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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

>> **Title**: Installation of Waste Heat Recovery based Captive Power Plants in 17 Nos Sponge Iron Plants of Orissa, India
Document Version: 02
Date of completion: 15/01/06

A.2. Description of the project activity:

All the 17 Sponge Iron Manufacturing Plants (Units) have decided to implement the project activity realizing the necessity of reducing CO_2 emissions, which are adversely impacting the environment, causing global warming concerns. At the same time the Units would stand to gain through savings achieved on Power Bills and the income derived from CERs from CDM. The reduction in CO_2 emissions is achieved through utilization of Waste Heat of flue gases from the Rotary Kilns (Flue gas temperature between 900^0C and 1000^0C) in Waste Heat Recovery Boilers with Steam Turbine Generators (WHRB_STG) for generating Electricity. This would reduce the burning of an amount of coal that is required to produce equivalent Electrical Power at the grid generating plants and consequently this would maximize the Energy Efficiency of the process of the Units by recovering the sensible heat of the waste flue gases that was being lost and converting it into electric power leading to a reduction in the burden on the environment through emission reductions and energy conservation. A combined Project Design Document (PDD) has been prepared on behalf of 17 Sponge Iron Manufacturing Plants, referred to as "Units". Each of the Units is having either 50 tpd (tonnes per day) or 100 tpd or both, capacity Rotary Kilns. All the percentile parameter factors are the same for both 100 tpd and 50 tpd Plants. The PDD has been prepared by BPNSI (Biju Patnaik National Steel Institute) with assistance from OSIMA (Orissa Sponge Iron Manufacturers Association). The Units are totally having 21 Nos of 100 tpd and 8 Nos of 50 tpd Rotary Kilns between them. The 100 tpd and 50-tpd kilns are expected to generate 2MW and 1 MW of Electrical Power respectively through WHRB_STG. The combined generation of electrical power by all the Units is expected to be 50 MW, operating for 24 hrs a day and 300 days a year, which is around 360,000 MU annually. The expected CERs of the project activity would be 296267.44 units annually. The WHRB_STG will replace the gas cooling and scrubbing system after the After Burning Chamber of the rotary kilns. The exhaust gases from the WHRB will pass through the ESP (Electrostatic Precipitator), where the collected dry ash will be disposed off into suitable landfills (as is being done at present) and then through the bag filters and finally the stack
The generated power would be utilized firstly for captive consumption of the Units and secondly, the excess Power would be uploaded into the grid.

View of project participants of the contribution of the project activity to sustainable development

The project activity contributes to the sustainable development, which, as defined by the indicators mentioned in Publication of the Ministry of Environment and Forests, under the Govt of India, 'Empowering People for Sustainable Development', 2002 means improvement in the fields of Social development, economic development, Technology upgradation, and alleviation of Environmental pressures
A short note on sustainable development has been annexed at Appendix 1
The immediate contributory factors in the Project activity towards sustainable development are:

1. Utilization of waste heat energy to generate electricity
2. Captive Generation of approximately 360,000 MU (million units equivalent to megawatt hours) / annum for both own consumption as well as export of the surplus to the Grid / other consumers, thereby not only eliminating the GRIDCO/OPTCL supply to this extent, but at the

same time augmenting the Grid Capacity, which would greatly help in improving the quality of electricity distributed to other social sectors.

3. Conserving coal, a non-renewable natural resource
4. Reduction of GHG (Carbon Dioxide – CO_2) at the Grid Supply Power Plants to the tune of 296267.440 tonnes of CO_2 in a 10-year crediting period (considering combined emission factor of 0.8439229)
5. Conservation of water, a scarce natural resource, through eliminating the use of venturi scrubbers/ gas coolers
6. Contributing to a significant increase in the local employment in the area of skilled and unskilled jobs for operation and maintenance of the new equipment and for additional housekeeping, enabling the reduction of poverty levels.
7. Contributing to the improvement in the quality of life in the peripheral villages, with possibilities of better quality of electricity supply, roads, schools & auxiliary businesses & shops, all contributing to sustainable development

A.3. Project participants:

>>

SL NO	Name of party involved (*) (host) indicates a host party	Private and/or public entities Project Participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
1	India	- Public entity Ministry of Environment & Forestry – **Host Party** (MoEF)	No
2	India	Public Entity - Biju Patnaik National Steel Institute (BPNSI),	Yes
3	India	Private Entity - Orissa Sponge Iron Manufacturers Association (OSIMA)	Yes
4	Japan	Private Entity - Steel Plantech CO (SPCO)	Yes
1	India	Project Participants - Pawansut Sponge Pvt. Limited (PSPL)	Yes
2	India	Project Participants - Shree Madhav Ispat Private Ltd (SMIPL)	Yes
3	India	Project Participants- L.N. Metalliks Ltd (LNML)	Yes
4	India	Project Participants - Maa Samaleswari Ferro Ispat (P) Ltd (MSFMPL)	Yes
5	India	Project Participants - Sponge Udyog (P) Ltd (SUPL)	Yes
6	India	Project Participants -Shree Mahabir Ferro Alloys Pvt. Limited (SMFAPL)	Yes
7	India	Project Participants - Pooja Sponge Pvt. Ltd (PSPL)	Yes
8	India	Project Participants - Jay Iron & Steels Limited (JISL)	Yes
9	India	Project Participants-Seeta Sponge Iron Ltd (SSIL)	Yes
10	India	Project Participants- Sri Balaji Metalliks (P) Ltd (SBMPL)	Yes
11	India	Project Participants-Shree Ganesh Metalliks Limited (SGML)	Yes
12	India	Project Participants - Swastik Ispat (P) Ltd (SIPL)	Yes
13	India	Project Participants - Bajrang Ispat (P) Ltd (BIPL)	Yes

14	India	Project Participants - Maa Sakumbari Sponge (P) Ltd (MSSPL)	Yes
15	India	Project Participants - Vedvyas Ispat Limited (VIL)	Yes
16	India	Project Participants- Pawanjay Sponge Iron Limited (PSIL)	Yes
17	India	Project Participants- Suraj Products Ltd (SPL)	Yes

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>> In the State of Orissa, India

A.4.1.1. Host Party(ies):

>> Host Party is India

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

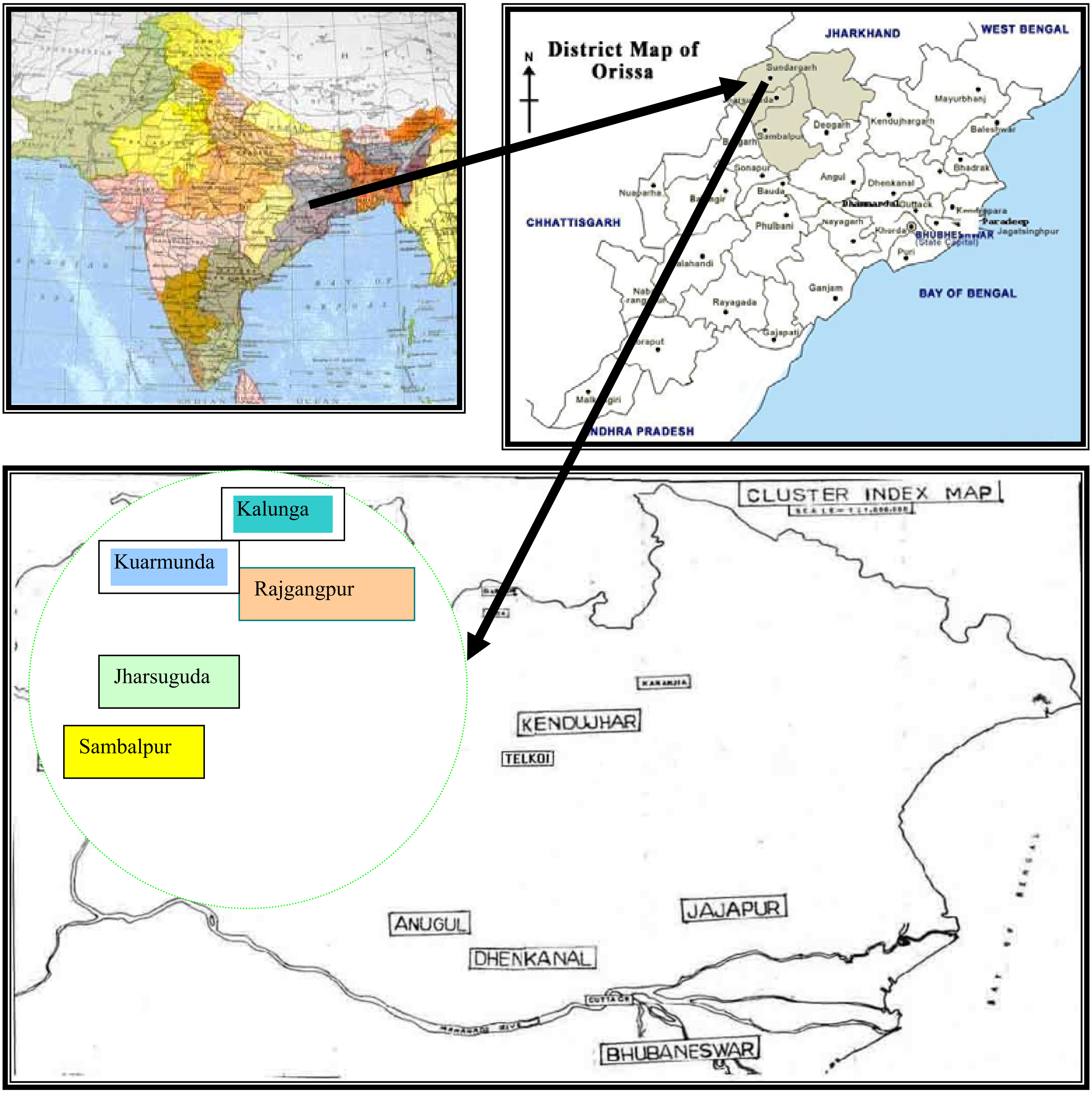
>> Region: Eastern Region / State: Orissa/ Province: Sundergarh, Rajgangpur, Sambalpur, Kuarmunda, & Jharsuguda

A.4.1.3. City/Town/Community etc:

>> City: Jharsuguda, Rourkela, Rajgangpur/ Town: Not applicable

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

>>The location of the project activity is shown in the map shown below.


District Map of Orissa
N
JHARKHAND
WEST BENGAL
CHHATTISGARH
BAY OF BENGAL
Sundargarh
Sambalpur
Deogarh
Kendujhargarh
Mayurbhanj
Baleshwar
Bhadrak
Sonapur
Angul
Dhenkanal
Bauda
Nuapada
Phulbani
Nayagarh
Cuttack
Kendrapara
Paradeep
Jagatsinghpur
Khorda
Puri
Ganjam
Rayagada
Gajapati
CLUSTER INDEX MAP
Kalunga
Kuarmunda
Rajgangpur
Jharsuguda
Sambalpur
KENDUJHAR
TELKOI
ANUGUL
DHENKANAL
JAJAPUR
BHUBANESWAR

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

>> Project activity pertains to Energy Industries (renewable & non renewable sources) as per Sectoral Scopes, Version 04 and applies to the methodology version ACM 0002/0004

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

>> The project activity envisages the replacement in the existing Rotary Kilns, of the (a) Gas cooling and (b) gas conditioning system with a WHRB_STG (Waste Heat Recovery Boiler with Steam Turbine Generator) for the production of Electrical Power utilizing the sensible heat of the waste gases leaving the kiln at about 900^0C – 1000^0C, which is now being wasted into the atmosphere. The project activity would reduce the final temperature of the waste gases to around 180^0C, which would increase the capture of SPM (Suspended Particulate Matter) at the ESP. The electrical power generated by the WHRB_STG would displace the electrical power imported from the grid for running the Units, as well as generate excess power for export to the Grid or other consumers

For a 100-tpd plant the boiler is expected to generate 11.7 tph of steam at 66 kg/cm^2 and 495^0C and for a 50-tpd plant the boiler would be correspondingly downsized at about 5.5 tph of steam at 66 kg/cm^2 and 495^0C. Approximately 5.1 tph of steam is required to generate 1 MW of electricity, hence a 100-tpd plant would generate 2 MW and a 50-tpd plant would generate 1 MW of electricity. The Steam Turbine Generator would be the high efficiency multistage type

The flue gases exiting the WHRB pass through multifield ESPs for trapping the suspended particulate matter (SPM), through bag filters and finally through a stack. The SPM collected by the ESP would be disposed off as dry ash. Other systems required for the plant include transformers, circulating water pumps, compressed air systems, ash handling, cooling water system, DM Water plant etc. The technology employed to generate electricity is technically and environmentally safe and does not damage the environment in any way during the lifetime of the project, which is expected to be around 30 years.

We have assumed 300 days a year, at 24 hrs/day (i.e. 7200 hours per year) working of the power plant. Annual power generation is expected to be about 360000 MU giving rise to emission reduction of 296267.44 @ baseline emission factor of tonnes of CO_2 equivalent.

Even though there is a high level of technology available within the host country (India), and no import of technology for the project activity is envisaged at present, efforts are being made to source the system from outside India, where the efficiency of the WHRB is around 62% as compared to 38.4% efficiency of indigenous equipment providing adequate finance is sourced

The project boundary encompasses the After Burning Chamber, the WHRB_STG, auxiliary systems of the power plant, the stack, transmission lines carrying power from the Captive Power Plant to the GRID, the Grid of GRIDCO /OPTCL receiving the generated power, the Eastern Regional Grid

Implementation schedule:

Once the project activity has been validated, and the CERs are assured, the Units would source the finance from the banks on the strength of the CERs and implement the project. The project activity would be implemented within 10 months of validation of PDD.

Figure below shows the Process of the Sponge Iron Manufacturing. It also defines the project activity boundary (within dotted lines)

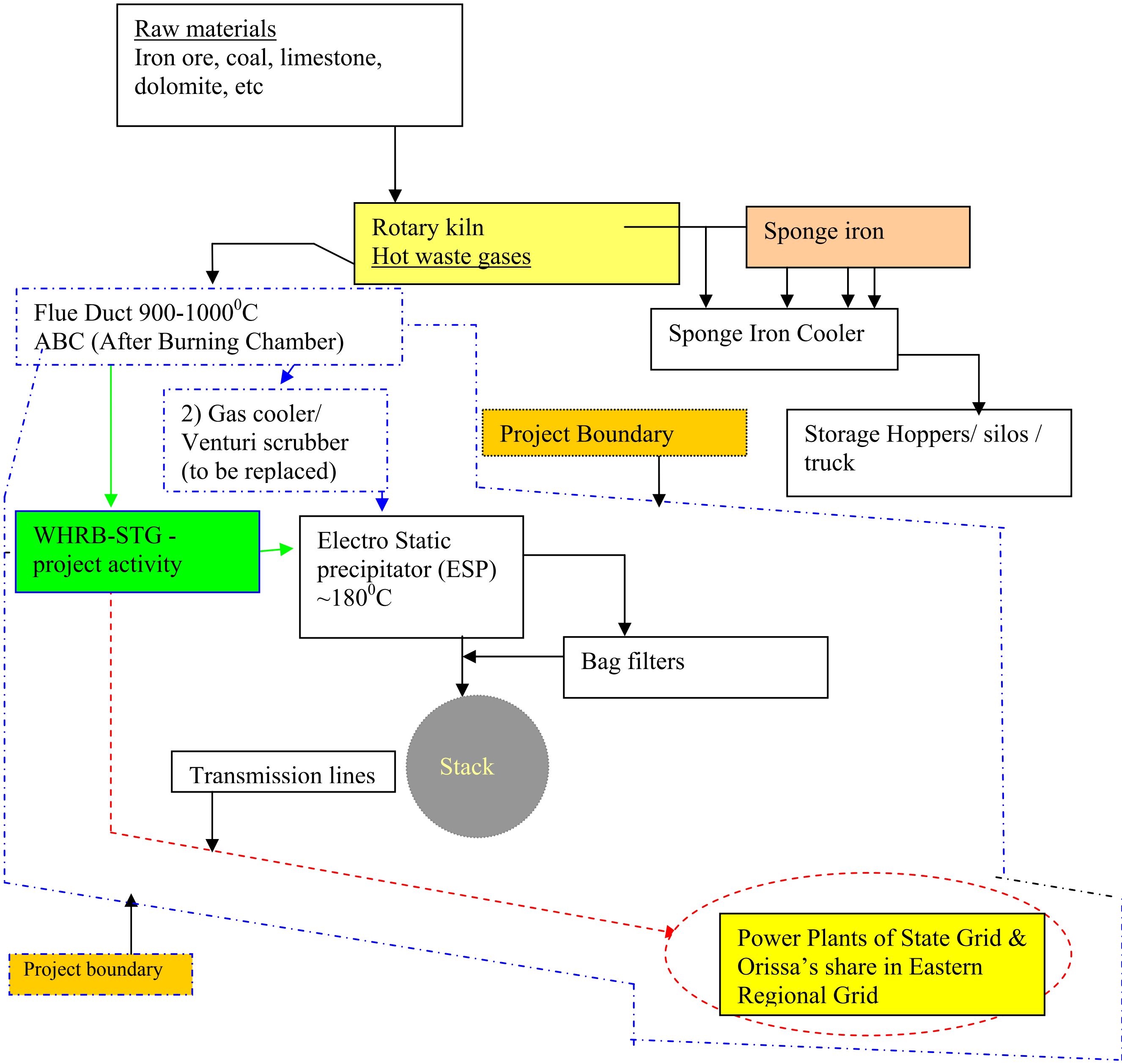


Figure showing Plant Process and defining Project boundary A 4.3

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

>> There are no national and/or sectoral policies compelling the implementation of the project activity to utilize the waste heat of gases and generate electricity. The project activity is over and above the basic requirements of the national/ sectoral policies. The Units are presently running their manufacturing processes by drawing power from the grid. In the absence of the project activity the Units would continue to draw power for running the Units from the grid. The electricity generated by the Units from the project activity of installation of WHRB_STGs would not only eliminate import of power from the grid to run the Units, but also have a surplus for export to the grid/other consumers. This would correspondingly reduce the necessity of the generating stations of the State Grid to generate the total Power generated by the project activity. The grid is predominantly thermal and therefore it can be assumed that the power generated for the Units is from thermal power plants by burning of coal. The project activity translates into considerable reduction in the use and burning of coal at the generating stations thus reducing the anthropogenic emissions of anthropogenic GHGs. This reduction is a direct result of, and which obviously would not have occurred in the absence of, the project activity. The other additionality criteria are dealt with in detail at B.3.
Considering a Baseline emission factor of 00.8439229 (details at Annex-3), net CO_2 emission reduction from the project activity is expected to be around 296267.44 tonnes of CO_2 / annum.

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

>>The chosen crediting period is ten years

Year	**Annual Estimation of emission reductions (Tonnes of CO2e)**
2005-06	296267.44
2006-07	296267.44
2007-08	296267.44
2008-09	296267.44
2009-10	296267.44
2010-11	296267.44
2011-12	296267.44
2012-13	296267.44
2013-14	296267.44
2014-15	296267.44
Total estimated reductions (Tonnes of CO2e)	2962674.40
Total no of crediting years	10 (ten) y
Annual average over the crediting period of estimated reduction (Tonnes of CO2e)	296267.44

A.4.5. Public funding of the project activity:

>> No public funding from parties included in Annex – 1 has been made available to the project activity

SECTION B. Application of a baseline methodology

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

>> Consolidated baseline methodology for waste gas and/or heat for power generation, reference ACM0004, Version 01, Sectoral Scope 01, Date July 8, 2005, and is applied to the project activity. As this methodology specifies that ACM0002, Sectoral Scope 01, Version 04, Date November 28, 2005 to be used for calculation of operating, build and combined margins of the project activity, this methodology will also be applied to the project activity

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

>> **Justification concerning the choice of the methodology:**

The methodology described in UNFCCC document ACM 0004 applies to electricity generation project activity, which displaces electricity generation with fossil fuels in the electricity grid or displaces captive electricity generation from fossil fuels. Since the electrical power generated by the project activity is connected to the grid, the operating and build margins and, by inference, the combined margin of the grid will be taken into account for calculating the emission factor. For this calculation of combined margin the UNFCCC approved methodology described in ACM 0002, Version 04, and Sectoral Scope 1 is followed. Though this methodology (ACM 0002) is applicable to grid-connected renewable power generation project activities, the procedure for the calculation of the combined margin is same for both and hence it has been rightly specified that ACM 0002 be referred to for this purpose alone and the remaining portion of the methodology be followed as per the UNFCCC document ACM 0004

As per the above methodologies:

1. For the baseline determination, project participants will only account for CO2 emissions from the electricity generation in fossil fuel fired power plants, that are displaced due to the project activity
2. The spatial extent of the project boundary includes the source of the waste heat, i.e. After burner Chamber of the rotary kiln, the power generating equipment, gas conditioning plant, Electro Static Precipitator (ESP), the stack, the project site and all power plants connected physically to the electricity system that the Units power generation plant is connected to.

For the purpose of determining the build margin (BM) and operating margin (OM) emission factor, as described below, that portion of electricity from the Eastern Regional Grid which is dedicated for Orissa exclusively and fixed as per power sharing agreement between GRIDCO and ERG and the balance of the whole of the generation by OHPC & OPGC, Captive Power Plants, TTPS have been included in the project boundary, as defined by the spatial extent of the power plants that can be dispatched without transmission constraints, since the application of this methodology does not result in a clear grid boundary, given the country specific variations in the grid management policies:

In a large country like India with layered dispatch systems, the Orissa State grid definition, GRIDCO/OPTCL will be used. The fossil fuel fired power plants of the Eastern Region connected to the electricity system of GRIDCO/OPTCL will also be included in the project boundary as mentioned above

The project activity meets the applicability conditions of the chosen methodology ACM 0004, since it is a scheme for electricity generation by utilizing the sensible heat of waste gases of the process, which displaces electricity generation with fossil fuels in the electricity grid

Electricity transfers from connected electricity systems to the project electricity system are defined as electricity imports and project electricity transfers to connected electricity systems are defined as electricity exports

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

>>The first step in application of the chosen methodology is to define the emissions that would be included or excluded from the project boundary. See Table B.2.a

Table – B.2.a

Overview on emissions sources included in or excluded from the project boundary as defined in the methodology

Sl No	Source	Emission Gas	Status on inclusion	Justification/explanation
Baseline	Grid electricity generation	CO2	**Included**	Main emission source
		CH4	Excluded	Excluded for simplification. This is conservative
		N2O	Excluded	Excluded for simplification. This is conservative
	Captive electricity generation	CO2	**Included**	Main emission source
		CH4	Excluded	Excluded for simplification. This is conservative
		N2O	Excluded	Excluded for simplification. This is conservative
Project Activity	On-site fossil fuel consumption due to the project activity	CO2	Excluded	May be an important emission source
		CH4	Excluded	Excluded for simplification.
		N2O	Excluded	Excluded for simplification.
	Combustion of waste gas for electricity generation	CO2	Excluded	It is assumed that this gas would have been burnt in the baseline scenario
		CH4	Excluded	Excluded for simplification.
		N2O	Excluded	Excluded for simplification.

The baseline scenario will include all possible options that provide or produce electricity for in-house consumption and / or other consumers. The project participants exclude the baseline options that:

- Do not comply with legal and regulatory requirements; or
- Depend on key resources such as fuels, materials or technology that are not available at the project site

The two steps involved in the application of the methodology in the context of the project activity are given below:

Step – I: Establishing additionality of the project activity

This step is based on the "Tool for the demonstration and assessment of additionality" of the version 02 approved in EB 22 on 28 November 2005.

Information/data related to industry practice and other regulatory and project related documents would be used to establish the additionality of the project activity. Details of step I are a part of Section B.3.

Step – II (A): Determining the Baseline Scenario

This step includes all possible options that provide or produce electricity for in-house consumption and / or sale to the grid and /or other consumers. All such options are excluded that do not comply with legal and or regulatory requirements, or that depend on key resources such as fuels, materials or technology that are not available at the project site.

The possible alternative scenarios in absence of the CDM project activity are as follows:

1. **The proposed project activity not undertaken as a CDM project activity**. This alternative is in compliance with all applicable legal and regulatory requirements. However the Units will

not, in the first place be able to generate sufficient funds or arrange loans from banks to purchase and install the necessary equipment required for the project activity, and also secondly, without the CDM benefits the Units would not be able to offset the losses and to service the loans even if the finance could somehow be arranged from the banks, and hence this alternative is not a suitable alternative. (See Table B3.2 in item B.3)

2. **Import of electricity from the Grid.** This alternative is in compliance with all applicable legal and regulatory requirements. As shown in Table 2, this alternative has no barriers to implementation. The baseline emission factor of the grid is far more conservative than coal based captive power plant as the grid mix are coal and hydro based, and hence is the natural choice for baseline scenario. This is the common practice at present.
3. **Captive Power generation on-site, using other energy sources than waste heat and/or gas, such as coal, diesel, hydro, wind etc**. This alternative is in compliance with all applicable legal and regulatory requirements. We will consider fossil fuels, as that is the plausible scenario, excepting the usage of natural gas, which is not available in this region and no possibility of it being available over the crediting period. Table B-2 proves that coal based captive power plant is not the baseline scenario
4. **A mix of options 2 & 3**. This alternative is in compliance with all applicable legal and regulatory requirements. Many of the Units have installed Captive Power Plants based on diesel fuel, but these are only used for emergency purposes, like interruption in power supplied from the grid, and hence will not be considered as an alternative
5. **Continuation of the present situation** This is import of electricity from the grid, with no project activity. In this case there would be no reduction of emissions

An overview of current situation in Orissa is given below:-

Total No of Sponge Iron Plants in Orissa:	157
√ No of permitted and operating plants:	**81**
No of Plants awaiting clearances for operation:	37
No of Plants under proposal for installation:	39

Table B.2.1: Baseline Options

The power requirement of sponge iron manufacturing industries are presently being met as follows: -

Baseline option 1: Proposed project activity not undertaken as a CDM project activity		0
Baseline option 2: Import of electricity from the grid		75
Baseline option 3: Fossil fuel (coal) based captive power plant		0
Baseline option 4: Fossil fuel (gas) based captive power plant		0
Baseline option 5: Fossil fuel (diesel) based captive power plant		4
Baseline option 6: Project Activity in checking those pending registration with EB for CDM benefits		2
(Source: Orissa Sponge Iron Manufacturing Association)	**Total**	**81**

The Ranking of the baseline scenarios is explained more clearly in Appendix 3, where a higher score means a more disadvantageous position.

Table B.2.1 summarizes the common practices adopted by sponge iron manufacturing industries to meet their power requirement. As per Table B.2.1, 75 sponge iron plants import electricity from the grid. Some of these Units have their own Captive Power Plants based on fossil fuel (Diesel), but these are only emergency stand-by generators to be used in case of power interruptions from the grid. Regarding Baseline Option 1: The project activity without CDM benefits – this will not occur due to financial barriers. Moreover even if the project activity does occur, it will not be sustainable as there would be no financial scope to service the loan. Hence this alternative has not been considered.

The Baseline option 2 occurs in 90% of the similar industries and is therefore a common practice. We may therefore conclude that from the assessment of common practices[1] adopted by the sponge iron units it is evident that Baseline option 2: Import of electricity from grid is the most common course of action among the identified baseline options.
If Step II (a) establishes that 'Import of electricity from the grid' is the most appropriate baseline option then the project activity will delay/displace equivalent electricity generation from the grid nor reduce emissions. If Step II (a) establishes that 'alternative electricity production from waste gas heat recovery captive power project systems' without CDM benefits is the most appropriate baseline option then the project activity will neither displace equivalent electricity generation from the fossil fuel based power projects and reduce emissions, and at the same time it would be financially unviable for sustained operations.

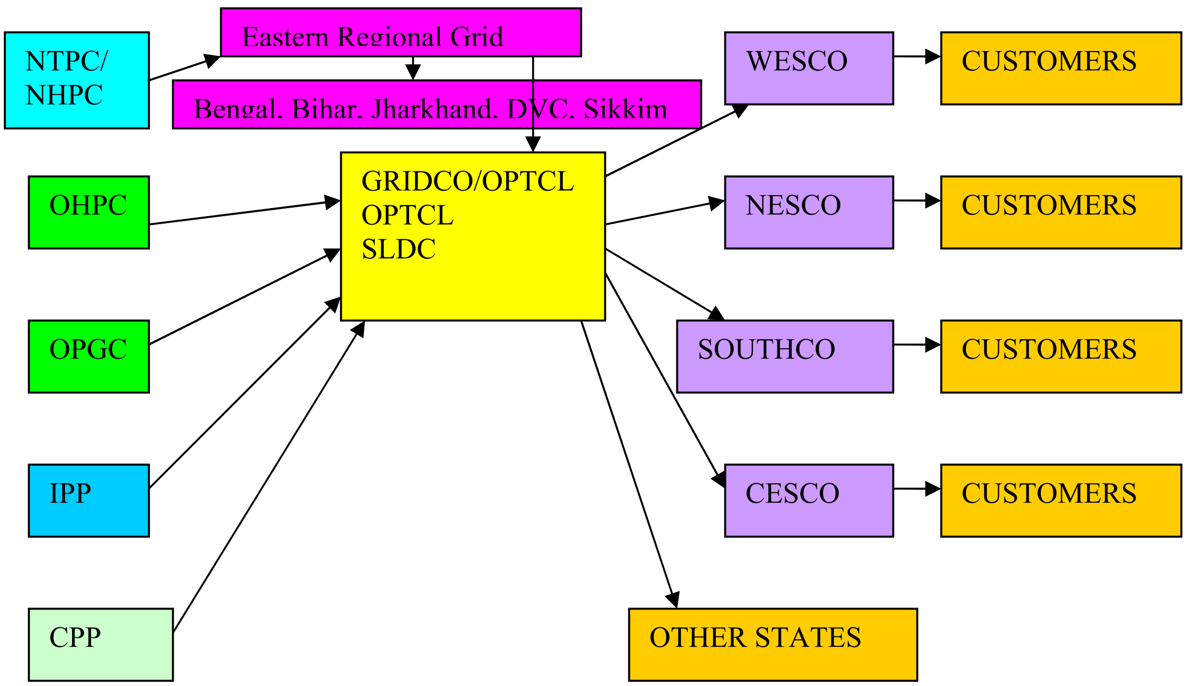
[1] The common practices in the crediting period will depend on changing national and sectoral policies if any. The planned national and sectoral laws and policies would be taken into consideration to arrive at the modified common practices.

Electricity Act 2003 is one of the major regulators, which could have an impact on the baseline options available to the sponge iron plants. Electricity Act, 2003 has simplified procedures for setting up grid connected and/or captive generation units. As per Clause 7 of the Electricity Act, 2003 "any generating company may establish, operate and maintain a generating station without obtaining a license under this Act if it complies with the technical standards relating to connectivity with the grid referred to in clause (b) of section 73". As per clause 9(1) of the Electricity Act, 2003 "notwithstanding anything contained in this Act, a person may construct, maintain or operate a captive generating plant with dedicated transmission lines: Provided that the supply of electricity from the captive generating plant through the grid shall be regulated in the same manner as the generating station of a generating company". With the Electricity Act, 2003 being introduced there is a possibility that 'Baseline option 2: Fossil fuel (coal) based captive power plant' and/or 'Baseline option 4: Fossil fuel (diesel) based captive power plant' become predominant baseline options. Since it is difficult to ascertain the impact of the Electricity Act, 2003 both Baseline options 1 & 2 are considered in Step 3 for 'Ranking of Baseline options'.
3. **Table B.2.2 shown in Appendix-3** provides for the **'Ranking of the baseline options'** based on the three criteria defined as per the methodology selected. In this the higher ranking is more prohibitive.

Step – II (B): Determining the Baseline Emissions
The baseline emissions and the emission reductions from project activity are estimated based on the Baseline Emission Factor (BEF) of the chosen grid or captive power plant depending on the baseline scenario and the quantum of electricity expected to be generated by the project activity. Baseline Emission Factor of the grid and the captive power plant are estimated as per the guidance provided in the methodology
The Current Delivery System in Orissa was studied for selection of a realistic grid representing the factual scenario associated with the project activity. Relevant information/data are provided herein.
Current Delivery System (Figure B.1)

Figure B.1: Flow Chart of Current Delivery System of Orissa

OHPC – Orissa Hydroelectric Power Corp, OPGC –Orissa Power Generation Corp, IPP – Independent Power Plants, CPP- Captive Power Plants
NTPC- National Thermal Power Corporation Ltd, SLDC – State Load Dispatch Centre
OPTCL-Orissa Power Transmission Corporation Ltd.



Indian power grid system (or the National Grid) is divided into five regional grids namely Northern, North Eastern, Eastern, and Southern and Western Region Grids. The Eastern Regional Grid consists of Bihar, Jharkhand, Orissa, West Bengal, Damodar Valley Corporation (DVC) and Sikkim state sector grids. These regional grids have independent Load Dispatch Centers (LDCs) that manage the flow of power in their jurisdiction. Power generated by state owned generation units and privately owned generation units would be consumed totally by respective states. The power generated by central sector generation plants will be shared by all states forming part of the grid in a fixed proportion. This central share amount has been allocated for the Orissa State. In Orissa, Grid Corporation of Orissa Limited (GRIDCO/OPTCL) Load Dispatch Centre (SLDC), Cuttack is the unit within GRIDCO/OPTCL (state grid authority), which has the responsibility of monitoring the state demand. Orissa Power Transmission Corporation Ltd – OPTCL is the sole Licensee for the Transmission, STU (State Transmission Utility) and SLDC functions of GRIDCO/OPTCL for the supply of power in the state. Under the commercial structure currently and as envisaged, GRIDCO/OPTCL purchases power from the various generating stations and supplies to the four Distribution Companies under the terms of a bulk Power Supply Agreement. The total installed capacity of the power generating stations in the National Grid, Eastern Regional Grid and the Orissa State Grid are provided given in Table-B 2.4

Therefore transmission and distribution system in Orissa has access to electricity generated from:

Orissa's share of generating stations set up by the Central Government ["Central Sector Plants"]

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

Orissa's State own generation

(a) This includes generating stations exclusively available to Orissa owned by Orissa Power Generating Corporation Limited (OPGC) and Orissa Hydro Power Corporation Limited (OHPC) and the Talcher Thermal Power Station owned by NTPC.

(b) Surplus availability from Independent Power Plants and Captive Power Plants

Power generated by all generation units as mentioned above is fed to the GRIDCO/OPTCL, OPTCL which is accessible all over Orissa State. Power mix is mainly thermal and hydro. There is a 1.49 MW wind power station and its contribution to the generation mix is negligible. Therefore GRIDCO/OPTCL is the point source that receives an electricity mix and further transmits the same to industries operating in Orissa.

The entire distribution system of the State has been further divided into four strategic business units.

Four distribution zones were first corporatized forming

Central Electricity Supply Company of Orissa Limited (CESCO)

Northern Electricity Supply Company of Orissa Limited (NESCO)

Western Electricity Supply Company of Orissa Limited (WESCO)

Southern Electricity Supply Company of Orissa Limited (SOUTHCO)

As per the proposed baseline methodology of "import of electricity from grid" following points have been considered and discussed while selecting the grid level:

Size of the project activity: From the above data we may conclude that the project activity, 50 MW waste heat recovery based power plants, is 0.964 % of the regional grid capacity as on 15th Nov, 2005 and 1.12 % of state grid capacity as on 2005. It is too small to have a significant impact on the regional grid in terms of percentage capacity and only marginally affecting changes in the generation and dispatch system (operating margin) or in delaying future power projects that may be commissioned during the crediting period (build margin) in the national or eastern regional grid. Therefore, the principal effect of the project activity would be on the lowest level of the grid i.e. the carbon intensity of the Orissa state grid.

Connectivity of grid: Orissa state grid (GRIDCO/OPTCL) may be considered as an isolated system boundary because GRIDCO/OPTCL solely decides on the amount of demand to be catered, the amount of energy to be produced and purchased, the source of power, the cost of electricity (purchase and selling price), net power cuts and subsequently the generation mix.

These decisions are independent as long as the state grid maintains the 'grid discipline'. This grid mix is entirely managed by the GRIDCO/OPTCL. The Orissa state grid is the most realistic choice of the grid for the project activity also because the power generated in this region is distributed in their jurisdiction only. This is illustrated by the fact that, even though Orissa being an energy surplus state there has been a mere 6.8% and 0.04% sale of power to other states in the year 2001-02 and 2002-03. Agreement for sale of power (150 to 180 MW round the clock) to Andhra Pradesh Transmission Company (APTRANSCO), was signed on 06.10.99 effective 10.10.99 for a period of one year. From 15-04-2002 the power supply to APTRANSCO has been stopped. GRIDCO/OPTCL had signed an agreement with Karnataka Power Transmission Corporation Limited (KPTCL) for sale of its surplus power of around 250 MW on 09-01-02, effective 10-01-2002. However due to transmission constraints in WR and SR the power flow could not be made possible. The inter-grid transmission of electricity is restricted due to poor transmission and distribution infrastructure. We may therefore conclude that due to poor infrastructural support inter-regional and inter-state grid transmission of power is very limited and we may consider Orissa state as an isolated grid, with connectivity to only the Eastern Region Grid. Though the electricity export is done by GRIDCO but it is not considered i.e. not subtracted from electricity generation data used for calculating and monitoring the baseline emission rate.

Taking into consideration point a) and point b) it is concluded that "GRIDCO/OPTCL" and its import provider the Eastern Region Grid is the most representative system boundary for the project activity. We would therefore determine the carbon intensity of the Orissa state grid in Step II to arrive at the baseline emission factor for baseline emission calculations for the project activity's crediting period.

Project boundary is as follows: The Unit's flue ducting leading into after burning chamber (ABC), the WHRB_STG, the multifield ESP, Bag Filters, Chimney Stack, Grid Power Plants supplying the Unit, Transmission lines and sub stations and is illustrated in Process chart at Figure 3

DETERMINATION OF CARBON INTENSITY OF THE CHOSEN GRID

Complete analysis of the system boundary's electricity generation has been carried out for application of the baseline methodology – combined margin (detailed in Annex 3) and baseline emission calculations.

From the step - Identification of alternative baseline scenarios it is found that "Import of electricity from grid" is the most appropriate baseline option. The project activity thus displaces equivalent amount of electricity from grid which is predominantly generated from thermal (fossiled fuel based) power plants. Further, as per ACM0004 baseline methodology the baseline Emission factor (BEF) of chosen Grid is calculated as per combined margin method of ACM0002 in Annex-3. Project activity emissions are zero as no auxiliary fuel is used for generation of start up or supplementary fuel for WHRB. Finally, annual emission reductions are found as the difference of baseline emissions and project emissions during the given year in tonnes of CO_2 equivalent

B) Determination of the carbon intensity of the chosen grid

Complete analysis of the system boundary's electricity generation mix, which has been carried out for calculating the emission factor of Eastern Region grid is as follows:

Combined Margin

The Combined Margin is calculated in the following steps.

Step 1: Calculation of Operating Margin

As mentioned above the project activity would have some effect on the Operating Margin (OM) of the Eastern Regional Grid. The Operating Margin emission factor(s) ($EF_{OM,y}$) is calculated based on one of the four following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

As per the methodology "Dispatch Data Analysis" (1c) is the first methodology choice.

The Dispatch Data OM emission factor ($EF_{OM\ Dispatch\ Data,\ y}$) is summarized as follows:

$$EF_{OM\ Dispatch\ Data,\ y} = \frac{E_{OM,\ y}}{EGy}$$

Where EGy is the generation of the project (in MWh) in year y, and $E_{OM,\ y}$ is the emissions (tCO2) associated with the operating margin calculated as

$$E_{OM,\ y} = \sum_h EG_h \cdot EF_{DD.\ h}$$

where EG_h is the generation of the Project (in MWh) in each hour h and $EF_{DD.\ h}$ is the hourly generation weighted average emissions per electricity unit (tCO2/MWh) of the set of power plants (n) in the top 10% of grid system dispatch order during hour h:

$$EF_{DD.\ h} = \frac{\sum F_{i,\ n,\ h} \cdot COEF_{i,\ n}}{\sum_n GEN_{n,\ h}}$$

Where 'F' is the fuel used per unit mass, COEF is the CO2 emission factor and GEN is the hourly generation from 'n' set of plants falling within the top 10% of the system dispatch.

To determine the set of plants (n), we have to obtain from the regional dispatch centre: a) the grid system dispatch order of operation for each power plant of the system; and b) the amount of power (MW) that is dispatched from all the plants in the system during each hour that the project activity is operating (GEN_h). At each hour 'h', each plant's generation is stacked (GEN_h) using the merit order. The set of plants (n) consists of those plants at the top of the stack (i.e. having the least merit), whose combined generation (S GEN_h) comprises 10% of total generation from all the plants during that hour (including imports to the extent they are dispatched). This data will be available on line from the data logger at SLDC (State Load Distribution Centre). It is not possible to determine the amount of power (MW) that is dispatched from all the plants in the system during each hour that the project activity is operating (GEN_h), as the project activity is yet to commence. Hence it has been decided to adopt the 1st method, i.e. Simple OM for calculating the baseline at the start of the project activity and the dispatch data will be available from the 1st year of operation and a new baseline will be calculated as per dispatch data analysis as above to arrive at the correct baseline emission factor.

The Simple OM emission factor ($EF_{OM,\ simple,\ y}$) is calculated as the generation- weighted average emissions per electricity unit (t CO2 /MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$\sum F_{i,\ j,\ y} \times COEF\ i,j$$

$$EF_{(OM,y)} = \frac{\sum_{i,j} }{\sum_j GEN_{j,y}}$$

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y ,
j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid,
COEF i, j is the CO2 emission coefficient of fuel i(t CO2/ mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in years (s) y, and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j

The CO2 emission coefficient COEFi is obtained as
$COEF_i = NCVi \ . EF_{CO2,i} \ . OXID_i$
Where
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO2,i}$ is the CO2 emission factor per unit of energy of the fuel i
Where available, local values of NCVi and $EF_{CO2,i}$ should be used. If no such values are available, Country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values
The simple OM emission factor can be calculated using either of the two following data vintages for year (s) y:
A three years average. based on the most recent statistics available at the time of PDD submission, or
The year in which project generation occurs, $EF_{OM,y}$ is updated based on ex post monitoring

The operating margin (OM) as per Simple Operating Margin analysis calculated on the above basis is 1001.25142 as per Table 5 (Please Refer to Table 5 at Annex 3)

As mentioned above the project activity will have a miniscule effect on the Operating Margin (OM) of the Eastern Regional Grid and Orissa State Grid. The baseline factor as per the Operating Margin takes into consideration the present power generation mix excluding low cost must run hydro-power projects of the selected grid, the design efficiency of the thermal power plants in the grid mix and the IPCC emission factors. The OM baseline factor is calculated as a 3-year average, based on the most recent statistics available at the time of PDD submission.

PRESENT POWER GENERATION MIX

The consumer in the State of Orissa gets a mix of power from the different sources. The figures of installed power capacity, share of the state in the central pool, and actual plant availability decides the content of power. The real mix of power in a particular year is however based on actual units generated from various sources of power. The GRIDCO/OPTCL network gets major portion of thermal & hydropower from Orissa Power Generating Corporation Limited (OPGC) and Orissa Hydro Power Corporation Limited (OHPC) respectively along with the central sector generation plants and IPPs. The actual generation data of the entire Orissa State for the year 2002 - 2003, 2003 – 2004 and 2004-2005 is presented in this document (sources are referred and listed in list of references), which includes own generation, purchase from central sector power plants and purchase from private sector power plants.

For the purpose of determining the Operating Margin, the percentage of the imported electricity to the total generation in the project electricity system is 14.7% and this fact has been duly considered while calculating the OM emission factor

Table: B.2.5 – Power Generation Mix of Orissa from the State Generating Stations[8]						
Power Plant	**Energy Source**	**Installed Capacity**	**Net Generation**	**Net Generation**	**Net Generation**	**Net Generation**
		in MW	**in MU**	**in MU**	**in MU**	**in MU**
		(31/03/02)	**(2001-2002)**	**(2002-2003)**	**(2003-2004)**	**(2004-2005)**
TTPS Stage I [NTPC]		240	2179.16	1997.424	2338.92	2859.67
TTPS Stage II [NTPC]		220				
IB Valley (I&II) [OPGC]		420	2317.27	2327.378	2663.74	2833.04
A Thermal Total:		**880**	**4496.43**	**4324.8**	**5002.66**	**5692.71**
2. Hydro						
Hirakud, Burla [OHPC]		331.5	925.16	515.806	3500	797.07
Hirakud, Chiplima [OHPC]		72				
Balimela P.H.[OHPC]		360		1049.47	523.274	1493.12
Rengali P.H. [OHPC]		250		772.18	620.974	731.27
U. Kolab P.H. [OHPC]		320		640.18	472.629	866.71
Indravati P.H. [OHPC]		600	2923.87	790.458	1710.72	2828.1
Machhkund PH [OHPC]		57.375	325.29	265.678	265	366.65
B. Hydro Total:		**1918.88**	**6636.15**	**3288.82**	**5475.72**	**7082.92**
3. Wind		0.00		0	0	
C. Wind Total:		**0**		**0**	**0**	
4. Principal CPPs						
NALCO , Angul		960	347.74	409.895	420	403.56
NALCO Damanjodi		55.5				
Rourkela Steel Plant		248	9.39	9.17		71.68
ICCL		108	113.54	99.921		67.34
HPCL [INDAL]		67.5	10.12	7.905		0.092
NBFA		30				37.91

FACOR		21	0	0		
NINL		38.5				23.93
ISPAT ALLOYS		40.46	0	0		
OTHERS		112.738	0	15.994		
D. Principal CPPs		**1379.5**	**480.79**	**542.884**	**420**	**604.512**
E. State Sector Total		**4480.573**	**11613.4**	**8156.5**	**10898.4**	**13380.142**

Table B.2.6

Transmission & Distribution Losses (OERC Target – Actual) GRIDCO/OPTCL & Distcos[19]		
	OERC Order (%)	**Actual (%)**
2000-01	**3.70**	**5.17**
2001-02	**4.18**	**5.17**
2002-03	**3.88**	**5.11**
2003-04	**3.58**	**4.15**
2004-05	**4.00**	**3.92**

GRIDCO calculates the Transmission & Distribution losses at 4% flat.

[19] Sources: GRIDCO/OPTCL/ OPTCL – An Overview 2005, Page 50

Table-B.2.7– Power Generation Mix of Orissa from the Central Generating Stations[9] over the past 4 years							
Sr. No	Energy Source	Central Share	Central Share	Generation	Generation	Generation	Generation
		(31/03/02)	(28/04/03)	(2001-2002)	(2002-2003)	(2003-2004)	(2004-2005)
	1	2	3	4	5	6	7
II.	Orissa's share in Central Schemes	MW	MW	in MU	in MU	in MU	in MU
1	**Thermal (coal)**						
	Farakka STPS (NTPC) (1600MW)	235	235	234.04	1421.839	1463.53	1320.24
	Kahalgaon STPS (NTPC) (840MW)	134.99	79	46.56	727.884	222.77	567.48
	Talcher STPS (NTPC) (1000MW)	262	318	397.2	1453.398	1453.4	2108.12
A.	**Total**	**631.99**	**632**	**677.8**	**3603.12**	**3139.7**	**3995.84**

	Thermal						
2	**Hydro**						
	Chukka (Bhutan)	58.46	47	143.96	232.436	253.37	235.41
B.	**Total Hydro**	**58.46**	**47**	**143.96**	**232.436**	**253.37**	**235.41**
	Regional Pool				18.861	0	
	Central Sector Total	**690.45**		**821.77**	**3854.42**	**3920.41**	**4231.14**
	% Hydro to total Generation in Central Sector			**17.50%**	**6.03%**	**6.46%**	**5.56%**

The Government of India, Ministry of Power, has revised these shares as per Document No. 3/13/2000-OM dated 11th April 2003. Table B.2.7 Column 7 provides the revised power generation mix from the central share generating stations.

Justification of exclusion of hydropower from operating margin in the case of hydro-dominated grids

The proposed baseline methodology ACM 0004 suggests 'exclusion of hydropower(low cost /must run power sources) from operating margin in the case of hydro-dominated grids' if the share of electricity from hydro **power is lower than 50%** of the total electricity generation in the grid in: average of the five most recent years or based on long term normal for hydroelectricity production

The actual generation data of the entire State of Orissa was analysed for the years 1999-2000, 2000-2001, 2001-2002, 2002-2003 and 2003-2004 to arrive at the contribution of the coal based power plants and the hydro based power plants in the GRIDCO/OPTCL grid mix. (Refer to Table B 2.8 - Power Generation Mix of Orissa for five most recent years for data information). It was found that the average share of the hydro-based power projects over the five most recent years was lower than 50% of the total electricity generation in the grid. Therefore, hydropower projects have been excluded from the operating margin.

Table: B.2.8 – Power Generation Mix of Orissa for five most recent years[10]

Energy Source	2000-01	2001-02	2002-03	2003-04	2004-05
Total Power Generation (MU)	11011.39	12435.13	11216.74	14818.79	17611.68
Total Hydro Power Generation (MU)	4957.99	6780.11	3288.82	5729.09	7318.75
Total ThermalPower Generation (MU)	6053.39	5655.02	7927.923	9089.7	10292.93
Hydro % of Total grid generation	**45.03**	**54.52**	**29.32**	**38.66**	**41.52**
Thermal % of Total grid generation	**54.97**	**45.48**	**70.68**	**61.34**	**58.48**

Hydro % of Total grid generation – Average of the five most recent years – 41.81%

EMISSION FACTORS

The emission factors used are given in Table B.2.9 and are based on a study from the OECD [OECD, 2000] and on the IPCC-guideline (IPCC, 1996). The emission factors vary widely depending on the type of fuel used. (Taken from www.ipcc.org)

Table B.2.9 Emission factors (IEA, Revised IPCC, 1996)	
	Source Emission Factor (tCO_2/TJ)
Nuclear, Biomass, Hydro, Solar, Wind	0
Diesel Oil	74.1
LPG	63.1
Natural Gas	55.1
Petroleum Coke	100.8
Coal	95.52

Standard emission factors given in IPCC for coal & gas (Thermal generation) are applied over the expected generation mix and net emission factors are determined for each year

EFFICIENCY

The most important parameter in estimating the emissions is the thermal efficiency of the power plant. The methodology requires the project proponent to use actual efficiencies of the power generating stations. In absence of consistent data on actual thermal efficiency the project proponent can use the anticipated energy efficiency documented in official sources. The design efficiency is expected to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than the nameplate performance would imply.

Table: B.2.10 – Energy Efficiency of Coal/Lignite based Generating Stations[11]		
Sr. No.	Energy Source	Efficiency
I.	**Orissa - State**	
1	TTPS Stage I [NTPC] / TTPS Stage II [NTPC]	32.85%[12]
2	IB Valley (I&II) [OPGC]	36.642%[11]
3	Principal CPPs	32.00%
II. Orissa - Central		
Farakka STPS (NTPC) (1600MW)		37.66%[11]
Kahalgaon STPS (NTPC) (840MW)		34.79%[13]

Talcher STPS (NTPC) (1000MW)	34.79%[12]
Average	**34.78%**

For the purpose of determining the OM emission factor, as described below, one of the following options will be used to determine the CO2 emission factor (s) for net electricity imports ($COEF_{i, j, imports}$) from a connected electricity system within the same grid:

a. 0 tCO2/MU, or
b. the emission factor(s) of the specific power plant(s) from which electricity is imported, if and only if the specific plants are clearly known, or
c. the average emission rate of the exporting grid, if and only if net imports do not exceed 20% of the total generation in the project electricity system, or
d. the emission factor of the exporting grid, determined as described in steps 1,2 and 3 below, if net imports exceed 20% of the total generation in the project electricity system

We have considered (b) above as we know the specific plants from which electricity is imported

Electricity exports will not be subtracted from the electricity generation data used for calculating and monitoring the baseline emission rate.

The proposed baseline methodology requires the project proponent to calculate the OM Baseline Emission Factor as a 3-year average, based on the most recent statistics. Though the Operating Margin emission factor, EF_{OMy} should have been calculated as per Dispatch Data Analysis OM, as specified in the methodology of ACM 0002, since adequate data of the generation could not be had because the project activity had not commenced. Hence the OM has been calculated as per simple OM basis as per ACM 0002.The OM Baseline Emission Factor is therefore calculated as the average of OM baseline emission factor of 2002-2003, 2003-2004 and 2004-2005. The Baseline Emission Factor as per OM calculated on simple OM basis is as follows:

Baseline Emission Factor as per OM = 999.51 tCO_2e/GWh generation for the base year 2002-2003.

Baseline Emission Factor as per OM = 999.69 tCO_2e/GWh generation for the base year 2003-2004.

Baseline Emission Factor as per OM = 1004.55 tCO_2e/GWh generation for the base year 2004-2005.

A 3-year average Baseline Emission Factor as per OM = 1001.25 tCO_2e/GWh generation

Source: An Overview of GRIDCO/OPTCL 2005, GRIDCO/OPTCL document "Power Purchased with Cost and Energy Sold During 2002-2003" received on 14/05/03, Tariff Order 2003-2004,OERC http://www.orierc.org/

[9] Source: An Overview of GRIDCO/OPTCL (2005) Note from GRIDCO/OPTCL (Document No. 3/13/2000-OM dated 11th April, 2003) and Tariff Order 2003-2004, OERC http://www.orierc.org/

BUILD MARGIN

For the purpose of determining the Build Margin (BM) emission factor, the spatial extent is limited to the project electricity system and is as shown below

Estimation of Net Emission Factor as per BM as per ACM 0002					
TTPS(StageI-Stage-II)					364.539177
NTPC-Kahalgaon STPS					68.3061479
NTPC-Talcher STPS					253.74913

Hydro power					0
Net emission factor in tCO2/mu (BM)					686.594455

(For details please see annex-3)

The project activity will have some effect on the Build Margin (BM) of the Orissa State Grid. The baseline factor as per the Build Margin takes into consideration the delay effect on the future projects. As per the proposed baseline methodology, the baseline factor for Build Margin is calculated as the weighted average emissions (in tCO_2 equiv./GWh) of recent capacity additions to the system, which capacity additions defined as the greater (in GWh) of most recent 20 per cent[14] of existing plants or the 5 most recent plants.

In case of Orissa grid 20% of the most recent plants sum up to 10 power plants. Therefore for our build margin calculation we take into consideration the 10 most recent plants built in Orissa given below in Table B.2.11.

The BM baseline factor is calculated ex-ante based on the most recent information available on plants Build for the sample group at the time of the PDD submission.

Table: B.2.11– Ten most recent plants Build in Orissa[15]

No.	Name of Power Plant	Fuel	Year of Commissioning	MW	MW For Orissa	2003-2004 (MU)	2004-2005 (MU)
1	Indravati P.H. [OHPC], U-4	Hydro	2001	150	600	1710.72	2828.10
2	Indravati P.H. [OHPC], U-3	Hydro	2000	150			
3	Indravati P.H. [OHPC], U-1	Hydro	1999	150			
4	Indravati P.H. [OHPC], U-2	Hydro	1999	150			
5	Kahalgaon STPS [NTPC] (840 MW) (Orissa Share-16.07%),U-4	Coal	1996	210	134.99	111.38	5653.17
6	Kahalgaon STPS [NTPC] (840 MW) (Orissa Share-16.07%),U-3	Coal	1995	210			
7	TTPS Stage I [NTPC]	Coal	1995	240	240	2338.92	2874.55

8	TTPS Stage II [NTPC]	Coal	1995	220	220		
9	Talcher STPS [NTPC] (Orissa Share-26.2%), U-1**	Coal	1995	500	262	1980.74	0
10	Talcher STPS [NTPC], U-2**	Coal	1996	500			0
Coal Based						**4431.04**	**8527.72**
Hydro Based						**1710.72**	**2828.10**
Total						**6141.76**	**11355.82**
Coal Based						**72.15%**	**75.10%**
Hydro Based						**27.85%**	**24.90%**

Baseline Emission Factor as per **BM = 686.59 tCO_2/GWh** generation for the base year 2004-2005

Net Baseline Emission Factor as per **CM = (1001.25+686.59)/2 = 843.923 tCO_2/GWh**

As per the methodology hydropower plant/s can be excluded from the operating margin if the share of electricity from hydro power is lower than 50% of the total electricity generation in the grid in: average of the five most recent[16] years. Since the hydropower share (average of last 5 years) is much lower than 50% of the total power generation; hydropower plants were excluded from the operating margin. The operating margin would be subject to variations if only new hydro projects are implemented and hydropower generation exceeds 50% of the total electricity generation in the grid. It was found that Orissa state has a fully met electricity demand condition at present. However the probability of future capacity additions in the crediting period is very poor and the operating margin is therefore not expected to vary significantly.

POWER GENERATION BY PROJECT ACTIVITY

The total power generated by the project activity during the crediting period is based on the power plant's capacity, the plant's annual electricity requirement and 300 operating days of power generation from the project activity per year.

The project activity will generate 296267.44 tCO2/MU per annum (2962674.4 tCO2/MU for a period of 10 years).

As a conservative approach the emission reductions due to energy savings from the Gas cooling/ venturi scrubber have not been taken into consideration, though the effect of losses due to transmission & distribution have been considered.

Therefore, a conventional energy equivalent of 3600000 MU for a period of 10 years would be generated by the project activity and this electrical energy will displace an equivalent amount of electricity the plant would have drawn from the grid. Without project activity, the same energy load would have been taken up by thermal power plants and emission of CO_2 would have been occurred due to coal combustion.

In the Orissa State sector, the responsibility of power generation rest with the Orissa Power Generation Corporation (for thermal power) and the Orissa Hydro Power Corporation (for hydel power). The Grid Corporation of Orissa Ltd (GRIDCO) and Orissa Power Transmission Corporation Ltd (OPTCL) and the STU (State Transmission Utility) discharges the transmission functions with separate distribution companies. The transmission and distribution system in Orissa has access to electricity generated from:

1. Orissa Hydro Power Corporation - *Hydro*
2. Orissa Power Generation Corporation - *Thermal*,
3. Talcher Thermal Power Station – NTPC *Thermal*,
4. Eastern Regional Electricity Board (EREB) (Central sector),
5. Captive Power Plants
6. Independent Power Plants

The average system demand and the average peak system demand in the State for 2004-05 are 1649 MW and 2295.04 MW respectively. Currently, there is surplus of 697 MW of peak power considering 80% availability of the central sector power and the energy surplus is about 3210 MU. In the early years of reforms, it was, however, estimated that the peak power demand in the state would be 3387 MW and the energy requirement 19166 MU. This estimate was prepared based on the assessment of industrial loads with due consultation with Industries Dept. and IPICOL. Now that the revised load demand scenario has changed, a revised estimate has been prepared basing on the comparison of Demand Projection by GRIDCO/OPTCL upto 12th Plan[17].

[17] GRIDCO/OPTCL, -An Overview, 2005

As per the Table B 2.12 given in Appendix-5, GRIDCO/OPTCL has projected a limited increase in the future power demand scenario in its Revision IV. With the present fully met power scenario in the Orissa state the capacity additions are delayed. The OERC authorities responsible for providing clearances to future capacity additions have asked for further justification from GRIDCO/OPTCL for future capacity additions. Therefore we may conclude from the above-mentioned information gathered from various published documents of GRIDCO/OPTCL that Orissa state has a fully met power situation and the probability of future capacity additions is very low. Some proposed power projects listed below were identified capacity additions for the Tenth Plan (2002-2007). However they are yet to complete major milestones like approvals from OERC, financial closures before starting construction. It is expected that these future capacity additions will not be implemented during the credit period. The generation weighted average emission rate at the operating margin is therefore not expected to vary over the credit period. The prospect of future Hydel Stations is bleak due to factors like displacement of people from expected inundation and their rehabilitation; hence expansion of capacity will be mainly restricted to thermal power plants

However if at all there is a sudden increase in the electricity demand scenario and the planned capacity additions get the necessary approvals and finances, there is a very small probability that some projects are implemented nearing the end of the project activity's credit period. It may also be noted that out of 1841MW of planned capacity additions 1420MW capacity would be contributed by the thermal projects and only 421MW capacity would come from hydro projects. In such an event the project activity would cause a small delay effect on these planned capacity additions. This delay effect has been captured in the build margin consideration.

Since the planned future capacity additions too are dominated by coal-based power plants the hydropower generation would be lower in the grid and the generation weighted average emission rate as per the operating margin and the build margin would not vary significantly.

We may therefore conclude that since the project activity is developed in a fully-met electricity demand scenario and where there is a very high uncertainty associated to implementation of planned capacity additions (comprising of 77% coal based) the baseline emission factor would not change significantly over the crediting period. The baseline emissions for the 10-year credit period have therefore been calculated based on the baseline emission factor for the base year.

Further the methodology also identifies that the project activity with capacity less than 1% of the grid size, itself would not have much of an effect on the future capacity additions to the grid and therefore the ex-ante calculations with future capacity additions, for future years are not necessary. The project activity size is less than 1% of the grid size and we may therefore consider the combine margin baseline emission factor as calculated above for the entire crediting period.

In addition to the emissions arising from fossil-fired power generation, additional CO_2 emissions occur during the transport of coal from coalmines (or ports). In the eastern region coalfields are not far from the coal-fired power stations. There is no such raw material transportation distance used in the project activity as in the case of the coal-fired power stations. This means transport emission will be nil in the project activity. Because of a lack of data on average transport distance for coal to power stations in Orissa we have not included fuel transport emissions in the system boundary of both the current situation and the project. This also provides a conservative estimate of the emission reductions.

Based on the Combined Margin Method detailed above, (see section E for calculations) the project activity will reduce 351059.84*0.8439229 = 296267.440 tonnes of CO_2 in 10 year of credit period. Hence, the project activity is not a baseline scenario and without project activity there will be emission as per the carbon intensity of the grid (843.9229 tCO_2/GWh) from which the project activity is not drawing electricity.

The Units will be generating Power over and above their captive requirements, which would be available for sale to other Plants or to the grid. In both cases this translates to a reduction in GHG emissions by an amount that would have been emitted by the coal burnt to generate this power

Please refer to A 4.4.1 on Page 13, for quantity of emission reductions by project activity

The two scenarios before and after the implementation of the project activity are as follows:

Scenario 1- Status-quo of the existing facility: In the before project activity scenario, the respective Unit purchases its electricity from GRIDCO/OPTCL, and for generating the same, a certain amount of carbon dioxide is being emitted into the atmosphere at the thermal power generation stations. At the same time, 100% of the heat energy in the flue gases is lost at the gas cooler, venturi scrubber and finally lost to the atmosphere through the stack. The before project scenario will continue in the absence of the project activity.

Scenario 2 – Project activity option: In the project activity scenario, the gas cooler and venturi scrubber will be replaced by a waste heat recovery based boiler, steam turbine generator (WHRB_STG) power plant. A major part of the heat energy of the waste gases would then be recovered and efficiently utilized to generate steam, which would generate electricity (approx 360000 MU/ year), to meet not only the Units' total electricity requirements (approx 176003.8 MU/ year), but have a surplus for sale outside (approx 183996.2 MU /year). The project activity will eliminate the need to generate that much Electricity and together with the surplus electricity after usage for captive consumption, will allow the grid to reduce this much of electricity generation at their power station.

In the absence of project activity, the Units would continue to draw power from GRIDCO/OPTCL, and the system boundary would include the grid's generation mix and/or a fossil fuel based captive power plant. The grid's generation mix comprises of power generated through sources such as coal based thermal power plants and hydro power stations. The project activity would therefore displace an equivalent amount of electricity the plant would have drawn from the grid. The displaced electricity generation is the element that would marginally impact and improve the operation of the existing power plants and delay future capacity additions and its associated actual emissions. The project activity would also decrease the SPM emissions by increased efficiency of ESP because of lower flue gas temperature reaching the electrostatic precipitators (ESP). Therefore the most appropriate approach for baseline methodology would be "Existing actual or historical emissions".

Justification concerning applicability conditions of the methodology:

The approved methodology ACM 0004 in conjunction with the approved methodology ACM 0002 determines the carbon intensity of the chosen grid mix/captive power plant through the analysis of the generation mix. It uses the existing actual or historical emissions of the power plants supplying power to the grid as baseline emissions. This approved baseline methodology applies to all CDM project activities, which are based on use of in-situ waste heat streams for generation of electricity that displaces imports of electricity from the grid or from any captive fossil fuel based electricity generation.

The present project activity of all the Units is a waste heat recovery based power project and presently, before project activity implementation, the Units are importing electricity from the GRIDCO/OPTCL. In Orissa, in the absence of the project activity, drawing power from GRIDCO/OPTCL is the only way to run the Unit economically, and therefore the most appropriate baseline option in absence of project activity would be 'Import of electricity from the grid'. (The same has been established in Step II (a): Determining the baseline scenario in detail).

Therefore, the project activity would be generating power from waste heat streams and displace imports of electricity from the grid. We may therefore conclude that the project activity meets the applicability conditions required by Annex 3 for this approved methodology.

Further, as per the Kyoto Protocol (KP), the baseline should be in accordance with the additionality criteria of article 12, paragraph 5(c), which states that the project activity must reduce emissions that are additional to any that, would occur in the absence of the certified project activity. Since the project

activity will reduce emissions that are additional to any that is occurring now in the absence of the project activity, this project activity can be certified as additional.
The methodology is based on the recommendations of UNFCCC CDM Executive Board and which suggests a five-step additionality test. If all the five steps meet the defined requirements, the project activity is considered as additional.
The project activity establishes its additionality based on Step I: Establishing additionality of the project activity of the methodology. The additionality aspect has been dealt in detail in Section B.3.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

>> As a first step to describing the process of identifying the emission reduction, the additionality of the project activity will have to be established.
Tool for the demonstration and assessment of additionality (version 02)

Step 0 Preliminary screening based on the starting date of the project activity
The Marrakesh Accords and decision 18/CP.9 provide guidance on the eligibility of a proposed CDM project activity.
1. (a) Since the CDM project activity is not likely to be submitted for registration before 31 December 2005, the crediting period has been selected as that falling from the date of registration for a fixed period of ten years.
(b) Evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity is based on corporate documentation that was available to third parties at, or prior to, the start of the project activity.
The project activity started after the Units' entrepreneurs attended an awareness campaign organized by BPNSI with OSIMA and SPCO of Japan at Mayfair Hotel, Rourkela on March 23, 2005 explaining about CDM's role in achieving the goals of reduction of GHG and the essentiality of sustainable development. The necessity and advantages of introducing the project activity, including the incentives available was discussed. The main message from the Unit owners was that though they were in full concurrence with the need to implement the project activity, they were of the opinion that the project activity was unviable in the absence of CDM benefits, because of the extremely high capital cost of the equipment required for waste heat recovery based power plant.
They said that the CDM benefits were necessary right from the date of implementation of the project activity and also necessary for the sustainability of the project activity. Since the Units were not in a position to offer any guarantees to the financial institutions because all the collateral securities including personal guarantees of the Units and their promoters had already been pledged to the banks, only the assurance of benefits from CDM will enable firstly for the financial institutions to extend loans, in the absence of other guarantees, and secondly the incentives from CDM were essential for the sustainability of the project activity. The Units were sure that the income from CDM during the crediting period was absolutely necessary to enable them to service the debts. The Meeting was well attended and comprised of nearly all the Units who were members of OSIMA. Follow up meetings were subsequently held and finally on September 15, 2005 the Units gave their letters of voluntary participation in the CDM Programme on being reassured of the benefits of CDM. Following this seminar the Units decided to proceed with the project activity commencing with the preparation of PDD.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Sub-step 1a: Define alternatives to the project activity:

1. Identification of realistic and credible alternative(s) available to the Project Proponents or similar project developers[4] that provide outputs or services comparable with the proposed CDM project activity[5].

The project activity is the generation of Power by utilizing the sensible heat of the waste gases.

The total power that would be generated by all the Units combined, is around 50 MW

Credible Alternatives:

The **first alternative** is to import this electricity from the Grid. This is the present and common practice among all the Units. Utilization of the power from the grid results in a certain quantity of Carbon Dioxide and other GHG emissions at the generating power plants of the grid. This alternative is in total compliance with all the statutory regulations and legalities applicable. Here the Project boundary will encompass all the generating Stations of the project electricity system supplying Power to GRIDCO/OPTCL and the Units themselves

The **second alternative** is to have a captive power plant (CPP) run on the fossil fuel coal. Here the Carbon Dioxide and other GHG will be emitted from within the Units' premises. This alternative is in total compliance with all the statutory regulations and legalities applicable

The **third alternative** is to have a captive power plant (CPP) run on the fossil fuel diesel / furnace oil. Here the Carbon Dioxide and other GHG will be emitted from within the Units' premises. This alternative is in total compliance with all the statutory regulations and legalities applicable

The **fourth alternative** is to have a captive power plant (CPP) run on the fossil fuel Natural Gas. Here the Carbon Dioxide and other GHG will be emitted from within the Units' premises. Though this alternative is in total compliance with all the statutory regulations and legalities applicable, this is not a credible alternative since presently Natural Gas is not available in this region[1]

The **fifth alternative** is to have a captive power plant (CPP) run on the wind energy. Here there are no emissions and provide the cleanest environment. This alternative is in total compliance with all the statutory regulations and legalities applicable. Though this alternative is in total compliance with all the statutory regulations and legalities applicable, this is not a credible alternative since wind energy is seasonal and there is not much wind to justify installation of wind millions for Power generation, which will be unable to cater to the requirements of the Units.

The **sixth alternative** is to have a captive power plant (CPP) run on the waste heat recovery system. Here the carbon dioxide and other GHG would be no longer emitted from within the Units' premises, but CDM benefits are not claimed. Though this alternative is in total compliance with all the statutory regulations and legalities applicable, this is not a credible alternative since without CDM benefits the project activity becomes financially unsustainable and hence not implementable

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

Sub-step 1b: Enforcement of applicable laws and regulations:

Since the proposed project activity is not the only alternative amongst the ones considered by the Project Proponents that is in compliance with all regulations, the proposed CDM project activity is additional.

Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3.)

Step 2 Investment analysis

Sub-step 2a Determine appropriate analysis method

We adopt Option 1. Application of a simple cost analysis

Sub-step 2b Option I. Apply simple cost analysis

Assumptions:

1) The cost of a WHRB_STG for a 2 MW Plant is approx Rs. 84 million, and for a 1 MW Plant it is Rs. 42 million, including installation and commissioning and auxiliaries.

2) Considering an annual rate of interest of 8.5% on the invested sum, for energy saving projects

3) Loan repayment period of 7 yrs

4) Sale of electricity at Rs 1.10 per unit (kWh) and purchase of electricity from the grid at Rs. 3.00 per unit

It is seen that the Project is not viable without the income from CER sales. Profitability Statement is shown in Table B.3.2, the annual units generated would be 50000*7200 = 360000 MU.

Table B.3.2

Profitability Statement for Installation of WHRB_STG

Capacity of power plant (MW)	50.00
Installed Cost of power plant / MW	Rs42,000,000.00
Capital employed	Rs2,100,000,000.0
% interest	8.50
Years repayment	7
Power units generated (Kwh)	360,000,000.00
Units Consumed (Kwh)	71,286,000.00
Rate of purchase of power/ unit	Rs3.00
T&D Losses prevented	2,851,440.00
Value of T&D Losses prevented	Rs8,554,320.00
Savings on consumed power	Rs213,858,000.00
Total savings on consumed power & T&D Losses prevented	Rs222,412,320.00
Units sold	288,714,000.00
Rate of sale of power/ unit	Rs1.10
T&D Losses @4%	11,548,560.00
Value of T&D Losses	Rs12,703,416.00
Income from power sales	Rs304,881,984.00
Total savings due to project activity	Rs527,294,304.00

Fixed overhead cost @ 2.5%	Rs52,500,000.00						
Variable overhead expenses @ 2.5%	Rs52,500,000.00						
Depreciation @ 6.25%	Rs131,250,000.00						
Total Overhead Costs	Rs236,250,000.00						
CER	296267						
Rate per CER @ $14.50 / CER & Rs44.0/$	Rs638.00						
CDM Benefits	Rs189,018,626.72						
	1st year	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**	**7th year**
Loan instalment repayment	Rs300,000,000.00	Rs300,000,000.00	Rs300,000,000.00	Rs300,000,000.00	Rs300,000,000.00	Rs300,000,000.00	Rs300,000,000.00
Balance to be paid	Rs1,800,000,000.00	Rs1,687,455,696.00	Rs1,549,411,392.00	Rs1,401,800,822.16	Rs1,242,456,486.48	Rs1,070,565,252.36	Rs885,129,749.71
Interest	Rs178,500,000.00	Rs153,000,000.00	Rs143,433,734.16	Rs131,699,968.32	Rs119,153,069.88	Rs105,608,801.35	Rs90,998,046.45
Liability to investor	Rs478,500,000.00	Rs453,000,000.00	Rs443,433,734.16	Rs431,699,968.32	Rs419,153,069.88	Rs405,608,801.35	Rs390,998,046.45
Total savings due to project activity	Rs527,294,304.00	Rs527,294,304.00	Rs527,294,304.00	Rs527,294,304.00	Rs527,294,304.00	Rs527,294,304.00	Rs527,294,304.00
Less overhead costs	Rs236,250,000.00	Rs236,250,000.00	Rs236,250,000.00	Rs236,250,000.00	Rs236,250,000.00	Rs236,250,000.00	Rs236,250,000.00
Net gain/(loss)	Rs187,455,696.00	Rs161,955,696.00	Rs152,389,430.16	Rs140,655,664.32	Rs128,108,765.88	Rs114,564,497.35	Rs99,953,742.45
Income from sale of CERs	Rs189,018,626.72	Rs189,018,626.72	Rs189,018,626.72	Rs189,018,626.72	Rs189,018,626.72	Rs189,018,626.72	Rs189,018,626.72
Net (loss)/ gain after CDM benefits	Rs1,562,930.72	Rs27,062,930.72	Rs36,629,196.56	Rs48,362,962.40	Rs60,909,860.84	Rs74,454,129.37	Rs89,064,884.27

It is clearly seen from the above statement that in the absence of CDM benefits the project activity is unviable. If it is concluded that the proposed CDM project activity is not financially attractive then proceed to Step 4 (Common practice analysis).

Step 3 Barrier analysis

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

Most of the lending institutions in India do not look kindly upon the Small & Medium Steel Sector entrepreneurs, because of their past records. These Units will be refused lending unless they can provide sufficient security against loans taken. As mentioned earlier, most of these Units are fairly newly established and have availed of loans against their available securities and personal guarantees. In order to implement the project activity the Units would have to go in for fresh borrowing and the Banks and Financial Institutions would lend money to these entrepreneurs only against tangible collateral securities, which is provided only by the benefits from CDM

Technological barriers, *inter alia*:

- Skilled and/or properly trained labour to operate and maintain the technologically advanced equipment is presently not available and it would take some time for an education/training institution in the host country to provide the needed skill, which could lead to equipment disrepair and malfunctioning. Since the project proponents have none of them ever dealt with Power generation, the technology is full of risk and will take time to absorb. This is a real barrier, which the project Proponents have accepted considering the benefits afforded by CDM.
- Lack of infrastructure for implementation of the technology.

The project activity is the first of its kind where the kiln size is 100 tonnes per day (tpd) capacity and below. For this project activity there are 8 Nos of 50tpd and 27 Nos of 100 tpd plants. It has been seen that the consistency of volume of flue gases can be achieved only with higher technology, so also with the design of waste heat recovery boilers, for utilizing flue gases greater than 950 –1000deg C.

Financial barriers:

There is no financial viability for the Units for installing WHRB_STG without the benefits of CDM. The Units, which would be implementing the project activity, are all comparatively small Units, with little or no access to Technology. The Units are financially weak with little or no support from financial institutions that would fund the project activity in the absence of CDM benefits. These Units would have to close down their operations as they would not be able to access funds to implement the project activity, in the absence of CDM benefits, nor would they at the debt servicing stage be capable of sustaining their production at least at break-even levels, in the absence of CDM benefits. Once the project activity has been implemented and the loans taken for funding the project activity have been repaid with the help of income from CERs, self-sustainability of operations can be achieved.
The implementation of the project activity is also loaded with risks, as there is no Unit of 100 tpd and below that has been able to generate the envisaged quantum of electricity from the project activity, due to lack of access to high end technology for their WHRB_STG. For this project activity, the Units will be accessing Technology for manufacture and installation of high efficiency WHRB_STG from reputed manufacturers in India or from outside the country.
It is felt that since the smaller Units do not have the financial means to access Technology from reputed firms, this has given rise to poor results of less than 1.8 MW per 100tpd. With the assurance of looking forward to CERs, which can form a good collateral guarantee for Institutional Lenders, the smaller Units can now access the same High Technology as available to the bigger Units from Annex 1 countries, to get efficient WHRB_STGs. Even if there is a statutory obligation to install a WHRB_STG to mitigate the CO_2 emissions, these smaller Units will not be able to follow the same due to the financial barriers, unless they are supported by additional income from CERs

The import of electricity from the grid is a viable alternative and the identified barriers do not affect the viability, since the level of investment for this alternative is negligible as compared to the project activity.

At least one viable alternative shall be identified.
. If both Sub-steps 3a – 3b are satisfied, proceed to Step 4 (Common practice analysis)
. If one of the Sub-steps 3a – 3b is not satisfied, the project activity is not additional.

Step 4: Common practice analysis

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

As shown in B.2 there are 81 working Sponge Iron Units in the State of Orissa. Of these Units, only 6 have implemented the project activity. Of the 6 Units that have implemented the project activity, all are of capacities greater than 250 tpd. All these bigger Units have implemented the project activity because it was financially viable to implement even without the additional income from the CERs. The Units that will be implementing the present project activity are all less than 100 tpd and will be implementing the project activity only because of the additional income from CERs that would make them sustainable. Hence implementation of the project activity for Units less than 100 tpd is not a Business as Usual scenario and not a common practice. The benefits and incentives expected due to approval and registration of the project activity as a CDM activity will improve the sustainability of the project activity. Further its consideration before project activity implementation was the only reason why these Units have opted for implementation of the project activity.
As mentioned above in Step 0, before implementation of the project activity these Units considered all the barriers mentioned above. These Units have been convinced that global warming was a serious issue and has to be addressed sooner than later, but they were also helpless in implementing the steps necessary to reduce the GHG, as it would mean financial burdens. But on being told that if they implement the necessary steps for reducing GHG then they would be eligible for CERs, which when traded meant additional income, and this income would make the project activity viable, the Units wholeheartedly agreed to implement the project activity. Moreover, the Japanese firm of M/s SPCO has supported the preparation of PDDs, and lessened the financial burden on the Units. The income from the CDM fund will provide additional coverage to the risk due to turbine failure, failure of project activity, shut down of plant, loss of production and inability to export the power to WESCO (if such a situation arises at any point of time within the crediting period).
The above steps have established that the initiative taken by the Units is additional and the anthropogenic emissions of GHG by sources will be reduced below those that would have occurred in the absence of the project activity. The project activity would achieve reductions of 2962674.4 tonnes of $CO_{2\,eq}$ in 10 year of credit period
Further with CDM project activity registration many more sponge iron manufacturing industries in Orissa would take up similar initiatives under CDM by overcoming the barriers to project activity implementation resulting in higher quantum of anthropogenic greenhouse gas emissions reduction.

Sub-step 4b: Discuss any similar options that are occurring:
The present project activity is the first of its kind, involving small rotary kilns of 100tpd & 50 tpd where the project activity is being implemented only on the strength of the income from CDM
From the financial statement shown at Table B.3.2, it is seen that even with the benefits of CDM the break-even point is after the third year of operation

Since Sub-steps 4a and 4b are satisfied, i.e. similar activities cannot be observed or similar activities are observed, but essential distinctions between the project activity and similar activities can reasonably be explained, we now go to step 5 (Impact of CDM registration).

Step 5: Impact of CDM registration

The benefits and incentives available in the CDM activity will support the sustainability of the project activity. Further it must be emphasized repeatedly that solely due to their (incentives and benefits) consideration before project activity implementation helped the Units to overcome the identified barriers (Step 2&3), and enabled the project activity to be undertaken. The reduction of GHG was the greatest incentive that attracted the Units to consider the implementation of the project activity, but the high cost of implementation for such small units was indeed a formidable barrier blocking all the efforts at implementation. Only when the Units understood about the incentives and benefits of the income that could be derived from the CDM, did they seriously consider the implementation. All the banks and financial institutions were reluctant to offer these small Units credit for implementing the project activity, because the Units had nothing to offer by way of collateral security. But once the concept of CER trading was explained to the banks, this barrier was overcome, as the banks could use the future earnings from the CERs as their collateral security. The support of the Japanese firm of M/s SPCO, who offered to buy the CERs in case the Units could not sell them elsewhere, also played a part in the banks acceptance to extend credit to these small Units. It is also envisaged that the CDM fund will provide additional coverage to the risk due to turbine failure, failure of WHRB, shut down of plant, loss of production and inability to export the power to WESCO (if such a situation arises at any point of time within the crediting period).

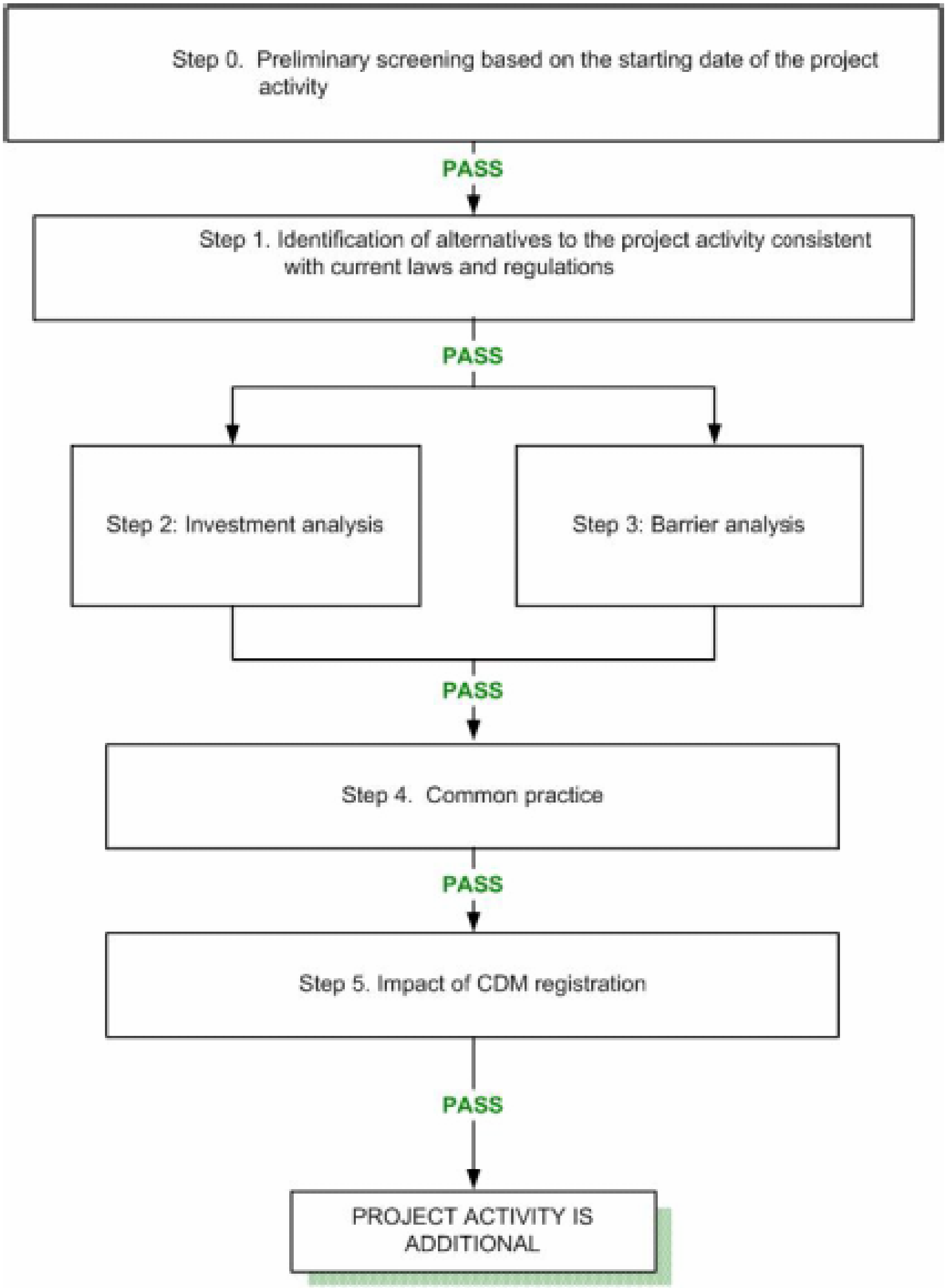
Thus the main criteria for CDM participation have been fulfilled: 1) Project activity is additional, & 2) Project activity will reduce the GHG below that existing before the project activity

The project activity would achieve 2962674.4 tonnes of CO_2 reductions in a 10-year of credit period.

Further with CDM project activity registration by the member Units of this project activity, many more sponge iron manufacturing industries in Orissa would take up similar initiatives under CDM by overcoming the barriers to project activity implementation resulting in higher quantum of anthropogenic greenhouse gas emissions reduction. The CDM registration lays a path to sustainable development by providing a cleaner environment, more economic development and infusion of high end Technologies

Moreover the registration of the project under CDM would enhance the visibility would aid GRIDCO/OPTCL, OSPCB (Orissa State Pollution Control Board), and the State Govt authorities to appreciate the GHG emission reduction efforts of the project proponent. Also the CDM income would be very useful to maintain the WHRB_STG.

Since Step 5 has been satisfied, the proposed CDM project activity is additional and not the baseline scenario


Step 0. Preliminary screening based on the starting date of the project activity
PASS
Step 1. Identification of alternatives to the project activity consistent with current laws and regulations
PASS
Step 2: Investment analysis
Step 3: Barrier analysis
PASS
Step 4. Common practice
PASS
Step 5. Impact of CDM registration
PASS
PROJECT ACTIVITY IS ADDITIONAL

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

>> The latest version 02 of Methodology ACM 0004 read in conjunction with ACM 0002 defines the project boundary as comprising the Units point of receipt of hot waste gases in the After Burner Chamber to its exhaust through the chimney, the transmission of electricity to GRIDCO/OPTCL and all power plants close feeding into GRIDCO/OPTCL from both within the state as well as the Eastern Region Sector. The combined margin is calculated based on this project boundary

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

>> The detailed baseline information as collected from GRIDCO/OPTCL and OERC are given in Annexure 3. The date of completion of the baseline study was January 15, 2006 the study was conducted by the consultants BPNSI, OSIMA and project participants.

Name of person/entity determining the baseline:

Mr. PG. Ittyerah, Joint Director cum Chief (R&D), Biju Patnaik National Steel Institute, Puri

See Contact person of the 17 Units at Annex 1 for the partnering entity

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:

>> September 15, 2005

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

>>The expected operational lifetime of the project activity 30y (thirty) years

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

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:

>> Yes

C.2.2.1. Starting date:

>> From the date of registration of the PDD with EB

C.2.2.2. Length:

>>10y (ten) years

SECTION D. Application of a monitoring methodology and plan

This section provides a detailed description of the monitoring plan, including an identification of the data and its quality with regard to accuracy, comparability, completeness and validity, taking into consideration the guidance contained in the methodology. The monitoring plan is attached in Annex 4.
The monitoring plan provides detailed information related to the collection and archiving of all relevant data needed to
- Estimate or measure emissions occurring within the project boundary,
- Determine the Baseline, and
- Identify increased emissions outside the project boundary.
The monitoring plan follows the instructions and steps defined in the approved monitoring methodology. Project participants will implement the registered monitoring plan and provide data, in accordance with the plan, through their monitoring report.
The data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whatever occurs later.
The Monitoring and Verification (M&V) procedures define a project-specific standard against which, the project's performance (i.e. GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on technical / efficiency / performance parameters. It also allows scope for review, scrutiny and benchmarks all this information against reports pertaining to M & V Protocols (MVP).

The MVP provides a range of data measurement, estimation and collection options/techniques consistent with good practices to allow project managers and operational staff, auditors and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project to have a clear, credible and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

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

>> **Title:** "Consolidated monitoring methodology for waste gas and/or heat for power generation"
Reference: UNFCCC approved consolidated monitoring methodology ACM 0004 Version 01 8 July 2005 read in conjunction with ACM 0002 Version 04, Sectoral Scope: 01 November 28, 2005.

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

>> The chosen monitoring methodology is used in conjunction with the approved baseline methodology ACM0004 /0002 - "Consolidated baseline methodology for waste gas and/or heat for power generation". The applicability criteria for the approved baseline methodology and approved monitoring methodology ACM0004 are similar and have been justified in section B.1.1. Thus the said methodology is applicable to the project activity.
The methodology requires the project participant to monitor the following:

- Net electricity generation from the proposed project activity:
- Data needed to calculate carbon dioxide emissions from fossil fuel combustion due to the project activity
- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with " Consolidated

baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);
- Data needed to recalculate the build margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with " Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002);
- Data needed to calculate the emission factor of captive power generation.

The project activity will have the monitoring of the generation of the total electricity generated and the auxiliary electricity thereby enabling the calculation of the net electricity supplied to the facility. As there will be no fossil fuel consumption in the project activity so monitoring of the same would not be required.

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

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

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

Since there will be no additional fuel used in project activity there will be no project emissions. As per the methodology ACM0004 project emissions are applicable only if auxiliary fuels are fired for generation start-up, in emergencies, or to provide additional heat gain before entering the WHRB. Since in the project activity there will be no auxiliary fossil fuel firing / consumption involved there will be no project emissions.
For Electricity generated by Project Activity

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 to be kept	Comment
1 EG_{GEN}	Quantitative	Total WHR Electricity generated	MWh/year	Measured	Continuously	100%	Electronic/paper	Credit period+ 2 years	Monitoring Location: The data will be calculated after collecting data from meters at Plant and DCS. Manager In charge would be responsible for calibration of the meters. see Annex-4 for details
2EG_{AUX}	Quantitative	Auxiliary consumption of Electricity from WHR sources	MWh/year	Calculated	Continuously	100%	Electronic/paper	Credit period+ 2 years	MONITORING LOCATION: The data will be calculated after collecting data from meters at Plant and DCS. Manager In charge would be responsible or calibration of the meters. see Annex-4 for details
3.EG_Y	Quantitative	Net Electricity supplied	MWh/year	Calculated(EG_{GEN}- EG_{AUX})	Continuously	100%	Electronic/paper	Credit period+ 2 years	Calculated from the above measured parameters.Algorithm for project emissions given in baseline

									methodology

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, Formulae/ algorithm, emissions units of CO_2 equ.)

>>Not applicable - Since there will be no additional fuel used in project activity there will be no project emissions

“For Baseline emission factor: grid power”

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	For which baseline method(s) must this element be included	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper	For how long is archieved data to be kept	Comment
4 EF_Y	Emission factor	CO2 emission factor of the Grid	tCO2/MWh	Calculated	Simple OM,BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as weighted sum of OM and BM emission factors
5EF_{OMY}	Emission factor	CO2 operating margin emission factor of the grid	tCO2/MWh	Calculated	Simple OM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as indicated in the relevant OM baseline method above
6EF_{BMY}	Emission factor	CO2 build margin emission factor of the grid	tCO2/MWh	Calculated	BM	Yearly	100%	Electronic	During the crediting period and two years after	Calculated as ($\sum F_{i,y}$ x COEF i,/ ∑mGENm,y

										over recently built power plants defined in the baseline methodolog y
7F_{ijy}	Fuel quantity	Amount of fossil fuel consumed by each power source/plant	t or m^3/year	measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from authorized latest local statistics
8.COEF $_{l,K}$	Emission factor coefficient	CO2 emission coefficient of each fuel type and each power source/plant	tCO2/ t or m^3	calculated	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Country and region specific values are taken to calculate COEF
9.GEN $_{J,Y}$	Electricity quantity	Electricity generation of each power plant	MWh/year	Measured	Simple OM BM	Yearly	100%	Electronic	During the crediting period and two years after	Obtained from authorized latest local statisitics

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

>>Emission factor of the grid (EF_{Grid})
Electricity baseline emission factor of the GRIDCO/OPTCL Grid (EFy) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build Margin (BM) factors according to the three steps. Calculations for this (CM) is based on data from official sources which is publicly available
Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described below:
As per ACM002 the Dispatch data analysis should be the first methodological choice. Where this option is not selected project participants shall justify why and may use the simple adjusted OM or the average emission rate method taking into account the provisions outlined hereafter. Since it is necessary to implement the project activity to calculate the Dispatch Data Emission Factor we are submitting the simple OM emission factor for this PDD. The Dispatch Data Emission Factor will be calculated at the end of the 1st year of operation. Both the methodologies have been presented herewith but the calculation of OM is on Simple OM
STEP 1:- Calculation of the OM emission factor
The Simple OM emission factor ($EF_{OM, simple, y}$) is calculated as the weighted average emissions (in t CO2 equ/MWh) of all generating sources serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

$$EF_{(OM, simple, y)} = \frac{\sum_{i,j} F_{i,j,y} \times COEF\ i,j}{\sum_{f} GEN_{j,y}}$$

Where COEF i, j is the CO2 emission coefficient of fuel i(t CO2/ mass or volume unit of the fuel), calculated as given below and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j
$F_{i,j,y}$ is the amount of fuel I (in a mass or volume unit) consumed by relevant power sources j in year(s) y , calculated as given below
j, refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from other grid
The CO2 emission coefficient COEFi is obtained as
$COEF_i = NCV_i \times EF_{CO2,i} \times OXID_i$
Where
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i
$EF_{CO2,i}$ is the CO2 emission factor per unit of energy of the fuel i
$OXID_i$ is the oxidation factor of the fuel
The simple OM emission factor ($EF_{OM, simple, y}$) is calculated separately for the most recent three years and an avg. value has been considered as OM emission factor for the baseline ($EF_{OM, y}$)
$EF_{OM, y} = \sum EF_{OM, simple, y} / 3$

After the first year of operation the Dispatch Data Emission Factor will be calculated as follows::
$EF_{OM.Dispatch\ Data.y} = E_{OM.y}/EG_Y$

Where EG_Y is the generation of the project (in MWh) in year y, and $E_{OM.y}$ are the emission (tCO2) associated with the operating margin calculated as

$$E_{OM.y} = \sum_h EG_{h.} EF_{DD.h}$$

$EG_{h.}$ is the generation of the project (in MWh) in each hour h and $EF_{DD.h}$ is the hourly generation _ weighted average emission per electricity unit (tCO2/MWh) of the set of power plants (n) in the top 10% of the grid system dispatch order during hour h;

$$EF_{DD.h} = \frac{\sum_{i,n} F_{i,n,h} \times COEF_{i,n}}{\sum_{n} GEN_{n,h}}$$

Where F i, n, h is the amount of fuel i (in a mass or volume unit) consumed by set of plants (n) in hours h
COEFi,n is the CO2 emission coefficient of coal i (tCO2/ mass or volume unit of fuel), taking into account the carbon content of the fuels used by relevant set of plants (n) falling within the system on an hourly basis
GEN is the electricity delivered to the grid
COEF = NCV.EFco2. OXID where: NCV is the net calorific value per mass or volume of a fuel i
Where F .COEF and GEN are analogous to the variables described for the simple OM method, but calculated on an hourly basis for the set of plant (n) falling within the top 10% of the system dispatch. To determine the set of plants (n), obtain from the Load Dispatch Centre of GRIDCO/OPTCL: a) the grid system dispatch order of operation for each power plant of the system; and b) the amount of power (MWh) that is dispatched from all the plants in the system during each hour that the project activity is operating (GEN h). At each hour h, stack each plants generation (GEN h) using the merit order. The set of plants (n) consists of those plants at the top of the stack (i.e. having the least merit), whose combined generation (∑GEN h) comprises 10% of total generation from all the plants during that hour (including imports to the extent they are dispatched).

STEP 2: Build Margin (BM): Calculate the Build Margin (BM) emission factor $EF_{BM,y}$ as the generation weighted average emission factor (t CO2/MWh) of a sample of power plants m, (which are 5 Power Plants built recently in the Eastern Regional Grid) as follows:

$$EF_{DD.h} = \frac{\sum_{i,m} F_{i,m,y}\ COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method above for plants m.
Project participants have selected Option 1 i.e. calculation of BM emission factor $EF_{BM,Y}$ ex-ante based on the most recent information available on plants already Build for sample group m at the time of PDD submission. The sample group m consists of the five power plants that have been Build most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been Build most recently, whichever is greater.
STEP 3: The Baseline Emission Factor EF_y is calculated as the weighted average of the OM emission as factor ($EF_{OM,y}$) and the BM emission factor ($EF_{BM,Y}$):
$EF_{y} = W_{OM.} EF_{OM,Y} + W_{BM.}\ EF_{BM,y}$

Where the weights W_{OM} and W_{BM} , by default are 50 % each (i.e. $W_{OM} = W_{BM}$, = 0.5) and $EF_{BM,y}$ & $EF_{OM,Y}$ are calculated as described in Steps 1 &2 above and are expressed in tCO2/MWh. The weighted average applied by the Project Participant is fixed for the crediting period and will be revised, if found necessary when the crediting period comes up for renewal.

Leakage: The emission arising during the construction and transportation of building materials are too insignificant to be considered. Also these emissions will not be taken into the calculations while fixing the CERs

The project activity mainly reduces the carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by electricity generated from the utilization of the heat from waste gases. The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$ER_y = BE_y - PE_y - L_y$

Where the baseline emissions (BE_y in tCO2) are the product of the baseline emissions factor (EF_y in tCO2/MU) calculated in Step 3, times the electricity supplied by the project activity to the grid (EG_y in tCO2 in MU). For electricity produced from waste gases heat recovery system PE_y is zero.

The leakages during project activity L_y is also zero

Hence, $ER_y = BE_y$

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

>> Not Applicable

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

>>Not applicable due to zero emissions in project activity

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

>> Not applicable due to zero emissions in project activity

D.2.3. Treatment of leakage in the monitoring plan

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

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

>> Not applicable

D.2.3.2: Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>Not applicable

D.2.4: Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>> The emission reduction ERy by the project activity during any given year y is the difference between baseline emissions through substitution of electricity generation with fossil fuels (BEy) and project emissions (PEy) as follows:

ERy = BEy – PEy

Where: ERy is the emission reduction of the project activity during the year y in tons of CO2

BEy is the emission reduction due to the displacement of electricity during the year in tons of CO2

PEy is the project emission during the year y in tons of CO2

PEy is zero and hence ERy = BEy

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.1.3-1	Low	This will be crosschecked by checkmeters installed by the State Distribution company to ensure that proper taxes and duties are paid on the Electricity Generated. The calibration of the equipment used will be verified by the Statutory Authority's verification agent
D.2.1.3-2	Low	The aux consumption will be measured through electronic meters which are calibrated by the State agency (GRIDCO/OPTCL) once a year and verified by the Statutory Authority's verification agent
D.2.1.3-3	Low	This is a calculated value
D.2.1.3-4-9	Low	All these data are in the public domain and available from the internet, GRIDCO/OPTCL reports, CEA reports and IPCC publications

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

>>Each Unit has an Operations and Process Manager who will be overall in charge of all the data acquisitions, calculations and calibration of the reports. Under the supervision of the Operation manager, there will be Engineers for Equipment Maintenance. These engineers will be in charge of the day-to-day collection and analyses of data and presenting the same to the Operation Manager. Calibration of all the instruments will be as per equipment suppliers' instructions/statutory obligations etc. M/s BPNSI will be coordinating this between the units through OSIMA and help facilitate acquisition of necessary technology for this purpose. A facilitation centre of BPNSI is already set up in this regard at Bhubaneswar.

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

>> The Monitoring methodology has been determined as ACM 0004, and will be implemented under the overall supervision and guidance of the Operations managers of the Units.
Mr. PG Ittyerah, Joint Director, Biju Patnaik National Steel Institute, Puri will be coordinating the project activity.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>As explained earlier, there will be no GHG emissions from the project activity as the WHRB is unfired and there will be no additional burning of fossil fuel, coal

E.2. Estimated leakage:

>>There will be no leakage from the system

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

>>Not applicable as there are no project activity emissions

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

>> As shown in Table 5 of Annex 3, the CM baseline emission factor is 0. 843922936 the baseline emissions are as follows: Baseline emissions BEy in any particular year y is calculated by
BEy = EFy $_X$ EGy
Where:
EFy Baseline emission factor
EGy Net electricity supplied to the facility

Anthropogenic emissions – baseline BEy

Year	Estimation of Net Electricity supplied to the facility, EGy (MU/year)	Estimation of emission factor, EFy in tCO2/MU	Estimate of Baseline emissions (Tonnes of CO2e) = BEy = EFy $_X$ EGy
2005-06	360000	0.84393	296267.44
2006-07	360000	0.84393	296267.44
2007-08	360000	0.84393	296267.44
2008-09	360000	0.84393	296267.44
2009-10	360000	0.84393	296267.44
2010-11	360000	0.84393	296267.44
2011-12	360000	0.84393	296267.44
2012-13	360000	0.84393	296267.44
2013-14	360000	0.84393	296267.44
2014-15	360000	0.84393	296267.44
Total Tonnes of CO2e	3600000	0.84393	2962674.40

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

>>2962674.40 Tonnes of CO_2e over a ten-year crediting period

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

>>
BEy = EFy x EGy
Where:
EFy Baseline emission factor = 0.84393
EGy Net electricity supplied to the facility = 3600000 MU over ten years
BEy = EFy x EGy = 2962674.40
Estimated emission reduction

Year	Estimation of project activity emissions (tons of CO2e)	Estimation of baseline emissions (tons of CO2e) BEy = EFy x EGy	Estimation of leakage (tons of CO2e)	Estimation of emission reductions (tons of CO2e) (5) = (3) - (2) - (4)
(1)	(2)	(3)	(4)	(5)
2005-06	0	296267.44	0	296267.44
2006-07	0	296267.44	0	296267.44
2007-08	0	296267.44	0	296267.44
2008-09	0	296267.44	0	296267.44
2009-10	0	296267.44	0	296267.44
2010-11	0	296267.44	0	296267.44
2011-12	0	296267.44	0	296267.44
2012-13	0	296267.44	0	296267.44
2013-14	0	296267.44	0	296267.44
2014-15	0	296267.44	0	296267.44
Total (tonnes of CO2e) over a 10-year crediting period	0	2962674.40	0	2962674.40

SECTION F. Environmental impacts

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

>> The implementation of the project activity impacts the environment as follows:

1. Construction phase impact: Since the impacts due to emissions from transportation of materials and equipment and noise level increase are purely temporary phenomena and need not be considered
2. Operational phase impact: all possible environmental impacts for the project activity have been identified and discussed for their impacts on the baseline environment that is prevailing before the project activity is implemented
3. Maintenance phase impact

The impacts envisaged during construction of the project activity were:

- Impacts on Soil Quality
- Impacts on air Quality
- Impacts on Noise Levels

The environmental impact during the construction phase is regarded as temporary or short term and hence does not effect the environment significantly. During the annual maintenance of the WHRB, the blow down water will be collected in the waste water tanks of the Units as is the practice now, & the solid wastes will be taken collected and disposed off together with the dry ash collected from the electrostatic precipitators, in appropriate landfills earmarked for the purpose at the plants.
The nature of the impacts that are evident during the operational and maintenance phase is discussed in detail below. All possible environmental aspects for the various project activities have been identified and discussed for their impacts on the baseline environment that prevailed before the project was executed. The following table summarizes the project's local and environmental, social and other impacts, benefits and the mitigation measures taken by PROJECT PARTICIPANT to reduce/minimise negative impacts if any and enhance the positive impacts.

SL.NO.	ENVIRONMENTAL IMPACTS	MITIGATION MEASURES/ REMARKS
I	**CATEGORY : ENVIRONMENTAL – NATURAL RESOURCE CONSERVATION**	
1	**Coal Conservation**: By displacing the electricity demand on the grid, the project activity reduces an equivalent amount of coal consumption that would have been required to meet the capacity requirements the plant. The project activity has also reduced the transmission and distribution losses of the grid as part of the power is being consumed at the same place where it is being generated. In addition, the power consumption for the venturi scrubber has also been avoided leading to more savings in the power. Water Conservation: Demineralized water, used to produce high pressure steam and auxiliary cooling water will be a closed loop recirculating system which reduces water consumption and effluent discharge to the environment.	The project activity is a step towards Coal and Water Conservation
II	**CATEGORY ENVIRONMENTAL – AMBIENT AIR QUALITY**	

1	Project Participants have their own in-house monitoring capability and conducts ambient air quality monitoring on a regular basis. It is expected that the SPM from the combined stack of Sponge Iron Unit and Power Plant would be quite low as compared to ambient air quality standards.	
III	**CATEGORY : ENVIRONMENTAL – AIR EMISSIONS**	
1	The project activity utilizes the heat content of the gases and thereby reduces heat energy release to atmosphere either as hot air emissions or as hot waste-water emissions from venturi scrubber. Most of the heat is lost in the wastewater generated while scrubbing/ gas cooling. Therefore the project has reduced thermal Pollution and heat energy loss. The heat energy lost earlier would now be converted to electrical energy. The future stack emission temperatures are expected to be lower.	The WHRB recovers most of the heat content of the waste gas to generate steam, which further generates electricity.
2	By displacing electricity demand on the grid, the project reduces emissions, related to coal-fired/thermal power production, which include GHG like CO2, SOx, NOx and particulates.	
3	The project activity is also expected to reduce the adverse impacts on air quality related to transportation of coal and coal-mining that would have been required to meet the additional capacity requirement of thermal power plants.	
IV	**CATEGORY : ENVIRONMENTAL - HYDROLOGY**	
1	The source of water for the plant is groundwater at the plant site. Due to substitution of the venturi scrubber with the WHRB_STG, the water could be better used for other purposes	
V	**CATEGORY: ENVIRONMENTAL – WASTE WATER GENERATION**	
1	The plant is designed on a 'zero discharge' concept	During the process the dissolved solid concentration of water increases, due to evaporation. In order to maintain the quality of water, a blow down is required. All the wastewater generated is recycled within the plant after treatment for: cooling water, dust suppression at ash dump area and horticulture purposes.
2	Effluents generated from the D.M water plant will be neutralized before discharge.	These effluents will be suitably used for dust suppression at ash silos
3	Additional manpower for the project activity has contributed to organic pollution load but the quantity	This is taken care of by well-designed Septic tanks

	addition is very low.	followed by soak pits.
VI	**CATEGORY: ENVIRONMENTAL - LAND**	
1	At present, industry has efficient pollution control devices at all units. Industry has also developed Green Belt in and around the plant premises.	There is no possibility of any negative impact on Land environment by existing or proposed units
VII	**CATEGORY: ENVIRONMENTAL – SOLID WASTE GENERTION**	
1	All the solid waste generated by the project activity will be utilized in fly ash brick manufacture and the rest land-filled. The dust generated from the boilers will be utilised for dumping in low lying areas, filling of abandoned mines and as filling material for road making.	Proper precautionary steps have to be for dumping the solid wastes from the project activity. To prevent any adverse impacts, 100 mm thick PCC lining should be provided before filling the abandoned mines. The entire ash dump should not be used at a time for dumping in an unplanned manner rather it should be done in small sectors. The filled up sector should be covered with a layer of at least 15 cm deep top soil over which, quick growing grass and other bushy shrubs should be grown.
VIII	**CATEGORY: ENVIRONMENTAL – NOISE POLLUTION**	
1	Insulated working areas especially in turbine floors, compressed air station will be provided. There would be sound proofing of the STG as is done in Foreign countries, so that the decibel level in the working areas is maintained well within the limits specified by the statutory authorities Noisy machinery will be put on vibratory isolators surrounded by sound absorbing barriers.	The workers working in the areas of high noise level should use ear plugs or ear muffs to protect their ears.
IX	**CATEGORY: SOCIAL-ECONOMIC**	
1	The project is not going to cause any damage to present traditional agriculture prevailing in that area. More ever, it may directly help the agriculture to improve by way of providing additional income from supplementary sources expected to be generated. The project activity site is within the premises and there is no human displacement. Therefore no rehabilitation programme was needed.	The project is expected to bring positive changes in the life style and quality of life.
X	**CATEGORY: OCCUPATIONAL HEALTH**	
1	The project participants have their own Occupational Health Centre which runs round the clock. The dispensary	Workers need capacity building on sanitation,

	is fully equipped with latest medicine and basic medical facilities. Safety of employees during operation and maintenance is taken care off as per factory rules and regulations.	cleanliness, hygiene and health care. Values of different factors which lead to occupational health hazards should be monitored and control measures should be specified. Regular drills for emergencies arising out of project activity should be held
XI	**CATEGORY: GREEN BELT**	
1	Each of the project participants would start a green belt development program simultaneously with the implementation of the project activity.	The green belt should be planted close to the area to be protected to optimise attenuation within physical limitations.
XII	**CATEGORY: ECOLOGY**	
1	The Units are situated on the outer skirts of Rourkela, Jharsuguda, Sambalpur and Rajgangpur, where there are no forests. Consequently the bio-diversity is not high. The area is rural type and several types of flora and fauna are found in the study area. The air emissions and effluent of the proposed unit, being within prescribed norms, are not having any impact on any of the environmental parameters.	-

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

>> Host party regulations require the Project Participants to obtain environmental clearance from the Orissa State Pollution Control Board. Environmental Impact Assessment has been conducted and the environmental clearance has been received. This project activity has positive environmental impacts. The Waste Heat Recovery Based Power Plant with ESP is cleaner and more energy efficient air pollution control measure as compared to the Venturi Scrubber with ESP. The project activity is not polluting and there are only positive impacts associated with the project activity as there is considerable amount of emission reduction of GHG leading to a decrease in global warming. Environment Clearance Documents are available with the project participants, and can be inspected on request.

SECTION G. Stakeholders' comments

>>The stakeholders of the project activity comprise of the
1. Owner/entrepreneurs of the Units
2. Peripheral (at a radius of 7.5 kms around the Units) village residents (Focus Groups)
3. Block level officials
4. District level officials
5. State Pollution Control Board – Member Secretary
6. Grid Corporation of Orissa Ltd (GRIDCO/OPTCL) – Chief Engineer (Transmission)
7. Govt officials like Secretary, Ministry of Steel & Mines, Industries, & Environment & Forests
8. Central Govt Ministry of Environment & Forests (MoEF)

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

>>The stakeholder comments were compiled as follows:
Firstly the stakeholders were apprised of the project activity and the benefits of sustainable development accruing from it
Secondly the stakeholders were requested to air their views on the project activity
1. Through personal interviews of the villagers on a representative basis of 2 members of each community of each of the 174 villages covered.
2. Through meetings with focus groups of each village Panchayat, i.e. a set of villages (usually five)
3. Through meetings at Block (group of Panchayats) levels
4. Through meetings with district collectors
5. Through meetings with the Member Secretary of the Orissa State Pollution Control Board
6. Through meetings with the GRIDCO/OPTCL Chief Engineer (Transmission)
7. Through meetings with Secretary, Industries Ministry
8. Through meetings with the Central Govt MoEF official in charge of CDM activities

G.2. Summary of the comments received:

>>The comments received were as follows:
1. Owner/ Entrepreneur: They have expressed their keen interest in participating in the CDM project activity because of the financial benefits accruable, the mitigation of GHG emissions and the sustainable development of the country as a whole. At the same time they were apprehensive about the source of finance to implement the project activity and were hopeful that the PDD would be registered at the earliest so that they could convince their Bankers about the income from the CERs, which would provide the necessary security
2. Peripheral village constituents: They were happy that their villages would develop because of the project activity, by way of employment opportunities, better delivery of electricity in their homes and farm machinery, less pollution, establishment of nearby schools and better roads.
3. Officials of Block, District, and State & Central Govt were apprised of the project activity. They noted that the project activity would bring all round improvement in the quality of life and was a mechanism whereby sustainable development could be brought about.
4. GRIDCO/OPTCL officials were relieved to note that a number of captive power plants were coming up in the State of Orissa, which would go a long way in alleviating the problem of voltage drops in the system due to excessive drawals

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

>>The summary of the comments brought out the fact that the entire cross-section of the stakeholders were convinced of the positive benefits arising out of the project activity, and hoped for an early implementation of the same. Regarding the apprehension of the entrepreneurs about the financing of the project activity, BPNSI has already discussed the question of financing of the project activity with several bankers and have received assurances from them about extending the necessary loans on the strength of the promoters' track record and more importantly on the strength of the CDM benefits.

Annex 1.1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	Biju Patnaik National Steel Institute
Street/P.O.Box:	Ramaballav Road
Unique ID	BPNSI-O/1
City:	Puri
State/Region:	Orissa
Postfix/Zip:	752001
Country:	India
Telephone:	232820
FAX:	232567
E-Mail:	bpnsipuri@sify.com
URL:	www.bpnsi.org
Represented by:	S. Dewan
Title:	Director
Salutation:	Mr.
Last Name:	Dewan
Middle Name:	
Fist Name:	Surinder
Department:	
Mobile:	9810517179
Direct FAX:	011-2651 7568
Direct tel:	
Personal E-Mail:	sdewan598@rediffmail.com, philip.ittyerahgmail.com

Annex 1.1(a) – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	Biju Patnaik National Steel Institute
Street/P.O.Box:	Ramaballav Road
Unique ID	BPNSI-O/2
City:	Puri
State/Region:	Orissa
Postfix/Zip:	752001
Country:	India
Telephone:	06752 232820
FAX:	06752 232567
E-Mail:	bpnsipuri@sify.com
URL:	www.bpnsi.org
Represented by:	PG Ittyerah
Title:	Jt Director
Salutation:	Mr.
Last Name:	Ittyerah
Middle Name:	George
Fist Name:	Philip
Department:	
Mobile:	09338216079
Direct FAX:	011-2651 7568
Direct tel:	06752 233301
Personal E-Mail:	philip.ittyerah@gmail.com

Annex - 1.2 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	Orissa Sponge Iron Manufacturer's Association (OSIMA)
Street/P.O.Box:	160, Ekamra Marg, Unit-VI
Unique ID	BPNSI-O/3
City:	Bhubaneswar
State/Region:	Orissa
Postfix/Zip:	751001
Country:	India
Telephone:	0674-2595161, 5534777
FAX:	0674-2595161
E-Mail:	osima_bbsr@rediffmail.com
URL:	
Represented by:	N. K. Das
Title:	Director
Salutation:	Mr.
Last Name:	Das
Middle Name:	Kishore
Fist Name:	Naba
Department:	
Mobile:	09437016675
Direct FAX:	
Direct tel:	0674-2595161
Personal E-Mail:	

Annex - 1.3 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. Pawansut Sponge Pvt. Ltd.
Street/P.O.Box:	Badmal
Unique ID	BPNSI-O/4
City:	Jharsuguda
State/Region:	Orissa
Postfix/Zip:	768201
Country:	India
Telephone:	06645-274000/274200
FAX:	06645-274000/273300
E-Mail:	pawansutsponge@yahoo.com
URL:	
Represented by:	Sanjay Kumar Khetan
Title:	Managing Director
Salutation:	Mr.
Last Name:	Khetan
Middle Name:	Kumar
Fist Name:	Sanjay
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.4 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. Shree Madhav Ispat Pvt. Ltd
Street/P.O.Box:	Siriapalli
Unique ID	BPNSI-O/4
City:	Jharsuguda
State/Region:	Orissa
Postfix/Zip:	
Country:	India
Telephone:	06645-274326, 0663-2002568
FAX:	06645-274326
E-Mail:	
URL:	
Represented by:	Sri Madhav Kumar Lodha
Title:	Director
Salutation:	Sri
Last Name:	Lodha
Middle Name:	Kumar
Fist Name:	Madhav
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.5 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. L. N. METALLIKS LTD.
Street/P.O.Box:	Vill- Sripura
Unique ID	BPNSI-O/5
City:	Jharsuguda
State/Region:	Orissa
Postfix/Zip:	768232
Country:	India
Telephone:	0663 - 2400481, 2521872
FAX:	0663 – 2405853
E-Mail:	lmcosbp@sancharnet.in , sales@lmcographite.com
URL:	
Represented by:	Sailesh Kumar. Agrawal
Title:	Director
Salutation:	Mr.
Last Name:	Agrawal
Middle Name:	Kumar
Fist Name:	Sailesh
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.6 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. Samaleswari Ferro Metals (P) Ltd.
Street/P.O.Box:	Bisalkhinda
Unique ID	BPNSI-O/6
City:	Sambalpur
State/Region:	Orissa
Postfix/Zip:	
Country:	India
Telephone:	0663-2541865,2541891
FAX:	0663-2541892
E-Mail:	stmpl@hotmail.com
URL:	
Represented by:	Sri Jayant Kumar Agrawal
Title:	
Salutation:	Mr.
Last Name:	Agrawal
Middle Name:	Kumar
Fist Name:	Jayant
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.7 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. Sponge Udyog (P) Ltd.
Street/P.O.Box:	Jiabahal, Kalunga
Unique ID	BPNSI-O/8
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770071
Country:	India
Telephone:	0661-2450231
FAX:	0661-2450231/2660162
E-Mail:	
URL:	
Represented by:	Mr.Birendra Gandhi
Title:	
Salutation:	Mr.
Last Name:	Gandhi
Middle Name:	
Fist Name:	Birendra
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.8 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. Shree Mahavir Ferro Alloys Pvt. Ltd.
Street/P.O.Box:	Kalunga, IDC
Unique ID	BPNSI-O/9
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770071
Country:	India
Telephone:	0661-2511552, 2661198
FAX:	0661-2511553, 2661199
E-Mail:	smfapl@gmail.com
URL:	
Represented by:	Mr. Vicky Jain
Title:	Director
Salutation:	Mr.
Last Name:	Jain
Middle Name:	
Fist Name:	Vicky
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	vicky.jain@gmail.com

Annex - 1.9 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/S. Pooja Sponge Pvt. Ltd.
Street/P.O.Box:	IDCO Industrial Estate, Kalunga
Unique ID	BPNSI-O/10
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770071
Country:	India
Telephone:	0661-2450235
FAX:	0661-2501019
E-Mail:	rkl_poooooja@sancharnet.in
URL:	
Represented by:	Dhajinder Gupta
Title:	Managing Director
Salutation:	Mr.
Last Name:	Gupta
Middle Name:	
Fist Name:	Dhajinder
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.10 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. Jay Iron & Steels Limited
Street/P.O.Box:	Balanda, Near Kalunga
Unique ID	BPNSI-O/11
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	759116
Country:	India
Telephone:	0661-2500503, 2508503
FAX:	0661-2500503
E-Mail:	
URL:	
Represented by:	Mr.Sunil Agarwal
Title:	Director
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	
Fist Name:	Sunil
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.11 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/s. Seeta Sponge Iron Ltd.
Street/P.O.Box:	Plot no-02, Kalunga Industrial Estate, Kalunga
Unique ID	BPNSI-O/12
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770071
Country:	India
Telephone:	06624-220771
FAX:	06624-220771
E-Mail:	rkl_konark@sancharnet.in
URL:	
Represented by:	Suresh Joshi
Title:	Managing Director
Salutation:	Mr.
Last Name:	Joshi
Middle Name:	
Fist Name:	Suresh
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.12 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/S. Sri Balaji Metalliks (P) Ltd.
Street/P.O.Box:	Khairbondh, Ranto Birkera, Kalunga
Unique ID	BPNSI-O/13
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770071
Country:	India
Telephone:	0661-2513331
FAX:	0661-2500187
E-Mail:	
URL:	
Represented by:	S. K. Pareek
Title:	Director
Salutation:	Mr.
Last Name:	Pareek
Middle Name:	K
Fist Name:	S
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.13 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/S. Shree Ganesh Metalliks Limited
Street/P.O.Box:	Chadrihariharpur, P.O- Kuarmunda
Unique ID	BPNSI-O/14
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770039
Country:	India
Telephone:	0661-2514450, 2514451, 2514452,2454250
FAX:	0661-2514454,2513043
E-Mail:	ganeshsponge@rediffmail. com
URL:	
Represented by:	Manoj Kumar Agarwal
Title:	Managing Director
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	Kumar
Fist Name:	Manoj
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.14 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/S. Swastik Ispat (P) Ltd
Street/P.O.Box:	Naikini Bahal, Kuarmunda
Unique ID	BPNSI-O/15
City:	Sundargarh
State/Region:	Orissa
Postfix/Zip:	770039
Country:	India
Telephone:	0661-2502210
FAX:	0661-2454479,2502358
E-Mail:	Sipl20042003@yahoo.com
URL:	
Represented by:	Rajesh Kumar Bagaria
Title:	Director
Salutation:	Mr.
Last Name:	Bagaria
Middle Name:	Kumar
Fist Name:	Rajesh
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.15 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	Bajarang Ispat (P) Ltd
Street/P.O.Box:	Kuarmunda
Unique ID	BPNSI-O/16
City:	Rourkela
State/Region:	Orissa
Postfix/Zip:	770039
Country:	India
Telephone:	0661-2400634,2400684
FAX:	0661-2400634,2400684
E-Mail:	bajrangispat@rediffmail.com
URL:	
Represented by:	Mr. Satish Kumar Garg
Title:	Director
Salutation:	Mr.
Last Name:	Garg
Middle Name:	Kumar
Fist Name:	Satish
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.16 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	Maa Sakumbari Sponge (P) Ltd
Street/P.O.Box:	Naiken Bahal, Kuarmunda
Unique ID	BPNSI-O/17
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770039
Country:	India
Telephone:	0661-2454493
FAX:	0661-2523139
E-Mail:	
URL:	
Represented by:	Mr.Samrat Agarwal
Title:	
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	
Fist Name:	Samrat
Department:	
Mobile:	9337400387
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.17 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/S. Vedavyas Ispat Limited
Street/P.O.Box:	Gobira, P.O- Kuarmunda
Unique ID	BPNSI-O/18
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770039
Country:	India
Telephone:	0661-2512404, 2500243, 2502105
FAX:	0661-2501331,2512404
E-Mail:	
URL:	
Represented by:	Om Prakash Agarwal
Title:	Managing Director
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	Prakash
Fist Name:	Om
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.18 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/S. Pawanjay Sponge Iron Limited
Street/P.O.Box:	Bijabahal, Kumjharia Kuarmunda
Unique ID	BPNSI-O/19
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770039
Country:	India
Telephone:	0661-2400652,2400112, 2401413
FAX:	0661-2401413/2400112
E-Mail:	pawanjaysponge@rediffmail.com
URL:	
Represented by:	G.C. P. Agarwal
Title:	Managing Director
Salutation:	Mr.
Last Name:	Agarwal
Middle Name:	P
Fist Name:	G.C
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex - 1.19 – (Contd)

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organisation	M/S. Suraj Products Ltd.
Street/P.O.Box:	Barapali, Kesarmal, Rajgangpur
Unique ID	BPNSI-O/20
City:	Sundergarh
State/Region:	Orissa
Postfix/Zip:	770017
Country:	India
Telephone:	06624-2221200,2222447, 0661-2451674, 2451023
FAX:	0661-2400422
E-Mail:	suproduct@rediffmail.com
URL:	
Represented by:	Y.K. Dalmia
Title:	Managing Director
Salutation:	Mr.
Last Name:	Dalmia
Middle Name:	K
Fist Name:	Y
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is envisaged in the project activity

Annex 3

BASELINE INFORMATION

For the project activity the baseline scenario was determined as equivalent electricity generation from the grid as shown in Sec. B2 earlier. As per ACM0004 methodology, if the baseline scenario is grid power supply then Emission Factor for the displaced electricity is calculated according to ACM0002 baseline methodology.

Arriving At the Baseline Scenario

The procedure for 'Determining the baseline scenario' suggests four steps in order to arrive at the most appropriate and conservative baseline scenario. The four steps are

1. Identification possible baseline options/alternatives
2. Assessment of common practices and modified common practices
3. Ranking of baseline options
4. Selection of appropriate and conservative baseline scenario

1. **Identification of possible baseline options**, which may be available with the project proponent in absence of project activity implementation refer Table- B.1.

The Baseline option #4 in Table B-1 is not considered because of non availability of Natural Gas Fuel in the region and there is no possibility of supply of gas in the near future in this region. The option that has the least barrier and is the most economically attractive should be considered as the baseline scenario. Although alternative 3 is the more economically attractive, the availability of coal to private parties is extremely volatile and there is little certainty in getting the same, and hence the import of electricity from the grid is the most economical and attractive alternative with the least barriers

2. **Assessment of common practices and modified common practices**[5]

The methodology requires the project proponent to analyze the current prevailing practices in the similar industries in order to assess the most common course of action among the identified baseline options.

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

In India, power is a concurrent subject between the state and the central governments therefore there are state utilities and central utilities. The electricity system in India is divided in to five regions – Northern, Eastern, Western, Southern and North – Eastern Electricity Boards. The management of generation and supply of power within the regional grids is undertaken by the load dispatch centres (LDC). In Orissa the SLDC (State Load Dispatch Centre) manages the import and export of electricity and the distribution within the State. The newly formed Orissa Power Transmission Corporation Ltd (OPTCL) is the Transmission manager, while the four Distribution Companies, SOUTHCO/WESCO/ CESCO AND NESCO manage the distribution to the different consumers. Different states within the regional grids meet the demand from their own generation facilities plus generation by power plants owned by the central sector i.e., National Thermal Power Corporation (NTPC) and National Hydro Power Corporation (NHPC) etc. Specific quota is allocated to different states from the central power plants. Depending on the demand and generation there are exports and imports of power within different states in the regional grid. The choices of regional grids minimizes the effect of inter state power transactions which are dynamic and vary widely. The regios have minimal interchange of electricity between themselves therefore a regional grid can be safely considered as the relevant electricity grid rather than going for the state grid. In our case the Project Electricity System includes the State's share of the Electricity

generate by the National Thermal and Hydro Power Corporations and the GRIDCO generating Stations and Captive Power Plants of the State.
National grid has not been chosen due to the lack of infrastructure and low inter-regional energy exchanges.
The formation of the National Power Grid has been envisaged in a phased manner as follows[4]:
Phase –1: HVDC interconnections between regions. This phase was completed in the year 2002.
Phase - 2: Strengthening of inter-regional connectivity with hybrid system consisting of high capacity AC (765 KV & 400KV) and HVDC lines. This phase is likely to be completed by the end of year 2007.
Phase – 3: Further, strengthening of National Grid is envisaged through 765 kV AC lines/HVDC lines to Southern region and linking North Eastern region with rest of the National Grid through high capacity transmission system. This phase is planned to be implemented by 2012.
The status of inter-regional energy exchange with respect to the Eastern Region for the past five years has been as follows[5]:

[5] http://cea.nic.in/gmd/IRExchanges.pdf

TABLE-1
THE EASTERN REGION ELECTRICITY BOARD (EREB) INTERCONNECTIVITY

REGION		2000 - 01	2001 -02	2002- 03	2003 -04	2004 - 05
From	To					
Northern	Eastern	16.80	22.00	1.60	9.00	0
Western	Eastern	0	0	0	0	0
Southern	Eastern	0	0	0	46.40	26.10
N.Eastern	Eastern	0	0	0	208.20	728.90
TOTAL						**755.00**

As can be seen the inter-regional exchange is presently too low due to the lack of infrastructure at present. The imports from other Regional Grids are too miniscule to affect the nature of the Eastern Regional Grid. Thus for the project activity National grid system is not being considered for the estimation of emission coefficient. Eastern Region grid which comprises of Jharkhand, Orissa, W Bengal, Bihar, Damodar Valley Corporation (DVC) is chosen as the grid system for the project activity, since the project activity is coming up in Orissa

B) Determination of the carbon intensity of the chosen grid

Complete analysis of the system boundary's electricity generation mix, which has been carried out for calculating the emission factor of Eastern Region grid is as follows:

Combined Margin

The approved consolidated baseline methodology ACM0002 suggests that the project activity would have an effect on both the Operating Margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the state grid mix) and Build Margin (i.e. weighted average missions of recent capacity additions) of the selected grid and the next baseline emission factor would therefore incorporate an average of both these elements.

Step 1: Calculation of Operating Margin

As mentioned above the project activity would have some effect on the Operating Margin (OM) of the Eastern Regional Grid. The Operating Margin emission factor(s) ($EF_{OM,y}$) is calculated based on one of the four following methods:

(e) Simple OM, or
(f) Simple adjusted OM, or
(g) Dispatch Data Analysis OM, or
(h) Average OM.

As per the methodology "Dispatch Data Analysis" (1c) is the first methodology choice. The Load Dispatch Centre of OPTCL maintains an accurate data of the imports and exports of electricity from the Eastern Regional Grid to GRIDCO/OPTCL, with respect to the quantum and source and the supply of electricity from and to the different distribution companies. At each sub station feeding the Units there are check meters to cross check the consumption and generation by the Project participants, over and above the meters within the Units, which are also calibrated and certified by OPTCL.

The Dispatch Data OM emission factor ($EF_{OM\ Dispatch\ Data,\ y}$) is summarized as follows:

$$EF_{OM\ Dispatch\ Data,\ y} = \frac{E_{OM,\ y}}{EGy}$$

Where EGy is the generation of the project (in MWh) in year y, and $E_{OM,\ y}$ is the emissions (tCO2) associated with the operating margin calculated as

$$E_{OM,\ y} = \sum_{h} EG_h \cdot EF_{DD.\ h}$$

where EG_h is the generation of the Project (in MWh) in each hour h and $EF_{DD.\ h}$ is the hourly generation weighted average emissions per electricity unit (tCO2/MWh) of the set of power plants (n) in the top 10% of grid system dispatch order during hour h:

$$EF_{DD.\ h} = \frac{\sum F_{i,n,h} \cdot COEF_{i,n}}{\sum_{n} GEN_{n,h}}$$

Where 'F' is the fuel used per unit mass, COEF is the CO2 emission factor and GEN is the hourly generation from 'n' set of plants falling within the top 10% of the system dispatch.

To determine the set of plants (n), we have to obtain from the regional dispatch centre: a) the grid system dispatch order of operation for each power plant of the system; and b) the amount of power (MW) that is dispatched from all the plants in the system during each hour that the project activity is operating (GEN_h). At each hour 'h', each plant's generation is stacked (GEN_h) using the merit order. The set of plants (n) consists of those plants at the top of the stack (i.e. having the least merit), whose combined generation (S GEN_h) comprises 10% of total generation from all the plants during that hour (including imports to the extent they are dispatched). This data will be available on line from the data logger at SLDC (State Load Distribution Centre). It is not possible to determine the amount of power (MW) that is dispatched from all the plants in the system during each hour that the project activity is operating (GEN_h), as the project activity is yet to commence. Hence it has been decided to adopt the 1st method, i.e. Simple OM for calculating the OM.

The operating margin (OM) as per Simple Operating Margin analysis is 1001.25142 as per Table 5

6 The low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass
7 CEA Reports 2000-01
8 Data not available
9 CEA Reports 2002-03
10 CEA Reports 2004-05
11 EREB Reports 2004-05

Orissa Power Generation Corporation performance report (Thermal Power) **(taken from OPGC website)**

Table: 2 – Power Generation Mix of Orissa from the State Generating Stations[8]

Power Plant	**Energy Source**	**Installed Capacity**	**Net Generation**	**Net Generation**	**Net Generation**	**Net Generation**
		in MW	**in MU**	**in MU**	**in MU**	**in MU**
		(31/03/02)	**(2001-2002)**	**(2002-2003)**	**(2003-2004)**	**(2004-2005)**
TTPS Stage I [NTPC]		240	2179.16	1997.424	2338.92	2874.55
TTPS Stage II [NTPC]		220				
IB Valley (I&II) [OPGC]		420	2317.27	2327.378	2663.74	2833.06
A Thermal Total:		**880**	**4496.43**	**4324.8**	**5002.66**	**5707.61**
2. Hydro						
Hirakud, Burla [OHPC]		331.5	925.16	515.806	3500	797.07
Hirakud, Chiplima [OHPC]		72				
Balimela P.H.[OHPC]		360		1049.47	523.274	1493.12
Rengali P.H. [OHPC]		250		772.18	620.974	731.27
U. Kolab P.H. [OHPC]		320		640.18	472.629	866.71
Indravati P.H. [OHPC]		600	2923.87	790.458	1710.72	2828.1
Machhkund PH [OHPC]		57.375	325.29	265.678	265	366.65
B. Hydro Total:		**1918.88**	**6636.15**	**3288.82**	**5475.72**	**7082.92**
3. Wind		0.00		0	0	
C. Wind Total:		**0**		**0**	**0**	
4. Principal CPPs						
NALCO , Angul		960	347.74	409.895	420	403.56
NALCO Damanjodi		55.5				
Rourkela Steel Plant		248	9.39	9.17		71.68
ICCL		108	113.54	99.921		67.34

HPCL [INDAL]		67.5	10.12	7.905		0.092
NBFA		30				37.91
FACOR		21	0	0		
NINL		38.5				23.93
ISPAT ALLOYS		40.46	0	0		
OTHERS		112.738	0	15.994		
D. Principal CPPs		**1379.5**	**480.79**	**542.884**	**420**	**604.512**
E. State Sector Total		**4480.573**	**11613.4**	**8156.5**	**10898.4**	**13395.04**

4% Transmission & Distribution Losses as per the OERC.

Table: 3 – Power Generation Mix of Orissa from the Central Generating Stations[9] over the past 4 years

Sr.No	Energy Source	Central Share	Central Share	Generation	Generation	Generation	Generation
		(31/03/02)	(28/04/03)	(2001-2002)	(2002-2003)	(2003-2004)	(2004-2005)
	1	2	3	4	5	6	9
II.	Orissa's share in Central Schemes	MW	MW	in MU	in MU	in MU	in MU
1	**Thermal (coal)**						
	Farakka STPS (NTPC) (1600MW)	235	235	234.04	1421.839	1463.53	1320.2
	Kahalgaon STPS (NTPC) (840MW)	134.99	79	46.56	727.884	222.77	567.45
	Talcher STPS (NTPC) (1000MW)	262	318	397.2	1453.398	1980.74	2108.08
A.	**Total Thermal**	**631.99**	**632**	**677.8**	**3603.12**	**3667.04**	**3995.73**
2	**Hydro**						
	Chukka (Bhutan)	58.46	47	143.96	232.436	253.37	235.41
B.	**Total Hydro**	**58.46**	**47**	**143.96**	**232.436**	**253.37**	**235.41**
	Central Sector Total	**690.45**		**821.77**	**3854.42**	**3920.41**	**4231.14**

	% Hydro to total Generation in Central Sector			**17.50%**	**6.03%**	**6.46%**	**5.56%**

Table: 4 – Power Generation Mix of Orissa for five most recent years[10]

Energy Source	2000-01	2001-02	2002-03	2003-04	2004-05
Total Power Generation (MU)	11011.39	12435.13	11216.74	14818.79	17611.68
Total Hydro Power Generation (MU)	4957.99	6780.11	3288.82	5729.09	7318.75
Total ThermalPower Generation (MU)	6053.39	5655.02	7927.923	9089.7	10292.93
Hydro % of Total grid generation	**45.03**	**54.52**	**29.32**	**38.66**	**41.52**
Thermal % of Total grid generation	**54.97**	**45.48**	**70.68**	**61.34**	**58.48**
Hydro % of Total grid generation – Average of the five most recent years – 41.81%					

Table 5

CALCULATION OF BASELINE EMISSION FACTORS AND EMISSION REDUCTIONS OF 50MW WASTE HEAT RECOVERY PROJECT						
YEAR OF OFFER		**2002-03**		**2003-04**		**2004-05**
Capacity addition & installed Capacity						
Sector	**Cap.Addn**	**Instl. Cap**	**Cap.Addn**	**Instl. Cap**	**Cap.Addn**	**Instl. Cap**
TTPS(StageI-Stage-II)		480				
IB Valley(UnitI & II)		420				
Total Thermal coal based,MW(Orissa)		900				
NTPC-Farakka STPS		235				
NTPC-Kahalgaon STPS		79				
NTPC-Talcher STPS		318				
Total Thermal coal based, MW(Central)		632				
Total CPP MW		1379.5				
Hydro, MW (Orissa)		1918.88				
Hydro, MW (Central)		58.48				
Total Hydro Based, MW (State+Central)		1977.36				
Total, MW		4888.86				

Generation Mix	MU		MU		MU	
YEAR	**2002-03**		**2003-04**		**2004-05**	
Sector						
TTPS(Stage I-Stage-II)	1997.42		2338.92		2859.67	
IB Valley(Unit I & II)	2327.38		2663.74		2833.04	
Total Thermal coal based,(Orissa)	4324.8		5002.66		5692.71	
NTPC-Farakka STPS	1421.84		1463.53		1320.24	
NTPC-Kahalgaon STPS	727.88		222.77		567.48	
NTPC-Talcher STPS	1453.4		1453.4		2108.12	
Total Thermal coal based,(Central)	3603.12		3139.7		3995.84	
CPP	542.89		542.89		604.38	
Hydro(Orissa)	3288.82		3288.82		7083.33	
Hydro(Central)	232.44		232.44		235.42	
Total Hydro Based (State+Central)	3521.26		3521.26		7318.75	
Total power generation	11992.07		12206.51		17611.68	
Total power generation with Hydro power Exclusion	8470.81		8685.25		10292.93	
Share of power generation from coal based power plants						
TTPS(Stage I-Stage-II)	0.23580035		0.26929795		0.27782857	
IB Valley(Unit I & II)	0.27475295		0.30669699		0.27524135	
NTPC-Farakka STPS	0.16785172		0.16850753		0.12826668	
NTPC-Kahalgaon STPS	0.08592803		0.02564923		0.05513299	
NTPC-Talcher STPS	0.17157745		0.16734118		0.20481243	
CPP	0.0640895		0.06250712		0.05871797	
Total	1		1		1	
Thermal Efficiency of Thermal power Stations						
TTPS(Stage I-Stage-II)	0.3285		0.3285		0.3285	
IB Valley(Unit I & II)	0.36642		0.36642		0.36642	
NTPC-Farakka STPS	0.3766		0.3766		0.3766	
NTPC-Kahalgaon STPS	0.3479		0.3479		0.3479	
NTPC-Talcher STPS	0.3479		0.3479		0.3479	
CPP	0.32		0.32		0.32	
Standard emission factor for coal in tco2/TJ	95.52		95.52		95.52	
Estimation of Net Emission Factor as per OM – Simple OM as per ACM 0002						
TTPS(Stage I-Stage-II)	251.405529		287.119979		296.215152	
IB Valley(Unit I & II)	262.620686		293.154174		263.087528	
NTPC-Farakka STPS	156.102988		156.712895		119.288697	
NTPC-Kahalgaon STPS	86.5059861		25.8217514		55.5038177	
NTPC-Talcher STPS	172.731495		168.466731		206.190012	
CPP	70.1459607		68.4140474		64.266823	
Net emission factor in tCO2/mu	999.512644		999.689578		1004.55203	

Average-Net emission factor in tcO2/mu			1001.25142			
Build Margin (BM)						
Sector						
Generation Mix						
Thermal coal based (Orissa) for the cohort of Plants identified						
TTPS(Stage I-Stage-II)					2859.67	
NTPC-Kahalgaon STPS					567.48	
NTPC-Talcher STPS					2108.12	
Hydro power					2828.5	
Total					8363.77	
Share of power generation from coal based power plants						
TTPS(StageI-Stage-II)					0.3419116	
NTPC-Kahalgaon STPS					0.06784979	
NTPC-Talcher STPS					0.2520538	
Hydro power					0.33818481	
Total					1	
Estimation of Net Emission Factor as per BM as per ACM 0002						
TTPS(StageI-Stage-II)					364.539177	
NTPC-Kahalgaon STPS					68.3061479	
NTPC-Talcher STPS					253.74913	
Hydro power					0	
Net emission factor in tCO2/mu (BM)					686.594455	
Combined Margin factor as per ACM 0002						
Net Baseline Emission Factor in tCO2/mu					**843.922936**	

Step 2: Calculation of Build Margin

The project activity would have some effect on the Build Margin (BM) of the Eastern Regional Electricity Board. The Build Margin emission factor ($EF_{BM, y}$) is calculated as the generation – weighted average emission factor (tCO2/MU) of a sample of power plants. The methodology suggests the project proponent to choose one of the two options available to calculate the Build margin emission factor ($EF_{BM,y}$)

Option 1:

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

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

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

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

Option 2:

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

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

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

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

Project Participants have adopted Option 1, which requires the project participants to calculate the Build Margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available on plants already built for sample group 'm' at the time of PDD submission. The sample group 'm' consists of either, (a) the five power plants that have been built most recently, or (b), the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MU) and that have been built most recently. Project participants are required to use from these two options that sample group that comprises the larger annual generation. As per the baseline information data, option (b) comprises the larger annual generation. Therefore for the project activity the sample group 'm' consists of (b) the power plants capacity additions on the electricity system for 2004-05 that comprise 20% of the system generation (in MU) and that have been built most recently.

Annex 4

MONITORING PLAN

The monitoring plan has been prepared in accordance with in ACM0004.
The project activity being a waste heat recovery based power generation one, there are no/negligible project emissions generated during operation of the project activity.
The monitoring methodology will essentially aim at measuring and recording through devices, which will enable verification of the emission reductions achieved by the project activity that qualifies as Certified Emission Reductions (CERs). The methods of monitoring adopted should also qualify as economical, transparent, accurate and reliable.
The project activity will employ state of the art monitoring and control equipments that will measure, record, report and control various key parameters like total power generated, power used for auxiliary consumption, flow rate, temperature and pressure parameters of the steam generated and steam sent to turbine for generation of power. The monitoring and controls will be part of the Distributed Control system (DCS) of the entire plant. All instruments will be calibrated and marked at regular interval to ensure accuracy.

Project factors affecting emission reduction claims

The potential factors that may affect the emission reduction claims are:-

Frequency of Monitoring:-

The emission reduction generated by the project is calculated by multiplying the total unit electricity generated by the appropriate Emission Factor calculated on the basis of current baseline scenario. Therefore it important to meter the net generation of power produced on real time basis. Thus such parameters that directly influence the total revenue generated from the emission reduction calculation by the project will be monitored on continuous basis through online monitoring system in place.

Reliability:-

The amount of emission reductions achieved by the project is dependent on the net energy generated from the project as well as baseline emission factor. Therefore meter readings calculating the final value of total electricity produced from the project side will be monitored with calibrated instruments. Calibration as per instrument specifications shall ensure reliability of measures. All power-measuring instruments will be calibrated once a year for ensuring reliability of the system.
For baseline emission factor calculation, data will be calculated from the reliable sources such as CEA reports, eastern regional electricity board reports etc.

Registration and Reporting:-

- Registration of data will be online in the control cabin through a microprocessor. Hourly data logging in log sheets in hard copies will be there in addition to software memory. Daily, weekly and monthly reports will be prepared stating the generation.
- There would be check meters installed at the grid sub stations to meter the electricity generated by the Units, which would be the basis for monthly payouts from GRIDCO/OPTCL to the Units for electricity received. This would be the additional monitoring device, which factors in possible failures of the Units metering system, for the emission reductions of the project activity, which is purely based on the electricity generated and the baseline emission factor, less the electricity used for auxiliary consumption at the WHRB_STG.
- Since there is no additional fossil fuel burnt in the project activity there would be no necessity of measuring the carbon dioxide

- The data dispatch centre data will be noted to monitor the composition of the Grid mix to see if there is any change necessary to be made for calculating the operating margin emission factor, at a frequency of monthly periodicity
- Monitor the changes in the grid mix on a monthly basis to calculate the build margin emission factor
- Since there are no project activity emissions no data need be collected or monitored for calculating the emission reductions of the WHRB_STG

ID No	Data Type	Data variable	Data Unit	Measured (m), calculated © or estimated (e)	Recording frequency	Proportion of the data to be measured	How will the data be archived	For how long is the archived data to be kept	Comment
1. Qi	Quantitative	Vol of aux fuel used by project activity	Tonnes or m3	measured	continuously	100%	Electronic/ paper	Credit Period + 2yrs	To be measured and used for estimation of project emissions
2. NCVf	Quantitative	Net calorific value of fuel (if any)	TJ/t or m3	measured	Monthly	Random	Electronic/ paper	Credit Period + 2yrs	To be measured and used for estimation of project emissions
3. EFi	Quantitative	Carbon emission factor of fuel	tC/TJ	National sources or IPCC defaults	monthly	random	Electronic/ paper	Credit Period + 2yrs	To be measured and used for estimation of project emissions
4. EG_{GEN}	Quantitative	Total Electricity generated	MWh/yr	Baseline measurement	Continuously	100%	Electronic	Credit Period + 2yrs	Monitoring location: meters at plant and DCS will measure the data. Manager In-charge would be responsible for regular calibration of the meter.
5. EG_{AUX}	Quantitative	Auxiliary Electricity3	MWh/yr	Baseline measurement	Continuously	100%	Electronic	Credit Period + 2yrs	Monitoring location: meters at plant and DCS will measure the data. Manager

									In-charge would be responsible for regular calibration of the meter.
6.EGy	Quantitative	Net Electricity generated by the Unit	MWh/yr	Calculated (EG_{GEN}-EG_{AUX})	Continuously	100%	Electronic	Credit Period + 2yrs	Calculated from the above measured parameters. Algorithm for project emission calculations given in baseline methodology.

APPENDIX –1

DETAILS ON SUSTAINABLE DEVELOPMENT (REFER A.2.)

Empowering people for Sustainable Development (EPSD) MOEF 2002

The EPSD defined the prerequisite framework for sustainable development as:

1. Democratic Continuity
2. Devolution of power to the people
3. Independent Judiciary
4. Civilian Control of armed forces
5. Independent Media
6. People's Participation

Objectives of Sustainable Development: -

i. Combating Poverty

ii. Empowering people

iii. Using core competence in Science & Technology

iv. Setting environment Standards, Conservation of Resources, Improving Core sectors Economy.

Targets Of Tenth Five-Year Plan With Respect To Sustainable Development

1. Economic growth, Social development, environment improvement, Reduction of poverty ratio by 5% points by 2007
2. Economic growth, Social development, environment improvement Reduction of poverty ratio by 15% points by 2012
3. All children in school to complete 5yrs in school by 2007
4. Reduction in gender gaps in literacy & wages rate by 50% by 2007
5. Increase in literacy rate 75% by 2007
6. Economy carrying capacity based Regional Development planning in 2002

The indicators for sustainable development have been derived from the Publication of the Ministry of Environment and Forests, 'Empowering People for Sustainable Development', 2002, which are

1.	Human Development Index	0.59 (127th in world)
2.	Human Poverty Index	33.10 (53rd in world)
3.	Environmental Sustainability	41.60

4. GHG Emissions 1995: 1ton CO2 e per capita
5. GDP & GDP per capita $2664 million & $2600

Source: CIA 2003, UNDP 2003, Yale & Columbia University 2002, Zinel & Treber 2003

The project activity contributes to the sustainable development, which, as defined by the indicators mentioned in IPCC (Intergovernmental Panel on Climate Change) by document, International Institute for Sustainable Development (IISD), Publication of the Ministry of Environment and Forests, 'Empowering People for Sustainable Development', 2002 and the UN Commission on Sustainable Development (UNCSD) means improvement in the fields of Social development, economic development, Technology upgradation, and alleviation of Environmental pressures

How the Project Activity Helps In Attaining Sustainable Development

Social: The project activity would result in increased local employment and an increase in equity of the distribution of resources. With the significant savings in Power costs, the unit cost of Production would be reduced, which would result in sustainability of the operations, which would give rise to stability in employment and development of the peripheral villages. A self-sustaining industry is the breeding ground for social infrastructure like schools, roads, and hospitals etc. all of which lead to sustainable development

Economic Efficiency: The project activity would result in reduction / elimination of the burden of imports of energy within the project boundary. The Units would be self sufficient in generating their requirement of power, thus saving on power and power related costs. With the help of an additional income from sale of CDM credits, the project activity becomes financially sustainable and helps in meeting debt servicing needs during the repayment period. Sustained growth of Industry leads to sustained growth of the Economy

Technological: The project activity would result in increased Energy Efficiency due to utilization of the sensible heat from the waste gases, which otherwise would have been cooled & discharged into the atmosphere. Because of the expected income that would subsequently accrue from trade of CERs, the Units would be able to source high-end technology to achieve increased boiler efficiency, complete combustion of the waste gases in the after burner chamber to achieve consistency of waste heat and also to procure high efficiency power generation equipment to get maximum benefits from the project activity. The project activity would increase the power availability by 360000 MWH assuming a generation of 2.00 MW per 100-tpd and 1.00 MW per 50–tpd kiln, and an efficiency of 94%, thereby reducing emissions by 296267.44 tonnes of CO_{2e} in a 10-year crediting period. Moreover there will be a drop in the energy consumption of the Units due to elimination of the Venturi scrubber and/or Gas Coolers, which, as a conservative measure, has not been considered in this PDD

The project activity will contribute, however small, to the growing needs of the surrounding villages with regard to a stable supply of basic electricity.

The replacement of Gas Cooling system with a CPP will at the same time eliminate the electrical energy component now being consumed by the Gas Cooling System and make available the excess electricity generated by the CPP for export. The Gas Cooling Systems are presently running on electrical loads ranging between 30KW – 200KW.

Environmental improvement The project activity helps to reduce the heat load in the atmosphere by utilizing the heat of the waste gases before emitting the same into the atmosphere. The project activity also generates electrical power by installation of WHRB_STG to utilize the sensible heat of the waste gases. This electricity substitutes the electricity that would have been generated by the grid power stations through burning of fossil fuel coal, thereby reducing GHG emissions to an extent of 296267.44 tCO_2e

APPENDIX –2

ABBREVIATIONS AND ACRONYMS USED IN THE PDD

ABBREVIATIONS AND ACRONYMS	
ABC	AFTER BURNING CHAMBER
ABT	AVAILABILITY BASED TARIFF
ACM	APPROVED CONSOLIDATED BASELINE & MONITORING METHODOLOGY
APTRANSCO	ANDHRA PRADESH TRANSMISSION COMPANY
BAU	BUSINESS AS USUAL
BM	BUILD MARGIN
BEF	BASELINE EMISSION FACTOR
BPNSI	BIJU PATNAIK NATIONAL STEEL INSTITUTE, PURI
CDM	CLEAN DEVELOPMENT MECHANISIM
CEA	CENTRAL ELECTRICITY AUTHORITY
CERC	CENTRAL ELECTRICITY REGULATORY COMMISSION
CERs	CERTIFIED EMISSION REDUCTIONS
CESCO	CENTRAL ELECTRICITY SUPPLY COMPANY OF ORISSA LTD
CM	COMBINED MARGIN
CO_2	CARBON DIOXIDE
CPP	CAPTIVE POWER PLANT
DCS	DISTRIBUTED CONTROL SYSTEM
DOE	DESIGNATED OPERATING ENTITY
DRI	DIRECT REDUCED IRON
DVC	DAMODAR VALLEY CORPORATION
EREB	EASTERN REGIONAL ELECTRICITY BOARD
EB	EXECUTIVE BOARD
ESP	ELECTRO STATIC PRECIPITATOR
GHG	GREEN HOUSE GAS
GRIDCO	GRID CORPORATION OF ORISSA LTD
IISD	INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT
IPCC	INTERGOVERNMENTAL PANEL on CLIMATE CHANGE
IPICOL	INDUSTRIAL PROMOTION and INVESTMENT COMPANY LTD
IPP	INDEPENDENT POWER PLANTS
IRR	INTERNAL RATE OF RETURN
KP	KYOTO PROTOCOL
KPTCL	KARNATAKA POWER TRANSMISSION CORPORATION LTD
LDCs	LOAD DESPATCH CENTERS
MoEF	MINISTRY OF ENVIRONMENT & FOREST, GOVT OF INDIA
MVP	MONITORING & VERIFICATION PROTOCOL
NESCO	NORTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LTD
NHPC	NATIONAL HYDROELECTRIC POWER CORPORATION LTD

NTPC	NATIONAL THERMAL POWER CORPORATION LTD
OECD	ORGANISATION for ECONOMIC CO OPERATION and DEVELOPMENT
OERC	ORISSA ELECTRICITY REGULATORY COMMISSION
OHPC	ORISSA HYDRO POWER CORPORATION LTD
OM	OPERATING MARGIN
OPGC	ORISSA POWER GENERATING CORPORATION LTD
OPTCL	ORISSA POWER TRANSMISSION CORPORATION LTD
OSIL	ORISSA SPONGE IRON LTD
OSIMA	ORISSA SPONGE IRON MANUFACTURERS ASSOCIATION
PDD	PROJECT DESIGN DOCUMENT
PLC	PROGRAMMABLE LOGIC CONTROL
RRR	REQUIRED RATE OF RETURN
SD	SUSTAINABLE DEVELOPMENT
SLDC	STATE LOAD DISPATCH CENTER
SOUTHCO	SOUTHERN ELECTRICITY SUPPLY COMPANY OF ORISSA LTD
SPCO	JP STEEL PLANT COMPANY, JAPAN
SPM	SUSPENDED PARTICULATE MATTER
SR	SOUTHERN REGION
STU	STATE TRANSMISSION UTILITY
TPA	TONNES PER ANNUM
TPD, tpd	TONNES PER DAY
UNCSD	UNITED NATIONS COMMISSION ON SUSTAINABLE DEVELOPMENT
UNFCCC	UNITED NATIONS FFRAMEWORK CONVENTION ON` CLIMATE CHANGE
WESCO	WESTERN ELECTRICITY SUPPLY COMPANY OF ORISSA LTD
WHRB _ STG	WASTE HEAT RECOVERY BOILER with STEAM TURBINE GENERATOR
WR	WESTERN REGION

Appendix – 3
Ranking of Alternative Baseline Scenarios

Table B.2.2							
Ranking criteria	**Guidance**		**Baseline Option 1**		**Baseline Option 2**		**Baseline Option 3**
			Import of Electricity from the grid		**Fossil fuel based CPP (coal)**		**Fossil fuel based CPP (diesel)**
		Rank	**Justification**	**Rank**	**Justification**	**Rank**	**Justification**
Aspects related to regulatory clearances	Implementation of projects in the baseline scenario is guided by the national & sectoral legislations & the clearance procedures involved. For certain projects clearance procedures are more stringent than others depending on the complexity of the projects	1	No clearances required from regulatory bodies	2	Well-defined clearance procedures exist, which only have to be strictly followed. Resistance from regulatory bodies exist to some extent due to intrinsic polluting emissions, which burdens the capacity of the environment	2	Well-defined clearance procedures exist, which only have to be strictly followed. Resistance from regulatory bodies exist to some extent due to intrinsic polluting emissions, which burdens the capacity of the environment
Aspects related to capital investment	Implementation of projects in the baseline scenario is guided by initial capital investments. These costs are compared to rank them as low/medium/high	1	Low investment required to set up the Units' Sub-station, which is not substantial	3	Highest capital investment required	2	Medium level capital investment required
Aspects related to technology	Implementation of projects in the baseline scenario is guided by technological	1	No technological complexities involved	3	Highest technological complexities involved	2	Medium technological complexities

	complexities and perceived risks related to implementation and operation of the project. This complexity is compared rank them as low/medium/high						involved
Aggregate score		3		8		6	

Appendix – 4
Calculation Of CERs Unit-wise

Sl No	Project Proponents Names	Annual Capacity (Tpa) @ 300 Working Days/ Year	Per Day Capacity (Tpd)	WHRB Power Plants (Proposed) (MU/ Yr) @ 2MW/100tpd, 1MW/50tpd	Annual captive power consumption (MU/ annum)	T & D losses saved on captive consumption @ 4% (MU/ annum) (6)*4%	Annual upload of electricity into the grid (MU/ annum)	T & D losses incurred on uploaded electricity @ 4% (MU/ annum) (8)*4%	Emission Reductions tCO2e/MU	Value of CERs
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
CLUSTER-1: JHARSUGUDA										**Rs**
1	PAWANSUT SPONGE PVT. LIMITED	30,000	100	14400	3218.4	128.736	11181.6	447.264	11883.67669	Rs7,486,716.31
2	SHREE MADHAV ISPAT PRIVATE LTD	30,000	100	14400	5572.8	222.912	8827.2	353.088	12042.63125	Rs7,586,857.69
3	L.N. METALLICS LTD	60,000	200	28800	5882.4	235.296	22917.6	916.704	23729.9237	Rs14,949,851.93
TOTAL:		**1,20,000 TPA**		**57600**	**14673.6**	**586.944**	**42926.4**	**1717.056**	**47656.23164**	**Rs30,023,425.94**
CLUSTER-2: SAMBALPUR										
4	MAA SAMALESWARI FERRO METALS (P) LTD	30,000	100	14400	4917.6	196.704	9482.4	379.296	11998.39619	Rs7,558,989.60

TOTAL:		**30,000 TPA**		**14400**	**4917.6**	**196.704**	**9482.4**	**379.296**	**11998.39619**	**Rs7,558,989.60**
CLUSTER-3: KALUNGA									0	
5	SPONGE UDYOG (P) LTD	30,000	100	14400	1735.2	69.408	12664.8	506.592	11783.54017	Rs7,423,630.31
6	SHREE MAHAVIR FERRO ALLOYS PVT. LIMITED	60,000	200	28800	5400	216	23400	936	23697.35503	Rs14,929,333.67
7	POOJA SPONGE PVT. LTD	60,000	200	28800	7135.2	285.408	21664.8	866.592	23814.50503	Rs15,003,138.17
8	JAY IRON & STEELS LIMITED	60,000	200	28800	3679.2	147.168	25120.8	1004.832	23581.17723	Rs14,856,141.65
9	SEETA SPONGE IRON LTD	15,000	50	7200	3002.4	120.096	4197.6	167.904	6035.898614	Rs3,802,616.13
10	SRI BALAJI METALICS (P) LTD	30,000	100	14400	1965.6	78.624	12434.4	497.376	11799.09536	Rs7,433,430.08
TOTAL:		**2,55,000 TPA**		**122400**	**22917.6**	**916.704**	**99482.4**	**3979.296**	**100711.5714**	**Rs63,448,290.01**
CLUSTER-4: KUARMUNDA										
11	SHREE GANESH METALIKS LIMITED	120000	400	57600	2102.4	84.096	55497.6	2219.904	46807.50176	Rs29,488,726.11
12	SWASTIK ISPAT (P) LTD	15,000	50	7200	3002	120.08	4198	167.92	6035.871608	Rs3,802,599.11
13	BAJARANG ISPAT (P) LTD	60,000	200	28800	1915.2	76.608	26884.8	1075.392	23462.08283	Rs14,781,112.18
14	MAA SAKUMBARI SPONGE (P) LTD	30,000	100	14400	3153.6	126.144	11246.4	449.856	11879.30179	Rs7,483,960.13

15	VEDVYAS ISPAT LIMITED	30,000	100	14400	3859.2	154.368	10540.8	421.632	11926.93955	Rs7,513,971.92
16	PAWANJAY SPONGE IRON LIMITED	45,000	150	21600	5608.8	224.352	15991.2	639.648	17878.25684	Rs11,263,301.81
TOTAL:		**3,00,000 TPA**		**144000**	**19641.2**	**785.648**	**124358.8**	**4974.352**	**117989.9544**	**Rs74,333,671.26**
CLUSTER-5: RAJGANGPUR										
17	SURAJ PRODUCTS LTD	45,000	150	21600	9136	122.4	12464	498.56	17911.2846	Rs11,284,109.30
TOTAL:		**45,000 TPA**		**21600**	**9136**	**122.4**	12464	**498.56**	**17911.2846**	**Rs11,284,109.30**
GRAND TOTAL:		**(8*1)+(21*2) = 50 MW**	**50 TPD*8 100TPD*21**	**360000**	**71286**	**2608.4**	**288714**	**11548.56**	**296267.4382**	**Rs186,648,486.10**

Appendix-5
Data pertaining to Generation and Distribution of power by GRIDCO / OPTCL

Table B.2.12: Comparison of Present Installed Capacity and Demand Projection by GRIDCO/OPTCL (2000-2012)

Year			**Maximum demand MW forecast**			
	Installed Capacity in MW		GRIDCO/OPTCL Forecast - I	GRIDCO/OPTCL Forecast - II (2000-10)	GRIDCO/OPTCL Forecast - III (2002-11)	GRIDCO/OPTCL Forecast – IV (2003-12)
2000-01			3070	1969		
2001-02	Orissa Hydro	1918.875	3387	2061	1850	
	Orissa Thermal	880				
	Orissa CPP	1379.5				
	Central	690.5				
	Total	**4868.875**				
2002-03	Orissa Hydro	1918.875	3545	2169	1924	
	Orissa Thermal	880				
	Orissa CPP	1379.5				
	Central	679				
	Total	**4857.375**				
2003-04			3734	2311	**2219**	**2201**
2004-05			3938	2405	**2357**	**2283**
2005-06			4151	2526	**2506**	**2385**
2006-07			4375	2673	**2647**	**2474**
2007-08			4611	2832	**2799**	**2564**
2008			4860	3004	**2962**	**2656**

-09					
2009 -10		5122	3208	**3137**	**2747**
2010 -11		5399		**3327**	**2834**
2011 -12		5691			2917

Source: An Overview of GRIDCO/OPTCL, OPTCL (2005)
As filed by GRIDCO/OPTCL before OERC (Orissa Electricity Regulatory Commission)

As per the Table B 2.12 GRIDCO/OPTCL has projected a limited increase in the future power demand scenario in its Revision IV

With the present fully met power scenario in the Orissa state the capacity additions are delayed. The OERC authorities responsible for providing clearances to future capacity additions have asked for further justification from GRIDCO/OPTCL for future capacity additions.

Therefore we may conclude from the above-mentioned information gathered from various published documents of GRIDCO/OPTCL that Orissa state has a fully met power situation and the probability of future capacity additions is very low. Some proposed power projects listed below were identified capacity additions for the Tenth Plan (2002-2007). However they are yet to complete major milestones like approvals from OERC, financial closures before starting construction. It is expected that these future capacity additions will not be implemented during the credit period. The generation weighted average emission rate at the operating margin is therefore not expected to vary over the credit period. The prospect of future Hydel Stations is bleak due to factors like displacement of people from expected inundation and their rehabilitation; hence expansion of capacity will be mainly restricted to thermal power plants

Projects of OHPC

(Taken from OHPCLtd.com)

Table B.2.13

Under Operation

Hirakud -I (Burla)	259.5 MW
Hirakud -II (Chipilma)	72 MW
Balimela	360 MW
Rengali	250 MW
Upper Kolab	320 MW
Upper Indravati	600 MW
Machkund	114.75 MW

Table B-11– Some capacity additions projected by GRIDCO/OPTCL

Under Construction

Potteru Small HE Project	6 MW

Under Expansion

Balimela Extension Project 150 MW (Additions Proposed)

Identified for Future Implementation

Chipilma - B 4 x 50 MW

Hirakud - B 4 x 52 MW

Sindhol Complex 16 x 20 MW

Ongoing Activities of OHPC

Table B.2.13

Sl. No.	Name	Addition of Increased Capacity	Year of Commencement	Probable date of completion / Commission
1.	Potteru S.H.E.P.	3 MW x 2 = 6 MW	1992	Autust'2003 (Delayed)
2.	R.M.&U of Unit 3&4, Burla Power House	16 MW (additional uprating)	17.7.2002	June'2005 (Delayed)
3.	Balimela Extension Project (Addition of 2 Units of 75 MW each to existing 6 Units of 60 MW each).	2 x 75 MW – 150 MW	August'2003	August'2006 (Delayed)

Table B.2.14

Sl. No	Name	Additional Installed Capacity	Probable year of commencement	Probable date of completion / commissioning
1.	Chiplima - B	200 MW	Proposed to be taken up during 11th Plan.	(Delayed)
2.	Hirakud-B	192 MW		(Delayed)
3.	Sindol Complex	320 MW	Proposed to be taken up during 11th Plan (Govt. of Orissa & MOP, Govt. of	(Delayed)
	(i) Deogaon -I	100 MW		(Delayed)
	(ii) Kapasira - II	100 MW		(Delayed)

	(iii) Godhaneswar-III	120 MW	India have decided the Project to be taken up by NTPC. NTPC requested to take steps to provide funds and take up Execution of the Project.	(Delayed)

Table B.2.15 – Some capacity additions projected by GRIDCO/OPTCL

Project Name	**Capacity in MW**
New Thermal Projects identified to be implemented during the Tenth Plan (2002-2007)	
IB Valley – 3&4 (OPGC) (2002-2007)	420 MW
IB Valley – 5&6 (AES) (2002-2007)	500 MW
Duburi TPS (KPC) (2002-2007)	500 MW
Total Thermal projects identified for capacity additions	**1420 MW**

Source: An Overview of GRIDCO/OPTCL (01.04.96 to 31.03.02), GRIDCO/OPTCL document "Power Purchased with Cost and Energy Sold During 2002-2003" received on 14/05/03, Tariff Order 2003-2004, OERC http://www.orierc.org/
Source: Tariff Order 2003-2004, OERC http://www.orierc.org/ & CEA website
Sources – Central Electricity Regulatory Commission (website)

-