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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

8 MW Captive power generation through waste heat recovery at Rana Sponge Ltd., Orissa

A.2. Description of the project activity:

Rana Sponge Limited (RSL) is an integrated steel manufacturing company under the Rana Group of Industries which is engaged in diversified businesses. RSL is located at Kulei village of Dhenkanal district in Orissa, India. The present manufacturing capacity of RSL consists of 0.115 million tonnes per annum (MTPA) of sponge iron and 0.082 MTPA of MS ingots. The total power requirement of the steel complex is presently met by importing power from the regional electrical utility company. The electricity utility company comes under the Eastern Regional electricity grid. RSL has installed a 12 MW captive power plant (CPP) at its facility to substitute grid power. The CPP is generating 8 MW of power using waste heat and proposed 4 MW power from a coal and char fired AFBC boiler.

Purpose of Project:

The primary purpose of the project is to recover the sensible heat content of the waste gases generated from DRI Kilns using Waste Heat Recovery Boiler (WHRB) to generate cleaner power and thus contribute to the energy security of the nation by conserving natural resources. The generated power substitutes grid power to meet the requirement of RSL's steel plant. The project activity results in green house gas emission reductions by generating cleaner power.

The CPP will operate in isolation from grid (stand alone mode) and supply power to the RSL's facility (sponge iron plant, steel rolling mills, mini blast furnaces and their ancillaries). All the power produced in the CPP will be consumed internally.

The project activity will also achieve

- Improvement of local environment through particulate emission reduction
- Technological up - gradation
- Fulfilling power requirement without adding to the transmission and distribution losses of the grid, as the power will be consumed at the place where it will be generated and RSL will not import power from the grid.
- Reducing the difference between demand and supply of power locally.
- Sustainable –economic growth

Projects contribution to sustainable development:

The contribution by the project activity to sustainable development has been listed below-

Social benefits: The project has resulted in direct and indirect employment generation during construction of captive power plant and also operation & maintenance of the utility in the region. It has contributed to enhancement of technical knowledge of concerned people by incorporation of new technology. The project will also promote downstream activity and the growth of service sector like transports and hotels, etc.

Economic benefits: The state will generate revenue out of manufacturing activities and supported by this captive power generation units and also through the purchase of equipments for the project activity in the way of VAT, excise duty, etc. This project activity would also entail business activities relating to logistics by road, rail and sea.

Environmental benefits: The project activity helps in reducing thermal pollution at the facility by utilizing waste gas of 950 - 1000 ^{o}C from DRI Kiln. The project leads to conservation of energy by means of incorporation of captive power plant and avoidance of emission related to its transportation. It is also eliminating CO_2, SO_x and NO_x emissions that would have occurred from the power plants to meet RSL's power requirement. The project will also mitigate air and land pollution by avoiding ash generation from coal based power generation in grid and disposal of ash for land filling.

Technological benefits: The Waste Heat Recovery System is a clean and efficient technology enabling the utilization of waste gas heat from the industrial process for power generation. The project will act as a clean technology demonstration project; encouraging development of such projects in the nation. The in-house generation of electricity is reducing transmission and distribution losses (T&D loss), which would have occurred in the case of supply of electricity from grid power plants to the RSL facility.

A.3. Project participants:

Name of the Party Involved ((host) indicates a host party)	Private and/or public entity(ies) Project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host)	Rana Sponge Limited (Private Entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party (ies):

India

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

Orissa

A.4.1.3. City/Town/Community etc:

Kulei, Dhenkanal district

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

The project activity is implemented within the industry premises of RSL in Kulei village, District Dhenkanal. The industry is situated in Orissa. .

The geographical location of RSL plant site has been shown in the maps below:


INDIA
States and Union Territories
N
PAKISTAN
CHINA (TIBET)
JAMMU & KASHMIR
Srinagar
HIMACHAL PRADESH
Shimla
Chandigarh
PUNJAB
UTTARANCHAL
Dehradun
HARYANA
DELHI
NEPAL
SIKKIM
Gangtok
BHUTAN
ARUNACHAL PRADESH
Itanagar
RAJASTHAN
Jaipur
UTTAR PRADESH
Lucknow
Patna
BIHAR
ASSAM
Dispur
NAGALAND
Kohima
Shillong
MEGHALAYA
Imphal
MANIPUR
Agartala
TRIPURA
Aizawl
MIZORAM
MYANMAR
GUJARAT
Gandhinagar
Bhopal
MADHYA PRADESH
Ranchi
JHARKHAND
WEST BENGAL
Calcutta
CHHATTISGARH
Raipur
ORISSA
BANGLADESH
DIU
DAMAN
DADAR & NAGAR HAVELI
MAHARASHTRA
Mumbai (Bombay)
Hyderabad
ANDHRA PRADESH
BAY OF BENGAL
ARABIAN SEA
Panaji
GOA
KARNATAKA
Bangalore
Chennai (Madras)
LAKSHADWEEP
MAHE (Pondicherry)
TAMILNADU
KARAIKAL (Pondicherry)
KERALA
Thiruvananthapuram
Port Blair
ANDAMAN & NICOBAR ISLANDS
Map not to Scale
Districts of Orissa
WEST BENGAL
N
Sundargarh
Jharsuguda
Mayurbhanj
Deogarh
Keonjhar
Balasore
Bargarh
Sambalpur
Nawapara
Sonepur
Angul
Bhadrak
Dhenkanal
Jajpur
Boudh
MADHYA PRADESH
Balangir
Cuttack
Kendrapara
Nayagarh
Khurda
Jagatsinghpur
Phulbani
Puri
BHUBANESHWAR
Now-rangpur
Kalahandi
Ganjam
Rayagada
Gaja-pati
State Capital
District Head Quarter
Koraput
BAY OF BENGAL
Map not to Scale
Malkangiri
ANDHRA PRADESH
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A.4.2. Category (ies) of project activity:

The project activity is an electricity generation project utilizing waste heat of flue gases where net electricity generation is approximately 32954 MWh per annum.The project is categorised as sectoral scope – 01 & 04: Energy industries (renewable / non-renewable sources) & Manufacturing Industries as per the scope of the project activities enlisted in 'List of sectoral scopes and approved baseline and monitoring methodologies'[1] on the UNFCCC website.

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

RSL has installed one 38 TPH WHRB to utilize sensible heat of flue gases emitting from DRI Kiln along with one 22 TPH AFBC boiler to fulfill the captive requirement of the plant. The waste gas containing high temperature and dust coming out from DRI Kiln at a rate of 90,000 Nm^3/hr will be received in the After Burning Chamber (ABC where further oxidation of gases occurs by providing excess oxygen to waste gases for conversion of carbon monoxide to carbon di-oxide) and will exit at a temperature of 900 – 1000 ^oC. No fuel is fired in the ABC. The ABC is connected with the 38 TPH Waste Heat Recovery Boiler to recover the sensible heat of waste gas for steam generation at 480 ^oC temperature and 65 kgf/cm^2 pressure. Steam generated from the 38 TPH waste heat recovery boiler is received in 12 MW steam turbine which will also be connected with proposed AFBC boiler for captive power generation.

1. **Waste Heat Recovery Boiler**

The Waste Heat Recovery (WHR) based Captive Power Plant is installed at Rana Sponge site to utilize the heat content of flue gases coming out of DRI Kiln. There is one 38 TPH WHR Boiler for 8 MW power generation. The details of WHR boiler are:

Description	Technical Particulars
Fuel to be burned/utilised	Flue gas from DRI Kiln
Steam pressure at super-heater outlet	65 kgf/cm^2
Steam temperature at super-heater outlet	480 ^oC
Steaming capacity	38 TPH
Gas outlet temperature	169 ^oC

The waste gas after maximum heat transfer in the WHRB is directed to exhaust stack at a temperature of 150^oC through multi field Electro Static Precipitators (ESP) which reduces suspended particulate matter below 100 mg /Nm^3. [2]

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

[2] Reference: www.cpcb.nic.in/StandardsSpongeIronPlants.doc

2. Steam Turbine

RSL has installed one 12 MW Turbo – Generator set of which 8 MW power is waste heat recovery based and 4 MW of the power generation is from proposed coal and char fired AFBC boiler along with main condenser, air ejector system (for main condenser), condensate pumps etc.
In the project activity, the high pressure steam from WHRB and proposed coal based AFBC boiler is fed to the 12 MW turbine through a common steam header. The steam turbine is coupled with a three phase electric generator which converts mechanical energy of the turbine to electrical energy.
The project activity will generate 32954 MWh of electricity per annum excluding auxiliary consumption.

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

The estimated emission reduction due to the project activity will generate 34,602 tonnes of CO_2 equivalent per annum considering the stabilized plant load factor. The chosen crediting period for the project activity is 10 years. Estimated emission reductions of the project during crediting period are shown in table below:

Year	Annual Estimation of Emission Reductions in tonnes of CO_2e
2008 – 2009	34,602
2009 – 2010	34,602
2010 – 2011	34,602
2011 – 2012	34,602
2012 – 2013	34,602
2013 – 2014	34,602
2014 – 2015	34,602
2015 – 2016	34,602
2016 – 2017	34,602
2017 – 2018	34,602
Total estimated reductions (tCO_2e)	**346,021**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**34,602**

A.4.5. Public funding of the project activity:

The project has not received public funding from any Annex-1 countries of UNFCCC.

SECTION B. Application of a baseline and monitoring methodology

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

Methodology: "Consolidated baseline methodology for GHG emission reductions for waste gas or waste heat or waste pressure based energy system"

Reference[3]: Approved consolidated baseline methodology ACM0012/ Version 02
Sectoral scope: 01 & 04

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

The chosen methodology 'ACM0012, version 02' is applicable to project activities that utilize waste gas and/or waste heat as an energy source for:

- Cogeneration; or
- Generation of electricity; or
- Direct use as process heat source; or
- For generation of heat in element process (e.g. steam, hot water, hot oil, hot air);

The project activity under consideration will utilize the heat content of waste gases emitted from the DRI kilns in WHRBs to produce steam which will be further used to generate electricity. Hence, the methodology is applicable to the project activity.

Following applicability criteria met by the project activity is explained below:

- *"If project activity is use of waste pressure to generate electricity, electricity generated using waste gas pressure should be measurable".*
  The project activity will utilise the sensible heat content of the waste gas to generate electricity.

- "*Energy generated in the project activity may be used within the industrial facility or exported outside the industrial facility*".
  The generated electricity by the project activity will be consumed within the industrial facility; electricity will not be exported outside the industrial facility.

- "*The electricity generated in the project activity may be exported to the grid*".
  The electricity that will be generated in the project activity will not be exported to the grid, would be consumed within the industrial facility.

- "*Energy in the project activity can be generated by the owner of the industrial facility producing the waste gas/heat or by a third party (e.g. ESCO) within the industrial facility*".

[3] Source: UNFCCC source : http://cdm.unfccc.int/DOE/scopes.html#13

RSL, the owner of the industrial facility will produce the waste gas within the industrial facility and also generate electricity by utilising the waste gas.

- *"Regulations do not constrain the industrial facility generating waste gas from using the fossil fuels being used prior to the implementation of the project activity."*
  Prior to the implementation of the project activity RSL was not generating waste gas in their industrial facility as it's a new industry which is set-up. There are no such regulations which constrain the industrial facility to generate waste gas from using the fossil fuels.

- "*The methodology covers both new and existing facilities. For existing facilities, the methodology applies to existing capacity. If capacity expansion is planned, the added capacity must be treated as a new facility.*"
  The project activity is a green-field power generation facility.

- "*The waste gas / pressure utilized in the project activity was flared or released into the atmosphere in the absence of the project activity at existing facility.*[4]"
  The waste gas utilized in the project activity would be released into the atmosphere in absence of the project activity as it is a common practice in similar industries in the region. The incorporation of the project activity has been commenced at the same time along with the deployment of industrial facility. Prior to the implementation of the project activity, no equipment was installed to utilise the waste gas. The DOE has verified during their site visit to ensure that there was no utilisation of waste gas. The delay in submission of the project activity for validation is due to financial constraint and management problem.

- "*The credits are claimed by the generator of energy using waste gas / heat / pressure*."
  The credits will be claimed by the RSL, the generator of energy using waste gas.

- *"For those facilities and recipients, included in the project boundary, which prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods:*
  - *o The remaining lifetime of equipments currently being used; and*
  - *o Credit period.".*

  The project being new facility and having equipment lifetime of 20 years the credits can be claimed for the entire fixed crediting period of 10 years.

- "*Waste gas / pressure that is released under abnormal operation (emergencies, shut down) of the plant shall not be accounted for*."
  The waste gas that will be released under abnormal operation of the plant (emergencies) will not be accounted as emission.

- *"Cogeneration of energy is from combined heat and power and not combined cycle mode of electricity generation".*
  The project activity is incorporation of power generation plant, is not installation of a cogeneration facility.

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[4] "*Facilities where the commercial production had began at the time when the Project Activity is submitted for validation*."

Hence, it is concluded that the project activity satisfies all the above mentioned conditions of the selected Approved Consolidated Methodology ACM0012 / Version 02 under Sectoral scope: 01 & 04.

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

According to the baseline methodology ACM0012, Version 02, the geographical extent of the project boundary shall comprise of

- The industrial facility where waste gas/ heat/ pressure is generated (generator of waste energy),
- The facility where process heat in element process/steam/electricity are generated (generator of process heat/steam/electricity).
- The facility/s where the process heat in element process/steam/electricity is used (the recipient plant(s)) and/or grid where electricity is exported, if applicable.

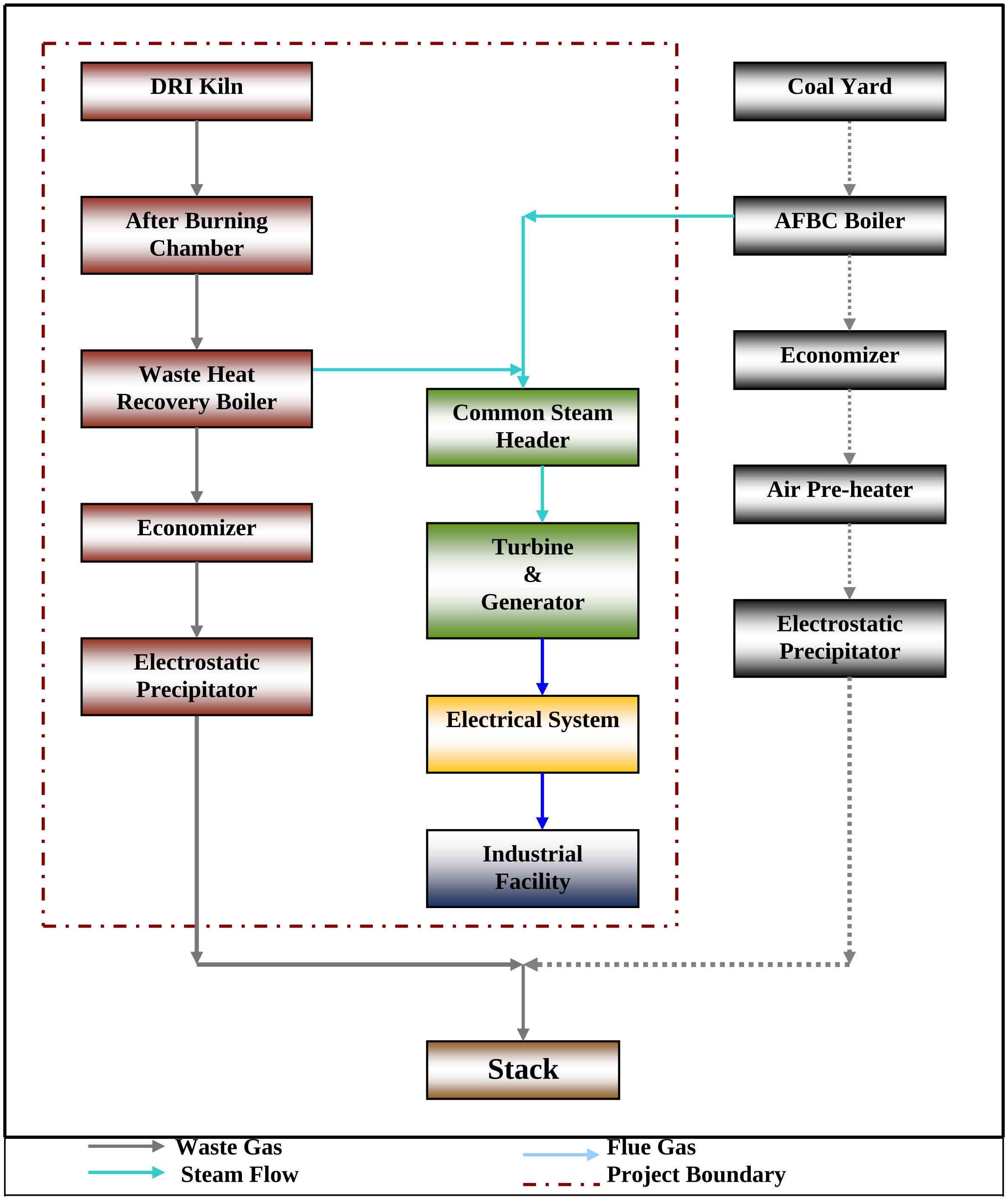
As per the methodology, the project boundary encompasses DRI Kiln, where the waste gas is generated, waste heat recovery boiler and other related accessories, captive power generating equipment such as turbine, generator etc, auxiliary equipment, power synchronizing system, steam flow piping, flue gas ducts, etc and the unit where generated electricity will be consumed.

Following table illustrates gases and emissions sources which will be included in the project boundary:

	Source	Gas	Included?	Justification / Explanation
Baseline	**Electricity generation, grid or captive source**	CO_2	Included	Main emission source. The emission due to power generation for regional grid is included.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Baseline emissions from generation of steam used in the flaring process, if any	CO_2	Excluded	Excluded as steam was not generated for flaring waste gas and also the project will be implemented at the time of commercial production starting.
		CH_4	Excluded	Excluded as not emitted.
		N_2O	Excluded	Excluded as not emitted.
Project Activity	**Supplemental fossil fuel consumption at the project plant**	CO_2	Excluded	Excluded as fossil fuel is not required.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	Supplemental electricity consumption	CO_2	Excluded	Not included in the project boundary
		CH_4	Excluded	Excluded for simplification

	Source	Gas	Included?	Justification / Explanation
		N_2O	Excluded	Excluded for simplification
	Project emissions from cleaning of gas	CO_2	Excluded	Excluded as waste gas cleaning is not required.
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification

The detailed project diagram is as follows:


DRI Kiln
After Burning Chamber
Waste Heat Recovery Boiler
Economizer
Electrostatic Precipitator
Coal Yard
AFBC Boiler
Economizer
Air Pre-heater
Electrostatic Precipitator
Common Steam Header
Turbine & Generator
Electrical System
Industrial Facility
Stack
Waste Gas
Steam Flow
Flue Gas
Project Boundary

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

The project activity involves incorporation of new waste heat recovery boiler to utilise sensible heat content of waste gas emanating from DRI Kiln. This would result in steam generation and the power thus generated will be used for production of finished products of the iron & steel industry. This in turn would reduce the demand of power procurement from the Eastern regional grid. In the absence of the project activity, the plant would have otherwise purchased power from the Eastern regional grid to meet the power requirement for production. This would have lead to consumption of fossil fuel and thus emission of green house gases, as the grid is mainly generates power by using fossil fuels. As per the consolidated baseline methodology ACM0012, suitable alternate options are selected for estimation of baseline emissions and described in the following section:

With the incorporation of waste heat recovery boiler in the plant site for captive power generation through utilisation of heat content of waste gas coming out of DRI Kiln, the plant will reduce the dependency over grid power which is not reliable. Thus the project activity will lead to conservation of fossil fuel by reducing fossil fuel consumption in grid for power generation and thus reduction of green house gases emission.

According to the Approved Consolidated Methodology ACM0012, version 02, the baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s).
As per the methodology the project participant shall exclude baseline options that:

- do not comply with legal and regulatory requirements; or
- depend on fuels (used for generation of heat and/or power), that are not available at the project site

Step 1: Define the most plausible baseline scenario for the generation of heat and electricity using the following baseline options and combinations

RSL identified the different potential alternatives to the project activity available to all other sponge iron industries in India. As defined in the consolidated methodology ACM0012, version 01, the realistic and credible alternatives were separately determined by considering the following criteria which was aligned with the Scenario 1.

i) What is the use of waste gas/heat/pressure in absence of the project activity?

- Option W1: Waste gas is directly vented to atmosphere without incineration.

  This cannot be a baseline scenario due to Environmental Regulation of host country (India) which restricts the industrial facility to vent out waste gas without incineration as the waste gas contains traces of carbon mono-oxide.

- *Option W2*: Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere (waste pressure energy is not utilized).

This is possible baseline scenario as it is as per the regulation of the host country and the common practice in the region.

- Option W3: Waste gas / heat is sold as an energy source

The waste gas would be vented out to the atmosphere without selling as an energy source by project proponent to other similar industries as there is no such demand. This is not practised in the region. Hence, it is not considered as baseline scenario.

- Option W4: Waste gas/heat/pressure is used for meeting energy demand.

There is no provision for utilisation of waste gases to meet the energy demand as the waste gas has no other use in integrated sponge iron industry. Hence, it is not a baseline scenario.

ii) How power would have been generated in absence of the project activity?

- Option P1: Proposed project activity not undertaken as a CDM project activity

This alternative is in compliance with all applicable legal and regulatory requirements but in absence of CDM benefit the project could not be implemented as it faces barriers like, investment barriers, technological barriers, etc (details have been provided in section B.5). Hence this is not considered for baseline option.

- Option P2: On-site or off-site existing/new fossil fuel fired cogeneration plant

The project activity is generation of electricity only using waste gas as there is no usage of steam in the industrial facility. Hence, installation of fossil fuel fired cogeneration plant is not a alternative option and is not considered as baseline scenario.

- Option P3: On-site or off-site existing /new renewable energy based cogeneration plant

As the project activity is generation of electricity only and in absence of the project activity RSL would purchase power from grid to meet their requirement. Also the industrial facility don't have requirement of steam and therefore cogeneration plant is not opted. Hence, the option is not a baseline scenario.

- *Option P4*: On-site or off-site existing/new fossil fuel based existing captive or identified plant

The possible baseline scenario can be onsite new fossil fuel based captive power plant as RSL didn't have fossil fuel based captive power plant in pre-project scenario. The possible fossil fuels can be used for power generation are coal, diesel and natural gas.

- Option P5: On-site or off-site existing/new renewable energy based existing captive or identified plant

On-site or off-site new renewable energy based captive power plant is in compliance with all applicable legal & regulatory requirements and can be a baseline option. In Orissa, renewable energy options which can be harnessed are solar, wind, biomass and hydro. Out of these options solar, wind and hydro power plant installation requires huge capital investment, huge land area and also the plant site is not suitable for wind and hydro power generation. RSL would have faced problem in arranging the fund. The power generation from aforesaid sources are not an attractive option owing to their power generation capacity depends on the nature. The power requirement of RSL cannot be met through biomass based captive power plant, as a part of biomass generated is being already in use as fuel in Orissa and also the availability of large quantity biomass through out the lifetime of the plant is not assured due to its availability depends on climatic condition, demand in market etc. Also procurement and collection of such a large quantum of biomass is a daunting task to the project proponent owing to unorganised market of biomass and availability of the same is not in a nearby area. Hence, this alternative is not considered as a baseline option.

- *Option P6:* Sourced grid-connected power plants

RSL would purchase required power from the Eastern Regional grid as the grid power is easily available at the plant area and no operational or technical problem to use the same. This would result in an equivalent amount of CO_2 emissions corresponding to the power generation in the grid connected thermal power plants. This alternative is in compliance with all applicable legal and regulatory requirements and can be a baseline option.

- Option P7: Captive electricity generation from waste gas (if project activity is captive generation with waste gas, this scenario represents captive generation with lower efficiency than the project activity)

Captive power generation through waste gas with lower efficiency than the project activity is in compliance with all legal & regulatory requirements and can be implemented in the RSL. It is not a feasible option as the power requirement of RSL cannot be fulfilled by the mentioned alternative and also the cost of power generation will increase. High cost of installation and higher cost of operation makes the option unviable. Hence, it is not considered a baseline option.

- Option P8: Cogeneration from waste gas (if project activity is cogeneration with waste gas, this scenario represents cogeneration with lower efficiency than the project activity)

Installation of lower efficiency cogeneration plant by utilising waste gas is economically unviable option and also the plant has no requirement of steam. Hence, this is not a baseline scenario.

Realistic and credible alternatives for heat generation are not considered for baseline scenario as the project activity will not resulted in heat generation.

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or Sectoral policies as applicable

The possible fossil fuels can be used for new fossil fuel based captive power generation unit are coal, diesel and natural gas.

- Orissa is one of the three states (others are Chattisgarh and Jharkhand)[5] which have most of the coal deposits in India. This alternative has advantages like high PLF, well established technology, easily available char and coal fines to the company. Thus the cost per unit of power generation would be the lowest. This would however result in an equivalent amount of CO_2 emissions corresponding to the power generation in the captive power plant of the industrial facility. This is in compliance with all applicable legal and regulatory requirements and can be a baseline option.

- A diesel or furnace oil based captive power plant is an alternative which meets legal and regulatory requirements. Diesel or furnace oil is not abundantly available in Orissa as the state does not have a oil reserve. Also the nation imports oil from other countries to meet the oil demand[6]. This is not feasible as the cost of power generation is higher in comparison to the coal based CPP and grid power even though it has benefits like fast start-up and easily available fuel. The option will also result in GHG emissions to the existing scenario. Hence this is not an economically feasible alternative.

- Natural gas based captive power generation project in Iron and steel industry are very few in India. Though this alternative is in compliance with all applicable legal and regulatory requirements it's not feasible as natural gas is not available in this part of India[7]. Hence, this alternative is not considered as a baseline option.

The grid power procurement is one of the most attractive options to the project proponent. The power generation scenario of the eastern region is as follows:

Generation Type	Capacity (MW)
Coal based Power Plant	14,149.88
Hydro Power Plant	2,496.53
Renewable Power Plant	46.76

The eastern region has huge coal reserves of around 206 billion tonnes which assures the availability of fuel in future and hence the coal based thermal power plants situated in the region is more than 80% of the total power generating units situated. So, the identified baseline energy source (coal) of grid power is abundantly available in the region and as well as in the host country indicating no supply constraint.

Hence, identified alternative available to RSL for power generation is Coal based captive power generation and grid power procurement.

Step 3: Step 2 and/or step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used.

[5] Source: http://www.gsi.gov.in/N_India_coal_resource_07.pdf

[6] Source: http://petroleum.nic.in/petstat.pdf

[7] Source: http://petroleum.nic.in/ng.htm

According to the baseline methodology "Tool for the demonstration and assessment of additionality shall be used to identify the most plausible baseline scenarios by eliminating non-feasible options (e.g.; alternatives where barriers are prohibitive or which are clearly economically unattractive)".

Barriers:

Major barrier in installation of coal based captive power plant is investment barrier, as a huge amount of investment is required for installation of 8 MW coal based captive power plant in comparison with initial investment for connection of grid power.

Other barriers are recruitment of skilled and unskilled personnel for operation & maintenance of coal based captive power plant which is not required in case of grid power procurement and requirement of a storage yard for storing coal which incurs a huge cost to company.

Parameter	Grid power	Coal based CPP[8]
Capital cost	Rs. 20 - 25 million (for 8 MW power)	Rs. 42.5 – 45.0 million / MW[9]
Cost of power	Energy charge: Rs. 3.00 / kWh Demand charge : Rs. 200 / kVA[10]	Rs. 1.78 – 1.92 / kWh [11]

Hence, P6, Import of electricity from the grid can be considered as the most plausible baseline scenario in the proposed project activity as this requires minimum investment & minimum recruitment of man-power for maintenance, having low risk of low cost coal availability in future.

As per the baseline methodology ACM0012, Version 02 "this methodology is only applicable if the baseline scenario, for all the waste gas generator (s) and the recipient plant(s) identified, is one of the two scenarios described in Table 1" of the baseline methodology.

Based on the various scenarios mentioned in the approved methodology, Scenario 1 (Project scenario: Generation of Electricity or heat only) is selected for the project activity considering how project would have generated electricity in the baseline and how waste gas would have utilized.

It can be inferred that for the project activity, the baseline is *Scenario 1*which is a combination of:
Option P6: Sourced grid connected power plants
Option W2: Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere (waste pressure energy is not utilized)
Project Scenario: Generation of electricity only.

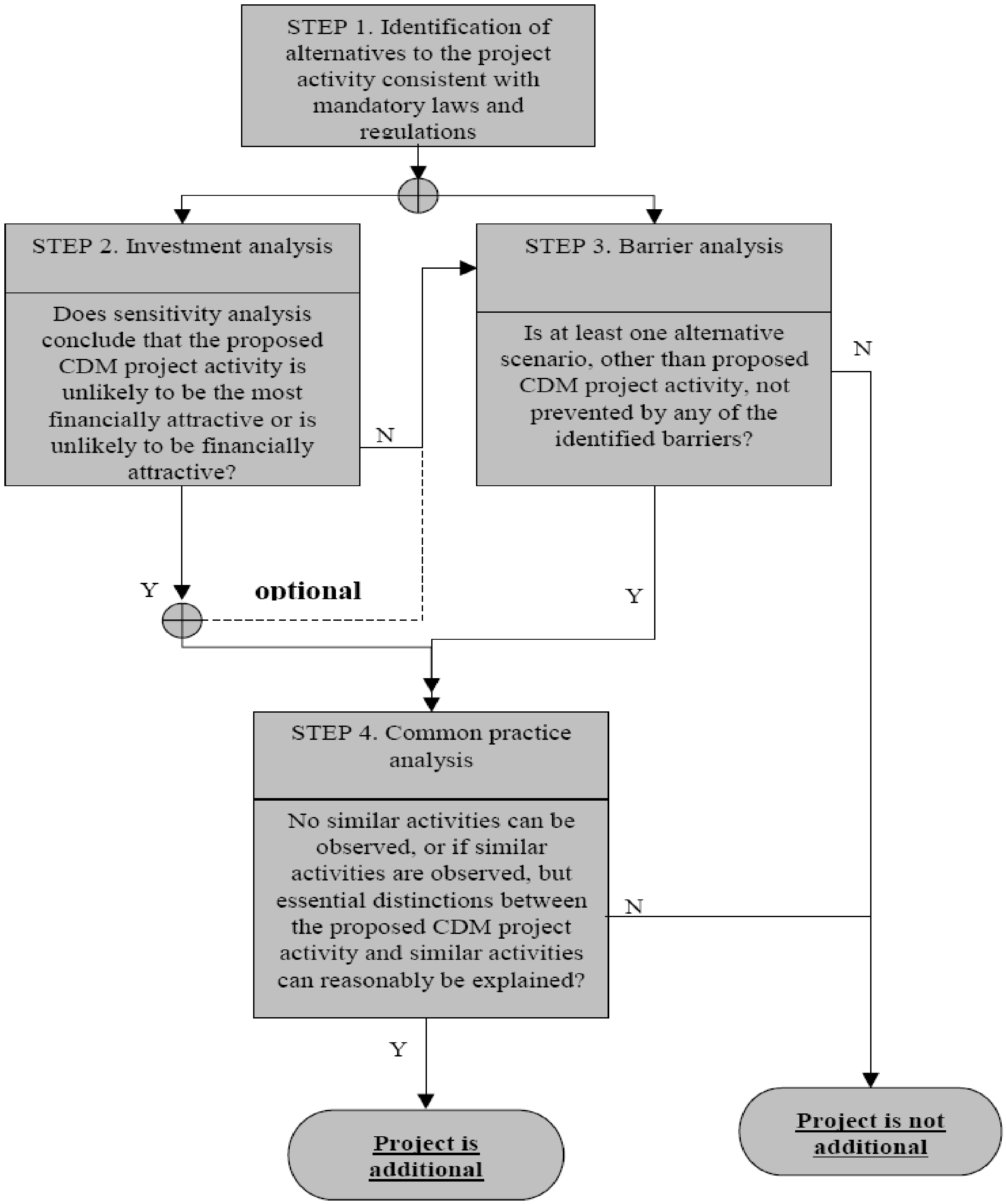
[8] Captive Power Plants- Case study of Gujarat India available at - http://iis-db.stanford.edu/pubs/20454/wp22_cpp_5mar04.pdf
9 Ref : Captive Power Plants : Case study of Gujarat, India
[10] Source : http://www.orierc.org/Orders/Tariff/03-04
11 Ref: Captive Power Plants: Case study of Gujarat, India

Scenario 1	Baseline Options		Description of situation
	Waste gas	Power / Heat	
1	W2	P6	The project proponent in absence of the project activity would have emitted waste gas emanating from DRI Kiln after incineration to remove traces of carbon mono-oxide and procured power from the regional grid to fulfil the demand.

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

According to the methodology ACM0012, version 02, "Tool for the demonstration and assessment of additionality, Version 04" is applied to demonstrate the additionality of the project activity.
As per the decision 17/CP.7 para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

The flow chart below provides a step-wise approach to establish additionality of the project activity:


STEP 1. Identification of alternatives to the project activity consistent with mandatory laws and regulations
STEP 2. Investment analysis
Does sensitivity analysis conclude that the proposed CDM project activity is unlikely to be the most financially attractive or is unlikely to be financially attractive?
STEP 3. Barrier analysis
Is at least one alternative scenario, other than proposed CDM project activity, not prevented by any of the identified barriers?
N
N
Y
optional
Y
STEP 4. Common practice analysis
No similar activities can be observed, or if similar activities are observed, but essential distinctions between the proposed CDM project activity and similar activities can reasonably be explained?
N
Y
Project is additional
Project is not additional

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

Sub-step 1a. Define alternatives to the project activity:

Sub-step 1b. Consistency with mandatory laws and regulations:

As discussed in section B.4 the feasible alternatives for electricity generation are as follows:
P4, On-site new coal based captive power generation
P6, Sourced grid connected power plants

This has already been described in B.4. and it is shown that all options are in compliance with the regulations of the Host Country and also the proposed project activity is not the only alternative. The baseline scenario identified is Scenario 1 which is a combination of:

Option P6: Sourced grid connected power plants
Option W2: Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere (waste pressure energy is not utilized)

Step 2: Investment analysis

According to the investment analysis the project proponent is required to determine whether the project activity is economically or financially less attractive than the most attractive alternative, without the revenue from the sale of certified emission reductions (CERs). Investment analysis is done as per the following steps:

Sub-step 2a. Determine appropriate analysis method

According to the "Tool for the demonstration and assessment of additionality (Version 04)" one of the three options viz; Simple Cost Analysis, Investment Comparison Analysis and Benchmark Analysis must be applied to determine whether the project is financially additional or not. Revenue of the project is determined by the cost savings gained through avoiding power purchase from the grid. Thus, a simple cost analysis cannot be done. Also investment comparison analysis is not applicable in this case as the project proponent does not have any expertise in captive power generation. The benchmark analysis is appropriate for this case as it can show the justification behind the investment decision for the project activity.

Sub-step 2 b. – Option III. Apply benchmark analysis

The project activity has a high investment as compared to investment for import of power from grid. The benchmark IRR for investment analysis is done considering the capital cost involved in the options available for RSL to make investment for their manufacturing activities. Revenue savings have been considered from the generation cost through waste heat recovery system against the suitable baseline options. The IRR has been calculated with and without CDM benefits for this project activity.

Sub-step 2c. Calculation and comparison of financial indicators:

The project IRR is 12.46% increasing to 16.03% with the inclusion of CER revenue. These calculations are based on a CER market price of € 10/ tCO_2e. The financial calculation is done by including all costs associated with the project activity. The costs include project cost, cost of grid based power, cost of power from captive power plant (coal based, waste heat recovery based, etc.) and other costs as applicable.

The data used for IRR estimation is as follows:

Particulars	Data	Unit
Plant capacity	12	MW
Operational days	290	days
Plant load factor	70%	
Auxiliary Consumption	11%	
Net Power Generation	52032.96	MWh p.a.
Electricity Tariff	3.00	Rs./kWh

Details of Cost for Power Plant:

Particulars	Amount (Lakhs INR)
Land & Land Development Cost	22.20
Building & Civil Construction	231.00
Plant & Machinery	2388.00
Misc. Fixed Assets	114.00
Taxes, duties & transport	497.42
Installation, erection and commissioning	43.00
Pre-operative expenses	65.00
Technical know-how	585.00
Cost of DG set	64.00

Source of Finance:

Project Cost	Lakhs INR
Total cost	3945.62
Equity	1546.68
Loan	2398.94

Step 3: Barrier Analysis

Operational Barrier:

<u>Fluctuation in waste gas generation:</u>

- As RSL depends on the captive power generation system for their production, the captive power plant operates in stand alone/isolation mode. The non-availability of waste gases due to any technical fault in the kilns prevents power generation in the project activity.

- If the heat content of the waste gas is not sufficient, the project activity will directly be affected since there are no inbuilt provisions to increase waste gas temperature through auxiliary fuel firing.

- Low capacity utilization of kilns would have direct impact on project's viability.
  As per Joint Plant Committee report "Survey of Sponge Iron Industry 2005-06". 77 units out of 147 coal based unit are going in for expansion in capacity. Jharkhand, Chattisgarh Orissa and West Bengal are states where majority of expansion activities will be commissioned. Also 58 more coal based units are under commissioning (as green field projects) in India.
  Constraints faced by sponge iron industry are:
  a) Raw Material
  b) Power
  c) Finance
  d) Labor
  The project proponent has to procure iron ore from the market from various sources. Due to change of sources the iron ore quality is inconsistent. As the grade "A" coal is not easily available; hence, coal of various grades as per availability is used. The variation in quality of coal also creates operational problem.
  Variation in quality & quantity of raw material like iron ore, coal etc due to above mentioned factors will directly affect unhindered operation of kiln at full capacity and thus resulting in uninterrupted supply of waste gas at high temperature from DRI kilns. Interrupted supply of waste gas will result in disrupted power generation and would have a detrimental effect on RSL's plant operation as the production of the plant primarily depends on induction furnace operation which run by the waste heat recovery based captive power plant. Under such situations RSL will generate power in DG sets installed at the plant to meet its power shortage which will incur huge cost to company.

- Cumulative effect of sustained variable frequency operation due to fluctuations in waste gas supply (at required temperature and at constant flow rate) may result in damage and decrease of life-time of equipments like steam turbine, generators and other power plant equipments and thus loss of asset for RSL.

- Non-availability of waste gas at the required temperature can also result in a complete closure of the project activity. Resumption of production process takes a long time. Hence, the power interruption even for a short spell destabilizes the manufacturing process, besides causing production loss and damage to the sophisticated equipments like steam turbo-generators due to thermal shock.

- Quality of steel products is heavily dependent on the quality of power supply. Poor quality of power supply not only results in reduced life of the equipment but also in poor quality of products.

Lack of relevant technical background:

Though RSL is mainly involved in steel manufacturing business, they are utilizing the waste heat of flue gas which would cause environmental pollution in absence of the project activity. As this is a diversification from the main business, they have employed skilled professionals for operation and maintenance of waste heat recovery based CPP which incur additional cost to company. As per Joint Plant Committee report “Survey of Sponge Iron Industry 2005-06” one of the constraints faced by the sponge iron industries is skilled labor crisis due to large no. of sponge iron industries are going for expansion and under-commissioning. This is a major constraint for RSL also.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives

It has been observed in Sub-step 3a that the project activity has its associated barriers to successful implementation. The barriers mentioned above are directly related to project activity only and do not inhibit implementation of either of the alternatives discussed in section B.4, such as the alternative of importing electricity from local grid.

Step 4: Common Practice Analysis

Coal based CPP and import of grid power are a common practice in the state of Orissa as the state is one of the three states (others Chattisgarh and Jharkhand) which has the highest coal deposits and also has enough power. At the time of implementation of the project activity, there were 73 sponge iron units[12] operational within the state and many more are in the process of starting operations. During the installation of waste heat recovery based power plant only 1 unit was situated in the district of Dhenkanal and 3 more are located in the neighboring district. Only 1 unit out of these units has Waste heat recovery based captive power facility which is in the district of Angul. Thus waste heat recovery based Captive power facility at iron & a steel industry is not a common practice in Orissa.

At the current scenario as per the Joint Plant Committee report “Survey of Indian Sponge Iron Industry 2005-06” lists the following:

1) Out of 147 surveyed Sponge Iron Industry of India, only 16 have captive power generation, only 4 out of these 16 are in Orissa.

2) In the state of Orissa almost every sponge iron plant that has put up WHRB power plant is based on CDM strength. Out of 73 sponge iron units in Orissa, till date, only four plants (Orissa Sponge Iron Ltd[13],

[12] Source: Orissa Sponge Iron Manufacturers’ Association, Bhubaneswar, Orissa

[13] Source: http://cdm.unfccc.int/Projects/registered.html (Ref No.: 0515)

Tata Sponge Iron Ltd.[14], Rourkela Steel Plant[15] and Shyam DRI Power Ltd[16]) have implemented Clean Development Mechanism project modalities for their waste heat recovery based captive power project to reduce GHG emission and avail the Carbon Credit revenues from sale of the carbon emission reductions.

3) The captive power generation based on WHRB (without CDM) is not sufficiently diffused in the region/ country, thus WHRB based captive power project is not prevailing practice.

CDM activity can not be treated as common practice as very few sponge iron industries has waste heat recovery based captive power plant.

Thus, the power requirement through the WHR process would not have been feasible to establish without the CDM opportunity due to above mentioned barriers.
Based on the above discussion to demonstrate the additionality, this project activity is additional as the anthropogenic emissions of GHG gases are reduced significantly, which otherwise would have occurred in the absence of this CDM project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Project Emissions Calculation:

Project Emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and electricity emissions due to consumption of electricity for cleaning of gas before being used for generation of heat/energy/electricity (According to the Approved Consolidated Methodology ACM0012, Version 01).

$PE_y = PE_{AF,y} + PE_{EL,y}$ ……………….. (1)

Where,

$PE_{y\ y}$ Project emissions due to project activity (tCO_2)

$PE_{AF,y}$ Project activity emissions from on-site consumption of fossil fuels by the cogeneration plant(s), incase they are used as supplementary fuels, due to non-availability of waste gas to the project activity or due to any other reason.

$PE_{EL,y}$ Project activity emissions from on-site consumption of electricity for gas cleaning equipment.

Baseline Emissions Calculation:

Baseline emissions for the year y shall be determined as follows:

$\boldsymbol{BE_y = BE_{En,y} + BE_{flst,y}}$ ……………….. (2)

Where,

[14] Source: http://cdm.unfccc.int/Projects/registered.html (Ref. No.: 0274)

[15] Source: http://cdm.unfccc.int/Projects/Validation/DB/LQJZ2CWJBLP6AC4EDVEC4YK7P748PQ/view.html

[16] Source: http://cdm.unfccc.int/Projects/Validation/DB/QZBLZO5Y1JV4CH5VXDZ8S5LNF3IA7M/view.html

BE_y are total baseline emissions during the year y in tons of CO_2
$BE_{En,y}$ are baseline emissions from energy generated by project activity during the year y in tons of CO_2
$BE_{flst,y}$ Baseline emissions from generation of steam, if any, using fossil fuel, that would have been used for flaring the waste gas in absence of the project activity (tCO_2e per year).This is relevant for those project activities where in the baseline steam is used to flare the waste gas.

Baseline emissions from generation of steam, using fossil fuel that would have been used for flaring waste gas in absence of the project activity is considered nil as the waste gas would not be flared in absence of the project activity.

The calculation of baseline emissions ($BE_{En,y}$) depends on the identified baseline scenario.
As the baseline scenario determined is Scenario 1 which represents the situation where the electricity is obtained from the grid. Baseline emissions from electricity ($BE_{electricity,\ y}$) that is displaced by the project activity shall be determined as follows:

$$BE_{En,\ y} = BE_{Elec,\ y}$$

$$BE_{Elec,y} = f_{cap} * f_{wg} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \ldots\ldots\ldots\ldots\ldots\ldots..\ (3)$$

Where,
$BE_{Elec,y}$ are baseline emissions due to displacement of electricity during the year y in tons of CO_2
$EG_{i,j,y}$ is the quantity of electricity supplied to the recipient j by generator, which in the absence of the project activity would have been sourced from ith source (I can be either grid or identified source) during the year y in MWh
$EF_{Elec,i,j,y}$ is the CO_2 emission factor for the electricity source (i= gr (grid) or i = is (identified source)), Displaced due to the project activity, during the year y in tons of CO_2/MWh
f_{wg} Fraction of total electricity generated by the project activity using waste gas
f_{cap} Energy that would have been produced in project year y using waste gas / heat generated in base year y.

Since the displaced electricity for RSL have been supplied by the connected grid system and the total electricity generation from the project activity is less than 60 GWh/yr, the emission factor for electricity system is done according to approved small-scale methodology AMS-I.D. The information pertaining to Eastern Region Grid has been used for this project activity. The CO_2 emission factor is provided by CEA. The detailed emission factor calculation is given in Annex 3.

As the part of electricity generated in units where both waste gas and other fuels are used and steam generated with different fuels in dedicated boilers are fed to turbine/s through common steam header the fraction of total electricity generated by the project activity using waste gas shall be calculated as follows:

$$f_{wg} = \frac{ST_{whr,\ y}}{ST_{whr,\ y} + ST_{other,\ y}} \quad \ldots\ldots\ldots\ldots\ldots\ldots..\ (4)$$

Where,
$ST_{whr,\ y}$ Energy content of the steam generated in waste heat recovery boiler fed to turbine via common steam header

$ST_{other, y}$ Energy content of steam generated in other boilers fed to turbine via common steam header

According to the methodology "the baseline emissions should be capped irrespective of planned/ unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuels type and quantity resulting into increase in waste gas generation". As the project activity is implemented in new facility, method 2 is used to calculate the same which is as follows:

$$f_{cap} = \frac{Q_{WG,BL}}{Q_{WG,y}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ (5)$$

$$Q_{WG,BL} = Q_{BL,product} * q_{wg,product} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ (6)$$

Where,
$Q_{WG,BL}$ Quantity of waste gas generated prior to the start of the project activity estimated using eqn 6 - in (Nm^3)
$Q_{BL,product}$ Production by process that most logically relates to waste gas generation in baseline. This is estimated based on 3 years average prior to start of project activity.
$Q_{wg,product}$ Amount of waste gas/heat/pressure the industrial facility generates per unit of product generated by the process that generates waste gas/heat/pressure.

Leakage Emissions Calculation:

The leakage emission is not considered as per the methodology ACM0012, Version 02. Hence, leakage emission is zero.

Emission Reduction Calculation:

The emission reduction due to the proposed project activity during the year y is calculated according to the Approved Consolidated Methodology ACM0012, Version 02, as follows:

$$\boldsymbol{ER_y = BE_y - PE_y} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ (7)$$

Where,
ER_y are the total emissions reductions during the year y (in tons of CO_2),
BE_y are the baseline emissions for the project activity during the year y (in tons of CO_2),
PE_y are the emissions from the project activity during the year y (in tons of CO_2),

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

Data / Parameter:	$EF_{grid,y}$
Data unit:	tCO_2 / MWh
Description:	CO_2 baseline emission factor for the grid electricity displaced due to the project activity during the year y
Source of data used:	Central Electricity Authority "CO_2 Baseline Database for the Indian Power Sector" Version 2, June 2007

Value applied:	1.05 tCO_2 / MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	CEA has calculated Combined margin (including inter-regional and cross-border electricity transfers) according to methodology ACM0002 (Version 06) for the year 2005 - 2006.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Project Emission:

The project activity is only electricity generation and no fossil fuel will be combusted during start-up of captive power plant. So, according to the methodology the project emission due to auxiliary fossil fuel consumption is not calculated.

$$\mathbf{PE_y} = 0.0 \ tCO_2e \ / \ annum$$

Baseline Emission:

$\boldsymbol{BE_y} = \mathbf{BE_{En,y}} + \mathbf{BE_{flst,y}}$

As the waste gas would not be flared by using fossil fuels in absence of the project activity, the baseline emission due to flaring the waste gas is considered zero.
$\mathbf{BE_{flst,y}} = 0 \ tCO_2$ / year

$BE_{Elec,y} = f_{cap} * f_{wg} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y})$

Baseline emission factor ($EF_{Elec,i,j,y}$) is determined as 1.05 tCO_2 / MWh calculated by CEA, India.

$BE_{Elec,y} = 34602 \ tCO_2$ / year

The yearly net power generation from the project activity is 32954.21 MWh.

As the project activity is 12 MW captive power generation of which 8 MW is from waste gas and rest 4 MW is fossil fuel (coal & char) based so f_{wg} is calculated as follows:

$$f_{wg} = \frac{ST_{whr,y}}{ST_{whr,y} + ST_{other,y}}$$

$f_{wg} = 0.63$

Total energy content of steam from WHRB ($ST_{whr,y}$) is calculated as follows:

Total energy content of steam from WHRB in kcal ($ST_{whr,y}$)
= Difference between enthalpy of steam at WHRB outlet and enthalpy of feed water (kcal/kg) * Total steam flow from WHRB (kgs/day)
= $h_1 * S_1$

$ST_{whr, y}$ = 2.594TJ/day
Where,
h_1 = 679.46 kcal/kg
S_1 = 912 TPD

The enthalpy of steam and feed water are calculated based on average temperature and pressure of the steam and feed water for the day and steam flow from WHRB per day is measured by the steam flow meter installed at the WHRB outlet.

Similarly, Total energy content of steam from other boiler i.e.; AFBC boiler ($ST_{other, y}$) is calculated as follows:

Total energy content of steam from AFBC boiler in kcal ($ST_{other, y}$)
= Difference between enthalpy of steam at AFBC boiler outlet and enthalpy of feed water (kcal/kg) * Total steam flow from AFBC boiler (kgs/day)
= $h_2 * S_2$

$ST_{other, y}$ = 1.502 TJ/day
Where,
h_2 = 679.46 kcal/kg
S_2 = 528 TPD

The enthalpy of steam and feed water are calculated based on average temperature and pressure of the steam and feed water for the day and steam flow from AFBC boiler per day is measured by the steam flow meter installed at the outlet of AFBC boiler.

The project activity along-with production unit (which consist DRI kilns) will be implemented jointly and also the project proponent is not going to change the fossil fuel quality and type. According to the methodology f_{cap} is considered as 1 if the waste gas generated in the year y is same or less than that generated in the base year.

$EG_{i,j,y} = EG_{NET}CPP$

$= EG_{GROSS}CPP - EG_{AUX}CPP$

= (58464.0 – 6431.04) MWh / year

= 52032.96 MWh / year

Baseline emission estimation:

Operating Years	Estimation of Net Electricity generation, EG_y (MWh/annum)	Estimation of Emission factor, EF_y (tCO_2e/MWh)	Estimation of baseline emissions BE_y (tCO_2e/annum)
April 08 – March 09	32954.21	1.05	34,602
April 09 – March 10	32954.21	1.05	34,602
April 10 – March 11	32954.21	1.05	34,602
April 11 – March 12	32954.21	1.05	34,602
April 12 – March 13	32954.21	1.05	34,602
April 13 – March 14	32954.21	1.05	34,602
April 14 – March 15	32954.21	1.05	34,602
April 15 – March 16	32954.21	1.05	34,602
April 16 – March 17	32954.21	1.05	34,602
April 17 – March 18	32,954.21	1.05	34,602
Total (tonnes of CO_2e)	**329,542**		**346,021**

According to B.6.1 the emission reduction of the project activity is the baseline emission of the project, namely:

$$ER_y = BE_y = EG_y * EF_{electricity, y}$$

Thus estimated annual baseline emission is 34,602 tCO_2e per annum.

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

The emission reduction due to project activity is calculated according to the formulae described in Section B.6.1.

Operating Years	**Estimation of project activity emissions (tCO_2e)**	**Estimation of baseline emissions (tCO_2e)**	**Estimation of leakage (tCO_2e)**	**Estimation of overall emission reductions (tCO_2e)**
April 08 – March 09	0	34,602	0	34,602
April 09 – March 10	0	34,602	0	34,602
April 10 – March 11	0	34,602	0	34,602
April 11 – March 12	0	34,602	0	34,602
April 12 – March 13	0	34,602	0	34,602
April 13 – March 14	0	34,602	0	34,602
April 14 – March 15	0	34,602	0	34,602
April 15 – March 16	0	34,602	0	34,602
April 16 – March 17	0	34,602	0	34,602
April 17 – March 18	0	34,602	0	34,602
Total (tonnes of CO_2e)	**0**	**346,021**	**0**	**346,021**

The emission reduction due to the project activity is 34,602 tCO_2 per annum.

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_{GROSS} CPP
Data unit:	MWh / yr
Description:	Gross power generation by the 12 MW captive power unit
Source of data to be used:	Metered and data recorded in log book and electronic spread sheet.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Expected annual gross electricity generation is 58464.0 MWh.

Description of measurement methods and procedures to be applied:	Gross electricity generation from the facility will be monitored on hourly basis through digital control system of the power plant.
QA/QC procedures to be applied:	Quality control and quality assurance procedures are planned for monitoring of the project related data as the data will be used as a supportive documentation to calculate gross electricity generation by the WHR based power generation unit. The uncertainty level of data archived is low as the measuring instruments will be installed and calibrated according to requirement.
Any comment:	The data measured will be hourly archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be kept for a period of two years after the end of the crediting period.

Data / Parameter:	EG_{AUX} CPP
Data unit:	MWh / yr
Description:	Auxiliary power consumption by the 12 MW captive power unit
Source of data to be used:	Metered and data recorded in log book and electronic spread sheet.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Expected annual auxiliary consumption is 6431.04 MWh.
Description of measurement methods and procedures to be applied:	Auxiliary consumption from the facility will be monitored on hourly basis through digital control system of the power plant.
QA/QC procedures to be applied:	Quality control and quality assurance procedures are planned for monitoring of the project related data as the data will be used as a supportive documentation to calculate auxiliary consumption by the WHR based power generation $unit_2$. The uncertainty level of data archived is low as the measuring instruments will be installed and calibrated according to requirement.
Any comment:	The data measured will be hourly archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be kept for a period of two years after the end of the crediting period.

Data / Parameter:	EG_{GROSS} WHR
Data unit:	MWh / yr
Description:	The annual gross electricity generation from the WHR based Captive power unit
Source of data to be used:	Recorded data from log book and electronic spread-sheet
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Expected annual electricity generation is 37027.2 MWh.
Description of measurement methods and procedures to be applied:	The gross power generation by the WHR based captive power facility will be estimated by multiplying total gross power generation by the Captive power plant with the fraction of energy produced using waste gas. The data will be recorded on hourly basis. EG_{GROSS} WHR = f_{wg} * EG_{GROSS}CPP
QA/QC procedures to be applied:	Quality control and quality assurance procedures are planned for monitoring of the project related data as the data will be used as a supportive documentation to calculate baseline emission. The uncertainty level of data archived is low as the energy meters will be maintained and calibrated as per industry standards.
Any comment:	The data measured will be hourly archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be kept for a period of two years after the end of the crediting period.

Data / Parameter:	EG_{AUX} WHR
Data unit:	MWh / yr
Description:	Auxiliary power consumption by the 8 MW waste heat recovery based captive power unit
Source of data to be used:	Calculated based on the total auxiliary consumption by the captive power plant and fraction of energy produced using waste gas.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Expected annual auxiliary consumption for this unit is 4072.99 MWh.
Description of measurement methods and procedures to be applied:	The auxiliary consumption by the WHR based captive power facility will be estimated by multiplying total auxiliary consumption by the Captive power plant with the fraction of energy produced using waste gas. The data will be recorded on hourly basis.

	EG_{AUX} WHR = f_{wg} * EG_{AUX}CPP
QA/QC procedures to be applied:	Quality control and quality assurance procedures are planned for monitoring of the project related data as the data will be used as a supportive documentation to calculate net power generation by the project activity. The uncertainty level of data archived is low as the measuring instruments will be installed and calibrated according to requirement.
Any comment:	The data measured will be hourly archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be kept for a period of two years after the end of the crediting period.

Data / Parameter:	EG_{NET}WHR
Data unit:	MWh / yr
Description:	The net electricity generation by the project activity per annum
Source of data to be used:	Calculated based on the gross power generation by the project activity and auxiliary consumption of the project activity.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The estimated annual electricity generation from the captive power unit is 32954.21 MWh.
Description of measurement methods and procedures to be applied:	The net power generation from the captive power $unit_1$ will be estimated by subtracting auxiliary power consumption by the captive power unit from gross power generation by the captive power unit. The data will be recorded on hourly basis. EG_{NET}WHR = (EG_{GROSS} WHR - EG_{AUX}WHR)
QA/QC procedures to be applied:	Quality control and quality assurance procedures are planned for monitoring of the project related data as it will be used as a supportive documentation to calculate baseline emission. The uncertainty level of data archived is low as the measuring instruments will be installed and calibrated as per manufacturer's specification.
Any comment:	The data measured will be hourly archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be kept for a period of two years after the end of the crediting period.

Data / Parameter:	S_1
Data unit:	kgs / day
Description:	Quantity of Steam flow at outlet of waste heat recovery boiler

Source of data to be used:	Metered through steam flow meter provided at the outlet of waste heat recovery boiler
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The data is required to calculate the total enthalpy of the steam from WHRB.
Description of measurement methods and procedures to be applied:	Log book maintained based on the DCS data which receive data from steam flow meters. The data is required to calculate the enthalpy of steam generated from the WHRB. The data will be daily recorded.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based power generation unit. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	S_2
Data unit:	kgs / day
Description:	Quantity of Steam flow at outlet of AFBC boiler
Source of data to be used:	Metered through steam flow meter provided at the outlet of AFBC boiler
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The data monitored is required to calculate the total enthalpy of the steam generated within the AFBC boiler.
Description of measurement methods and procedures to be applied:	Log book maintained based on the DCS data which receive data from steam flow meters. The data is required to calculate enthalpy of steam generated from AFBC boiler. The data will be monitored on daily basis.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based power generation unit. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	T_1
Data unit:	^0C
Description:	Steam temperature at the outlet of Waste heat recovery boiler
Source of data to be used:	Monitored through temperature meter installed at the outlet of WHRB
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The data is required to estimate enthalpy of the steam generated from the WHRB
Description of measurement methods and procedures to be applied:	Log book maintained on the basis of DCS data which receive data from temperature meter installed at the WHRB outlet. The data is required to calculate enthalpy of the steam generated from the WHRB. The data will be daily monitored.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the project activity. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	T_2
Data unit:	^0C
Description:	Steam temperature at the outlet of AFBC boiler
Source of data to be used:	Monitored through temperature meter provided at the outlet of AFBC boiler
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The monitored data is required to estimate the enthalpy of the steam generated from the AFBC boiler.
Description of measurement methods and procedures to be applied:	Log book maintained on the basis of DCS data which receive data from temperature meter installed at the AFBC boiler outlet. The data is required to calculate enthalpy of the steam generated from the AFBC boiler. The data will be daily monitored.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based captive power generation unit. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial

	facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	P_1
Data unit:	kg/cm^2
Description:	Steam pressure at the outlet of waste heat recovery boiler
Source of data to be used:	The pressure gauge provided at the outlet of waste heat recovery boiler
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The monitored data is required to estimate the enthalpy of the steam generated from the WHRB.
Description of measurement methods and procedures to be applied:	Log book maintained on the basis of DCS data which receive data from pressure gauge installed at the outlet of WHRB. The data is required to calculate enthalpy of steam generated within the WHRB.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based captive power generation unit. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	P_2
Data unit:	kg / cm^2
Description:	Steam pressure at the outlet of AFBC boiler
Source of data to be used:	The pressure gauge provided at the outlet of AFBC boiler
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The monitored data is required to estimate the enthalpy of the steam generation from the AFBC boiler.
Description of measurement methods and procedures to be applied:	Log book maintained on the basis of DCS data which receive data from pressure gauge installed at the outlet of AFBC boiler. The data is required to calculate enthalpy of steam generated within the AFBC boiler.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based captive power generation unit. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.

Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	$T_{feed\ water\ 1}$
Data unit:	^{0}C
Description:	Temperature of feed water at the inlet of WHR boiler
Source of data to be used:	Monitored through temperature meter provided at the inlet of WHR boiler
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The monitored data is required to estimate the enthalpy of the feed water for the WHR boiler.
Description of measurement methods and procedures to be applied:	Log book maintained on the basis data received from temperature meter installed at the WHR boiler inlet. The data is required to calculate enthalpy of the feed water for the WHR boiler. The data will be daily monitored.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based captive power generation unit. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	$T_{feed\ water\ 2}$
Data unit:	^{0}C
Description:	Temperature of feed water at the inlet of AFBC boiler
Source of data to be used:	Monitored through temperature meter provided at the inlet of AFBC boiler
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The monitored data is required to estimate the enthalpy of the feed water for the AFBC boiler.
Description of measurement methods and procedures to be applied:	Log book maintained on the basis data received from temperature meter installed at the AFBC boiler inlet. The data is required to calculate enthalpy of the feed water for the AFBC boiler. The data will be daily monitored.

QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based captive power generation unit. The uncertainty level of data is low as the measuring instruments will be calibrated as per manufacturer's specification.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	$ST_{whr, y}$
Data unit:	kcal /day
Description:	Total energy content of the steam generated in WHRB fed to turbine via common steam header
Source of data to be used:	The total energy content is calculated based on the difference of enthalpy of steam generated in the WHRB and enthalpy of feed water.
Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The data is required for calculation of the gross electricity generation from the WHR system.
Description of measurement methods and procedures to be applied:	The total energy (kcal) content of the steam generated in WHRB is calculated by = Difference between enthalpy of steam at WHRB outlet and enthalpy of feed water (kcal/kg) * Total steam flow from WHRB (kgs/day) $= h_1 * S_1$ The data will be recorded on daily basis.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data is required to calculate total electricity generation from the project activity.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after crediting period

Data / Parameter:	$ST_{other, y}$
Data unit:	kcal / day
Description:	Total energy content of the steam generated in other boiler (AFBC boiler) fed to turbine via common steam header.
Source of data to be used:	The total energy content is calculated based on the difference of enthalpy of steam generated in the AFBC boiler and enthalpy of feed water.

Value of data applied for the purpose of calculating expected emission reductions in section B.6	100%. The data is required for calculation of the gross electricity generated from the AFBC boiler.
Description of measurement methods and procedures to be applied:	The total energy (kcal) content of the steam generated in AFBC boiler is calculated by = Difference between enthalpy of steam at AFBC boiler outlet and enthalpy of feed water (kcal/kg) * Total steam flow from AFBC boiler (kgs/day) = $h_2 * S_2$ The data will be recorded on daily basis.
QA/QC procedures to be applied:	Quality control & quality assurance procedure are planned as the data monitored is required to calculate total electricity generation from the WHR based captive power unit.
Any comment:	The data measured will be daily archived both in paper and electronic spreadsheet whereby the paper documentation will be kept with the industrial facility for the period of one year and the electronic data will be maintained till 2 years after the crediting period.

B.7.2 Description of the monitoring plan:

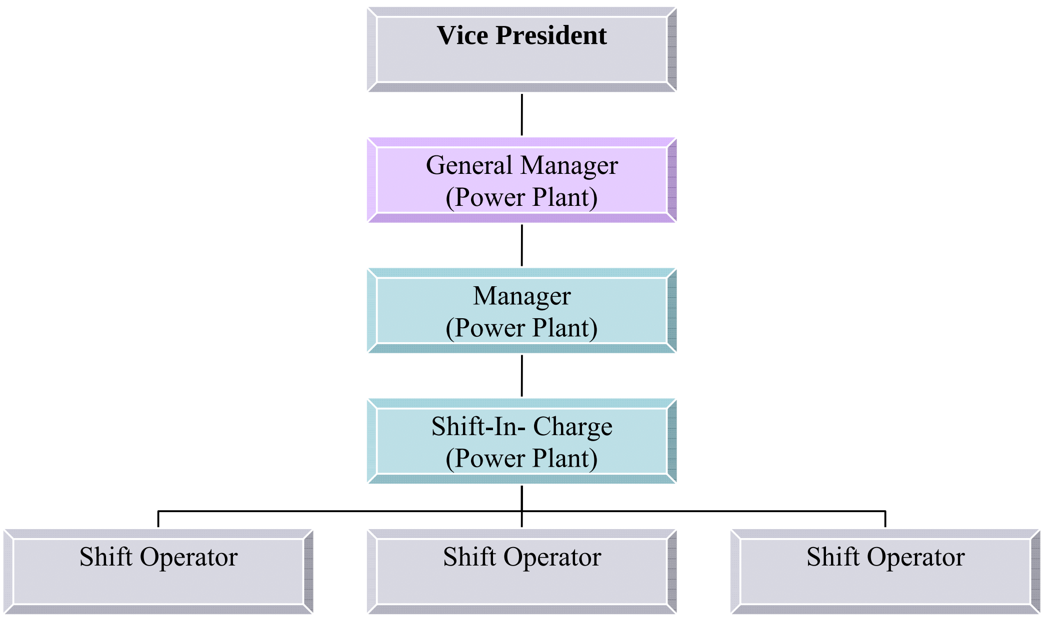
The monitoring plan defines the procedures and responsibilities for GHG performance, monitoring, measurement, reporting of data and dealing with uncertainties and covers the responsibilities regarding plant operation and maintenance.

Vice President will be in charge of all CDM related matters. General Manager of captive power plant will be responsible for complete operation, maintenance and management of entire captive power plant and will assist the Vice president in all CDM related matters. Power Plant Manager will be responsible for operation, maintenance, record handling and review of the monitoring plan according to methodology. He will ensure quality of the data monitored and recorded. He will be responsible for monthly reporting to the General Manager. Shift In-charge of Power Plant will be responsible for monitoring measurements and daily reporting. Shift in-charge of power plant will assist the Manager of Power plant in record handling, record checking and review. He will check the data recorded by the operator of each section and report to Power plant Manager. Three shift operators of each section like boilers, turbine etc will record the data of the project activity continuously which is represented in the section B.7.1. According to the monitoring frequency mentioned in the previous section the operator will measure data and record in the log- book and report it to shift in-charge.

RSL will engage its existing resources and also recruit new resources to manage, monitor and ensure quality control of the monitoring and recording of the desired data for the CDM project activity. RSL will calibrate all the measuring instruments for quality assurance of the data monitored.

Formation of CDM team:

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



The details are given below:

Designation	Responsibility
Vice President	Responsibility of compliance with CDM related matters
General Manager (Captive power plant)	Responsibility of complete operation & maintenance of entire captive power plant.
Manager (Captive Power Plant)	Responsibility of completeness of data. Quality assurance of data gathered by the Shift in- charge of CPP. Monthly reporting to the General Manager of power plant.
Shift In-charge (Captive Power Plant)	Responsibility of calibration of meters, review of data recorded by shift operators, daily report formation for CPP.
Shift Operators (Boilers, Turbine, RO plant)	Responsibility of continuous data recording and maintenance of equipments and calibrating instruments of CPP.

The detailed monitoring plan is given in the Annex 4

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

The baseline study is done by the consulting team: Verve Consulting Private Limited.

Date of completion of baseline: 08/08/07

Verve Consulting Private Limited
4387 / 4819 – A, Tankapani Road,
Bhubaneswar – 751018, India
www.verveconsult.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

July, 2004

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

20 years

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

C.2.1. Renewable crediting period

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

April, 2008

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

As per Article 12 of the Kyoto Protocol CDM project activity should be contributed to the sustainable development of the host country. Hence assessment of project's impacts on the local environment and on society is key element of the project.

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

Air pollution mitigation:

- Thermal pollution is reduced which would occur in absence of the project activity due to emission of waste gases of 950 – 1000 ^{o}C from DRI kiln into atmosphere. The flue gas having the temperature of 150 ^{o}C is released to the atmosphere due to waste heat based CPP.

- The project is reducing ash and particulate emission which would be emitted in absence to the project activity. The exit gases from the kiln, after maximum heat recovery in WHRB are passed through Electro Static Precipitators (ESP) to arrest the dust particles and thus control dust emission up to 75 mg/Nm^3. The dust particles are collected in the hoppers (installed below the ESP) and conveyed by means of conveyors and are dumped in the earmarked area within the plant site. This will be further disposed by trucks. Also emission of sulphur di-oxide, oxides of nitrogen is reduced by cleaning through Dry gas cleaning system which would emit in absence of the project activity.

- The project is generating electricity without emitting additional GHGs. The DRI Kiln off gas is passed through After Burning Chamber to burn out the traces of carbon mono-oxide present in the flue gas. RSL would purchase grid power in absence of the project activity which results in GHG emission.

- During construction phase the environmental impact is negligible and also it is a temporary impact. Therefore, it does not affect the environment considerably.

Green Belt Development:

- Green Belt is being developed in 10 acres of land for plantation of non-fruit bearing and fast growing trees to improve the aesthetics as well as to contain the fugitive dust emission. Unpaved areas within the plant site are provided with grass cover to help reduce noise pollution and air pollution.

Land:

- The project activity is not affecting forest, local flora & fauna. No human displacement or re-settlement has happened due to the project activity.

Water pollution mitigation:

- No discharge will be there outside the premises. Hence due to the zero discharge condition, no adverse impact will be there in the water regime.
- The fly ash in the form of slurry is settled in ash pond and the overflowing water is either recycled or reused.

All efforts are done to create a cleaner environment. The emission levels from the stack, ambient air quality around the plant; noise levels are periodically monitored.

Conclusion:

Project activity is environment friendly and is generating employment and other benefits. The project will attain sustainable development of the region.

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

The project activity does not require Environmental Impact Assessment study as per the regulation of Host Country by Ministry of Environment & Forest. The project activity has received Consent to Establish from Pollution Control Board. RSL has already accomplished successful trial run after getting the permission of trial run from Orissa State Pollution Control Board. They have applied for Consent to Operate from the Orissa State Pollution Control Board.

SECTION E. Stakeholders' comments

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

As per the statutory requirement of CDM projects, to take the opinion of the concerned stakeholders on the waste heat recovery based CDM project of Rana Sponge Limited, stakeholders' consultative meeting was organised by the industry on 21st May, 2007 at the industry premises of Rana Sponge Limited located at the Kulei village of Dhenkanal district.

The meeting was invited by public notice in regional newspaper and in the English newspaper along with the personal invitation to each of the concerned stakeholders to present their views on the CDM project initiatives taken by RSL.

The following are stake holders present at the meeting to keep the transparency in the operational activity of the project promoter and thereby meeting local/ environmental regulations.

1. District Magistrate, Dhenkanal
2. Block Development Officer, Parjang
3. Village Sarpanch, Kulei village
4. Regional Officer, Orissa Pollution Control Board
5. Representative from Village Committee Member, Kulei village
6. Representative from Village Committee Member, Kulei village
7. Local Representative, Kulei village
8. Chairman, Rana Sponge Ltd.
9. Vice President, Rana Sponge Ltd.
10. General Manager (Gen. Admn.), Rana Sponge Ltd.
11. General Manager (CPP), Rana Sponge Ltd
12. Manager (P & A), Rana Sponge Ltd
13. Manager (F & A), Rana Sponge Ltd
14. Liaison Officer, Rana Sponge Ltd
15. Safety Officer, Rana Sponge Ltd
16. Furnace In- charge, Rana Sponge Ltd
17. In-charge of Rolling Mill Division, Rana Sponge Ltd.
18. CDM Consultants, Verve Consulting Pvt. Ltd.

The mechanism of waste heat recovery as power project and the Clean Development Mechanism project of Rana Sponge Limited was introduced by the Vice President of RSL and CDM consultant jointly. Then the technical principle and process flowchart, as well as the project environment impact related to environment benefits were introduced in detail by the CDM consultants.

E.2. Summary of the comments received:

RSL management apprised the local representatives of Kulei village about the project activity. The District Magistrate, Block Development Officer, Village Sarpanch appreciated and Regional Officer from the Orissa Pollution Control Board appreciated the Clean Development Mechanism concept and its benefits. They encouraged this initiative made by Rana Sponge Limited.

The salient details are as follows:

After company officials and CDM consultants explained the project activity following questions were raised during meeting and replied.

Questions	Reply
Environmental effect of the project activity	The CDM consultant explained that the project itself controls the pollution by reducing thermal and air pollution through utilisation of waste heat of flue gas emanating from DRI kiln and also by reducing fossil fuel consumption for power generation.
Can RSL generate surplus power so that local people can be benefited?	Officials from RSL clarified that RSL can't generate more than 8 MW as the design capacity of DRI Kiln is for 8 MW only.
Waste generated within industry premises.	Waste generated from the project activity is fly ash only which is disposed for land filling in the plant site. Fly ash is collected from the waste gas emitting from DRI Kiln which is utilised in waste heat recovery boiler for power generation.
Possibility of damage to the local environment & on the health of local people	There is no detrimental effect on local people health due to the project activity as the project is non-polluting activity and also reducing thermal pollution.

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

No negative comment was reported from stake holders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Rana Sponge Limited
Street/P.O. Box:	Remuan, Hatatota
Building:	Pradhan Bhawan
City:	Talcher
State/Region:	Orissa
Postfix/ZIP:	759100
Country:	India
Telephone:	+91- 06762 - 292526
FAX:	+91- 0674- 2301485, +91-06760 - 242401
E-Mail:	ranasponge@rediffmail.com
URL:	
Represented by:	
Title:	Chairman
Salutation:	
Last Name:	Rana
Middle Name:	Qamruzama
First Name:	Hazi
Department:	
Mobile:	
Direct FAX:	+91- 0674 - 2301485
Direct tel:	+91- 0674 - 2300243
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project.

Annex 3

BASELINE INFORMATION

As the Orissa grid is part of the eastern regional grid the emission factor of Eastern region is considered.

EMISSION FACTORS:

Weighted Average Emission Rate (tCO2/MWh) (excl. Imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.72	0.73	0.74	0.71	0.71	0.71
East	1.09	1.06	1.11	1.10	1.08	1.08
South	0.73	0.75	0.82	0.84	0.78	0.74
West	0.90	0.92	0.90	0.90	0.92	0.87
North-East	0.42	0.41	0.40	0.43	0.32	0.33
India	0.82	0.83	0.85	0.85	0.84	0.82
Simple Operating Margin (tCO2/MWh) (excl. Imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.98	0.98	1.00	0.99	0.97	0.99
East	1.22	1.22	1.20	1.23	1.20	1.16
South	1.02	1.00	1.01	1.00	1.00	1.01
West	0.98	1.01	0.98	0.99	1.01	0.99
North-East	0.73	0.71	0.74	0.74	0.71	0.70
India	1.02	1.02	1.02	1.03	1.03	1.02
Build Margin (tCO2/MWh) (excl. Imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.53	0.60
East					0.90	0.97
South					0.71	0.71
West					0.77	0.63
North-East					0.15	0.15
India					0.70	0.68
Combined Margin (tCO2/MWh) (excl. Imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.76	0.76	0.77	0.76	0.75	0.80
East	1.06	1.06	1.05	1.07	1.05	1.06
South	0.87	0.85	0.86	0.86	0.85	0.86
West	0.87	0.89	0.88	0.88	0.89	0.81
North-East	0.44	0.43	0.44	0.44	0.43	0.42
India	0.86	0.86	0.86	0.86	0.86	0.85

Weighted Average Emission Rate (tCO2/MWh) (incl. Imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.72	0.73	0.74	0.71	0.72	0.72
East	1.09	1.03	1.09	1.08	1.05	1.05
South	0.74	0.75	0.82	0.84	0.78	0.74
West	0.90	0.92	0.90	0.90	0.92	0.88
North-East	0.42	0.41	0.40	0.43	0.48	0.33
India	0.82	0.83	0.85	0.85	0.84	0.81

Simple Operating Margin (tCO2/MWh) (incl. Imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.98	0.98	1.00	0.99	0.98	0.99
East	1.22	1.19	1.17	1.20	1.17	1.13
South	1.03	1.00	1.01	1.00	1.00	1.01
West	0.98	1.01	0.98	0.99	1.01	0.99
North-East	0.73	0.71	0.74	0.74	0.84	0.70
India	1.01	1.02	1.02	1.02	1.02	1.02

Build Margin (tCO2/MWh) (not adjusted for imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.53	0.60
East					0.90	0.97
South					0.71	0.71
West					0.77	0.63
North-East					0.15	0.15
India					0.70	0.68

Combined Margin in tCO2/MWh (incl. Imports)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.76	0.76	0.77	0.76	0.75	0.80
East	1.06	1.05	1.04	1.05	1.04	1.05
South	0.87	0.85	0.86	0.86	0.85	0.86
West	0.87	0.89	0.88	0.88	0.89	0.81
North-East	0.44	0.43	0.44	0.44	0.49	0.42
India	0.85	0.86	0.86	0.86	0.86	0.85

Annex 4

MONITORING INFORMATION

The purpose of monitoring is to achieve actual and credible emission reduction estimation on the part of the project activity. The project proponent therefore needs to monitor and archive data required for estimation of the baseline and project emission. The baseline emission being solely dependent on the amount of electricity generated by the waste heat recovery based captive power generation system; the data to be monitored for baseline emission calculation is as follows:

Data to be monitored:

1. Steam quantity from WHRB in project activity
2. Steam quantity from AFBC boiler
3. Temperature of steam from WHRB
4. Pressure of steam from WHRB
5. Temperature of steam from AFBC boiler
6. Pressure of steam from AFBC boiler
7. Temperature of feed water for WHRB
8. Temperature of feed water for AFBC boiler
9. Gross power generation from turbine in power plant
10. Auxiliary power consumption in power plant

Detail of monitoring plan is given below:

Calibration of relevant instruments:

Since the reliability of the monitoring system is limited by the accuracy of the measurement system and the quality of the relevant equipment, all measuring instruments would be calibrated at least once a year to ensure the reliability of the system and the accuracy of the readings. Once the meters are found to be malfunctioning or registering data outside the acceptable limits of accuracy, it shall be repaired, re-calibrated or replaced as soon as possible.

Recording and the preservation of relevant data:

The monitoring data will be daily recorded both in electronic spreadsheet and log-book, and then kept for two years. The writing of monitoring data must be normative and can not be optionally altered. If the monitoring data assuredly need to be adjusted, it will be modified after being approved by the manager of the power-plant. The person who modified the monitoring data must make a signature where the modification has been made. In remarks column, the reason why the monitoring data are modified and modifying data will be written, and the signature will also be required.

The authenticity, veracity, timeliness and standardization of the monitoring data should be checked by Shift In-charges. Based on daily monitoring data, the monthly monitoring report must be compiled carefully. And the monthly monitoring report must be submitted to the General Manager of the power plant, who will verify this monthly monitoring report.
All monitoring data will be preserved throughout the whole 10 years crediting period and the following two years. Necessary back-up of monitoring data will be done at regular intervals.

Maintenance of instruments and equipments used in data monitoring:

The operation & maintenance (Electrical & Mechanical) department is responsible for the proper functioning of the equipments/ instruments and inform the concerned department for corrective action if found not operating as required. Corrective action will be taken by the concerned department and a report on corrective action taken will be maintained time to time along with the details of problems will be rectified.

CDM Team and Responsibility:

1. Operator – Captive power plant: The person will be responsible for ensuring proper running of the equipments in terms of routine checks on daily basis, periodical maintenance. The person will also be entitled for observing the operation of data recording through DCS control system pertaining to the quantity of electricity generated.

2. Technician – Captive power plant: The person will be responsible for proper functioning of the captive power plant. The individual will also be responsible to cross check the reading of the energy meter and intimate the project proponent under improper functioning of the same.

3. Supervisor – Operation & maintenance department: The person concerned will be responsible for operation and periodic maintenance pertaining to immediate replacement of parts worn out or damaged of the captive power units. The person is also entitled to ensure proper monitoring of the data/parameters. The responsibility can be broadly classified as:

    - Ensuring Preventive Maintenance
    - Ensuring Break Down Maintenance
    - Machine operation including resetting
    - Ensuring transparency and correctness of recording.

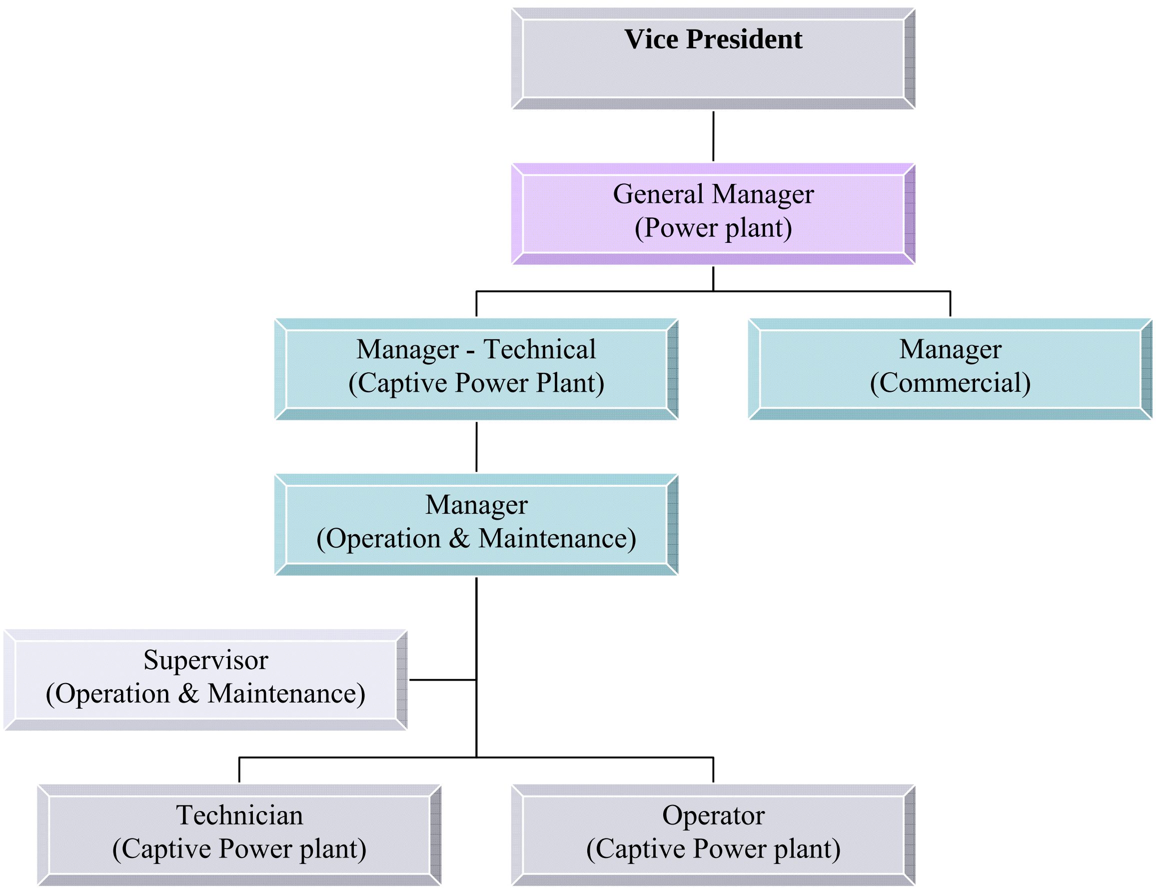
4. Manager -Operation and Maintenance: The person will be entitled to generate monthly report and provide the same to the project proponent. The person would also be responsible to ensure correctness of monitored data and timely check and calibration of the monitoring equipment.

5. Manager- Power plant: The person will be responsible for completeness of data. He will ensure quality of the data monitored and recorded. He will be responsible for review of daily report generated by the shift in-charge and also for monthly report formation and assist the General Manager to check complete operation.

6. Manager - Commercial: The person would be responsible for carrying out all short of communication related to the CDM.

7. General Manager (Power plant): The person would be responsible for generation of yearly report and review of monthly report done by the Manager (Power plant). He will also review the monitoring plan according to methodology.

8. Vice President: The person will head the CDM team and its action and will be entitled to validate the annual report pertaining to the emission reduction estimation.



Training on Operation & maintenance of power plant:

The operation and maintenance of the waste heat recovery based captive power plant will be carried out by the team engaged at the project site by the project proponent. The project proponent does not have experience related to operation and maintenance of the waste heat recovery based thermal energy generation. As such training programme will be conducted on site for the personnel of operation & maintenance department of the captive power plant during erection and commissioning period. Along with the relevant training the operation of the project activity would be supervised by representatives (technician) of Equipment supplier for a period of one year with assistance from RSL personnel, who will be thus trained. The training programme will be conducted by the Manufacturing Company.

The training programme will involve:

- Explanation on concept of modern thermal station.
- Introduction to the waste heat recovery technology.
- Design and function of water and steam drums, heaters and tubes.
- Design and function economisers, super heater etc.
- Design and function of fans and compressors.
- Design and function of soot blowers
- Design and function of boilers
- Design and function of turbine and auxiliaries
- Design and function of alternator and excitation system
- Design and function of coal handling plant
- Design and function of ash and slag handling plant
- Design and function of treatment of water
- Design and function of fire protection and gas leakage system
- Design and function of turbine/generator control and protection system.
- Interpretation of Thermal System's documents code sign and alarms.
- Operation mode
- Data logging
- Recovery from abnormal operation condition.
- Emergency cases
- Trouble shooting
- Planning of maintenance service.
- Use of maintenance manual
- Design and function of monitoring instruments

Training on monitoring and archiving of data related to the project activity:

Training is provided to the staff member of the power plant on the procedure of recording and archiving of data. The training pertaining to the monitoring and archiving of the data is carried out by General Manager – Captive power plant along with the CDM consultant. The details procedure of emission reduction estimation will also be explained to the monitoring team.

Internal audits of CDM project compliance:

CDM audit shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. The internal audit team involves a CDM consultant and the respective person would provide assistance to the organizational audit team in carrying out internal audit. The internal audit team headed by the Vice President will be responsible for reviewing and providing necessary co-operation to conduct the audit and take corrective actions so as to remove the non-conformities within a specified time frame. Internal audit to be carried out can be broadly segmented which is as follows:

- Review of the monthly report quarterly.
- Annual review of emission reduction (calculated) during the crediting period.

The internal audit team would report on

- Non-conformity of data monitored

- Effectiveness of the implemented monitoring methodology and plan
- Modification required in monitoring plan and procedure
- Implementation and effectiveness of any corrective actions in previous recommendation

The project proponent will obtain the auditor's acceptance of non-conformities, along with the proposed corrective actions. The Vice President shall report on the progress of implementation of corrective actions. The non-conformities if any shall be closed within the stipulated time frame and closure shall be approved by the Vice President.

Internal audits of CDM project compliance:

CDM audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing. Internal audit should be done at the interval of six months.

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