
Last Name:	Aggarwal
Middle Name:	-----
First Name:	Moolchand
Department:	Board of Directors
Mobile:	09238748261
Direct FAX:	91-6645-274314
Direct tel:	09810107935
Personal E-Mail:	works@smcpgl.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public Funding is available from Annexure-I Country

Annex 3
BASELINE INFORMATION
Base line information (sources of information)

S.No.	Data	Source
1.	Individual Plant Capacity	Data available from CEA official website, has been used where in the EF_{CO2} calculated for the Regional Grid.
2	Individual Plant Generation & Auxiliary Consumption	Data available from CEA official website, has been used where in the EF_{CO2} calculated for the Regional (http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20web .
3	Fuel Consumption	Data available from CEA official website, has been used where in the EF_{CO2} calculated for the Regional Grid.
4	NCV, EF_{CO2}, OXIDi	From IPCC guideline

Datasheet form CEA Website for OM, BM and CM:

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**3.0**
DATE	**15 December 2007**
BASELINE METHODOLOGY	**ACM0002 / Ver 07**

EMISSION FACTORS

Weighted Average Emission Rate (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.72	0.73	0.74	0.71	0.72	0.73	0.74
East	1.06	1.03	1.09	1.08	1.05	1.05	1.00
South	0.74	0.75	0.82	0.84	0.79	0.74	0.72
West	0.90	0.92	0.90	0.90	0.92	0.89	0.86
North-East	0.42	0.41	0.40	0.43	0.52	0.33	0.40
India	0.82	0.83	0.85	0.85	0.84	0.81	0.80

Simple Operating Margin (tCO2/MWh) (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.98	0.98	1.00	0.99	0.98	1.00	1.00
East	1.22	1.19	1.17	1.20	1.17	1.13	1.09
South	1.02	1.00	1.01	1.00	1.00	1.01	1.00
West	0.98	1.01	0.99	0.99	1.01	1.00	0.99
North-East	0.74	0.71	0.74	0.74	0.90	0.70	0.70
India	1.01	1.02	1.02	1.02	1.02	1.02	1.01

Build Margin (tCO2/MWh) (not adjusted for imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North					0.53	0.60	0.63
East					0.90	0.97	0.93
South					0.70	0.71	0.71
West					0.77	0.63	0.59
North-East					0.15	0.15	0.23
India					0.69	0.68	0.68

Combined Margin in tCO2/MWh (incl. Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
North	0.76	0.76	0.77	0.76	0.76	0.80	0.81
East	1.06	1.05	1.04	1.05	1.04	1.05	1.01
South	0.86	0.85	0.86	0.85	0.85	0.86	0.85
West	0.87	0.89	0.88	0.88	0.89	0.82	0.79
North-East	0.44	0.43	0.44	0.44	0.52	0.42	0.46
India	0.85	0.86	0.86	0.86	0.86	0.85	0.84

Formulae used to estimate baseline emissions (units of CO_2 equ.)

Selected methodology is ACM 0004 Version 02 03 March 2006.
The project activity meets the applicability conditions of baseline methodology, namely.

1. Project activity generates 16 MW electricity from waste heat in waste gases, without adding any GHG emission.
2. The project activity displaces CO_2 emissions from the fossil fuel based power and hence achieves reduction of CO_2 emissions.
3. There will be no fuel switch in rotary kiln that produces flue gases with waste heat after completion of project activity.

Project Emission

Project emissions are applicable only if auxiliary fuels are fired for generation start up, in emergencies, or to provide additional heat gain before entering the Waste Heat Recovery Boiler.

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

Where,

PE_y = Project Emission in year y (tCO_2)
Q_i = Mass or volume unit of fuel consumed (t or m^3 or KL) = 0 (no fuel is used)
NCV_i = Net calorific value per mass or volume unit of fuel I (TJ/t or m^3 or KL)
EF_i = Carbon emission factors per unit of energy of the fuel I (tC/TJ)
$OXID_i$ = Oxidation factor of the fuel I (%)

No fuel is used for start up in WHRB power project hence PE_y becomes Zero (0)

Baseline Emissions

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

Where,
EG_y = Net quantity of electricity supplied to manufacturing facility by the project during the year y, MWh
EF_y = CO_2 baseline emission factor for the electricity displace due to the project activity during the year t; tCO_2/MWh
$BE_{electricity, y}$ = Baseline Emission for the year y.

CO_2 baseline emission factor in the baseline scenario is determined to be grid power supply, the emission factor for displaced electricity is calculated as in ACM0002

Leakage

There is no leakage in the project activity, hence Ly becomes Zero (0)

Emission Reductions

Project activity mainly reduces CO_2 through substitution of coal based captive electricity generation.

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

$$ER\ y = BE\ y - PE\ y - L_y$$

Where,

ER y = are the emission reduction of the project activity during the year y in tons of CO_2.

BE y = are the baseline emissions due to displacement of electricity during the year y in tons of CO_2,

PE y = are the project emission during the year y in tons of CO_2

L y = are the project leakage during the year y in tons of CO_2

Emission Factor

Grid emission factor has been considered as baseline, to arrive at the emission reduction due the project activity, which is 1.01 tCO_2/MWh for Eastern Region Grid as per the data of Central Electricity Authority (CEA), Government of India, Ministry of Power (available with CEA's official website).

Annex 4
MONITORING INFORMATION

Calculation of Steam Generation and Consumption per day.

ID number	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 kept	Comment
1. $Q_{COAL\ AFBC}$	Quantitative	volume of auxiliary fuel i.e. coal fed at AFBC	Tonnes	Measured (m)	continuously and logged on hourly basis	100%	Electronic/ paper	10+2 years	Volume of auxiliary fuel i.e. Coal fed has been considered on 100% coal feed basis, however actual coal feed rate recorded and will be taken in to account.
2. $Q_{WR\ AFBC}$	Quantitative	volume of auxiliary fuel i.e. Washery reject fed at AFBC	Tonnes	Measured (m)	continuously and logged on hourly basis	100%	Electronic/ paper	10+2 years	Volume of auxiliary fuel i.e. Washery reject fed has been considered on 75% whashery reject feed basis however actual feed rate recorded and will be taken in to account.
3. $Q_{CHAR\ AFBC}$	Quantitative	volume of auxiliary fuel i.e. Char/ dolochar fed at AFBC	Tonnes	Measured (m)	continuously and logged on hourly basis	100%	Electronic/ paper	10+2 years	Volume of auxiliary fuel i.e. Char/dolochar fed has been considered on 50% char/dolochar feed basis, however actual feed rate recorded and will be taken in to account.
4. $NCV_{COAL\ AFBC}$	Quantitative	NCV of coal at AFBC	TJ/t	Measured (m)	continuously	100%	Electronic/ paper	10+2 years	The calorific value of fuel will be analysed from the continuously drawn samples
5. $NCV_{WR\ AFBC}$	Quantitative	NCV of washery reject at AFBC	TJ/t	Measured (m)	continuously	100%	Electronic/ paper	10+2 years	The calorific value of fuel will be analysed from the continuously drawn samples.
6. $NCV_{CHAR\ AFBC}$	Quantitative	NCV of char/ dolochar at AFBC	TJ/t	Measured (m)	continuously	100%	Electronic/ paper	10+2 years	The calorific value of fuel will be analysed from the continuously drawn samples

ID number	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 kept	Comment
7. Me_1	Quantitative	Electricity generated from TG1	kWh	Measured (m)	continuously	100%	Electronic/ Paper	Credit Period + 2 Years	Meters are sealed by Orissa Government 's Deputy Electrical Inspector as company has to pay cess on any power generated in CPP. Incharge (O&M) would be responsible for regular calibration of the meters.
8. Me_2	Quantitative	Electricity generated from TG2	kWh	Measured (m)	continuously.	100%	Electronic/ Paper	Credit Period + 2 Years	Meters are sealed by Orissa Government 's Deputy Electrical Inspector as company has to pay cess on any power generated in CPP. Incharge (O&M) would be responsible for regular calibration of the meters.
9. Me_3	Quantitative	Auxiliary consumption of CPP	kWh	Measured (m)	continuously	100%	Electronic/ Paper	Credit Period + 2 Years	Energy meters will be installed at all the auxiliary consumption sources to record the energy consumption in auxiliary loads Me3 is the summed up value of all the recorded data, used as auxiliary consumption. Archived data will be kept for crediting period + 2 years

ID number	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 kept	Comment
10. $EG_{total, year}$	Quanti tative	Total Electricity generated from CPP	MWh /year	measured (m)	continuously	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be measured online from meters (Me_1 & Me_2) at plant and DCS and added together. Manager In-charge would be responsible for calibration of the meters.
11. $EG_{AUX\ CPP}$	Quanti tative	Total Auxiliary Electricity Consumption by CPP	MWh /year	measured (m)	continuously	100%	Electronic/ Paper	Credit Period + 2 Year	Energy meters will be installed at all the auxiliary consumption sources, Me3 is the summed up value of all the power, used as auxiliary consumption Archived data will be kept for crediting period + 2 years.
12. $EG_{Y\ CPP}$	Quanti tative	Net Electricity Generation by CPP	MWh /year	Calculated (c)	continuously	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be calculated after collecting data from plant and DCS. Manager In-charge would be responsible for calculation
13. EG_{GEN} Or EG_{year}	Quanti tative	Gross Electricity generated by WHRB-1& 2	MWh /year	measured (m)	continuously	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be calculated after collecting data from plant and DCS. Manager In-charge would be responsible for calculation
14. EG_{AUX}	Quanti tative	Auxiliary electricity Consumption by WHRB-1 & 2	MWh /year	measured (m)	continuously	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be calculated after collecting data from plant and DCS. Manager In-charge would be responsible for calculation

ID number	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 kept	Comment
15. EGy	Quantitative	Net Electricity Generation by WHRB-1 & 2	MWh /year	calculated (c)	continuously	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be calculated after collecting data from plant and DCS. Manager In-charge would be responsible for calculation.
16. $Q_{WG\ WHRB1}$	Quantitative	Flow rate of waste gases at WHRB1	Nm^3/hr	Measured (m)	Continuously and logged on hourly basis	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be collected through flow meter installed with WHRB. Manage Incharge would be responsible for regular calibration.
17. $Q_{WG\ WHRB2}$	Quantitative	Flow rate of waste gases at WHRB2	Nm^3/hr	Measured (m)	Continuously and logged on hourly basis	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be collected through flow meter installed with WHRB. Manager Incharge would be responsible for regular calibration.
18. $T_{WG\ WHRB1}$	Quantitative	Temperature of waste gases from WHRB1	^0C	Measured (m)	Continuously and logged on hourly basis	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be collected through temperature meter installed with WHRB. Manager Incharge would be responsible for regular calibration of the meter.
19. $T_{WG\ WHRB2}$	Quantitative	Temperature of waste gases from WHRB2	^0C	Measured (m)	Continuously and logged on hourly basis	100%	Electronic/ Paper	Credit Period + 2 Year	The data will be collected through temperature meter installed with WHRB. Manager Incharge would be responsible for regular calibration of the meter.

ID number	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 kept	Comment
20. NCV WG WHRB1	Quanti tative	Net Calorific Value of Waste gas going in to WHRB1	TJ/Nm^3	measured (m)	continuously	100%	Electronic/ paper	Credit Period + 2 Year	The data will be calculated from measured data. Manager Incharge would be responsible for calculation.
21. NCV WG WHRB2	Quanti tative	Net Calorific Value of Waste gas going in to WHRB2	TJ/Nm^3	measured (m)	continuously	100%	Electronic/ paper	Credit Period + 2 Year	The data will be calculated from measured data. Manager Incharge would be responsible for calculation.
22. Hr	Quanti tative	Average Plant efficiency	TJ/MWh	Calculated (c)	Yearly		Electronic/ paper	Credit Period + 2 Year	The data will be calculated from measured data. Manager Incharge would be responsible for calculation.

I. Table for monitoring

Serial No.	Activity
1.0	**GHG Performance Parameter**
1.1	The monitoring protocol requires SMC to monitor the following GHG Performance parameters for estimating the emissions reductions from the waste heat based CPP: • Gross generation of electricity by the entire CPP • Auxiliary consumption by entire CPP • Calorific value of all types of fossil fuel used. • Quantity of all types of fossil fuel consumed. • Net quantity of waste gas available for electricity generation in CPP. • Temperature of waste gas going in to WHRBs. • NCV of waste gas going in to WHRBs. • Net electricity generation from waste heat recovery.
2.0	**Metering System**
2.1	The metering system for the CPP consist of • Internal metering system is regularly calibrated, the generation meters are sealed by Electrical Inspectorate, it gives total generation from each TG Set. • In house metering system of SMC (for metering the generation of power, auxiliary consumption,) • Waste gas Flow meters for monitoring of net waste gas flow in to WHRB-1&2. • Temperature transmitter for waste gas going in to WHRB-1&2. The two numbers TG meters are located in the TG building itself. They are used to monitor SMCs electricity generation from the CPP. These meters are sealed by Deputy Electrical Inspector, Govt. of Orissa, these meters are calibrated from standard testing laboratory and sealed by DEI(G
2.2	**In house Metering System of SMC** SMC has an in-house metering system, which monitors the overall performance of the waste heat based CPP. The metering system mainly comprises of four meters. • 2 in-house generation meters- One for each TG set. • In-house Auxiliary consumption meters to record auxiliary power consumption to generate power.. The in-house generation meters (or the Energy Meter) and consumption meters are micro-processor based metering device which monitor the net unit of Energy generated and auxiliary electricity consumed by SMC's CPP. In-house captive auxiliary power consumption meters (or the Kilowatt Hour meter) are mainly micro-processor based metering device. In case of requirement the SMC may also install the normal energy meters at various locations. The number and place of metering can be changed to suit the actual field requirement. Installation of all such meters will be well documented. All the meters will be calibrated from

	the reputed agencies.
3.0	**Calibration of the Metering System**
3.1	All the metering devices are calibrated at regular intervals so that the accuracy of measurement is ensured all the time. The meters recording total generation is calibrated by standard testing laboratory and Electrical department officials. The other meters are calibrated internally/externally as per suppliers calibration schedule following the standard procedures for calibration.
4.0	**Reporting of the Monitored Parameters/ Authority and Responsibility of monitoring and reporting**
4.1	**Metering System** The SMC personnel read the power generation metering system for recording the net electricity and the total generation from the CPP on the First day of the subsequent month and keep the complete and accurate records for proper administration. In case of requirement the accuracy of the main meter reading may be substantiated by the check meter reading. In the event that the main meter is not at service, then the check meter shall be used. A monthly report is prepared based on these meter reading, which is sent to the Electrical Inspector as monthly statuary return.. The Shift Engineer (Electrical) takes daily reading of the Main meters of the metering system and keeps the complete and accurate records in the reading book (maintained at the plant) for proper administration. The reading are verified by the Manager (Electrical and Instrumentation) on a daily basis and sent to the Incharge (O&M) for his review and for preparing the daily report.
4.2	**In-house Metering System of SMC** The Shift Engineer (Electrical) monitors hourly data on total generation, auxiliary consumption, net electricity available. The hourly data are recorded in the log book. The complete and accurate records in the log book are signed by the Shift Engineer (Electrical). Both of these reports are sent to the Incharge (O&M) for his review on a daily basis. On the basis of the reported parameters, a complete and accurate executive daily summary report is prepared and signed by the Incharge (O&M) and sent to the G.M. (Power Plant) / CDM Officer for proper administration. DCS will measure the respective parameters and reporting is done shift wise by shift in-charge based on the online measurements.
5.	**Uncertainties and Adjustments:**
5.1	The hourly, daily and monthly data are recorded at various points as stated above. Any observations (like inconsistencies of reported parameters) and/or discrepancies in the operation of the power plant will be documented as “History” in the daily report prepared by the General Manager (Plant) along with its time of occurrence, duration and possible reasons behind such operational disruptions. Necessary

	corrective actions will be undertaken at the earliest. All the meters will be properly calibrated as per schedule hence the uncertainty level will be low. Any discrepancies in the Main reading (for example, difference between main meter and check meter reading or extreme deviation in the net generation figure, if identified, will immediately be brought to the notice of General Manager as well as to Electrical Inspector. Corrective actions to be undertaken at the earliest after identification of reason of such discrepancy. Furthermore, as a safety measure, the total power generating system is equipped with an Automatic Alarming System which gives a prior indication of any fluctuations in the operating parameters of the power plant thereby enabling the operators to take necessary preventive measures. These measures will be undertaken in order to detect and minimize the uncertainty levels in data monitoring.
6.0	**Experience and Training**
6.1	All the Shift Engineers (Electrical and Instrumentation, Operations) are qualified engineers/ technologists. All the operators of the boiler power plant are IBR certified and NPTI certified engineers, and they also undergo an exhaustive on-the-job training program including plant operations, data monitoring and report preparation this will be well documented.
6.2	**Emergency Preparedness Plan** The total power generating system of the waste heat based CPP is equipped with an "Automatic Alarming System"(this is a function of DCS) which helps the operators to take necessary preventive actions before any kind of non-functioning of the power plant results in. SMC. CPP has a fire fighting system in place. In addition SMC has standard procedures for tackling emergencies arising from • Blackout • Low boiler drum level/ low feed water level • High flue gas temperature from sponge iron kiln. • Load throw off • Boiler Tube leakage. Boiler tripping at alarm systems.
(f)	**Reference** Project Design Document, maintenance manuals and standard OEM procedures.
	Records 1. Log Book, maintained by electrical & instrumentation department at site, containing eight hourly data or shift wise data for all the in-house metering system. 2. Daily Executive Summary submitted to the General Manger

		(Plant), prepared by Incharge (O&M) at site containing daily data for all the in-house metering system and record of any history with details.
	3.	Daily report containing the performance parameters of the power plant and record of any history with details, maintained at site with a copy being sent to the unit head of the SMC.
	4.	Monthly Report on net quantity of electricity generated at SMC's Captive Power Plant and Electricity Duty returns submitted by SMC on generation archived at site with a copy being sent to the unit head of SMC.
	5.	Calibration certificate of the meters maintained at site.

(A) Purpose

To define the procedures and responsibilities for GHG Performance, Project Management , Registration, Monitoring, Measurement and Reporting of data and dealing with uncertainties.

(B) Scope

This procedure is applicable to 16 MW waste heat based i.e. WHRB power project of SMC, India.

(C) Authorities and Responsibilities of Project Management, Registration, Monitoring, Measurement and Reporting:

Shift Incharge (Operations): Responsible for reporting daily data of the waste gas fed in to boilers, coal fed in to AFBC of the Captive Power Plant. The report is then sent to the Manager (O & M) for his review.

Incharge (O&M) : Responsible for reviewing the monitored parameters on hourly basis

and presenting a daily executive summary report, duly signed by himself, to the General Manager (Plant).

Shift Incharge (Electrical): Responsible for taking meter reading for electricity generation and wheeling shift-wise. The report is then sent to the Incharge (O&M) for his review on a daily basis.

G.M. (Power Plant) / CDM Officer: Responsible for summarizing data of Electrical, Mechanical, Process (operation) Departments and report the same to the Director and CMD (SMC) on a daily basis.

Appendix I : Abbreviation

^{0}C	Degree Centigrade
ABC	After Burning Chamber
AFBC	Atmospheric Fluidized Bed Combustion
Annex	Annexure
BOD	Biochemical Oxygen Demand
BM	Build Margin
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reduction
CM	Combined Margin
COD	Chemical Oxygen Demand
CPP	Captive Power Plant
dB	Decibel
DEI(G)	Deputy Electrical Inspector (Generation)
DM	De-Mineralized
DRI	Direct Reduced Iron
E&I	Electrical and Instrumentation
EB	Executive Board
EHT	Extra High Tension
EIA	Environmental Impact Assessment
ESP	Electro Static Precipitator
GHG	Green House Gas
HSD	High Speed Diesel
HT	High Tension
IBR	Indian Boiler Regulation
Kcal	Kilo calorie
kg/cm^2	Kilogram per centimeter square.
kWh	Kilo Watt hour
M^3/hr.	Meter cube per hour
MLA	Member of State Level Legislative Assembly
MU	Million Units
MW	MW
MWh	Mega Watt hour
Nm^3/h	Normal Meter Cube per Hour
NPTI	National Power Training Institute
OM	Operating Margine
OSEB	Orissa State Electricity Board
OSERC	Orissa State Electricity Regulatory Commission
OSPCB	Orissa State Pollution Control Board
O&M	Operation and Maintenance
PDD	Project Design Document
PLF	Plant Load Factor
SE(P)	Superintending Engineer (Project)
SMC	SMC Power Generation Ltd..
STG	Steam Turbine Generators
TJ	Terra Joule

WESCO Western Electricity Supply Company of Orrissa Ltd.

Appendix II: COMPARATIVE COST ANALYSIS AND SENSITIVITY ANALYSIS FOR LEVELISED COST OF GENERATION

S.No.	Parameters	WHRB based Power Plant (without CDM) at 66% 16 MW	WHRB based Power Plant (without CDM) at 71% 16 MW	WHRB based Power Plant (without CDM) at 76% 16 MW	WHRB power plant (with CDM) 16 MW	Coal based power plant 16 MW	COAL based power plant 33 MW	
A]	**Identified Financial Indicators**							
1	Capacity	16	16	16	16	16	33	MW
2	IRR	10.20%	12.39%	14.49%	22.06%	21.91%	23.09%	
3	Average Cost Benefit Ratio	3.49%	5.08%	6.68%	12.71%	13.27%	14.34%	
4	10 years Average unit cost of electricity generation	1,832.55	1704.91	1594.07	861.57	1452.75	1395.189	Rs./MWh
B]	The Parameters used for the above.							
1	Investment per MW	45.00	45	45	45.312	35.00	35.00	Million Rs./MWh
2	Number of operational days/Year	350	350	350	350	350	350	days
3	PLF	66%	71%	76%	66%	95%	95%	
	a) Variable Cost							
4	Operation and Maintenance Cost/MW	286.48	266.304	248.78	288.47	173.15	173.15	Rs./MWh
5	Deduct CDM Revenue from cost ***	0.00	0	0	-1000.55			
6	Fuel Cost per MWh	0.00	0	0	0	611.73	611.73	Rs./MWh

Contd…..Appendix-II

S.No.	Parameters	WHRB based Power Plant (without CDM) at 66% 16 MW	WHRB based Power Plant (without CDM) at 71% 16 MW	WHRB based Power Plant (without CDM) at 76% 16 MW	WHRB power plant (with CDM) 16 MW	Coal based power plant 16 MW	COAL based power plant 33 MW	
C]	**Fixed Cost per annum**							
6	Average Manpower cost per MWh	159.77	148.52	138.75	159.77	103.43	50.15	Rs./MWh
7	Depreciation per MW	476.40	442.85	413.72	479.72	257.45	257.28	Rs./MWh
8	Interest	713.89	664.92	622.39	718.29	365.67	365.66	Rs./MWh
9	Backup power cost	407.49	378.79	353.87	407.49	0.00	0.00	Rs./MWh
10	Administrative Exp.	17.90	16.64	15.55	17.90	41.92	46.24	Rs./MWh
11	First year's Average unit cost of electricity generation	2,061.93	1918.03	1793.05	1071.09	1,553.35	1504.21	Rs./MWh

*** applicable only for WHRB based power plant (without CDM)

Sensitivity analysis is done based on different PLF.

Appendix III : LIST OF WHRB POWER PROJECT UNDER CDM PROCESS

S. No.	Project Title	Region	Methodology	Emission Reduction Estimated	Capacity	No. of Kiln connected to WHRB Kiln Capacity
1	TSIL – Waste Heat Recovery Based Power Project	Orissa	ACM0004 ver. 1	30,161	7.5 MW	2 Kilns 120000 TPA
2	OSIL - Waste Heat Recovery Based Captive Power Project	Orissa	ACM0004 ver. 1	32,481	10 MW	1 Kiln 100000 TPA
3	8 MW Waste Heat Recovery based Captive Power Project at OCL	Orissa	ACM0004 ver. 1	25,713	8 MW	4 Kilns X 100 TPD
4	RSP – Waste gas based captive power project in Integrated Iron & Steel Plant	Orissa	ACM0004 ver. 1	35,390	15 GWh/ Annum	Waste gases from B.F.
5	Bhushan Steel & Strips Limited (BSSL) : Grid –Connected Electricity Generation by Waste Heat Recovery from Sponge Iron Direct Reduction (DR) Kilns	Orissa	ACM0004 ver. 2	557,479	33 MW & 77 MW	8 Kiln X 500 TPD
6	Utilization of waste gases for power generation at NINL, India	Orissa	ACM0004 ver. 2	188,300	8.7 MW	Waste gases of B.F.
7	Power generation from waste heat of submerged arc furnaces	Orissa	ACM0004 ver. 2	99,807	13 MW	Heat of Waste gases from SAM
8	"Bhaskar Steel & Ferro Alloys Ltd. (BSFAL) 8 MW captive power generation through waste heat	Orissa	ACM0004 ver. 2	51,756	8 MW	1 Kiln X 350 TPD
9	AIPL WHRB 1&2	Orissa	ACM0004 ver. 2	96,589	16 MW	2 Kilns X 350 TPD
10	SMC WHRB 1&2	Orissa	ACM0004 ver. 2	100,276	16 MW	2 Kilns X 300 TPD
11	SML WHRB CPP	Orissa	ACM0004 ver. 2	141,936	17.7 MW	1 Kiln X 300 TPD 4 Kilns X 100 TPD 2 Kilns X 50 TPD
12	Bhushan Power and Steel Limited–Waste Heat Recovery Based Captive Power Project.	Orissa	ACM0004 ver. 2	294,827	40 MW & 60 MW	4 Kilns X 500 TPD
13	Aarti Steels Limited – Waste Heat Recovery based Captive Power Project	Orissa	ACM0004 ver. 2	106,145	12 MW	1 Kiln X 500 TPD
14	Utilization of waste heat of Coke Dry Cooling Plant gas for power generation at NINL, India	Orissa	ACM0004 ver. 2	48,749	5.3 MW	Coke Oven gases
15	SHYAM DRI WHR CPP	Orissa	ACM0004 ver. 2	119,735	19 MW	2 Kiln X 350 TPD
16	10 MW Waste Heat Recovery (WHR) project by Deepak Steels and Power Limited, India	Orissa	ACM0012 ver.1	392080	10 MW	2 Kiln X 50 TPD, 2 Kiln X 100 TPD

IRR Calculation without CDM support

YEARS	GROSS FIXED ASSETS	INVENT--ORIES	TOTAL INVEST--MENT	OPERATING PROFIT	INTER--EST	DEPREC--IATION	GROSS CASH INFLOW	NET CASH FLOW	DISCOUNTED VALUE AT	
									10.20%	20.20%
0	720.00		720.00					-720.00	-720.00	-720.00
1		17.04	17.04	10.52	53.83	35.92	100.26	83.22	75.524	69.241
2		1.71	1.71	10.66	52.35	35.92	98.93	97.22	80.062	67.294
3		0.00	0.00	14.09	47.45	35.92	97.47	97.47	72.839	56.129
4		0.00	0.00	21.44	40.10	35.92	97.47	97.47	66.099	46.698
5		0.00	0.00	29.60	31.94	35.92	97.47	97.47	59.983	38.852
6		0.00	0.00	37.77	23.77	35.92	97.47	97.47	54.434	32.324
7				37.77	23.77	35.92	97.47	97.47	49.397	26.893
8				37.77	23.77	35.92	97.47	97.47	44.827	22.374
9				37.77	23.77	35.92	97.47	97.47	40.679	18.615
10				37.77	23.77	35.92	97.47	97.47	36.915	15.487
11				37.77	23.77	35.92	97.47	97.47	33.500	12.885
12				37.77	23.77	35.92	97.47	97.47	30.400	10.720
13				37.77	23.77	35.92	97.47	97.47	27.587	8.919
14				37.77	23.77	35.92	97.47	97.47	25.035	7.420
15				37.77	23.77	35.92	97.47	97.47	22.719	6.173
									0.00	-279.98
								=	279.98	
							I.R.R.	=	**10.20%**	

IRR Calculation with CDM support

FINANCIAL ANNEXURE - X :: CALCULATION OF INTERNAL RATE OF RETURN (IRR) & NPV

YEARS	GROSS FIXED ASSETS	INVENT--ORIES	TOTAL INVEST--MENT	OPERATING PROFIT	INTER--EST	DEPREC--IATION	GROSS CASH INFLOW	NET CASH FLOW	DISCOUNTED VALUE AT	
									22.06%	32.06%
0	725.00		725.00					-725.00	-725.00	-725.00
1		17.06	17.06	83.61	54.16	36.17	173.93	156.87	128.525	118.793
2		1.71	1.71	83.75	52.68	36.17	172.60	170.89	114.707	97.992
3		0.00	0.00	87.22	47.75	36.17	171.14	171.14	94.114	74.312
4		0.00	0.00	94.62	40.35	36.17	171.14	171.14	77.106	56.272
5		0.00	0.00	102.83	32.14	36.17	171.14	171.14	63.172	42.612
6		0.00	0.00	111.05	23.92	36.17	171.14	171.14	51.756	32.268
7				111.05	23.92	36.17	171.14	171.14	42.403	24.435
8				111.05	23.92	36.17	171.14	171.14	34.740	18.503
9				111.05	23.92	36.17	171.14	171.14	28.462	14.011
10				111.05	23.92	36.17	171.14	171.14	23.319	10.610
11				111.05	23.92	36.17	171.14	171.14	19.105	8.034
12				111.05	23.92	36.17	171.14	171.14	15.652	6.084
13				111.05	23.92	36.17	171.14	171.14	12.824	4.607
14				111.05	23.92	36.17	171.14	171.14	10.506	3.489
15				111.05	23.92	36.17	171.14	171.14	8.608	2.642
									0.00	-210.34
								=	210.34	
							I.R.R.	=	**22.06%**	

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