



**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 : SML WHRB CPP

CDM document version No : 2

Date of the CDM document : April 20, 2007

A.2. Description of the project activity:

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Purpose of the project :

The purpose of the proposed project activity is to generate electricity by using waste heat contained in the waste flue gases released from seven numbers of ABCs (After Burning Chamber) from seven numbers of DRI (Direct Reduction Iron) sponge iron kilns comprising of 1 numbers of 300 TPD, 4 numbers of 100 TPD and 2 number of 50 TPD each. The heat contained in waste gases is transferred to water, which converts water in to steam in seven numbers of WHRBs (Waste Heat Recovery Boiler) generating in aggregate- 86.4 tonnes/h of steam, out of which 48.4 tph steam is generated at 45 kg/cm² pressure and 420±5deg C temperature in 6 number of waste heat recovery boilers which are connected through one common header to feed steam in to TG-1(8MW). As per normal calculations from the available heat in the flue gases about 2.2 MW equivalent power can be generated from each 100 TPD plant, thereby from this group of six kilns, having aggregate 500 TPD sponge iron production capacity, about 11 MW power could have been planned. However looking into the lack of sufficient knowledge and experience in the region at the planning stage the company had only planned to set up a 8 MW capacity turbine and accordingly established the WHRBs. The seventh WHRB will generate 38 tph steam at 67 kg/cm² pressure, 490±5deg C temperature which is fed in TG-2 (20 MW) through another independent common header which also receives 41tph steam from AFBC. In aggregated total 17.7 MW electricity will be generated from Waste Heat recovery.

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 SML Plant itself and Surplus power (when due to any reason the captive demand for power will be less than the generated power) is exported to the North Eastern Electricity Supply Company of Orissa Limited (NESCO) as infringe power which is not likely to realise any value at present.

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**

SML is putting up an integrated steel complex to produce Sponge Iron, Pig Iron, Steel billets, Rolling Mill etc in phased manner. The Company has already installed 800 TPD sponge iron production capacity along with 8 MW power generation from WHRB, which is the part of the present project activity. The company is installing another TG set with 20 MW capacity to generate 9.7 MW power from waste heat through WHRB and 10.3 MW from coal based CPP in the next phase of expansion in its capacity. The company is implementing the total 17.7 MW WHRB power plant as CDM Project activity, which includes the existing 8 MW WHRB power plant & the second 9.7 MW WHRB power plant under implementation. The company will be following CDM registration procedures for the entire capacity.

The company is implementing the captive power plant with 8 MW and 20 MW STGs, to generate total 28 MW Captive power. 17.7 MW power will be generated from waste heat recovery boiler steam. For which two nos. of 5 tonnes/h, four nos. 9.6 tonnes/h capacity WHRB are already established and one no.38 tonnes/h capacity WHRB is being established. Total seven nos. of WHR boilers will produce 86.4 tph steam. The remaining steam will be generated from Coal Based Fluidised Bed Boiler. The generated power is consumed firstly to meet the auxiliary power requirement of the WHRBs and captive power plant and then balance for in house captive requirement for the associated industrial manufacturing activities such as operation of Sponge Iron Kiln, Induction Furnace, Rolling Mill for production of steel etc. The back up or standby support power required to meet the fluctuating power generation from WHRB, would be drawn from NESCO which is the local grid and which is part of eastern regional grid. In case of Surplus the power is wheeled to the Grid. All costs of installing the required equipments for synchronising and evacuating the power to NESCO Grid were borne by SML.

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 17.7 MW generated from steam; produced from waste heat recovered from waste gases in seven number WHRBs, which would have been otherwise generated by increasing the capacity of the Coal fired Boiler in the captive power plant, at the same time the heat contained in the flue gases would have been let to the atmosphere without any utilisation, as the company has no other use for the waste heat. There is no legal requirement to recover the heat for any other useful purpose.

The total CO₂ emission reduction for the entire crediting period of 10 years, have been calculated at 1419363.00 Tonne CO₂ equivalents in 10 years. The other benefits being reduction of CO₂ emissions considering global scenario, sustainable development through better energy efficiency and it also leads to the improvement of local environment.

SML will have proper monitoring system to calculate the power generated out of the CPP and accurately record the reduction in CO₂ emissions. SML will follow monitoring plan to achieve complete transparency in monitoring, recording and calculating reduction in CO₂ emissions.

The Project activity achieves the following goals.

- Utilisation of waste 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 pollution even though no such statutory requirement exists.

Social benefit to state

The project activity increases the employment within the company for skilled manpower and Professionals due to the project activity. The project activity also increases the employment outside the company for skilled manpower and Professionals due to the implementation as well as operation of 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 CO₂ emission. The WHRB power saves coal combustion thus to this extent the fly ash generated pollution is saved in addition the pollution caused in the coal mining and transportation also is saved.

Reduction of T & D Losses of Power

The Power generated by the project activity is mainly used for in house requirement and consumption without any significant T&D losses. This is significant as grid has more than 32% T&D loss.

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

The ESP shall remove the ash from Flue Gases which will reduce the SPM levels in the atmosphere. The ash is collected in ash hopper and is given free of cost to 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 ash can alternatively be used to backfill the cavities in the mining areas and mined out land.

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	Sree Metaliks 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, India

A.4.1.3. City/Town/Community etc.:

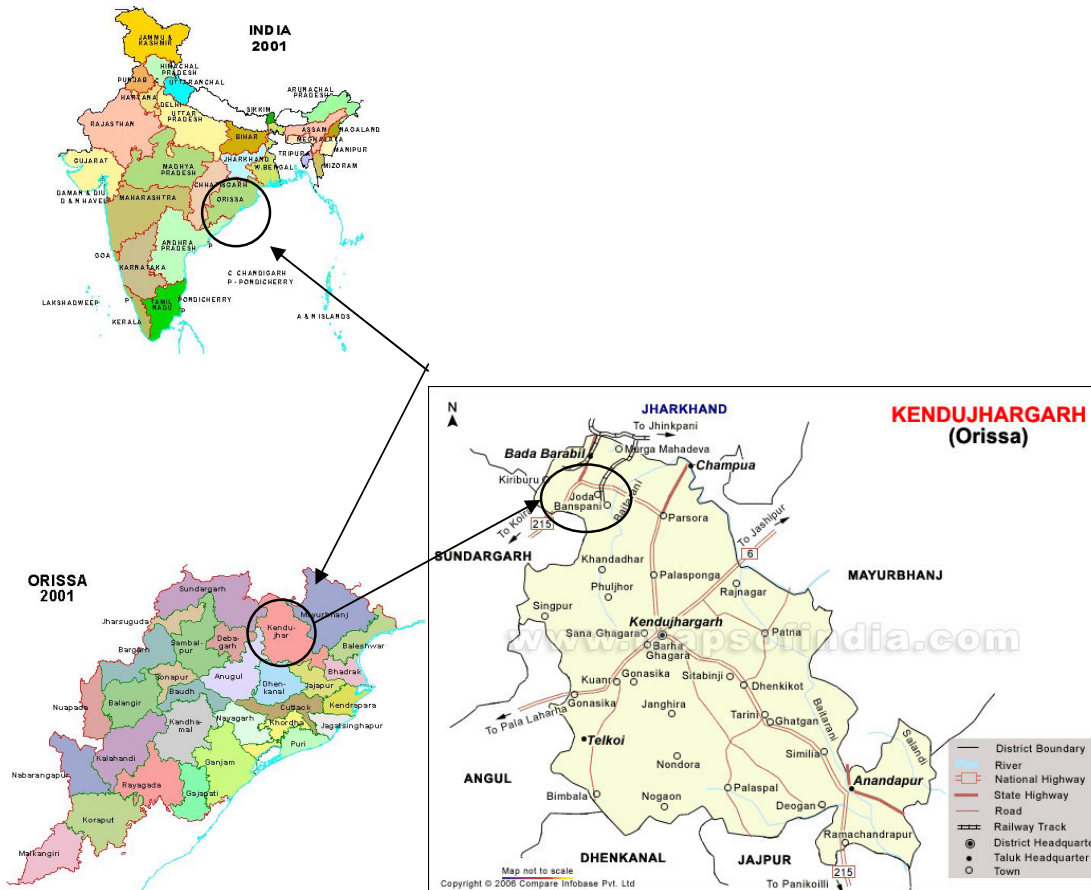
>> Village:Loidapada, Guali,Dist. Keonjhar, State-Orissa.

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 Loidapada, Guali about 20 km away from Barbill on Rorkela-Barbill road



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

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The project activity is an electric power generation project utilising waste heat where aggregate electricity generation savings is equivalent to 105138 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 SML utilises the waste heat content of flue gases coming out of ABCs of sponge iron kilns.

The Exhausted flue gases from rotary kilns is received at their respective ABCs for further incineration where the waste gas temperature reaches to about 900 – 1000⁰C. 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 produces aggregate 86.4 tph of steam, comprising of 48.4 tph at 45 kg/cm² pressure and 420±5 deg C temperature from 6 number of boilers and 38 tph, 67 kg/cm² pressure, 490±5deg C temperature from 7th WHRB. The WHRBs are 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 is kept at less than 180⁰C. The feed water temperature is maintained at the inlet to economiser 105⁰C for six number of boilers and 130⁰C for seventh boiler.

The medium pressure and high pressure steam from WHRBs is used to operate high efficiency extraction cum condensing multi stage STGs to generate 17.7 MW Electricity from WHRBs.

Ash collected from all WHRBs hoppers & ESP will be conveyed from 2 numbers of boiler mechanically and for rest of boiler 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 is condensed in water cooled condenser.

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

Total Waste water is recycled and reused after treatment.



The generated power shall be firstly used to meet the captive power requirement of the company and the surplus will be fed to the grid.

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

The project activity is likely to operate maximum for 330 days in a year. No supplementary fuel is used in WHRB.

The project activity was started with the board resolution dated 10 July 2002 followed up with equipment selection and ordering process in March 2003.. The First 8 MW WHRB Captive Power Plant was commissioned on 19th August 2004 and the zero date for CER calculation & quantification of CO₂ reduced by this Project activity would be from the date of registration as CDM project activity.

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 ₂ eq
2007-2008	141936.300
2008-2009	141936.300
2009-2010	141936.300
2010-2011	141936.300
2011-2012	141936.300
2012-2013	141936.300
2013-2014	141936.300
2014-2015	141936.300
2015-2016	141936.300
2016-2017	141936.300
Total for credit period	1419363.000
Average per year	141936.300

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.

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

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The approved 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. The steam produced by WHRBs by recovering heat from flue gases coming out of DRI sponge iron kiln, is used to generate electricity in STG. The Power is used in house and surplus is exported to grid as infringe power.
3. In the absence of the Project activity, the electricity requirement would have been met by coal based captive power generation. The CO₂ emission reduction achieved by reduction of corresponding CO₂ emissions in fossil fuel based captive power plants of the company.
4. There will be no fuel switch in sponge iron manufacturing process after the implementation of the project activity.
5. The base line calculations for CO₂ emission reduction are in line with approved methodology and are calculated using IPCC values and the performance data provided by the manufacturer for the TG set and the Boiler.
6. The project activity also reduces the thermal impact on the environment in the local area by recovering waste heat from flue gases.
7. By successful operation of project activity, the project activity will be able to displace/ substitute equivalent to 17.7 MW power from Coal based captive power plant of the company, with an average emission reduction of 141936.300 tCO₂ eq./annum (**Ref. Section- B 6.3**).
8. The project activity adds no additional GHG emission.

Hence it is concluded that the selected methodology meets the conditions set out in approved methodology

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.

In line with methodology the project boundary comprises of the WHRBs, STGs, Auxiliary equipment, Power synchronising system, steam flow piping, flue gas ducts, where project participant has full Control.

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

	Source	Gas		Justification / Explanation
Baseline	<i>Coal Based Captive Electricity generation</i>	<i>CO₂</i>	<i>Included</i>	<i>Main emission source</i>
		<i>CH₄</i>	<i>Excluded</i>	<i>Excluded for simplification. This is conservative.</i>
		<i>N₂O</i>	<i>Excluded</i>	<i>Excluded for simplification. This is conservative.</i>
Project Activity	<i>Heat of waste gas for electricity generation</i>	<i>CO₂</i>	<i>Excluded</i>	<i>In absence of the Project Activity the hot gases would have been let to the atmosphere. As well as no extra fuel or support fossil fuel is fired.</i>
		<i>CH₄</i>	<i>Excluded</i>	<i>Excluded for simplification</i>
		<i>N₂O</i>	<i>Excluded</i>	<i>Excluded for simplification</i>

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

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We explain below the basic assumptions of the base line methodology.

1. Project activity displaces the CO₂ emissions from fossil fuel based captive electricity generation from the captive power plant based on the coal.
2. Project activity is based on waste heat recovery to generate up-to 17.7 MW electricity to be used for captive purposes mainly, without emitting any additional GHG.
3. There is no provision to use any other fuel in the proposed Project activity other than waste heat from flue gases coming from ABCs of Rotary kilns.
4. There will be no fuel switch in rotary kiln from where the waste gases are produced and, further used in project
5. In the absence of Project activity, the electricity requirement would have been met by Coal based Captive power generation. The CO₂ emission reduction will be achieved by reduction of corresponding CO₂ emission in fossil fuel based Captive power plants of the company.
6. There is no legal binding that the waste heat is to be recovered.
7. So far any other use of waste heat in any other way would not effectively reduce the CO₂ emissions directly / indirectly. SML has no other alternative use for thermal energy.

As highlighted in baseline methodology we consider the following potential alternatives

1. Proposed project activity not undertaken as a CDM activity
2. Import of electricity from grid
3. New CPP based on Diesel oil as alternative fuels



4. New CPP based on Gas alternative fuels
5. New CPP based on Coal as other alternative fuels
6. A combination of 2,3,4 and 5
7. Alternative use of waste heat from flue gases
8. The continuation of the current situation

Detailed explanations of each alternative are given below:

1. Proposed project activity not undertaken as a CDM activity

In absence of the CDM benefit the proposed project activity possibly could not be implemented due to number of barriers such as Technology barrier, Financial barriers, Investment etc. as explained in B.3.

In absence of the proposed project activity the unit would meet the complete electricity requirement 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.

2. Import of electricity from grid

This will meet all legal and statutory obligations of Country. As the power from NESCO grid is mainly fossil fuel based the reduction of CO₂ emissions is not achieved in this situation. The electricity purchase rate is high compared to coal based captive power generation cost and company has to face power tripping due to poor grid infrastructure resulting in production loss. Hence, SML is putting up 28 MW captive generating capacity to avoid production losses due to power interruptions.

3. New CPP based Diesel oil as alternative fuels

A CPP based on diesel oil/ furnace oil can be installed. The Diesel or any Petroleum Fuel based Power Plants are not feasible because of highly fluctuating rates and higher cost of generation, than the coal based CPP power cost and even grid power cost. Also this option will add GHG gas emissions to the existing scenario. It also involves high capital cost and high cost of operation.

4. New CPP based Gas as alternative fuels

Natural gas is not available in this area and hence ruled out as possible fuel.

5. New CPP based on Coal as alternative fuels

SML has already obtained IEM to generate power from coal based thermal power plant. Coal is abundantly available fuel as the state lies within the coal belt. In addition company is generating huge quantity of char/dolachar, which can be used. In addition to this char / dolachar can also be sourced from other neighbouring sponge iron manufacturers at no cost. The generating cost of coal based (based on char/ dolochar) CPP will be lower as well as generation will be regular with +95 % PLF.

There is no legal compulsion for Sponge Iron Plant to set up the captive power generation or to set up a waste heat recovery system. In addition to this there is also no restriction to generate own power through a CPP based on 100 % Coal or based on coal mixed with Char/ Dolochar. Hence Coal, Char / Dolachar, based captive power plant is economically most attractive.

**6 A combination of 2, 3/4 & 5**

The combination faces the same difficulties as in 2, 3, 4 or 5. Hence the combination is not feasible.

7. Alternative use of waste heat from flue gases

The waste heat is not useful in any form of use in the existing plant as SML does not have heating requirements in the process of manufacture of sponge iron where thermic oil or hot water or Hot Steam can be used. Generally the hot gases are let out into atmosphere leading to thermal emission. So far other use for waste gases and waste heat has not been developed in sponge iron manufacturing.

8 The continuation of current situation

In absence of the captive power generation the SML was drawing power from NESCO grid. It can continue to do the same. However the company does not want to depend only on grid power as grid has frequent tripping of power which results in production losses, as well as cost of power is high.

Other alternatives common to similar units:

1. Most of the units operating induction furnaces independently have opted for grid power. But due to frequent power cuts and high tariff of power, they are facing problem.
2. Many units have put up coal based captive power generation while only a few have put WHRB based CPP due to the CDM strength.
3. Most of the units operating with 100 TPD and/or smaller Sponge Iron Plants have not used waste heat for any gainful purpose and they emit the waste heat in to atmosphere and meet their power requirement by drawing power from the Grid. The company was the first company to put up WHRB power with 100 TPD and 50 TPD DRI Kilns.

In view of the above, the only flexible alternative to SML is to select a coal based captive power plant which can also run on Char/ Dolochar. Since WHRB based power generation is not consistent, hence plant can not run smoothly only on WHRB power alone. Annualised cost of WHRB power is comparatively found to be higher than coal based CPP power due to fluctuating PLF and other indirect costs.

Economical Analysis of alternatives as per the current scenario:

Alternative	Capital Cost	Cost Comparison	Comment
1. Project activity not as CDM activity but installed just as WHRB based power plant	Rs 45.00 million/MW	Annualized indirect revenue recovery from WHRB power would be lower than fossil fuel based FBC boiler CPP; due to affected PLF and uncertain fluctuation as well as lack of revenue during export of surplus power to the grid.	Various technology, investment & financial barriers will hinder the implementation of the project. Also annualized indirect revenue recovery from WHRB power will become lower due to affected and fluctuating plant load factor.
2. Import from grid	Will require payment for line laying cost +	Power procurement cost is higher (including the	SML will face power tripping due to poor



	deposit as security for 17.7 MW power supply	weighted average of Demand Charge) than coal, char/dolochar, based captive power.	transmission system in grid power. This option faces no other legal barrier.
3 Alternative fuel HSD	Rs.30.00 Million/MW	Above Rs 8/- unit. ref TISCO diesel power cost	HSD prices escalate regularly and generating cost high. Economically not attractive
4 Alternative fuel Gas	Not an option.	Not applicable	Not an option, as Gas is not available in Orissa state
5 Alternative fuel Coal+ Char/ Dolochar,	Rs.35.00 million/MW	Annualised cost of power consumed from captive generation will be lowest because of better PLF and availability of Coal, Char/ Dolochar	SML could have put up 17.7 MW coal based CPP instead of WHRB with lower capital cost, with better revenue realisation (on annualised basis), as well as higher and stable PLF. Company is putting 10.3 MW coal based AFBC along with 17.7 MW WHRB based CPP. Hence Coal based CPP is economically most attractive.
6. Combination of grid and coal power	Will require payment for line laying cost + deposit as security for 17.7 MW supply & Rs. 35.00 million/MW for coal based CPP Power.	SML will be paying demand charges for the contract demand even if it is not required to draw power as well as incur the power generation cost in captive power plant hence the ultimate cost of power will be higher.	SML will be paying much higher cost compared to the coal based captive generation cost. SML will also bear power cuts and resultant production loss. This option faces no barrier
7. Alternative use of waste heat	Not applicable	Not applicable	SML has no alternative use for heat energy.
8. Continuation of current situation	Same as alternative 2	Same as alternative 2	This is same situation as Alternative 2 this option faces no barrier

The analysis of the above 8 alternatives shows that the best options available to SML is to go for alternative-5 i.e. Coal, Char / Dolochar based power plant. The methodology requires SML to select the baseline which is economically most attractive and faces no barrier. Normal choice for baseline is coal based CPP as per methodology.



The project activity displaces CO₂ emissions from the fossil fuel based captive power plant and hence achieves reduction of CO₂ emissions. We select Coal based captive electricity generation as base line to calculate the base line emissions. In line with methodology, emission factor will be calculated as in ACM 0002.

Summarization of National Policy on the Environment and Energy Conservation:

(A) National Policy

In India the environment issues are regulated by a number of Acts, such as Environment Protection act 1986, Air (Prevention and Control of Pollution) Act 1981 and Water (Prevention and Control of Pollution) Act 1974, the above acts are enforced by the Ministry of Environment of Forest Govt. of India, Central Pollution Control Board and the State Pollution Control Board, (in Orissa State it is known as Orissa State Pollution Control Board). There are a number of notifications issued by Govt. of India as well as State Govt. towards the control of Air Pollution, Water Pollution and protection of the Environment. In addition to the above the govt. and the above agencies also issue certain guidelines and policies for better Environment protection and pollution control. But these policies and guidelines do not form the part of the Law and Rules to be enforced by the govt.

As per the prevailing Rule and Regulations it is not mandatory to establish WHRB Power Plant with Sponge Iron Plant. The Central Pollution Control Board New Delhi had issued a draft code on Environment Standard Code of practice for Pollution Prevention of Sponge Iron Plants in November 2005. In which the board has proposed to the entrepreneurs having more than 100 TPD Kiln to establish the WHRB Power generation. But the same is not legally mandatory.

The above code is mainly the suggestive practice which the entrepreneurs can adopt and it is not the part of the Air (Prevention and Control of pollution) Act 1981. Hence this can not be considered as the legal requirement.

(B) Status of the Company

The company has obtained from OSPCB permission to establish and consent to operate under the Air Act & Water Act. Since any industrial activity is required to seek “permission to establish” & “consent to operate” from the State pollution Control Board before commencement of the activity. Hence the company applied for the same to SPCB and sought clearances. There exists no regulation or the legal requirement in the present laws to establish WHRB captive power plant by the Sponge Iron Industry.

Key methodological Steps followed in determining the baseline scenario

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

We have discussed above, each alternative and shown that the Coal based captive electricity generation as base line scenario.



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

We have shown the additionality of project activity using the “Tool for demonstration and assessment of additionality version-03” In Section B.5

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

We have established that project activity generates the electricity from waste heat and this electricity displaces Coal based captive electricity generation which is mainly fossil fuel based power and there is no fuel switch being done in the Sponge Iron Rotary kiln where the waste gases are produced.

In Section B.5; we have demonstrated the project activity is additional by using the tool for the demonstration of additionality.

Key Information and data used to determine the baseline scenario

Key information data like generation of electricity, fuel consumption, auxiliary fuel consumption, calorific value, oxidation factor, emission factors are taken from the following sources to determine the baseline scenario:

- 1) Most efficient steam consumption in TG set per MW of power Generation from the original equipment supplier specification.
- 2) Boiler efficiency has been considered as per Nameplate of boiler manufacturer.
- 3) IPCC Guidelines.
- 4) The base line calculations for CO₂ emission reduction are in line with approved methodology and data drawn from IPCC and 20 MW turbine specification of manufacturer as it is more efficient in generation of electricity per tonne of steam. Coal based AFBC captive power plant efficiency is calculated after considering boiler efficiency as per manufacturer nameplate 83% in line with Option- A 3 of methodology.
- 5) Enthalpy of steam through standard steam table (molier chart) published by Bureau of Indian Standard.

These data are given in Annex-3 under Base line information (Baseline calculations)



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 registered CDM 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 Kiln, only the waste heat in the flue gases is utilised 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 continuedly emitted to the atmosphere.

Hence the project activity achieves reduction in CO₂ emission by displacing the fossil fuel based captive power of the company by WHRB based captive power which does not generate any CO₂.

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 3) of approved at the 29TH 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.

We have discussed realistic and credible alternatives available to project activity in B.4 and have come to conclusion that the generation of power from Coal based Captive power plant 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 03) of EB-29..

We show that the project activity faces significant technical, financial and investment barriers and in the absence of CDM finance these barriers would impact the project activity.

The base line methodology outlines five steps to demonstrate additionality.

**STEP 0 - Preliminary screening based on the starting date of project activity**

a.	Provided evidence of the starting date of CDM project activity	The board resolution of 10 th July 2002 considered as starting date of project activity. The company recognises that CDM crediting period will commence after registration.
b.	Provide evidence that incentive from the CDM was seriously considered in the decision to proceed with the project activity.	The board meeting discussed regarding possible CDM benefit which would help in reducing the risk associated with the project activity. The extracts of the board meeting of 10 th July 2002 will be made available to DOE.

STEP 1 - Identification of alternatives to the project activity consistent with mandatory laws and regulations.**Step 1.a**

	Identify realistic and credible alternatives	<p>In section B.4 all the possible alternatives have been discussed for the alternatives recognised were:</p> <ol style="list-style-type: none"> 1) Project activity not as CDM activity. 2) Import from Grid. 3) Alternative fuel HSD. 4) Alternative fuel Gas. 5) Alternative fuel Coal + Dolochar 6) Combination of grid and coal power. 7) Alternative of Waste heat. 8) Continuation of current situation. <p>SML has concluded that use of fossil fuel like coal, char/dolochar, as fuel is the most attractive option economically, as per ACM 0004. The grid power was being used by the company before the installation of WHRB power as CDM project, company is also installing coal based CPP. We select coal based captive electricity generation being economically most attractive as baseline.</p>
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Step 1.b Enforcement of applicable laws and regulations:

1	Alternative shall be in compliance with legal and regularly requirements.	All the alternatives are in compliance with current legal and regulatory requirements.
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Although the project faces the barrier defined in “Investment Analysis” in Step 2 of “Tool of demonstration and assessment of additionality (version -3) of EB-29, But SML selected only the Step 3 Barrier Analysis.



STEP-3 SML 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 proposed project activity.

3.a.1	Investment barriers No access to international capital markets due to real or perceived risks.	SML have not received any foreign assistance and they are not in a position to access the international capital markets.
3.a.b	Technological barrier Availability of know how for WHRB power plant for 100 TPD & 50 TPD kilns	In the year 2002 when company decided to establish WHRB power plant with it's 50 TPD and 100 TPD DRI Kilns, at that time there was not even a single WHRB power plant operating in the area for Waste Heat Recovery from flue gases of 50 TPD and 100 TPD DRI Kilns. This was creating a doubt and uncertainty about its success in the mind of promoters. This was a potential barrier for establishment of WHRB.
	Skilled and or properly trained labour not available Lack of infrastructure for implementation of the technology	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) Labour 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 as per availability is used. The variation in quality of coal also creates operational problem.



		<p>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.</p> <p>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.</p> <p>2) Company has to procure all the necessary equipment required for proper implementation of the project. Extra synchronisation infrastructure was also required due to the requirement of remaining connected to NESCO grid. So when 17.7 MW WHRB power has to be synchronised with grid power, company has to install grid synchronisation system resulting in additional cost.</p> <p>3) Company has started venture in integrated steel project they did not had any previous experience in generation of power. Hence having no previous experience in power generation, acts as technical barrier.</p> <p>4) The Sponge Iron Rotary Kiln operation is dependant on many factors such as Iron Ore quality, Coal quality etc., the flue gas temperature and quantity variations result in lowered steam generation and hence reduced power generation.</p> <p>Due to the variations observed, the PLF of WHRB is more affected than the coal based captive power plant.</p> <p>5) The Sponge Iron Kiln has to take frequent shut down due to the raw material quality problem, this results in WHRB shut down also and hence the</p>
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		<p>power generation loss. Due to the inconsistency of WHRB power generation, company has to maintain the agreement with NESCO for supply of backup power.</p> <p>6) The documentation in the form of NESCO agreement is available.</p> <p>7) If the temperature of flue gas exceeds 1000⁰C, 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 to carry 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.</p> <p>8) The inlet temperature to ESP has to be maintained at about 160⁰C, as the higher or much lower temperature of flue gas will damage ESP.</p> <p>Hence the boiler has to work at its design 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.</p>
	Barriers due to prevailing practice.	
	Discuss the project activity in host country.	<p>1) In year 2002-2003 when the company decided to set up the WHRB power plant there was no example of successful operation of a WHRB power plant based on any 100 TPD or 50 TPD or a group of 100 TPD and 50 TPD DRI plants, who had utilised the waste heat of flue gases to generate power. The company was emitting hot flue heat from the flue gases in to the atmosphere since it's inception of 1st 50 TPD DRI plant from 1998 till the commissioning of WHRB power plant. The company was finding it as a matter of substantial risk and barrier to pool</p>



		<p>the heat and to convert this in to steam and then in to power. The company was able to successfully implement the project because of the possible CDM strength.</p> <p>2) Even at the current scenario as per the Joint Plant Committee report as “Survey of Indian Sponge Iron Industry 2005-06” lists the following:</p> <p>a) Out of 147 surveyed Sponge Iron Industry surveyed only 16 have captive power generation, 8 out of 16 them are in adjoining state Chhattisgarh. Balance states of India have 89 Sponge Iron Units (out of 147 Surveyed) and only 8 have captive power generation</p> <p>3) In the state of Orissa almost every sponge iron plant who has put up WHRB power is based on CDM strength.CDM activity can not be treated as common practice.</p> <p>4) The captive power generation based on WHRB (without CDM) is not sufficiently diffused in the region/ country, thus WHRB based captive power project is not prevailing practice.</p> <p>JPC Report can be made available and the units going in for CDM benefit can be checked from UNFCC website.</p>
	Operational Barrier	<p>Being the first company to put up a WHRB project in a group of 6 numbers of small capacity DRI Kilns with different capacity had all the risks of operation.</p> <p>In addition the project is located in remote area where not enough technical support infrastructure was available and even today not properly available. All these had operational barriers to set up and run the project.</p>
	Regulatory Barriers	<p>1) The provision to export surplus power for sale to the grid is not available.</p> <p>2) The demand charges payable even if</p>



		NESCO is not in position to supply power for any reason. Hence these act as regulatory barrier
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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 NESCO grid (Alternative-2)

None of the above barriers act as barriers in this alternative and NESCO 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 NESCO. But the grid power is costlier than coal based captive power, as well as the grid is having poor infrastructure resulting in interruption of supply.

2) CPP based on HSD/Gas (alternatives 3 and 4)

None of the above act as a barrier in 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

None of the above barriers act as barriers in this alternative. This option is economically most attractive as increase in the capacity of coal based CPP can be achieved with minimum cost to meet the total steam requirement of the CPP.

4) Combination of grid and coal power (Alternative 6) also faces no barriers. None of the above barriers acts as barrier to this alternative too.

5) Alternative use of Waste Heat from Flue Gases (Alternative 7) -there is no use of waste heat form flue gas in the SML hence, no such heat requirement in the plant. No other beneficial use of the waste heat is in practice in the region.

6) Continuation of the current situation, as shown above the continuation of current situation is to draw more power from grid. This option will face no barrier but company has to face power cuts.

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 Analyse other activities similar to project activity.**

1.	Provide an analysis of any other activity implemented	In Orissa state Tata Steel, Orissa Sponge, Orissa 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 company is also one of the pioneer company to establish WHRB power based on the CDM strength by combining the waste heat from a number of smaller capacity kilns.
2	Activities in similar scale.	The project activity is 800 TPD (2 nos. X 50 TPD, + 4 Nos.X 100 TPD + 1 No x 300 TPD) Sponge Iron capacity. As per the available information there is no other plant of this combination which has gone for WHRB based power generation. Specially the 50 TPD plants have no WHRB installed with it. Even 100 TPD plants have not considered the installation of WHRB the company is the first one to go for WHRB with 100 TPD DRI Kiln.

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

1.	Discussion of similar activities	<p>The present project activity is WHRB based 17.7 MW captive power plant based on the waste heat available from seven number of kiln of different production capacity ranging from 50 TPD to 300 TPD.</p> <p>As per the available information all sponge iron projects who are putting up WHRB power are in the process of CDM validation or PDD preparation stage to seek the CDM support</p> <p>However none of the 50 TPD plants have put up any waste heat recovery system. Even most of 100 TPD plants have not put up any WHRB. The company is actually the first one to go for it in this size of the Kilns.</p>
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JOINT PLANT COMMITTEE REPORT ON “SURVEY OF INDIAN SPONGE IRON INDUSTRY 2005-06”

Under the aegis of the Ministry of steel, a joint plant committee (JPC) was constituted, by government of India, and 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 labour 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 summarised 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 labour 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 an insignificant 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 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.”

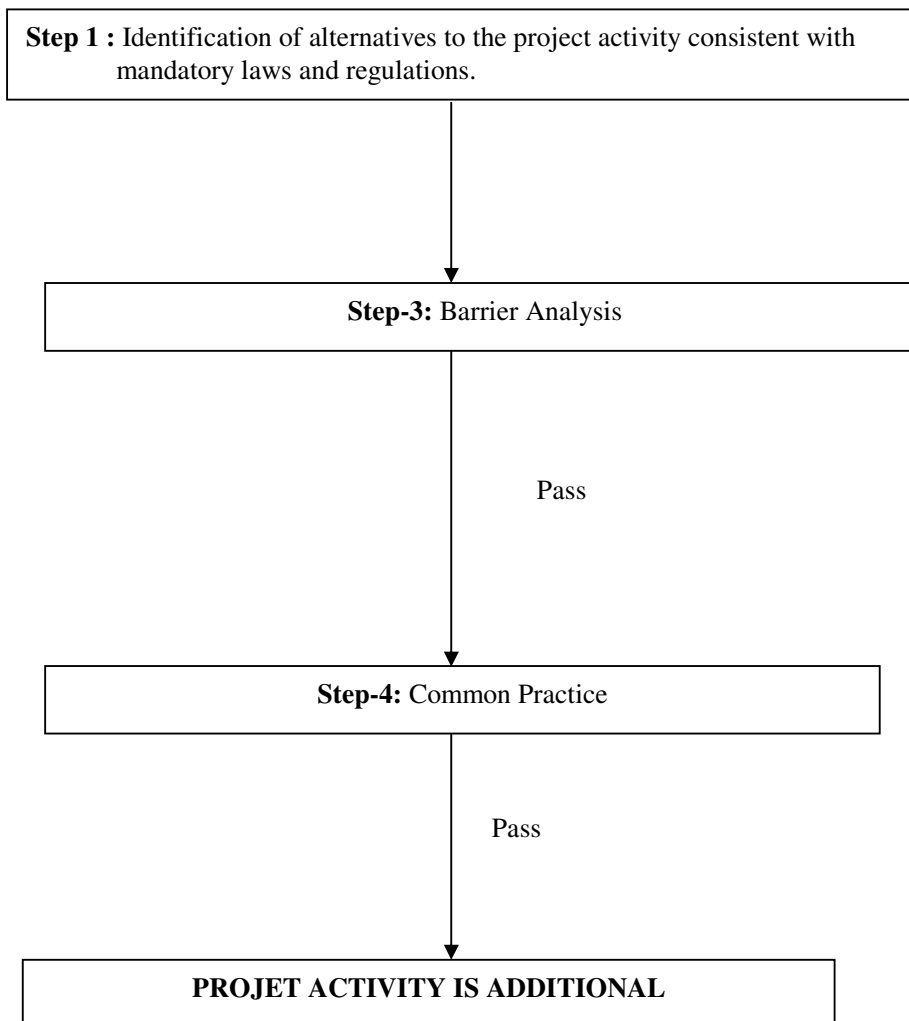
Jharkhand, Chhatisgarh and Orissa are states where majority of this fresh capacity will be installed

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 : How the Project is additional



**B.6. Emission reductions:****B.6.1. Explanation of methodological choices:**

>>

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 17.7 MW electricity from waste heat, without adding any GHG emission.
2. The project activity displaces CO₂ emissions from the fossil fuel based Captive power plant and hence achieves reduction of CO₂ emissions.
3. There will be no fuel switch in rotary kiln that produces flue gases with waste heat after completion of project activity.

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

(Copy this table for each data and parameter)

Data / Parameter:	EGGEN / Electricity
Data unit:	MWh
Description:	Gross
Source of data used:	Electronic meter
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The electronic meters are provided at the output of the turbines. The meter reading from TG1 is recorded manually and maintained in daily log book, the meter reading from TG2 will be available on 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 Both these meters will be sealed by Orissa government electrical department as company has to pay cess on any power generated in CPP. The meter is calibrated by government department.
Any comment:	Nil

Data / Parameter:	EG AUX / Electricity
Data unit:	MWh
Description:	Gross
Source of data used:	Electronic meter/ calculated
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The electronic meters provided at the feeder to each auxiliary consumption source. The meters readings is recorded manually and maintained in daily log book, 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.
Any comment:	Nil

Data / Parameter:	EG y / Electricity
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Data unit:	MWh
Description:	Gross
Source of data used:	Calculated
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	EG y=EGGEN - EGAUX
Any comment:	Nil

B.6.3 Ex-ante calculation of emission reductions:

>>

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

If the baseline scenario is determined to be captive power generation either (existing or new) ,the Emissions factor for displaced electricity is calculated as follows;

Calculation of emission factor for captive power baseline :

$$EF_{\text{captive}, y} = EF_{\text{CO}_2, i} / \text{Eff}_{\text{captive}} \times 44/12 \times 3.6 \text{ TJ}/1000 \text{ MWh}$$

Where.

$EF_{\text{captive}, y}$:	Emission factor for captive power generation (tCO ₂ /MWh)
$EF_{\text{CO}_2, i}$:	CO ₂ emission factor of fuel used in captive power generation tC/TJ
$\text{Eff}_{\text{captive}}$:	Efficiency of captive power generation (%)
44/12	:	Carbon to Carbon Dioxide conversion factor
3.6/1000	:	TJ to MWh conversion factor

To estimate boiler efficiency, project participants may chose between the following two options

Option A

1. Measured efficiency prior to project implementation
2. Measured efficiency during monitoring.
3. Manufacturers nameplate data for efficiency of existing boilers

Option B

Assume a boiler efficiency of 100% based on the net calorific values as a conservative approach

We have selected Option A 3 .

Leakage (Ly)

There is no leakage in the project activity

Emission Reductions



Project activity mainly reduces CO₂ 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), as follows:

$$ER_y = BE_y - PE_y$$

Where,

ER_y = are the emission reduction of the project activity during the year y in tons of CO₂.

BE_y = are the baseline emissions due to displacement of electricity during the year y in tons of CO₂,

PE_y = are the project emission during the year y in tons of CO₂

No project emission is considered and no leakage is considered

Where the baseline emissions

$$BE_y \text{ in tCO}_2 = EF_{\text{captive}, y} \times EG_y$$

$$EG_y = E_{\text{GEN}} - E_{\text{AUX}} = \text{Net electricity supplied by project activity}$$

No project emission and no leakage is considered inline with methodology

We have followed the approved baseline methodology ACM0002 for formulas used in estimating baseline emissions:

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 Net Emission Reduction:

Installed capacity of power generation	17.7 MW
Number of working days/year	330
number of working hours/day	24
Gross generation of electricity at 100% PLF	140184 MWh
Gross Generation at 75% PLF	105138 MWh
Auxiliary consumption	10%
Net Generation (Gross Generation – Auxiliary consumption)	94624.20 MWh
Emission Factor (EF _y)	1.5 tCO ₂ e/MWh
Emission Reduction/Year	141936.300 tCO ₂ e/Year

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



>>

Year	PLF expected	gross generation MWh	Auxiliary Consumption @ 10%	Net generation MWh	Emission Factor tCO ₂ eq/MWh	Net CO ₂ reduction achieved tCO ₂
1st	0.75	105138	10513.8	94624.20	1.500	141936.300
2nd	0.75	105138	10513.8	94624.20	1.500	141936.300
3rd	0.75	105138	10513.8	94624.20	1.500	141936.300
4th	0.75	105138	10513.8	94624.20	1.500	141936.300
5th	0.75	105138	10513.8	94624.20	1.500	141936.300
6th	0.75	105138	10513.8	94624.20	1.500	141936.300
7th	0.75	105138	10513.8	94624.20	1.500	141936.300
8th	0.75	105138	10513.8	94624.20	1.500	141936.300
9th	0.75	105138	10513.8	94624.20	1.500	141936.300
10th	0.75	105138	10513.8	94624.20	1.500	141936.300
		1051380	105138.00	946242.00		1419363.000
Average reduction /Year						141936.300 tCO ₂ /Year

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)

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	EGGEN / Electricity
Data unit:	MWh
Description:	Gross electricity generated
Source of data to be used:	The electronic meters are provided at the output of the turbines. The meter reading from TG1 is recorded manually and maintained in daily log book, the meter reading from TG2 is recorded in DCS and the same will be transferred to log book to be maintained by shift engineer , approved by shift in charge as the daily report This meter is sealed by Orissa government electricity department 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	100%
Description of	Log book maintained based on Manual reading of TG1 meter and DCS data



measurement methods and procedures to be applied:	received from TG2 meter.
QA/QC procedures to be applied:	Log book signed by plant manager daily. Meters calibrated regularly. As Orissa government 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:	Nil

Data / Parameter:	EG AUX / Electricity
Data unit:	MWh
Description:	Auxiliary electricity consumption
Source of data to be used:	The electronic meters provided at the feeder to each auxiliary consumption source. The meters readings for TG1 is recorded manually and maintained in daily log book, the meter reading for TG2 will be available on DCS continuously and maintained in daily log book. Both these readings will be summed up to arrive at total auxiliary consumption. These data are 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	100%
Description of measurement methods and procedures to be applied:	Log book maintained based on meter reading and data received from DCS meter.
QA/QC procedures to be applied:	Log book signed by plant manager daily. Meters calibrated regularly
Any comment:	Nil

Data / Parameter:	EG y / Electricity
Data unit:	MWh
Description:	Net electricity generated
Source of data to be used:	calculated $EG_y = EG_{GEN} - EG_{AUX}$
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
Description of measurement methods and procedures to be applied:	Based on log book maintained by manually recorded data for TG1 and DCS records for TG2.



applied:	
QA/QC procedures to be applied:	Log book signed by plant manager daily. Meters calibrated regularly
Any comment:	Nil

Data / Parameter:	STEAM FLOW QTY, (F1, F2,F3)
Data unit:	T/hr.
Description:	Steam flow from WHRB-7, AFBC and input of TG2
Source of data to be used:	The steam flow meter provided at the output of WHRB-7, AFBC, input of TG2. The meter reading will be available on 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
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
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. The meters are regularly under QC/QA procedure.
Any comment:	Nil

Data / Parameter:	Steam Temp(T1,T2)
Data unit:	⁰ C
Description:	Steam Temperature in output of WHRB-7and AFBC
Source of data to be used:	The temperature meter provided at the output of WHRB-7 and AFBC. The meter reading will be available on 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
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
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. The meters are regularly under QC/QA procedure. Manager –In- Charge would be



	responsible for regular calibration of meter.
Any comment:	Nil

Data / Parameter:	Steam Pressure (P1,P2)
Data unit:	kg/cm ³
Description:	Steam pressure in outlet of WHRB-7 and AFBC.
Source of data to be used:	The pressure gauge (meter) provided at the output of WHRB-7and AFBC. The meter reading will be available on 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
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100%
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. The meters are regularly under QC/QA procedure. Manager –In- Charge would be responsible for regular calibration of meter.
Any comment:	Nil

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 17.7 MW waste heat based WHRB power project of SML

(C) Responsibilities

Shift Engineer (Operations): Responsible for proper operation of the mechanical equipments, reporting shift wise or eight hourly data of steam generated from WHRBs, steam fed to turbines, parameters of steam and flow meter reading of the captive power plant. The report is then sent to the Manager (O & M) for his review.

Shift Engineer (Electrical): Responsible for proper operation of electrical equipment and taking meter reading for electricity generation. The report is then sent to the Manager (E&I) for his review on a daily basis.



Shift Engineer (maintenance): Responsible for proper maintenance management. The report is then sent to the Manager (plant) for his review on a daily basis

Manager (Plant): 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 (Plant).

General Manager/DGM : 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 and CDM officer will be directly reporting to him

CDM Officer : He will be reporting to General Manager and 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 April 2007
Preparation of this document has been done by “Indus Financial and Technical Consultants Ltd.”, whose address is :
Shri Lalit Kumar Singhania
Shri Vikas Thakur
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**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:**

>> 10/07/2002

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

>> 20 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:>> 1st January 2007 or from the date of registration or from**C.2.2.2. Length:**

>> 10 Years

**SECTION D. Environmental impacts**

>>

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

>>

The Project activity is to produce 17.7 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 is 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 950⁰C into atmosphere. Project activity recovers the waste heat and save; energy and reduces thermal emission by controlling gas temperature below 200⁰C.
 - i) Generates electricity without adding any additional GHG emissions.
 - ii) The power generated by new project activity is 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 is collected in ash hoppers provided in WHR boiler.
4. The proposed ESP shall remove the ash from flue gases which is collected in Ash Hopper. This ash is given free of cost to 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 Fly Ash can alternatively be used to recover the mined out areas, by backfilling it.

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 insignificant as enumerated in D1, No adverse impact on environment is 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 is kept below 90dB.

**Thermal Pollution:**

In absence of the project activity the hot flue gases will be let out causing considerable thermal pollution as was being done before the implementation of the project activity.

The heat is recovered in the boiler and the flue gases let out by 4 Nos. of 30 m height stacks and one number of 50 m height below 200⁰C temperature 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/nm³ while acceptable legal standard is 150 mg/nm³.

Impact on Water environment

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

All the waste water is neutralized before using for plantation.

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

No discharge is there outside the premises. Hence due to the zero discharge condition, no adverse impact is 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 brick manufacturing units, and for back filling of the Mined out areas or for such other useful purposes.

Safety Management

To ensure safe working conditions:

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

All efforts are taken to create and maintain clean environment.

Parameters like Noise, Fugitive Emission as well as point source emissions is 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:

>>

SML 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 – Loidapada, Guali Gram Panchayat
- 3) Northern Electricity Supply Company of Orissa Ltd (NESCO)
- 4) State Pollution Control Board, Orissa (SPCB)
- 5) Ministry of Commerce and Industry.

E.2. Summary of the comments received:

>>

SML management apprised the representatives of village Panchayat of village-Guali about the project activity. The members of Panchayat appreciated and had expressed their no objection for project activity. Guali Gram Panchayats have issued no objection certificate.

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

Sarpanch, village Guali raised the points of activities required to be carried out by company during periphery development committee meeting.

Permission have been sought from the State agencies like NESCO, 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, clearance from OSPCB (State Pollution Control Board) were considered while preparation of CDM Project Design Document. SML management representatives met various stake holders for appraisal regarding project activity and sought the support.

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

The peripheral development has been undertaken by the company in line with Sarpanch comments. In addition company has planted a large quantity of trees surrounding area.

All the comments were taken on record. No adverse comment was received.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY.**

Organization:	Sree Metaliks Limited
Street/P.O.Box:	Gurudwara Road
Building:	
City:	Loidapada, Guali, Barbil, Dist- Koenjhar
State/Region:	Orissa
Postfix/ZIP:	758035
Country:	India
Telephone:	+91 6767 276674
FAX:	+91 06767 275529
E-Mail:	mdmetaliks@sancharnet.in
URL:	
Represented by:	Mahesh Agarwal
Title:	Managing director
Salutation:	
Last Name:	Agarwal
Middle Name:	
First Name:	Mahesh
Department:	Board of Directors
Mobile:	+91 94370 76292
Direct FAX:	+91 06767 275529
Direct tel:	+91 06767 276674
Personal E-Mail:	



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.	Parameter	Source
1	Steam parameters considered	From AFBC Boiler Specification.
1	Boiler Efficiency	Considered 83% as per methodology based on the manufacturers nameplate.
2	Steam consumption / MWh	Turbine manufacturer's performance guarantee data.
3	Steam enthalpy	ISI Steam Table in SI Units
4	Emission factor (EF _{CO2}) for coal	IPCC default value
5	Carbon to Carbon-di-oxide conversion factor	IPCC default value

Technical Specification of Turbine as per Manufacturer:**STG-1**

1. Capacity of Turbine : 8 MW
2. Inlet Steam pressure : 42 kgf/cm²
3. Inlet Steam Temperature : 410⁰C
4. Steam Consumption : 38.2 T/hr.

STG-2

1. Capacity of Turbine : 20 MW
2. Inlet Steam pressure : 63 kgf/cm²
3. Inlet Steam Temperature : 485⁰C
4. Steam Consumption : 76.6 T/hr.

Specification of AFBC boiler

1. Capacity of Boiler : 41 T/hr.
2. Steam pressure : 67 kgf/cm²
3. Steam Temperature : 490⁰C

Formulae used to estimate baseline emissions (units of CO₂ equ.)

We have followed the approved baseline methodology ACM0004 for formulas used in estimating baseline emissions:

If the baseline scenario is determined to be captive power generation either (existing or new), the Emissions factor for displaced electricity is calculated as follows;

Calculation of emission factor for captive power baseline :

$$EF_{\text{captive}, y} = EF_{\text{CO}_2, i} / \text{Eff}_{\text{captive}} \times 44/12 \times 3.6 \text{ TJ}/1000 \text{ MWh}$$

Where.

- EF_{captive, y} : Emission factor for captive power generation (tCO₂/MWh)
 EF_{CO₂, i} : CO₂ emission factor of fuel used in captive power generation tC/TJ



Eff_{captive}	:	Efficiency of captive power generation (%)
44/12	:	Carbon to Carbon Dioxide conversion factor
3.6/1000	:	TJ to MWh conversion factor

To estimate boiler efficiency, project participants may chose between the following two options.

Option A

1. Measured efficiency prior to project implementation
2. Measured efficiency during monitoring.
- 3 Manufacturers nameplate data for efficiency of existing boilers

Option B

Assume a boiler efficiency of 100% based on the net calorific values as a conservative approach

We have selected Option A3



Annex 4 MONITORING INFORMATION

1. Calculation of Net Power Generated from SML 17.7 MW project Plant:

To achieve the above we follow the steps below (as per instrumentation plan given in the schematic diagram enclosed):

- (a) Monitoring of electricity generation and auxiliary power consumption in the 8 MW TG-1, WHRB 1 to 6 is done through the electric meter only. The steam parameters are not required to be monitored from this set up of 8 MW TG Set, as 100% of steam and power is generated from WHRB's only.
- (b) Proportionate power generation calculation is required to be done in TG2 having 20 MW capacity, because this TG is also drawing steam from AFBC as well as from WHRB7. Hence the net power generation due to WHRB7 is calculated on proportionate steam contribution.

Calculation of Net Power Generation:

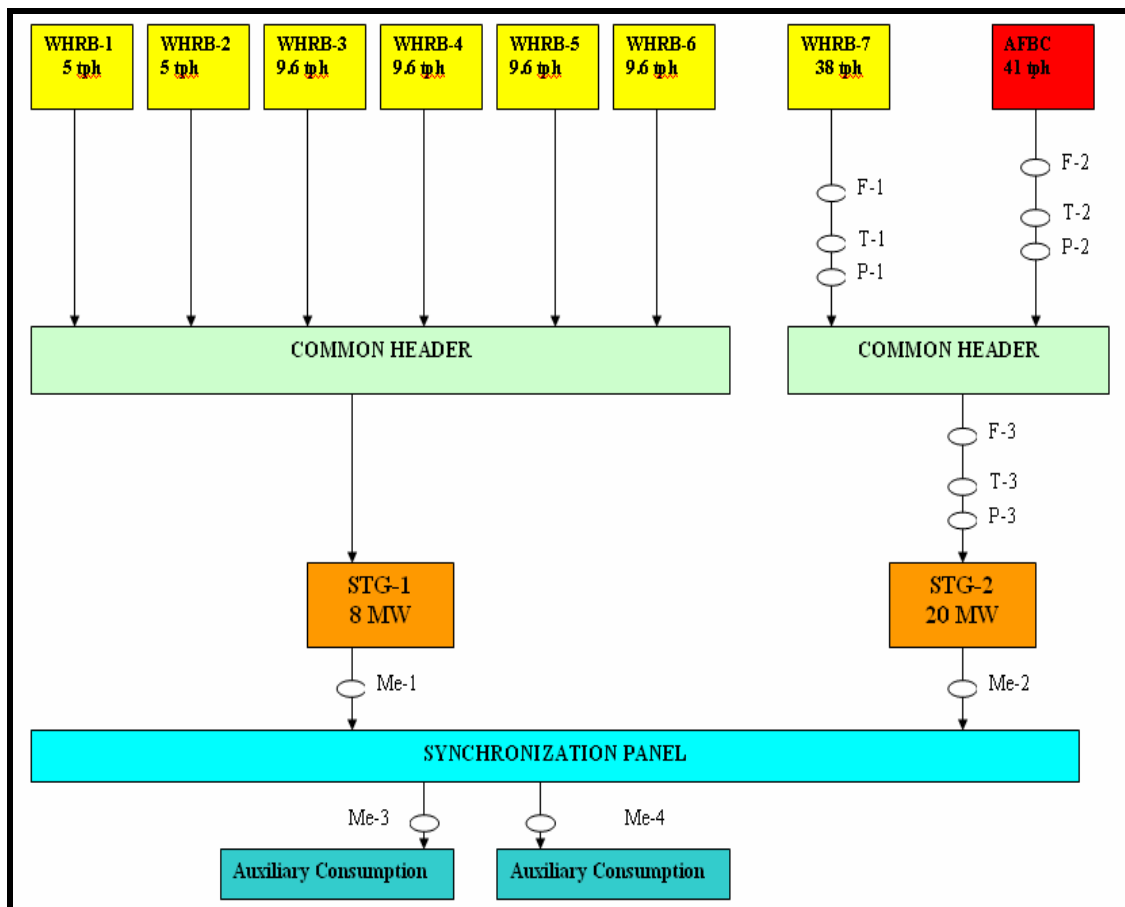
Calculation of Net Power generation from the Project activity i.e. SML WHRB CPP.

A	Calculation of Enthalpy of Steam fed from WHRB-7 (H1)	=	Ent X F1 = H1
B	Calculation of Enthalpy of Steam fed from AFBC (H2)	=	Ent X F2 = H2
C	Calculation of Enthalpy of Steam fed to TG-2 (H3)	=	Ent X F3 = H3
D	Electricity Generated by TG-1	=	Me1
E	Electricity Generated by TG-2	=	Me2
F	Percentage Contribution in Enthalpy of Steam from WHRB-7 in total enthalpy of steam used for power generation by TG-2 = Enthalpy of Steam from (WHRB-7/ Total Enthalpy of steam fed into TG-2) X 100	=	$\frac{A \times 100}{C}$
G	Electricity Generation from WHRB-7 = % Contribution of Enthalpy of Steam from WHRB-7 X Gross Electricity Generated by TG2(EG _{GEN})	=	F X E
H	Gross Electricity Generation by WHRBs	=	D + G
I	Auxiliary Consumption by Project Activity (E _{AUX})	=	Me ₃ + Me ₄
J	Net Electricity generated by WHRBs (EG _y)	=	I – H

Note: (1) Steam enthalpy E_{nt} in K Cal/Kg is arrived by using thermodynamic steam tables, based on the pressure and temperature readings.



(ii) Schematic Drawing and Details of Monitoring Plan and Metering Points :



Steam Monitoring Parameter	Metering Point
Pressure at Outlet of WHRB-7	P ₁
Pressure at Outlet of AFBC	P ₂
Temperature of Outlet of WHRB-7	T ₁
Temperature at Outlet of AFBC	T ₂
Flow of steam of Outlet of WHRB-7	F ₁
Flow of steam of Outlet of AFBC	F ₂
Flow of steam of inlet of TG-2	F ₃
Electrical Monitoring Parameter	
Gross Power Generation from TG-1	Me ₁
Gross Power Generation from TG-2	Me ₂
Gross Power consumed in Auxiliary loads for 8 MW generation	Me ₃
Gross Power consumed in Auxiliary loads for 20 MW generation	Me ₄

**I. Table for monitoring**

Serial No.	Activity
1.0	GHG Performance Parameter
1.1	<p>The monitoring protocol requires SML to monitor the following GHG Performance parameters for estimating the emissions reductions from the waste heat based CPP:</p> <ul style="list-style-type: none"> • Gross generation of electricity by the CPP (Independently from each TG set) • Auxiliary consumption • Net quantity of steam available from the waste heat recovery boilers (WHRB-1 to 7) for electricity generation in CPP. • Total Steam availability to and consumed in TG2. • Temperature and pressure of steam from WHRB-7 boiler. • Net electricity generation from waste heat recovery.
2.0	Metering System
2.1	<p>The metering system for the waste heat based CPP consist of</p> <ul style="list-style-type: none"> • Electrical metering system calibrated and sealed by Deputy Electrical Inspector Generation for metering total generation from each TG Set. • In house metering system of SML for metering the generation of power, auxiliary consumption. • Steam Flow meters for monitoring net steam flow from WHRB-7 after the vent before the common header at entry port. • Flow meter for steam inlet to turbine TG2. • Temperature gauge for WHRB-7 boiler. • Pressure gauge for WHRB-7 boiler.
	<p>The two numbers TG meters are located in the TG room itself. They are used to monitor SML's net electricity and total generation from the CPP. All these meters are calibrated from standard testing laboratory Govt of Orissa, Bhubaneshwar and sealed by DEI(G).</p>
3.0	Calibration of the Metering System
3.1	<p>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 Govt of Orissa, Bhubaneshwar and sealed by DEI(G). The other meters are calibrated internally as per supplier's calibration schedule following the standard procedures for calibration.</p>
4.0	Reporting of the Monitored Parameters/ Authority and Responsibility of monitoring and reporting
4.1	<p>Metering System</p> <p>The SML personnel read the power generation from metering system for recording the net electricity and the total generation from the CPP on the last day of every month or 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</p>



	<p>main meter is not at service, then the check meter shall be used. A monthly report is prepared based on the meter readings, which is sent to the Electrical Inspector as monthly legal return.</p> <p>The Shift Engineer (Electrical) takes daily reading (at a fixed time) 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 General Manager (Plant) at the Administrative Building in the plant for his review and for preparing the daily report.</p>
5.	Uncertainties and Adjustments:
5.1	<p>The shift wise or eight 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.</p> <p>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 Electrical Inspector. Corrective actions to be undertaken at the earliest after identification of reason of such discrepancy.</p> <p>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.</p> <p>These measures will be undertaken in order to detect and minimize the uncertainty levels in data monitoring.</p>
6.0	Experience and Training
6.1	<p>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 including plant operations, data monitoring and report preparation.</p>
6.2	<p>Emergency Preparedness Plan</p> <p>The total power generating system of the waste heat based CPP is equipped with an “Automatic Alarming System” which helps the operators to take necessary preventive actions before any kind of non-functioning of the power plant results in. SML. CPP has a fire fighting system in place.</p> <p>In addition SML has standard procedures for tackling emergencies arising from</p> <ul style="list-style-type: none"> • Blackout • Low boiler drum level/ low feed water level



	<ul style="list-style-type: none"> • High flue gas temperature from sponge iron kiln. • Load throw off • Boiler Tube leakage. • Boiler tripping at alarm systems.
(f)	<p>Reference Project Design Document, maintenance manuals and standard OEM procedures.</p>
	<p>Records</p> <ol style="list-style-type: none"> 1. Log Book, maintained by electrical & instrumentation department at site, containing daily data for all the in-house metering system. 2. Daily Executive Summary submitted to the Vice president/General Manger (Plant), prepared by electrical & instrumentation department 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 SML. 4. Monthly Report on net quantity of electricity generated at SML's Captive Power Plant and Electricity Duty returns submitted by SML on generation achieved at site with a copy being sent to the unit head of SML. 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 17.7 MW waste heat based i.e. WHRB power project of SML, India.

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

Shift Engineer (Operations): Responsible for reporting shift wise or eight hourly data of the steam generated from boilers, steam fed to turbines, parameters of steam and flow meter reading of the Captive Power Plant. The report is then sent to the Manager (O & M) for his review.

Manager/Sr. Manager (O&M) : Responsible for reviewing the monitored parameters on an eight hourly or shift based and presenting a daily executive summary report, duly signed by himself.

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



Manager/Sr. Manager (E&I): Responsible for reviewing the monitored parameters shift-wise and presenting a daily executive summary report, duly signed by himself, to the General Manager (Plant).

General Manager / Vice President (Plant): Responsible for summarizing data of Electrical, Mechanical, Process (/operation) Departments and report the same to the Vice President (Power) or to CMD (SML) 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
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
COD	Chemical Oxygen Demand
CPP	Captive Power Plant
dB	Decibel
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
SML	Sree Metaliks Ltd.
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
MU	Million Units
MW	Mega Watt
MWh	Mega Watt hour
Nm ³ /h	Normal Meter Cube per Hour
NESCO	Northern Electricity Supply Company of Orissa Ltd.
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
Qty	Quantity
SPCB	State Pollution Control Board
