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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Electrotherm 30 MW combined waste heat recovery and coal based captive power plant at Kutch

Version 04

7 November 2008

A.2. Description of the project activity:

The Electrotherm 30 MW combined waste heat recovery and coal based power plant at Kutch (hereafter, the "Project") developed by Electrotherm India Limited (EIL) (hereafter referred to as the "Project Developer") is a waste heat utilisation project at an iron and steel facility in Gujarat State in India (hereafter referred to as the "Host Country"). The total installed capacity of the power plant will be 30 MW, with a predicted power generation from waste heat recovery (WHR) of 86,606 MWh per annum.

The Project will be developed at an integrated steel facility in Samikhiyali Village, Kutch District, Gujarat State. The facility was established in 2005, with an annual output of 216,000 t of finished iron and steel products including iron pipes and stainless steel. At the end of 2006 the company started the installation of their own Direct Reduction Iron (DRI) plant within the existing steel factory. The DRI plant will be equipped with two sponge iron kilns; the first kiln, with a capacity of 250 tonnes per day (TPD), was commissioned in December 2005[1] and the second kiln, with a capacity of 350 TPD, is expected to be fully operational by July 2008.

Until recently, the Project Developer had been drawing electricity from the grid to supply power to its integrated steel plant. Recently, the Project Developer has installed a thermal captive power plant (CPP) using coal[2] as fuel. The new CPP started power generation in March 2008. It consists of a 30MW turbine which is supplied with steam from two fluidised bed combustion (FBC) boilers with a capacity of 65 tonnes per hour (TPH) each.

The Clean Development Mechanism (CDM) project is the installation of two waste heat recovery boilers with a capacity of 28.5 TPH and 36 TPH respectively in order to generate power from the hot flue gases from the sponge iron kilns. These gases are currently vented into the atmosphere as waste heat. The total amount of waste heat consisting of approximately 19% CO_2, 15% H_2O, 62% N_2, 3% O_2 and 0.5% CH_4 is currently vented into the atmosphere after being cooled and treated by electrostatic precipitators (ESP) to ensure that the waste gas emissions are within the prescribed norms. The electricity generated by the WHR boilers would in the absence of the CDM be generated by the grid or by the coal fired captive power plant which has been commissioned recently, both technologies with higher carbon intensity.

The project is contributing to sustainable development of the Host Country. Specifically, the project:

1 After initial production of about 2 months the kiln had to shutdown due to operational problems and commercial production was taken up again in September 2006

2 Hereinafter the term 'coal' in relation to the baseline captive power plant will be used as a synonym for the fuel mix used in the baseline. The fuel mix will consist of different combinations of several fossil fuels like domestic coal, imported coal, Kutch lignite, coal char, dolo char and coal fines. Depending on their relative prices and availability, the project developer will decide upon the actual fuel mix to be used in the power plant at a given point of time in order to realize the lowest cost of power generation of the baseline power plant.

- Increases employment opportunities in the area where the project is located: approximately seventy persons will be employed for the operation of the power plant
- Enhances the local investment environment and therefore improves the local economy
- Diversifies the sources of electricity generation, important for meeting growing energy demands and the transition away from fossil fuel-supplied electricity generation
- Makes use of waste energy resources for sustainable energy production
- Reduces the use of fossil energy sources

A.3. Project participants:

Name of 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)	Electrotherm India Limited (private entity)	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group PLC (private entity)	No

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

India (the "Host Country")

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

Gujarat State, Kutch District

A.4.1.3. City/Town/Community etc:

Samikhiyali Village, Bhachau Taluk

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

The geographical location is latitude N 23° 18' 17.34 / longitude E 70° 28' 37.25.
These GPS coordinates are for the location of the steel factory in which the CDM project takes place.

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

According to Annex A of the Kyoto Protocol, the project activity falls under UNFCCC Sectoral Scopes:

- 1-Energy Industries (renewable/non-renewable sources) and
- 4-Manufacturing industries

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

The Project is a waste heat recovery power generation project using waste flue gas from two sponge iron kilns in the direct reduction iron plant of the Electrotherm steel facility, with a total installed capacity of 30 MW. It is expected that 86,606 MWh will be generated from the waste heat energy content of the flue gases generated in the two DRI kilns.

In the iron reduction process in the steel plant, coal and iron ore are passed through two rotary kilns at high temperatures (over 1,000° C) to reduce the iron ore to sponge iron. The reduction process yields, among other things, carbon dioxide and carbon monoxide. These gases leave the kiln at high temperatures (950° C) and may therefore be utilised to generate power. After leaving the kiln the hot gases are passed through an After Burner Chamber (ABC) where further oxidation of the gases occurs, i.e. carbon monoxide to carbon dioxide. The gases are then fed to waste heat recovery boilers and drawn through electrostatic precipitators (ESP) and ultimately released via the stack.

The project involves the installation of two WHR boilers including After Burner Chambers (ABC). These components are added to other thermal power plant equipment like one 30 MW turbine and one generator, one steam header, a water supply and a cooling system. All this thermal power plant equipment has been commissioned recently and the project activity only adds two WHR boilers including its associated components like water and steam pipes as well as the ABC.

The waste heat recovery boiler technology employed in the project activity is available in India. The technology utilized in the CDM project will be two Cethar Vessels WHR boilers with a capacity of 28.5 TPH and 36 TPH respectively.

Table A 4-1 The specification of major equipment in the project activity

Name	Number	Technical parameter		Manufacturer
Generator	1	Make: Standard power: Standard rotational speed: Output voltage:	HTP/JPEF 30.0 MW 3000/min 11 kV	Hangzhou Steam Turbine Co. Ltd
Steam turbine	1	Make: Standard power: Standard rotational speed: Pressure of main gas: Temperature of main gas:	HTC 30.0 MW 3000/min 63 Bar 490 C	Hangzhou Steam Turbine Co. Ltd

WHR boiler	1	Capacity: 28.5 TPH Type of firing: traveling grate working pressure: 65 Bar working temperature: 490°C Steam outlet Temperature: 490°C	Cethar Vessels Pvt Ltd
	1	Capacity: 36 TPH Type of firing: traveling grate working pressure: 65 Bar working temperature: 490°C Steam outlet Temperature: 490°C	Cethar Vessels Pvt Ltd

The Project started construction in October 2006 and the total construction period was estimated to be 18 months. The project is expected to start operation in June 2008 with one WHR boiler and in October 2008 with the second WHR boiler.

During the crediting period, the project equipment is not expected to be substituted by other or more efficient technologies.

Table A 4-2 Timeline showing the installation of the major equipment involved in the project activity ('Project'), and whether this equipment would have been implemented anyway without the CDM project.

SN	Activity	Baseline or Project	Construction Start	Operation Start
1	Installation of Sponge Iron Kiln I	implemented anyway	May-05	December-05
2	Installation of Sponge Iron Kiln II	implemented anyway	April-07	July-08
3	Installation of FBC Boiler I	implemented anyway	October-06	March-08
4	Installation of FBC Boiler II	implemented anyway	October-06	March-08
5	Installation of WHR Boiler for Kiln I	Project	October-06	June-08
6	Installation of WHR Boiler for Kiln II	Project	September-07	October-08
7	Installation of 30MW Turbine	implemented anyway	November-06	November-07
8	Start of power generation			March-08

The Project Developer has not operated its own waste heat recovery power plant before. The setup of the power plant, especially the fact that two fuel sources provide steam for one turbine, requires a skilled and experienced workforce to operate the plant at its highest efficiency. No experience on how to operate and maintain a WHR power plant is available in the company, therefore an additional experienced workforce has to be employed and provision of training is required. A total of approximately seventy people will be involved in its operation and maintenance. Additional training for those employees is required and will be provided for a period of about two to three months by Cethar Vessels Ltd., which is the boiler supplier.

Table A 4-3: The main technical parameters involved in the project are described in the table below:

		Source
Total installed capacity (MW)	30	Detailed Project Report (DPR)
Operating time yearly (days)	289	Obtained from 1st year operational data of kiln I

Parasitic Power loss (%)	10.5%	Detailed Project Report (DPR)
Average kiln load factor	79.2%[3]	Obtained from 1st year operational data of kiln I
Expected annual power generation from the WHR component (MWh)	86,606MWh	Calculation

The project activity will generate about 86,606 MWh of electricity from waste flue gases and therefore does not emit any greenhouse gases. In the absence of the project activity, the same amount of electricity would have been imported from the grid or produced by a coal based captive power plant.

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

The estimation of the emission reductions in the first crediting period is presented in the table below:

Table A4-4: Estimation of the emission reductions in the first crediting period

Year	The estimation of annual emission reductions (tCO2e)
2008 (August to December)	26,607
2009	68,419
2010	68,419
2011	68,419
2012	68,419
2013	68,419
2014	68,419
2015	68,419
2016	68,419
2017	68,419
2018 (January to July)	39,911
Total estimated reductions (tonnes of CO_2e)	**613,868**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**61,386**

Refer to section B.6.3 for further details on the quantification of GHG emission reductions associated with the project.

A.4.5. Public funding of the project activity:

No public funding as part of project financing from parties included in Annex I of the convention is involved in the project activity.

3 Kiln capacity utilization of 63% over 365 days, considering kiln downtime for maintenance the load factor is 79% over 289 days

SECTION B. Application of a baseline and monitoring methodology

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

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

Reference: UNFCCC Approved consolidated baseline methodology ACM0012 / Version 01, adopted at EB 32

ACM0012 also refers to the latest version of ACM0002: "Consolidated Methodology for Grid-connected Electricity Generation from Renewable Sources" and the "Tool for the Demonstration and Assessment of Additionality".

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

Methodology applicability conditions	Proposed Project Activity
The methodology applies for project activities that utilise 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 will generate electricity by utilising waste heat sources vented from the direct iron reduction process in a steel plant.
Energy generated in the project activity may be used within the industrial facility or exported outside the industrial facility.	The energy generated by the project activity will be used 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 within the industrial facility.	The energy will be produced by the owner of the industrial facility producing 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.	There are no regulations constraining the industrial facility generating waste gas from using the fossil fuels being used prior to the implementation of the project
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 implemented at two newly installed sponge iron kilns

The waste gas/pressure utilised in the project activity was flared or released into the atmosphere in the absence of the project activity at the existing facility. This shall be proven by either one of the following: o By **direct measurements** of energy content and amount of the waste gas for at least *three years* prior to the start of the project activity. o **Energy balance** of relevant sections of the plant to prove that the waste gas/heat was not a source of energy before the implementation of the project activity. For the energy balance the representative process parameters are required. The energy balance must demonstrate that the waste gas/heat was not used and also provide conservative estimations of the energy content and amount of waste gas/heat released. o **Energy bills** (electricity, fossil fuel) to demonstrate that all the energy required for the process (e.g. based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g. balance sheets, profit and loss statement) that no energy was generated by waste gas and sold to other facilities and/or the grid. The bills and financial statements should be audited by competent authorities. o **Process plant** manufacturer's original specification/information, schemes and diagrams from the construction of the facility could be used as an estimate of quantity and energy content of waste gas/heat produced for rated plant capacity/per unit of product produced. o **On site checks** by DOE prior to project implementation can check that no equipment for waste gas recovery and use has been installed prior to the implementation of the CDM project activity.	Not applicable, since the project will be installed at a new facility

The credits are claimed by the generator of energy using waste gas/heat/pressure. o In case the energy is exported to other facilities an agreement is signed by the owner's of the project energy generation plant (henceforth referred to as generator, unless specified otherwise) with the recipient plant(s) that the emission reductions would not be claimed by recipient plant(s) for using a zero-emission energy source.	The credits are claimed by the generator of energy using waste heat. Energy is not exported to other facilities.

Hence, as the applicability criteria are met, ACM0012 Version 01 is applicable for the project activity.

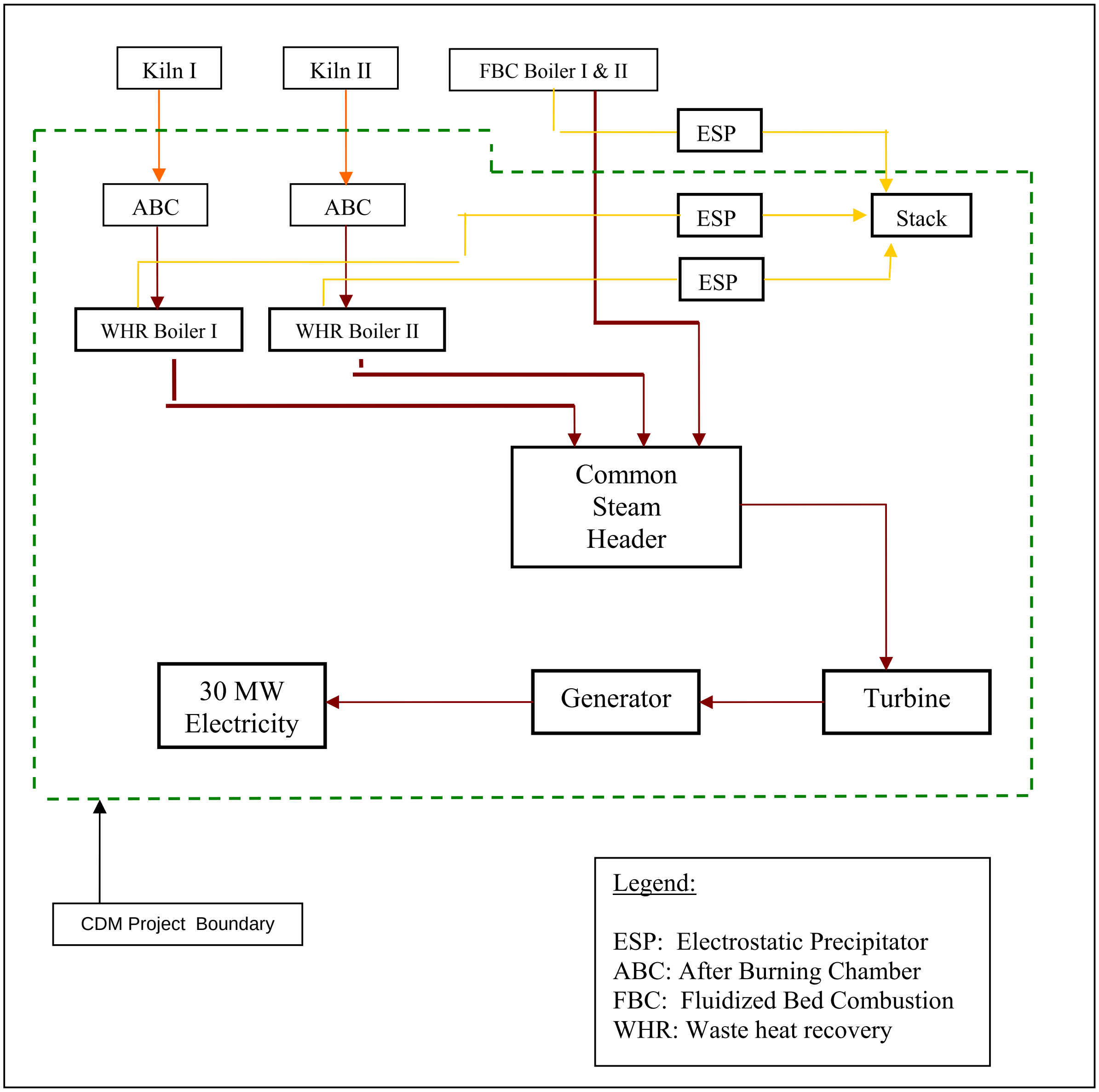
B.3. Description of how the sources and gases included in the project boundary

The GHGs included in or excluded from the project boundary are listed as follows:

Baseline			
Source	**Gas**	**Included ?**	**Justification / Explanation**
Electricity generation, grid or captive source	CO_2	Included	Main Emission Source
	CH_4	Excluded	Excluded for simplification. This is conservative.
	N_2O	Excluded	Excluded for simplification. This is conservative.
Fossil fuel consumption in boiler for thermal energy	CO_2	Included	Main Emission Source
	CH_4	Excluded	Excluded for simplification. This is conservative.
	N_2O	Excluded	Excluded for simplification. This is conservative.
Fossil fuel consumption in cogeneration plant	CO_2	Included	Main Emission Source
	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	CO_2	Included	Main Emission Source
	CH_4	Excluded	Excluded for simplification. This is conservative.
	N_2O	Excluded	Excluded for simplification. This is conservative.

Project Activity			
Source	**Gas**	**Included ?**	**Justification / Explanation**
Supplemental fossil fuel consumption at the project plant	CO2	Included	Main Emission Source
	CH4	Excluded	Excluded for simplification.
	N2O	Excluded	Excluded for simplification.
Supplemental electricity consumption	CO2	Included	Main Emission Source
	CH4	Excluded	Excluded for simplification.
	N2O	Excluded	Excluded for simplification.
Project Emissions from cleaning of gas	CO2	Included	Only in case waste gas cleaning is required and leads to emissions related to the energy requirement of the cleaning
	CH4	Excluded	Excluded for simplification.
	N2O	Excluded	Excluded for simplification.

The following diagram illustrates the project boundary:



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

Selection of the baseline scenario:

The selection of the baseline scenario is followed in accordance with ACM0012 / Version 1.

The baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s). Realistic and credible alternatives are determined for:

- Waste heat use in the absence of the project activity; and
- Power generation in the absence of the project activity; and
- Steam/heat generation in the absence of the project activity

Step 1: Define the most plausible baseline scenario for the generation of electricity and for the use of waste gas

According to ACM0012, the baseline candidates should be considered for the following facilities:

- For the industrial facility where the waste heat is generated; and
- For the facility where the energy is produced; and
- For the facility where the energy is consumed.

Since the waste heat is generated in the facility where power is generated as well as consumed, only one facility is considered for determination of the baseline scenario.

a) Use of the waste heat

To determine the baseline scenario for the use of waste heat, the following options should be considered:

W1 Waste heat is directly vented to the atmosphere without incineration;
W2 Waste heat is released to the atmosphere after incineration or waste heat is released to the atmosphere;
W3 Waste heat is sold as an energy source;
W4 Waste heat is used for meeting energy demand.

W1: Waste heat is directly vented to atmosphere without incineration;
After leaving the kiln, hot waste flue gases would be released into the atmosphere without incineration since the methane content is too low (0.5%) for the gas to be effectively combusted.

W2: Waste heat is released to the atmosphere after incineration or waste heat is released to the atmosphere;
Not applicable, since waste heat cannot be incinerated, due to the low hydrogen and methane content, and in addition, no regulations are in place that call for the incineration of waste gas.

W3: Waste gas/heat is sold as an energy source;
There is no existing infrastructure available to export the waste heat for third party use. No third party is located nearby the plant that could use the waste heat.
W4: Waste heat is used for meeting energy demand.

There is no useful application for waste heat in the sponge iron manufacturing process. Waste heat would therefore be left unused and vented into the atmosphere in the absence of the project activity. So far no other use for waste heat has been developed in sponge iron manufacturing. As demonstrated in section B.5., the majority of sponge iron plants usually release waste heat into the atmosphere[4] and the installation of waste heat recovery boilers has only been taken up by a minority of plants. Among all captive power plants in the steel sector in India, coal represents the main fuel source, with over 90% of the total fuel.[5]

Out of the different baseline options, the only realistic option is W1: Waste heat is directly vented to the atmosphere without incineration. This is in compliance with all legal requirements, and there are no legal obligations on the project developer to utilise waste heat at the steel works. This scenario is therefore taken as the baseline scenario for the use of waste heat.

b) Power generation

To determine the baseline scenario for energy generation, the following options are considered:

P1 Proposed project activity not undertaken as a CDM project activity;
P2 On-site or off-site existing/new fossil fuel fired cogeneration plant;
P3 On-site or off-site existing/new renewable energy based cogeneration plant;
P4 On-site or off-site existing/new fossil fuel based existing captive or identified plant;
P5 On-site or off-site existing/new renewable energy based existing captive or identified plant;
P6 Sourced from Grid-connected power plants;
P7 Captive Electricity generation from waste gas with lower efficiency than the project activity;
P8 Cogeneration from waste gas.

P 1. Proposed project activity not undertaken as a CDM project activity;
The Project Developer may set up waste heat recovery systems to generate electricity. However, this alternative faces a number of barriers (as detailed in Section B.5) making it an unattractive investment. The major risk associated with WHR technology is the uncertainty of the availability and quality of the waste heat as a fuel, and therefore the reliability of power generation. At the same time, this alternative is not common practice in the region according to the analysis of Step 4 of Section B.5. Hence this alternative cannot be taken as a part of the baseline scenario.

P2/P3. On-site or off-site existing/new fossil fuel fired/renewable energy cogeneration plant;
There is no heat or steam requirement at or near the industrial facility where the proposed project is implemented. Therefore this alternative can be excluded as a baseline scenario.

P4. On-site or off-site existing/new fossil fuel based existing captive or identified plant;
This scenario represents a likely option for the project developer. Presently, the steel plant is drawing its entire energy supply from the grid. The project developer has the option to install a 30 MW thermal captive power plant. In fact, two 65 TPH FBC boilers have been installed at the project site recently, which are able to produce 30MW of power. Such a thermal power plant would represent a continuation of

4 As demonstrated in step 4 of section B5

5 The Captive Power Plants: A Case Study; page 36

the business as usual practice for a steel mills in the host country since coal represents over 90% of the fuel source of all captive power plants in the steel sector in India.[6]
Though coal prices, especially for high grade coal, are under upward price pressure due to capacity expansion of the power and the sponge iron sector, power generation from coal will remain competitive since other fossil fuel prices like natural gas (see below) are increasing as well. Biomass prices are expected to further increase due to the installation of new biomass power plants. Indeed, the majority of biomass power projects are realised as CDM projects since they are confronted with risks relating to fuel price hikes.[7]

The Project Developer also has the option of generating captive power using diesel oil or furnace oil. However, diesel oil or furnace oil based power plants are not feasible because building such a plant would incur significant additional capital expenditure, without generating significant savings in fuel costs compared to coal (see table B.4.-1). This option is economically not feasible since it involves high capital costs as well as a high cost of power generation.

Although natural gas is available in the western region of India, where major domestic gas fields exist, installing a new natural gas based captive power plant to replace the existing coal fired power plant would represent significant investment costs, as well as incurring a higher cost per unit of power generation (see table B.4.-1). Furthermore, security of gas supply also poses a barrier to the use of this alternative. A study by the International Energy Agency (IEA)[8], identified concerns about gas supply security and price stability, one reason why coal remains the main energy source in the country. It is shown that the gas supply-demand gap in India will increase in the future. Domestic gas production is insufficient to meet demand, increasing the country's dependency on gas imports from international markets. In 2004/05, gas fired power plants had to operate at a low load factor of 58% due to shortage of gas supply. Based on Liquefied Natural Gas prices, the power generation cost from gas was Indian Rupee (INR) 2.45 in Gujarat in 2004/05, which is higher than the cost of generation from coal (below INR 2.00; see table B.4.-1). The study mentions that due to the price pressure from international markets, this price level is expected to increase in the future.

Because of a favourable regulatory framework for captive power generation in the state of Gujarat (namely resolution No. CPP 1197/2253/PP (1998) related to captive power projects)[9], industries which require medium to large amounts of energy are installing CPP using coal, gas or naphtha as fuel.[10] Since natural gas as a fuel source faces certain risks, and since the investment costs as well as the generation cost are lower for coal (see table B.4.-1), a coal based CPP is the only plausible baseline scenario falling under this option.

P5. On-site or off-site existing/new renewable energy based existing captive or identified plant;
Another baseline option for power generation is a power plant using renewable energy sources like biomass or wind. However, such power plants face different barriers like higher investment cost and higher cost of power generation as compared to coal (see table B.4.-1). Due to the high investment cost and risks of such projects, and given that in the baseline the project developer already has a coal fired captive power plant that can meet its needs without further capital investment, the construction of a

6 The Captive Power Plants: A Case Study; page 36

7 See PDD's of several biomass based power projects proposed or registered as CDM project with the UNFCCC

8 International Energy Agency (IEA); Paper: Focus on Asia-Pacific, Gas fired power generation in India – Challenges and Opportunities, http://www.iea.org/textbase/work/2006/gb/papers/power_india.pdf, 30.08.07

9 Captive Power Plants: Case Study of Gujarat, India; page 23 ff

10 Captive Power Plants: Case Study of Gujarat, India; page 18, 20

renewable energy power plant using biomass or wind is not feasible for the project developer and cannot be considered as a viable baseline alternative.

Out of the different options for captive power generation, a captive power plant based on coal is the most attractive baseline alternative available to the project promoter due low investment costs and lower operating costs as compared to other fossil fuels such as gas.

P6. Sourced from Grid-connected power plants;
This scenario represents the current practice at the project site. Grid electricity is used for power supply in the steel plant of the project developer. There is no additional investment required for the continuation of this practice. Continuing to use the power from the grid does not expose the project developer to any risks and does not require any resources. This option is a viable option for the project developer.

P7. Captive Electricity generation from waste gas (this scenario represents captive generation with lower efficiency than the project activity.);
This scenario involves generation of electricity using waste heat, at a lower efficiency than the CDM project, and faces numerous barriers to its development, as outlined in section B.5. Generation of a similar quantity of electricity using waste heat, with a lower efficiency than the project activity, would mean that more waste heat would be required to generate the same quantity of electricity. This is not viable since there are no other unused sources of waste heat available. If the deficit of electricity generation were supplied using the coal boilers, in addition to a waste heat facility of lower efficiency, this alternative could theoretically be implemented. However, it would face similar technological and other barriers to the project activity. Furthermore installation of less efficient equipment would pose additional risks of reliability, downtime due to failure, and increased operation and maintenance costs. The technical difficulties of using waste gas, including the corrosive nature of the gas, the variable gas quality and availability, and the difficulty in hiring and training qualified staff to operate the equipment, would be even more acute for less efficient, less advanced equipment. Therefore this scenario faces similar or stronger barriers to scenario P1, and is therefore not considered a viable baseline alternative. These barriers are discussed in detail in section B.5.

P8. Cogeneration from waste gas.
Not applicable since steam is not required within or near the industrial facility.

Table B.4 – 1: Investment cost and cost of power generation of different technologies[11]

Alternative	*Investment cost per MW installed capacity (million Indian Rupee INR)*	*Unit cost of power generation (Indian Rupee INR/kWh)*	*comments*
Grid Electricity	zero	INR 4.09/kWh[12]	no additional investment required since the steel plant currently already consumes grid electricity
Coal/lignite	42.5 – 52.5	1.59 – 1.92	Economically most attractive alternative due to low generation cost.
Diesel oil / furnace oil	7.5 – 15	3.5 – 4.6	Not economically due to high generation cost.
Natural Gas	42.5 – 50	2.3 – 3.3[13]	Not economically due to high generation cost, fuel availability and price risk.
Wind[14]	40 – 50	(2.25 - 2.75)	Not economically due to high investment cost and high power generation cost
Biomass	48[15]	1.70 - 2.05[16]	Not economically due to high investment cost and high power generation cost

In view of the above, the only attractive alternatives available to the Project Developer are to continue importing grid electricity or to build a coal fired captive power plant. Using grid electricity and generating captive power using coal is in compliance with Host Country regulation. Taking into account that the project developer has been importing power from the grid prior to the CDM project activity and in order to maintain conservativeness, option P6 (grid electricity) is taken as the baseline for this project.

This is conservative since it generates smaller greenhouse gas emissions because power plants feeding the grid:

11 Captive Power Plants: Case Study of Gujarat, India; page 20

12 see electricity bill of EIL

13 International Energy Agency (IEA); Paper: Focus on Asia-Pacific, Gas fired power generation in India – Challenges and Opportunities, http://www.iea.org/textbase/work/2006/gb/papers/power_india.pdf, 30.08.07

14 http://mnes.nic.in/booklets/Book6-e.pdf

15 http://www.gefweb.org/Documents/Council_Documents/GEF_C20/CC_-_India_-_Biomass.pdf, page 12

16 http://www.leonardo-energy.org/drupal/files/essentials3%20-%20Biomass%20Power%20Gen.pdf?download

- use a mix of fossil fuels and renewables, while captive thermal plant would use only char residue from the kiln, coal and lignite (which are highly carbon intensive fossil fuel);
- and are generally more efficient than captive plants because of their larger size.

For instance, assuming a fuel emission factor of 25.8 tC/TJ and a plant efficiency of 33%, the emission factor of a power plant using coal comes to about 1 tCO_2/MWh, compared to 0.79 tCO_2/MWh for grid electricity, which is used as the baseline emission factor.

c) Steam/heat generation

Not applicable since the project activity does not generate process steam/heat.

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

As demonstrated above, coal is the most attractive baseline fuel for a captive power plant due to the low investment and low cost of power generation.

Coal is available in the Host Country in abundance. The country produces 55% of its electricity from this source.[17] There are large coalfields existing in the eastern part of India, and in addition India imports coal from abroad. The state of Gujarat is well connected by ports through which imported coal is supplied to India. Therefore, no supply constraints or shortages of coal as the principal energy source in the Host Country are expected in the future.

After the consideration of different baseline alternatives for power generation and alternative uses of waste gas, as well as the identification of the most plausible choice of the baseline fuel, it can be concluded that the baseline is either the supply of electricity from the grid or the generation of an equivalent amount of electricity by a coal based captive power plant. In order to maintain conservativeness, grid electricity is selected as the baseline scenario, since it generates smaller greenhouse gas emissions.

Table B 4-2: Key information and data used to determine the Baseline

Variable	**Value / Unit**	**Source**
Electricity generation of the project in year y	86,606MWh	calculation
Combined margin of the western regional electricity grid	0.79 tCO2/MWh	CEA[18]

17 Ministry of Power: Annual Report 2005/06

18 CEA 2007, version 3.0

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):

In the region where the project activity is located, there are already eleven existing sponge iron plants, three more are planned to be built. The main source of electricity of these units is grid electricity and thermal captive power plants. There are only three existing WHR power plants, all of which are seeking CDM benefits. (see step 4 below).
There are more captive power plants installed in the state of Gujarat than on average in India and the fact that at least 85% of the installed capacity of CPP is using fossil fuels demonstrates that installing a captive power plant using waste heat as fuel is a very unpopular practice in the state due to several barriers that threaten the economic feasibility of such projects.
In the following paragraphs, several barriers to waste heat recovery projects are discussed in order to explain the unpopularity of waste heat recovery projects in the state of Gujarat.

The start of the crediting period of this project activity is not prior to the date of registration, however for the assessment of additionality it is important to note that the CDM was taken into account for the investment decision and in the planning stage of the project.
After negotiating with a carbon buyer, the company signed an Emission Reduction Purchase Agreement on 13th of October 2006, which is very close to the start of the project activity. Prior to signing an Emission Reduction Purchase Agreement, there have been discussions over several months with the buyer as well as with other consultants, and a Due Diligence undertaken by the buyer. The project developer was well aware of the risks such type of projects are confronted with, and therefore was aware of and considered CDM financing throughout the planning and development of the project.

The tool for the demonstration and assessment of additionality (version 4 adopted at EB29) is used to demonstrate additionality of the project activity, which follows the subsequent steps:

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

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

The discussion in section B.4. shows that the baseline scenario is either the supply of electricity from the grid or the generation of electricity by a captive power plant using coal as a fuel. Therefore the three following alternatives to the project scenario are considered:

Alternative 1. The proposed project activity not undertaken as a CDM project activity, and

Alternative 2. On-site existing coal based captive power plant

Alternative 3: Import of electricity from the grid

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

There are no mandatory laws compelling the project developer to develop this type of renewable energy facility. The baseline alternatives do not contradict any mandatory laws or regulations.

Step 3. Barrier analysis

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

a) Technological barriers

The success of the proposed CDM project is dependent upon the quality and availability of the fuel it uses to generate power since the power output is the main source of project revenues. Power output and hence the project economics are affected by the quality and availability of waste heat; its specific characteristics as discussed below therefore pose a serious threat to the success of the project.
The following aspects related to technological and other barriers that increase the risk of the project activity have been investigated in a barrier alanysis: (a) impact of waste heat availability on the power generation potential of the project activity, (b) impact of specific raw material (ore, coal) quality and prices on the project performance and operational levels of the underlying industry and (c) impact from lack of qualified labour to operate the project plant.

<u>Waste flue gas quality and availability</u>

One major problem of using waste heat for power generation is the quality (energy content) and amount of the flue gases used in the boiler. The quality of waste heat is dependent on its temperature and pressure. Temperature, pressure and amount of waste heat vary over time and are dependent on the process where waste heat is generated. Changes in the fuel (waste gas) consistency occur according to the operational performance of the sponge iron kilns from which the gases are released, as well as from changing quality and composition of the iron ore and coal used as feedstock in the kiln. Due to this dependency on a core process of the project developer's main business it is not possible to directly control the power output from WHR boilers. Output levels of sponge iron are demonstrated in table B. 5-1 and B. 5-2. As can be seen from the tables, the actual output of the kiln varied from a low of 1,887 tons per month to a high of 7,088 tons per month, which means the capacity utilization varied between 25% and 94%, during the first year of operation. Such large fluctuations in sponge iron production mean significant fluctuations in the electricity output of the waste heat recovery based power generation system, and therefore in revenues from the project. Since the total power requirement of the downward processes of the steel unit remains more or less constant[19] even during lower sponge iron production intervals, this dependency of WHR technology on the sponge iron output makes the attractiveness of the project highly uncertain because of the lower asset utilization and increased coal consumption.

Apart from the underlying sponge iron production output levels from which waste heat is released, other critical factors impacting the operational parameters of the kiln, and therefore the waste heat flue gas characteristics, are the quality of iron ore and coal used as raw material in the kiln[20]. An uninterrupted long-term supply of high quality coal with a homogenous consistency is essential in order to guarantee optimal operational conditions of the kiln. However, such a supply is not fully guaranteed in India due to the limited domestic availability of such coal types, as well as existing competition for such high quality raw material from other sponge iron plants and the power sector.[21] Both industrial sectors are expanding capacities which creates rising competition for high quality raw

19 The sponge iron kiln only requires minimum amount of energy to operate, which is insignificant as compared to the steel factory.

20 Steelworld.com – Steal Research Papers: Coal : The most critical raw material for sponge iron making, http://www.steelworld.com/coalcri.htm, 30.08.2007

21 Steelworld.com – Steal Research Papers: Coal : The most critical raw material for sponge iron making, http://www.steelworld.com/coalcri.htm, 30.08.2007

material. Imported high grade coal is expensive and logistically difficult to supply.[22] While the power sector remains competitive since it can shift to low grade raw material and select the cheapest fuel option[23], iron making industries will suffer from a competition in the high grade coal segment. Either the cost of iron production increases, production output decreases or product quality deteriorates from poor raw material quality. Decreasing sponge iron production would directly affect the attractiveness of the WHR power project.

Similarly, low quality iron ore also affects the operational behaviour of the kiln in a negative manner. Only low quality iron ore is available in the Indian market[24]. Due to the fact that there is currently a huge capacity expansion happening in the sponge iron sector in India, the supply of high quality iron ore will be further constrained in the future.[25]

Unavailability of high quality iron ore results in the utilisation of ore with a high content of fines which causes problems in the WHR boiler operation resulting in additional cost and downtime for cleaning of the boiler and other equipment.[26] Using such ore with a high content of fines requires a higher amount of coal to be used in the kiln which results in a higher particulate load of the flue gas leaving the kiln. This particulate matter removes some energy from the flue gases, thereby reducing the actual usable energy at the WHR boiler inlet.

Changing flue gas quality, like varying temperature and pressure of the gas, also affects the steam parameters and hence turbine efficiency. Lower steam inlet temperature and pressure at the turbine hampers turbine efficiency and increases steam consumption inside the turbine.[27]

Waste heat recovery boilers are unavailable for power generation more frequently compared to coal boilers due to the fact that the kiln requires regular shutdown for maintenance. On an average[28], the sponge iron kiln is operating for 289 days a year (see table 5-1) whereas a coal boiler usually operates up to 350 days a year.

In addition to the technical difficulties listed above, which make power output from a waste heat recovery project variable and uncertain, market conditions for raw material and sponge iron might also impact the level of power generation from the WHR power plant, since increasing raw material prices for iron ore in combination with a decrease in sponge iron prices[29] might result in a reduction of sponge iron production. At the beginning of 2006, seventy sponge iron plants and over hundred iron units in Chattisgarh State had to shut down their production due to the unavailability of iron ore[30]. A

22 Ministry of Coal, Government of India: The Expert Committee on Road Map for Coal Sector Reforms, New Delhi, December 2005, page 58

23 A captive thermal power plant will select the cheapest fuel option as described under footnote 1 which makes it more competitive as compared to all other baseline options

24 P.R.K. Raju: Sponge Iron Industry – An overview of problems and solutions; published in: Steelworld, July 2005, page 20; http://www.steelworld.com/technology7.pdf, 30.08.2007

25 P.R.K. Raju: Sponge Iron Industry – An overview of problems and solutions; published in: Steelworld, July 2005, page 20: http://www.steelworld.com/technology7.pdf,; Joint Plant Commitee: "Survey of Indian Sponge Iron Industry 2005-06 – Highlights and findings, 2005-06", page 6

26 http://www.rimbach.com/scripts/Article/PEN/Number.idc?Number=12

27 Patel M.R., Navin Nath - Improve Steam Turbine Efficiency, http://www.iffco.nic.in/applications/Brihaspat.nsf/6dca49b7264f71ce65256a81003ad1cb/fddd5567e90ccfbde52569160021d1c8/$FILE/turbine.pdf, 30.08.2007, page 3-6

28 This data is taken from the operational performance of the existing sponge iron kiln I during its first year of operation

29 P.R.K. Raju: Sponge Iron Industry – An overview of problems and solutions; published in: Steelworld, July 2005, page 20; http://www.steelworld.com/technology7.pdf, 30.08.2007

30 Ban on ore prices gain momentum; published in Steelworld, January 2006, page 8; http://www.steelworld.com/analysis0106.pdf

coal based power plant would be unaffected by such a reduction in sponge iron production since it is not dependent on waste heat production from the kiln operation.

The above mentioned reasons mean that the power output, and therefore investment attractiveness of a waste heat recovery power plant, is highly uncertain. In the event of unavailability of high grade coal due to the aforementioned facts, a coal based captive power plant can still operate without any loss of output since it is not dependant on waste heat availability but can use a higher amount of lower grade coals that are readily available domestically in order to produce the same amount of electricity.[31]

Apart from the availability of fuel for a coal based power station, such projects can select the cheapest fuel mix available. In the baseline, the project developer will either use grid electricity or a captive power plant fuelled partly with coal char, which is a by-product of the iron reduction process having a NCV of 2800 kcal/kg, to co-fire in the FBC boiler along with other fuels like imported coal, domestic coal and Kutch lignite[32]. This coal char is a zero-cost fuel for the project developer and it is expected that coal char will constitute about 10% of the total fossil fuel to be used. This further decreases the fuel cost in the baseline option of a coal based captive power plant and improves the economics of such an alternative. Being located in vicinity to a coal belt (Kutch coal fields), the project developer also has access to cheap fossil fuel sources (Kutch lignite). Depending on relative prices of imported coal, domestic coal and kutch lignite, as well as the availability of no-cost coal char, the project developer will optimize the fuel mix of the thermal power plant in order to realize the lowest fuel cost combination.

Table B. 5-1: Operational data of the kiln[33]

	actual (tons)	days	capacity (TPD)	maximum capacity (TPD)	relative output capacity (TPD)	capacity utilization	load factor
Sep-06	4001	26	250	7500	6500	53.3%	61.6%
Oct-06	2121	16	250	7500	4000	28.3%	53.0%
Nov-06	1887	13	250	7500	3250	25.2%	58.1%
Dec-06	5603	29	250	7500	7250	74.7%	77.3%
Jan-07	6350	31	250	7500	7750	84.7%	81.9%
Feb-07	3340	17	250	7500	4250	44.5%	78.6%
Mar-07	5768	28	250	7500	7000	76.9%	82.4%
Apr-07	4178	23	250	7500	5750	55.7%	72.7%
May-07	7088	31	250	7500	7750	94.5%	91.5%
Jun-07	6778	30	250	7500	7500	90.4%	90.4%
Jul-07	3393	17	250	7500	4250	45.2%	79.8%
Aug-07	6707	28	250	7500	7000	89.4%	95.8%
average	4768	24.1	250	7500	6021		
	57214	**289**	**3000**	**90000**	**72250**	**63.6%**	**79.2%**

Table B 5-1 shows the operational parameters of the kiln installed at the steel plant where the CDM project is implemented. It can be observed that the average capacity utilization of the kiln and thereby

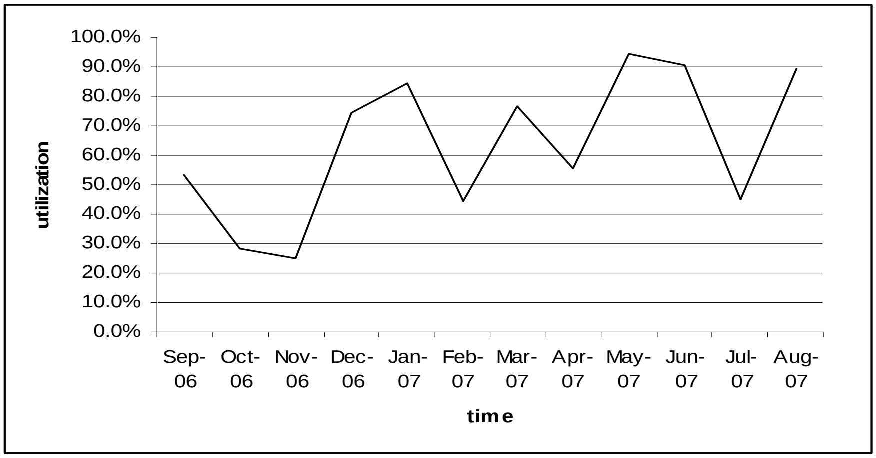
31 The boiler volume and fuel handling systems are designed to use low grade fuel of 4000 kcal/kg in the absence of higher grade fuel to produce the same energy output as compared to high grade fuels of up to 6500kcal/kg

32 Lignite form the coal fields in Kutch district in which the project is located

33 Plant data from 1st year of 250 TPD sponge iron kiln operation

its power generation capacity is only 63.6%. This is very low as compared to thermal power stations which usually have a load factor of over 90%. The data in table B 5-1 also reflects the aforementioned discussions about variations in the waste heat availability. The lowest capacity utilization value was 25.2% and the highest was 94.5%. Such a wide variation demonstrates the uncertainty of waste heat availability and power generation potential from the waste heat recovery power plant. (see table B 5-2)

Table B. 5-2: Capacity Utilization of the kiln[34]



In addition to fluctuations in waste gas quantity, the kiln is only operational 289 days per year, as opposed to 330-350 days for a coal power station. In addition, the load factor of the WHR power plant (79%) is considerably lower when compared to coal (95%). Due to higher downtimes for maintenance and fluctuating waste heat availability, the utilization factor varies considerably as compared to coal. Table B. 5-3. shows the unreliability of WHR power generation. By comparing the electricity output from WHR at different capacity utilization levels with coal it can be observed that the gap in electricity generation varies between 90,000 MWh and 0.6 MWh. This comparison demonstrates the large gap between the two options and the unpredictability of power output from WHR technology.

Table B. 5-3: Comparative electricity output

	coal	**WHR**				
capacity utilization[35]	95%	25.2%	44.3%	63.3%	78.9%	94.5%
net electricity (MWh)	123,120	32,659	57,348	82,037	102,254	122,472
balance to coal (MWh)	**0**	**-90,461**	**-65,772**	**-41,083**	**-20,866**	**-648**

In terms of fuel availability, the analysis of evidence shows a fundamental difference between thermal and waste heat recovery power plants in that the latter's profitability depends on a lot of parameters which are uncertain and beyond the control of the project activity, such as prices in a specific coal quality segment, iron ore prices and quality and sponge iron prices as well as parameters related to the internal operation of the sponge iron kiln. Coal boiler operation and output, on the other hand, does not depend on such factors but only on coal prices and availability – and there is an abundant supply of cheap coal in

34 Plant data from 1st year of 250 TPD sponge iron kiln operation

35 Assumed operational days of 360 per year

India and particularly in the project area. This is exacerbated by the facts that coal boilers have the flexibility to use a mix of many types of coal optimised according to market prices, while waste heat recovery boiler can use only one type of fuel whose availability is very variable.

Given the technological risks and resulting financial disadvantages related to WHR technology, the project developer would not implement a WHR project which requires additional capital expenditure since he already has a grid connection in the baseline or would rather install a coal based power station instead of a WHR power plant.

Waste heat characteristics:

High dust content and particulate matter of the waste heat also increase the downtime of the WHR boiler[36], which reduces the utilization of the WHR boiler even below the above discussed utilization rate which only relates to the kiln operation but not to the operation and maintenance requirements of the boiler.

In terms of fuel quality, the analysis of evidence clearly shows the negative impact that the poor and varying quality of waste heat can have on the project equipment (boiler, turbine), while coal is a much more reliable fuel whose precise quality can be measured and adjusted if needed.

b) Common practice barriers

As demonstrated in the common practice analysis (step 4, below), this project is one of the first of its kind in the state: it is one of the first WHR power plants at an iron and steel facility in the state of Gujarat. Therefore, the project faces a significant barrier due to prevailing practice.

Considering the country as a whole, no reliable information about the success rate of WHR technology in the Indian steel sector is currently available to the project developer, which poses a considerable risk to the implementation of the proposed CDM project.

c) Other barriers

Labour availability:
Another danger to the project is the company's internal capacity to control and operate the power plant. The proper controlling of a WHR power system requires specific skills of the workforce who is handling the power plant.
General skills to operate a fossil fuel based power plant are not sufficient to operate a combined WHR and coal based power plant efficiently, due to the above mentioned technological challenges a WHR plant is confronted with. Specifically, the coordination of the fossil fuel feeding due to the fluctuating power generation from waste heat boilers requires specific skills of the workforce. A reduced power output might result from improper training and insufficient skills of the workforce handling the power plant.

The project developer has not operated WHR boilers previously. There is no experience available in the existing workforce of the project developer to maintain and operate a waste heat recovery based

36 http://www.rimbach.com/scripts/Article/PEN/Number.idc?Number=12

power generation system. Therefore new engineers have to be employed and training has to be provided by an external consultant in order to achieve the required performance and efficiency of power generation from waste heat sources. A training period of at least three months is necessary to enable the workforce to operate the plant properly and at its maximum efficiency.

Additional training for those employees is required and will be provided by for a period of about two to three months by HIQ Power Associates Ltd. which is the Engineering Procurement Construction (EPC) - contractor for the project as well as by Cethar Vessels Ltd., which is the boiler supplier.

A revision of the origin of staff recruited for the power plant operation shows that there is a lack of adequately skilled local labour since the project developer hired about 50% of its staff from regions other than the State of Gujarat[37].

The lack of properly trained labour leads to a higher probability of damages to the equipment and underperformance of the power plant. In order to properly train labour, the project developer has to bear significant additional costs.

Finally, the skills of the workforce are a much more critical factor in the proper operation of the combined waste heat recovery and coal based power plant compared to a fossil fuel only based power plant due to the higher technological challenges involved as highlighted above. Therefore, the probability of underperformance of the power plant due to manpower related mistakes is much higher than it is for fossil fuel only based power plants.

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

The above discussed barriers affect the viability of the WHR recovery power project. None of these barriers is applicable to the alternatives to the proposed CDM project, specifically to the selected baseline scenario, which is the continuation of drawing power from the grid. Therefore, the proposed WHR power plant is less attractive to the project developer as compared to the continuation of current practices or the installation of a captive coal based power plant.

The alternatives of drawing power from the grid as well as a fossil fuel based CPP do not face inconsistency of fuel supply and quality to the same levels as a WHR plant, they are not dependant on the operational parameters of a kiln, and do not have problems in finding properly skilled labour. Power generation from coal based boilers is more predictable since fuel feed rate, combustion air blow rate, temperature and pressure of the steam can be controlled and therefore the optimum heat rate and load factor can be achieved. A WHR power plant is dependant on the operational parameters of the kiln which vary considerably (see table 5.2). Due to the wide fluctuation of waste heat availability as well as more frequent boiler shutdowns for maintenance, the power generation potential of a WHR power plant is more unpredictable as compared to a coal based power plant. Since coal is easily available and not dependant on operational parameters of other processes the power generation from a coal based power plant can be determined in advance. Moreover, the heating potential of the coal used in the baseline is known whereas the heating potential of the waste heat depends on its quantity, temperature and pressure which vary according to the operational parameters of the underlying iron reduction process.

37 Project developer staff recruitment records

Due to the unpredictability and unreliability of waste heat power generation and therefore potential additional cost for coal as well as poor asset utilization, the project developer cannot accurately determine the project performance and the return from the investment. The project would not be feasible to implement without CDM financing. The project developer would continue to draw power from the grid or implement a captive power plant based on coal as fuel.

Step 4. Common practice analysis

Sub-step 4a. Analyse other activities similar to the proposed project activity

The following common practice analysis assesses whether the 'common practice' barrier is strong enough to discourage investment in waste heat recovery power generation without availability of CDM funding. The project developer identified all similar industries to which similar economic conditions apply. As most suitable 'reference industries', all sponge iron plants located in the state of Gujarat ('reference region') have been chosen since (a) those industries are from the same industrial sector as the industry in which the project activity takes place, (b) are exposed to the same regulatory framework and economic as well as market conditions as the industry in which the project activity takes place and (c) because the total number of all 'reference industries' (14 companies, 11 existing plants with 15 existing sponge iron units, 3 plants under construction) is large enough to arrive at a representative result of such an analysis. In addition, the analysis also investigates similar activities occurring in sponge iron plants in India as well as captive power plants outside the sponge iron sector. Table B. 5.5. summarises the information available from credible sources.

As mentioned before, there are more captive power plants installed in the state of Gujarat than on average in India[38] and the fact that at least 85%[39] of the installed capacity of CPP is using fossil fuels demonstrates that installing a captive power plant using waste heat as fuel is a very unpopular practice in the state due to several barriers that threaten the economic feasibility of such projects. Though the capacity addition of captive power plants in the state of Gujarat has increased by 380% between 1991 and 2000[40], waste heat recovery captive power plants are still very unpopular and are only taken up due to the availability of CDM benefits, as demonstrated below.

Apart from the technological and other barriers as discussed above, barriers due to common practice can be much better quantified and demonstrate much clearer that the project would not be implemented without the availability of CDM benefits.

As per the Kutch Iron and Steel Association, there are eleven sponge iron plants operating in Kutch District and another three plants are planned.[41] Most of the existing units source their electricity from the grid or from thermal captive power plants. The units under planning or construction status propose to use grid electricity only. There are only three existing power plants that combine WHR, coal and grid electricity import as their power source, all of which are seeking CDM benefits.

38 Captive Power Plants: Case Study of Gujarat, India; page 13

39 Captive Power Plants: Case Study of Gujarat, India; page 19

40 Captive Power Plants: Case Study of Gujarat, India; page 13

41 Kutch Iron and Steel Association

According to a study of the Joint Plant Committee, which surveyed a representative sample of 147 existing sponge iron plants in India, only 16 plants have a captive power generation facility (either fossil fuel or WHR)[42]. This represents an adoption of captive power generation technology in only 10.8% of all sponge iron plants in India. As per this study, there are no captive power generation facilities existing in the state of Gujarat, hence there are no captive power plants using waste heat operating in the state of Gujarat.[43]

The Ministry of Industry of Gujarat has listed all industrial installations within the metallurgical industry in the state.[44] An investigation by the project developer found that there is no waste heat recovery power plant mentioned in this database (except SAL steel ltd, which is developed as CDM project[45]) and is therefore consistent to all other information available about power generation practice in the region.

The Central Electricity Authority (CEA) of India has published a study of captive power plants in India in 2005. In total, there are two hundred and eight captive power plants existing in India with a total installed capacity of 7,633 MW. Among these CPP's from different industrial sectors, only fourteen (6.7%) run on waste heat, waste gas or a mix between waste heat/gas and fossil fuels. The existing WHR plants amount to a total of 294 MW installed capacity (3.8% of the total captive power installed capacity in India).[46] As per this study, there is no existing captive power plant based on waste heat recovery in the State of Gujarat, even though Gujarat is with approximately 15 sponge iron plants one of the biggest sponge iron producing states in India and India is the largest sponge iron producer globally[47].

A working paper published by Stanford University in 2004 investigates captive power plants in Gujarat state.[48] It is said that Gujarat state has a favourable regulatory environment for the installation of CPPs in the industrial sector. The market share of CPPs in the state is 22% as compared to the total installed capacity in Gujarat, which is very high in comparison to other states in the country. The study identifies 163 CPPs in Gujarat using coal, natural gas, naphta, residual crude oil, furnace oil, high speed diesel, light diesel oil and lignite as fuels.[49] These CPPs are installed in different industries including the steel industry. However, there was no existing CPP identified using waste heat as fuel source. Therefore it can be concluded that as per this study this project is one of the first waste heat powered captive power plant in the state.

Table B. 5.5. Common practice of power supply

		All sectors	Sponge iron sector
India	# Plants	n/a	147 [Joint Plant Committee study: 'Survey on the Indian sponge iron industry']
	# Plants with CPP	280 [CEA report: 'Details of captive power plants and status of supply of surplus power to the grid']	16 i.e. 10.8% inc. 8 in Chhattisgarh [Joint Plant Committee study: 'Survey on the Indian sponge iron industry']
	# Plants with CPP with WHR	3.8% [CEA report: 'Details of captive power plants and status of supply of surplus power to the grid']	21 with CDM [UNFCCC website]

42 Joint Plant Committee – highlights and findings: Survey of Indian Sponge Iron Industry 2005-06, p.7

43 Joint Plant Committee: Survey of Indian Sponge Iron Industry 2005-06, p.38

44 Industries Commissionerate, Government of Gujarat; excel file provided to DOE during validation

45 See footnote 52

46 CEA: Report on Tapping of Surplus Power from Captive Power Plants

47 http://www.simaindia.org/may_sima_2007.pdf, editorial

48 Captive Power Plants: Case Study of Gujarat, India, p 11, 13, 16, 23-31,

49 Captive Power Plants: Case Study of Gujarat, India, p 9

Gujarat	# Plants	ca. 740 [Stanford University study: 'Captive Power Plants: A case study of Gujarat' says 163 represents 22% of all plants]	11 existing (15 'units') + 3 new [Kutch iron & Steel Association survey: 'Sponge iron plants in Kutch District']
	# Plants with CPP	163 [Stanford University study: 'Captive Power Plants: A case study of Gujarat']	zero [Joint Plant Committee study: 'Survey on the Indian sponge iron industry'] 8 [Kutch iron & Steel Association survey: 'Sponge iron plants in Kutch District']
	# Plants with CPP with WHR	zero [Ministry of industry, Gujarat] 0-10% ('other fuel sources including renewable energy') of 163 [Stanford University study: 'Captive Power Plants: A case study of Gujarat']	zero [PP] first of its kind [Letter from Honourable Secretary of Kutch Iron and Steel Association] 4 [Kutch study] - all seeking CDM 1 (with CDM) [5 Ministry of Industry Gujarat]

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

The different studies mentioned above clearly demonstrate that energy generation from waste heat is not a common practice in Gujarat or in India as a whole. A few WHR based power plants have been implemented in the past few years, but these power plants are being realised as CDM projects.

Table B. 5.6. WHR power plants in sponge iron industry registered as CDM projects[50]

	Company	**Location**
1	Godawari Power and Ispat Ltd.	Chattisgarh
2	Tata Sponge Iron Limited	Orissa
3	OCL India Limited	Orissa
4	Monnet Ispat Limited	Chattisgarh
5	Jai Balaji Sponge Limited	West Bengal
6	Vandana Global Limited	Chattisgarh
7	Shri Bajrang	Chattisgarh
8	Shree Nakoda	Chattisgarh
9	Orissa sponge iron ltd	Orissa
10	SKS Ispat Limited	Chattisgarh
11	Usha Martin Limited	Jharkhand
12	Rashmi Sponge Iron Pvt	Chattisgarh
13	Godawari Power and Ispat	Chattisgarh
14	MSP steel and power ltd	Chattisgarh
15	Ind Synergy Ltd	Chattisgarh
16	Sri Ramrupai Balaji Steel Limited	West Bengal

50 http://cdm.unfccc.int/Projects/index.html, 01 October 2007

17	Nalwa Sponge Iron Limited	Chattisgarh
18	Gippl	Maharashtra
19	Gipl	Chattisgarh
20	Ramswarup Loh Udyog	West Bengal
21	Kamachi Sponge & Power Corporation Limited	Tamil Nadu

Apart from those registered CDM projects, several other WHR power plants are currently proposed as CDM projects. This demonstrates the increased uptake of waste heat recovery technology with the benefits of CDM financing, and helps reinforce the conclusion that in the absence of CDM financing, waste heat recovery for power generation is not common practice in the host country.
The Joint Plant Committee report indicates that only 10.8% (16) of all surveyed sponge iron plants in India have a power supply based on captive power generation from thermal sources or waste heat recovery. At the time of validation[51], 21 waste heat recovery projects in the sponge iron sector were registered as CDM projects meaning that it is unlikely that many waste heat recovery plants are developed without access to carbon finance. This study does not mention any existing captive power plants in sponge iron industries in the state of Gujarat.

Among all Indian states, the one with the most similar conditions to Gujarat is the state of Chhattisgarh, which also has a high concentration of sponge iron plants due to its proximity to raw material sources. Chhattisgarh state is host to 8 of the 16 captive power plants identified by the Joint Plant Committee and to 12 of the 21 registered waste heat recovery projects in India sponge iron sector – which again suggests that CDM has been a key driver in incentivising waste heat recovery projects in the sponge iron industry, which were not happening before the CDM incentive started to materialise.

To the knowledge of the project developer there are only three more sponge iron plants in the region currently installing WHR technology, which are proposed as CDM projects.[52] Gujarat is one of the largest sponge iron producing states in India, and there are eleven existing and three planned (or under construction) sponge iron plants in the region, none of which currently has a waste heat based captive power plant which is not implemented as CDM project.[53]

Summary

CDM revenues provide a secure long term source of revenues for the project in hard currency, mitigating the risks associated with investing in this type of project. Due to the high risks associated with waste heat recovery technology, the project developer was only able to take the decision to invest and go ahead with the project implementation after the additional revenues from CDM were considered.

The project activity would not happen in the absence of CDM funds since the project developer has the option to continue a more attractive alternative for power generation with a lower risk profile. CDM revenues compensate for the risks involved in WHR technology, enabling the project developer to implement the proposed CDM project.

51 Which is later than the date of the Joint Plant Committee report, which may explain some of the discrepancies between the numbers,

52 Namely: Mono Steel India Ltd, Welspun India Ltd and SAL Steel Ltd.

53 Kutch Iron and Steel Association

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As per the Methodology ACM0012 / version 1, emission reductions from the project are equal to baseline emissions minus project emissions. No leakage emissions are applicable under this methodology.

Baseline Emissions:

As per the discussion in Section B.4, the baseline scenario is identified as the continuing supply of electricity from a coal based CPP. Given the large energy demand of a steel mill, even in the project scenario the coal captive power plant will not be completely shut down, and the project developer will still continue to produce electricity from a coal captive power plant, since the amount of electricity from the waste heat recovery plant is not sufficient to meet the energy demand. Therefore the project activity will reduce GHG emissions by displacing emissions from coal.

As per ACM0012, version 1, baseline emissions are given as:

BE (y) = BE en, y (1)

Where:

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

Note: since the waste gas is not flared in the baseline, *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 in tCO_2e per year) is not considered

<u>*Baseline emissions for scenario 1*</u>

In the case of the project activity, electricity is obtained from a specific existing power plant. Therefore:

BE en, y = BE elec, y (1a)

Where

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

Note: since the project activity is generating electricity only, *BE ther, y* (baseline emissions from thermal energy (due to steam and/or process heat) during the year *y* in tonnes of CO_2) is not considered

$$BE_{elec,y} = f_{cap} * f_{wg} * \sum_{j}\sum_{i} ((EG_{i,j,y} * EF_{elec,i,j,y})) \quad (1a - 1)$$

Where:

f cap = Energy that would have been produced in project year y using waste heat generated in base year expressed as a fraction of total energy produced using waste heat in year y. The ratio is 1 if the waste heat generated in project year y is same or less then that generated in base year. The value is estimated using equation (1f) and (1f-1)

f wg = Fraction of total electricity generated by the project activity using waste heat. Since the steam used for generation of the electricity is produced in dedicated boilers but supplied through a common header, this factor is estimated using equation (1e).

EG i,j,y = is the quantity of electricity supplied to the recipient *j* by generators, which in the absence of the project activity would have been sourced from *i*-th source (the coal fired captive power plant) during the year *y* in MWh, and

EF elec, i,j,y = is the CO_2 emission factor for the electricity source i (i=is (identified source) = combined margin of the western regional electricity grid in tons CO_2/MWh

Calculation of the energy generated in units supplied by waste gas and other fuels

The fraction of energy produced by the project activity is calculated based on 'situation 2' from methodology ACM0012, using equation 1.e, as follows. This method is applicable since all boilers provide superheated steam to the common header.

$$f_{wg} = ST_{whr,y} / (ST_{whr,y} + ST_{other,y}) \quad (1e)$$

Where:

ST whr, y = Energy content of the steam generated in waste heat recovery boiler fed to turbine via common steam header (GJ)

ST other, y = Energy content of the steam generated in other boilers fed to turbine via common steam header (GJ)

Capping of baseline emissions

Since the project uses waste gas from newly built sponge iron kilns, data on waste gas released, flared or combusted for the past 3 years does not exist. Therefore method 2 from methodology ACM0012 is used to estimate the cap on baseline emissions. f cap is estimated using equations 1.f and 1.f-1:

$$f_{cap} = Q_{WG,BL} / Q_{WG,y} \qquad (1f)$$

Where:

Q (WG, BL)	=	Quantity of waste gas that is likely to be generated by the two kilns (250TPH ar 350TPH) and vented into the atmosphere in the baseline, estimated using equation 1f-1. (Nm3)
Q (WG, y)	=	Quantity of waste gas used for energy generation during year y (Nm3).

$$Q_{WG,BL} = Q_{BL,product} * q_{wg,product} \qquad (1f\text{-}1)$$

Where

$Q_{(BL, product)}$	=	Production by process that most logically relates to waste gas generation in the baseline. Since the project is a new facility and no three years data is available, manufacturer's data will be used.[54]
$q_{(wg,product)}$	=	Amount of waste heat the industrial facility generates per unit of product generated by the process that generates waste heat. This is estimated as per the manufacturer's specification.

Project emissions:

No project emissions occur due to the supplemental consumption of fossil fuel at the project plant.

Emission Reductions

Emission reductions due to the project activity during the year *y* are calculated as follows:

$$ER_y = BE_y - PE_y$$

[54] The parameter Q (BL, product) is established based on the clarification AM_CLA_0071

Where:

ER y = are the total emissions reductions during the year *y* in tons of CO_2

BE y = Baseline emissions from the project activity during the year *y* in tons of CO_2

PE y = Project emissions for 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:	Q WG, BL
Data unit:	m^3 of waste heat at NTP or other relevant unit
Description:	Average quantity of waste heat generated in three years prior to the start of the project activity.
Source of data used:	Manufacurer's specifications
Value applied:	1,166,400,000 Nm^3/yr
Justification of the choice of data or description of measurement methods and procedures actually applied:	Estimated based on information provided by the technology supplier on the waste heat generation per unit of product and volume or quantity of production. (180,000 t × 6,480 Nm^3/t = 1,166,400,000 Nm^3)
Any comment:	The three year's average quantity of waste heat is estimated on the basis of specifications from the manufacturer regarding the average waste heat generation as well as the kiln operation. This value is a conservative estimate of the potential waste heat generation from the process that most logically relates to the waste heat generation.

Data / Parameter:	Q BL, Product
Data unit:	t
Description:	Production associated with the relevant waste energy generation as it occurs in the baseline scenario. The minimum of the following two figures should be used: (1) historical production data from start-up (or three years which ever is lower) of the plant or (2) the most relevant manufacture's data for normal operating conditions. In case of new facilities or where data is not available the manufacture's data for normal operating conditions shall be used.
Source of data used:	Project proponents and manufacturer
Value applied:	180,000 t / year
Justification of the choice of data or description of measurement methods	Based on manufacturer specifications. Since the project is a new facility and data for three years prior to the project implementation is not available the approach for new facilities is used. As per the manufacturer's information, under normal operating conditions, kiln 1

and procedures actually applied:	would produce 250 tons per day and kiln 2 would produce 350 tons per day. Both kilns would normally operate for 300 – 330 days a year. For conservativeness, the lower end of the range for annual operational days is used. This parameter is based on the clarification AM_CLA_0071.
Any comment:	The value is determined based on manufacturer information about normal operating conditions of the kilns.

Data / Parameter:	q wg, product
Data unit:	Nm^3 / Ton
Description:	Specific waste heat production per unit of product (plant product which most logically relates to waste heat generation) generated as per manufacturer's data. This parameter should be analysed for each modification of the process which can potentially impact the waste heat quantity. (Nm3/Ton)
Source of data used:	Manufacturer's specification
Value applied:	6,480 Nm3/t
Justification of the choice of data or description of measurement methods and procedures actually applied:	It is determined based on information provided by the technology supplier on the normal waste heat generation and sponge iron output.
Any comment:	Value is estimated using the equipment specification for the sponge iron kilns.

Data / Parameter:	EF
Data unit:	t CO_2 / MWh
Description:	Carbon intensity of the grid to which the Project supplies electricity or from which the Project displaces electricity
Source of data used:	Central Electricity Authority, India: CO2 Emission database for the power sector, version 3 (December 2007)
Value applied:	0.79
Justification of the choice of data or description of measurement methods and procedures actually applied :	Baseline emission factor is calculated according to ACM0002 and published by CEA India: Emission database of the Indian power sector, version 3 (December 2007)
Any comment:	Under the assumption that the power plants feeding the grid a) use a mix of fossil fuels and renewables, while captive thermal plant would use only char residue from the kiln, coal and lignite (which are highly carbon intensive fossil fuel); and b) are generally more efficient than captive plants because of their larger size. Assuming a fuel emission factor of 25.8 tC/TJ and a plant efficiency of 33%, the emission factor of a power plant using coal comes to about 1 tCO_2/MWh, compared to 0.79 tCO_2/MWh for grid electricity, which is used as the baseline emission factor.

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante emission reduction calculations are as follows:

ER (y) = BE (y) – PE (y)

Where:

ER: Emission reductions (t CO_2e)

BE: Baseline emissions (t CO_2e)

PE: Project Emissions (t CO_2e)

y: a given year

Step 1. Calculate baseline and project emissions

As per the project participants calculation, the expected annual net electricity displaced by the project activity will be 86,606 MWh, and the baseline emissions will be calculated as per the methodology described in section B 6.1 above, thus,

$BE_{elec,y} = f_{cap} * f_{wg} * \Sigma\Sigma ((EG_{i,j,y} * EF_{elec,i,j,y}))$

$= (180{,}000 \text{ t} \times 6{,}480 \text{ Nm}^3/\text{t}) / (1{,}123{,}632{,}000 \text{ Nm}^3) \times 0.4287 \times 202{,}019 \text{ MWh} \times 0.79 \text{ tCO}_2/\text{MWh}$

$= 68{,}419 \text{ tCO}_2\text{e}$

Step2. Estimation of emission reductions (ERy)

Emission reductions are equal to baseline emissions minus project emissions:

$ER_y = BE_y - PE_y = 68{,}419 – 0 = 68{,}419 \text{ tCO}_2\text{e}$

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

Year	Estimation of Project activity Emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of Emission reductions (tonnes of CO_2e)
2008 (August to December)	0	26,607	26,607
2009	0	68,419	68,419

2010	0	68,419	68,419
2011	0	68,419	68,419
2012	0	68,419	68,419
2013	0	68,419	68,419
2014	0	68,419	68,419
2015	0	68,419	68,419
2016	0	68,419	68,419
2017	0	68,419	68,419
2018 (January to July)	0	39,911	39,911
Total	0	**613,868**	**613,868**

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

The project uses the monitoring methodology described in AMC0012, version 1, EB32.

B.7.1 Data and parameters monitored:

Capping of baseline emissions:

Data / Parameter:	**Q wg, y**
Data unit:	Nm^3
Description:	Quantity of waste heat used for energy generation during year y (Nm^3)
Source of data to be used:	plant data measurement records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,123,632,000
Description of measurement methods and procedures to be applied:	Direct continuous measurements by project participants through an appropriate metering device (e.g. flow meter, installation between ESP and stack).
QA/QC procedures to be applied:	Measuring equipment will be regularly calibrated to the applicable industry standards according to manufacturer recommendation. During the time of calibration and maintenance, alternative equipment should be used for monitoring. If calibration and maintenance is carried out during downtime of the kiln and boiler, no alternative equipment will be used since there won't be any heat flow that needs to be measured.
Any comment:	Measurement uncertainty (accuracy) is smaller than 0.5%

Data / Parameter:	EG i,j,y
Data unit:	MWh
Description:	Quantity of electricity supplied to the recipient *j* by generator, which in the absence of the project activity would have sourced from *i*- th source (*i* is the identified source) during the year *y* in MWh
Source of data to be used:	Recipient plant(s) and generation plant measurement records. The project plant supplies all its electricity generated to the steel plant. There is a calibrated electricity meter installed at the project plant which is located inside the premises of the steel complex. The metered electricity at the generation plant has to be reported to the electricity board for taxation purposes. Since the electricity board does not allow a second meter to be installed at the recipient plant, the electricity meter at the generation plant will be used to determine the total electricity generated by the captive power plant and supplied to the recipient plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	202,019
Description of measurement methods and procedures to be applied:	Electricity will be continuously measured with an electricity meter and data will be recorded monthly.
QA/QC procedures to be applied:	The energy meters will undergo regular maintenance and calibration to industry standards according to manufacturer recommendation. The methodology requires sales records and purchase receipts to ensure consistency of the data monitored. Since the project is a captive power plant such purchase receipts won't be available from a third party. Instead of using third party purchase receipts, internal accounting records will be used for verification. To ensure consistency, the data will be cross-checked with fossil fuel consumption as well as sponge iron production output to ensure consistency of the applied steam energy parameters monitored under this methodology.
Any comment:	Data shall be measured at the recipient plant(s) and at the generation plant for cross check. The project plant supplies all its electricity generated to the steel plant. There is a calibrated electricity meter installed at the project plant which is located inside the premises of the steel complex. The metered electricity at the generation plant has to be reported to the electricity board for taxation purposes. Since the electricity board does not allow a second meter to be installed at the recipient plant, the electricity meter at the generation plant will be used to determine the total electricity generated by the captive power plant and supplied to the recipient plant. See also '<u>Metering of Electricity from waste heat recovery supplied to the steel plant' below in section B.7.2.</u>

Fraction of electricity generated from WHR

Data / Parameter:	**STwhr,y**
Data unit:	kJ/kg
Description:	Energy content of the steam generated in waste heat recovery boiler fed to turbine via common steam header
Source of data to be used:	Steam tables
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,393.21 kJ/kg 65 bar, 490°C Assumed average of 51.1 TPH Expected annual WHR steam energy applied to turbine: 3,393.21 kJ/kg * 51,100 kg/h * 8760 h/yr = 1,518 TJ/year
Description of measurement methods and procedures to be applied:	Energy content will be calculated on the basis of monitored steam flow, temperature and pressure.
QA/QC procedures to be applied:	The steam flow, temperature and pressure meters will undergo regular maintenance and calibration to the industry standards according to manufacturer recommendation.
Any comment:	

Data / Parameter:	**ST (other), y**
Data unit:	kJ/kg
Description:	Energy content of the steam generated in other boilers fed to turbine via common steam header
Source of data to be used:	Steam tables
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3,393.21 kJ/kg 65 bar, 490°C Average 68.1 TPH Expected annual FBC steam energy applied to turbine: 3,393.21 kJ/kg * 68,100 kg/h * 8760 h/yr = 2,023 TJ/year
Description of measurement methods and procedures to be applied:	Energy content will be calculated on the basis of monitored steam flow, temperature and pressure.
QA/QC procedures to be applied:	The steam flow, temperature and pressure meters will undergo regular maintenance and calibration to the industry standards according to manufacturer recommendation
Any comment:	

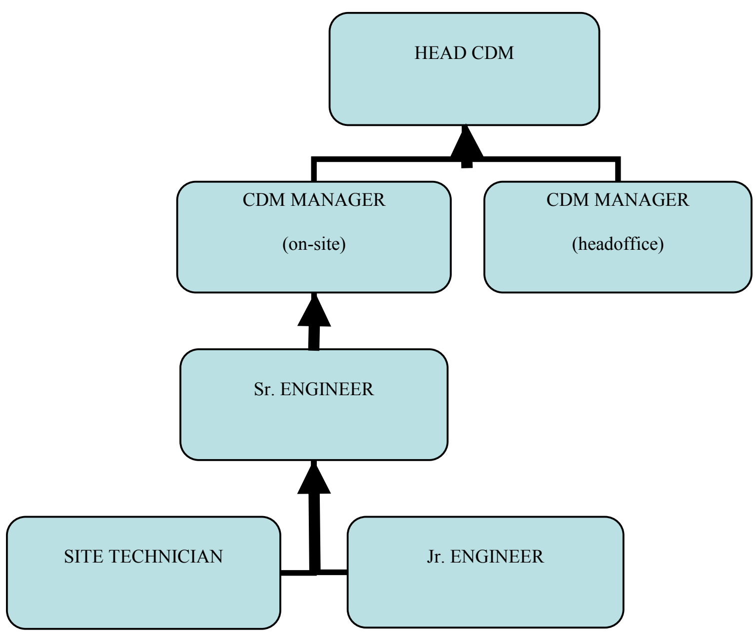
B.7.2 Description of the monitoring plan:

This section details the steps taken to monitor on a regular basis the GHG emission reductions from the Electrotherm 30MW waste heat recovery based power project in India.

The Monitoring Plan for this project has been developed to ensure that from the start, the project is well organised in terms of the collection and archiving of complete and reliable data.

Prior to the start of the crediting period, the organisation of the monitoring team will be established. Clear roles and responsibilities will be assigned to all staff involved in the CDM project and an on-site CDM Manager will be nominated. The on-site CDM Manager will have the overall responsibility for the monitoring system related to this project, particularly the checking of data as well as the management of the collection, storage and archiving of all data and records. A preliminary organisation chart is shown in figure B.7-1 below.

Figure B.7-1: Monitoring Organisation



A formal set of monitoring procedures will be established prior to the start of the project. These procedures will detail the organisation, control and steps required for certain key monitoring system features, including:

a) CDM staff training
b) CDM data and record keeping arrangements
c) Data collection

d) CDM data quality control and quality assurance
e) Equipment maintenance
f) Equipment calibration
g) Equipment failure

See Annex 4 for a description and the scope of these procedures.

Regular internal audits will be conducted to assure consistency of monitored data. EcoSecurities will perform a regular final check of the data and analyse project performance prior to any verification.

A preliminary set of monitoring tasks and responsibilities is described below, final monitoring roles & responsibilities will be defined before the operational start of the project and if necessary adjusted according to internal requirements during the crediting period.

Site Technician

- Meter readings and data collection
- Recording of data

Jr. Engineer

- Record keeping of the raw data
- Assist in meter reading

Senior Engineer

- Management of equipment calibrations
- Management of equipment maintenance

CDM Manager (On-site)

- Supervision of Sr. Engineer, Site Technician & Jr. Engineer
- Quality control of monitoring system
- Arrangement of staff training
- Cross checking of data

The On-Site CDM Manager will be responsible for ensuring that the procedures are followed on site and for continuously improving the procedures to ensure a reliable monitoring system is established.

All staff involved in the CDM project will receive relevant training laid down in training procedures. Records of trained CDM staff will be retained by the Project Developer. The CDM Manager will ensure that only trained staff is involved in the operation of the monitoring system.

Metering of Electricity from waste heat recovery supplied to the steel plant

The main electricity meter for establishing the total electricity delivered to the steel plant (detailed in B.7.1) will be installed at the main control room. In order to determine the portion of electricity generated from the waste heat recovery boilers, the energy content of WHR-steam as well as of FBC-steam will be monitored.

The steam flow meters are located in between the FBC/WHR boilers and the common steam header. Temperature and pressure are monitored before the steam enters into the common steam header. Steam flow, temperature and pressure are monitored continuously by the decentralized control system (DCS).

All data will be back-upped and shall be kept until two years after the end of the crediting period.

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 and the monitoring methodology were concluded on 25 May 2008. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group PLC, listed in Annex 1 of this document as a project participant.

Contact: henning.thiel@ecosecurities.com

Detailed baseline information is attached in Annex 3.

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:

03 October 2006

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

More than 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:

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

The crediting period will start on 01 August 2008 or the date of registration, whichever is later

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

The project is not expected to create severe environmental impacts, and an EIA is not required for the establishment of the power plant since the total investment cost is below INR 1,000,000,000. However, an EIA was carried out by the project developer because the sponge iron plant and the power plant were planned and implemented almost simultaneously and the investment cost for both projects exceeds the above mentioned threshold.

Table D. 1 shows identified environmental impacts of the WHR power plant and mitigation measures.

Table D. 1: Identified environmental impacts

	Environmental impact	Mitigation measure
Air	Increased suspended particulate matter and gaseous emissions	Installation of stacks of adequate height as well as an ESP to maintain concentrations in prescribed norms
Water	Increased industrial wastewater	The wastewater will be used for sprinkling inside the premises for dust suppression.
Noise	Increased noise level	Ear protection will be provided to workers in high noise areas and noise from the turbine room will be controlled by providing an acoustic enclosure or by treating the room acustically.

The EIA did not identify any adverse environmental impacts resulting from the project activity. Those identified impacts were classified as not significant and mitigation measures are planned.

For the installation of the power plant, an approval from the Pollution Control Board is required. This approval will be recorded and provided during validation.

As mentioned, the plant will have an electrostatic precipitator which will limit particle emissions to less than 150mg/Nm3. Particle emissions will therefore meet the regulations governing air pollution (Air Prevention and Control of Pollution Act, 1981). There is no water pollution associated with the plant as water will only be used for indirect cooling and steam generation.

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:

As highlighted above environmental impacts are not considered significant and the plant will meet all local and national environmental policies and standards. There is only noise pollution occurring in the area where the turbine is located. Noise protection will be provided to the workforce that is affected.
With mitigation controls planned as part of the project design, construction and operation, and the contribution made by the project to sustainable development at local and national scale, the project is expected to have an overall positive impact on the local and global environment.

SECTION E. Stakeholders' comments

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

According to national legislation, all CDM projects must carry out a stakeholder consultation which includes inviting key local stakeholders to provide comments. These comments must be taken into account in the design and operation of any project.

The project developer has published an advertisement in 2 local newspapers in order to inform a wide range of local stakeholders and invite their comments on the project. One advertisement was placed in English language in 'The Times of India', Ahmedabad issue on 19 February 2007; a second advertisement was placed in 'Divya Bhaskar' in Gujarati, the local language on 19 February 2007.

In addition, the project developer has identified 14 parties (see table below) from the government and private sectors, and from the steel and power industries as well as from the local population. Those stakeholders were informed about the CDM project by a letter describing the project and its related impacts on the environment and invited them to give their comments about the project. A questionnaire was attached to those letters, asking specific questions about the impact of the CDM project on the socio-economic environment and living quality of affected people.

Table E-1: List of identified local stakeholders

SN	Name of Party & Address
1	Mr. Shri Babubhai Meghji Shah
2	Mr. Subhash Golchha Hon. Gen. Secretary Kutch Iron & Steel Association
3	Mr. SB Raval, Managing Director M/s Paschim Gujarat Vij Co. Ltd,
4	Mr. Nimish Phakdey Hon. General Sec. Federation of Kutch Industries Association
5	Mr.M. Ozat, Village Mamlatdar,
6	Mr. CL Meena, Pollution Control Board Guajrat,

7	Mr. Shri Jashvant Acharya Director, Gujarat Energy Development Agency,
8	Smt. Vijayalaxmi Joshi, IAS (CMD), Gujarat Urja Vikas Nigam Ltd,
9	Mr. SK Negi (MD), Gujarat Energy Transmission Corporation Ltd,
10	Mr. Kanjhi, Local Villager, Kutch, Gujarat, INDIA.
11	Mr. Chnnaram, Sarpanch, Gram Panchayat,
12	Mr. Patel, Gram Panchayat, Village : Secretary (Talati)
13	Indian Renewable Energy, New Delhi. India Habitat Centre Complex,
14	Ms. G. Subba Rao, Gujarat Energy Regulatory Commission,

All stakeholders were given a 30 days period to submit their comments.

E.2. Summary of the comments received:

The project developer received back 7 filled questionnaires out of 14 distributed. The project developer made an evaluation of the replies in order to understand the stakeholders' opinion and to address possible negative comments. It was found that the answers to the respective questions indicate that there are no concerns from the local stakeholders towards the socio-economic as well as ecological impacts of the CDM project and that all stakeholders support such clean technology projects.

Another 2 stakeholders submitted their comments in response to the newspaper advertisement published by the project developer. Mr. Patel and Mr. Purohit both welcome the CDM project as it contributes in their opinion to better environmental standards.

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

Mr. Patel asked for more details of the CDM project and a draft PDD was sent to him on 3 March 2007.

In conclusion, the local stakeholder consultation was very successful since its result was that no local people will be affected in a negative manner by the implementation and operation of the CDM project. Rather than that, local stakeholders are convinced that such projects contribute to a better socio-economic environment. No objection was expressed by any of the stakeholders of the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Electrotherm India Ltd.
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URL:	http://www.ecosecurities.com
Represented by:	COO & President
Title:	Dr.
Salutation:	Sir.
Last Name:	Costa
Middle Name:	Moura
First Name:	Pedro
Department:	
Mobile:	

Direct FAX:	
Direct tel:	+44 1865 202 635
Personal E-Mail:	cdm@ecosecurities.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the proposed project.

Annex 3

BASELINE INFORMATION

coal CPP				
load factor FBC	=	95%		%
h / yr	=	7920		h/yr
internal consumption	=	10.5%		%
Waste Gas				
operational hours of kinls	=	6,936		h
Q WG 1 (h)	=	72,000		Nm 3 / h
Q WG 2 (h)	=	90,000		Nm 3 / h
Q WG (h) total	=	162,000		Nm 3 / h
Q product BL	=	180,000		t/yr
Q product y	=	173,400		t/yr
Q product	=	25		t/h
q product	=	6,480		NM3/t
Q wg (bl)	=	1,166,400,000		Nm 3 /yr
Q wg (Y)	=	1,123,632,000		Nm 3 /yr
CDM				
EG total supplied (y)	=	202,019		MWh / a
EG total supplied (y) WG	=	86,606		MWh / a
EG total supplied (y) FBC	=	115,413		MWh / a
% WHR energy	=	42.87%		%
h / yr	=	6,936		h
whr	=	51.1		TPH
fbc	=	68.1		TPH
lf whrb	=	79.20%		%
ST energy FBC	=	3,393		kJ/kg
ST energy FBC	=	2,023		TJ/year
ST energy WHR	=	3,393		kJ/kg
ST energy WHR	=	1,518		TJ/year
ST whr (load)	=	289		days
ST coal (load)	=	330		days

Annex 4

MONITORING INFORMATION

CDM Monitoring System Procedures

Procedure name	Description
CDM Staff training	This procedure outlines the steps to ensure that staff receives adequate training to collect and archive complete and accurate data necessary for CDM monitoring.
CDM data and record keeping arrangements	This procedure provides details of the sites data and record keeping arrangements. The arrangements ensure that complete and accurate records are retained by the CDM Manager within the quality control system. Data and records will be stored and archived according to this procedure.
Data collection	This procedure will outline the steps to collect the data from the monitoring equipment.
CDM data quality control and quality assurance	Data and records will be checked prior to being stored and archived. Data from the project will be checked to identify possible errors or omissions.
Equipment maintenance	This procedure outlines the steps to provide regular and preventative maintenance to the monitoring equipment
Equipment calibration	This procedure details the process of organising and managing the calibration process.
Equipment failure	This procedure details the process of data collection in the case that an emergency situation occurs such as a problem with the monitoring equipment.

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