Voluntary Carbon Standard
Project Description

[Date of the VCS PD]

07/09/2009

[Table of Contents]

S.No	CONTENT
1	Description of Project
2	VCS Methodology
3	Monitoring
4	GHG Emission Reductions
5	Environmental Impact
6	Stakeholders comments
7	Schedule
8	Ownership

1 Description of Project:

1.1 Project title

8MW Waste Heat Recovery Based Power Project by Sree Rengaraaj Power India Private Limited.

Version: 02

Date : 07/09/2009

1.2 Type/Category of the project

As per Voluntary Carbon Standard (VCS) -2007.1 the Project falls under GHG emission reductions from waste energy recovery projects.The total capacity of the project activity is 8 MW.

Sectoral Scope : Energy Industries (renewable/ non-renewable sources) and Manufacturing Industries

Category : **ACM0012**"Consolidated baseline methodology for GHG Emission Reduction from waste energy recovery projects".

Version : 3.1

Reference :

http://cdm.unfccc.int/UserManagement/FileStorage/FI2PAALEOP8XPVOS2NVDFSQ8RVMUBS

1.3 Estimated amount of emission reductions over the crediting period including project size:

This project activity reduces the green house gas emission in the range of 5,000-1,000,000 tCO_2e per year. The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid. If the absence of this project activity both Rengaraaj steel and its sister concern will import power from southern regional grid. The Plant Load Factor for this project activity is 80%. Net Electricity generated from this project is 50,458 MWh/yr. Electricity generated from waste heat projects being GHG neutral, the annual GHG emission reduction through this project activity is estimated to be 43,179 tonnes of Carbon dioxide equivalent.

Table-1: Estimated amount of emission reductions over crediting period (From 28th March 2006 to 27th March 2016)

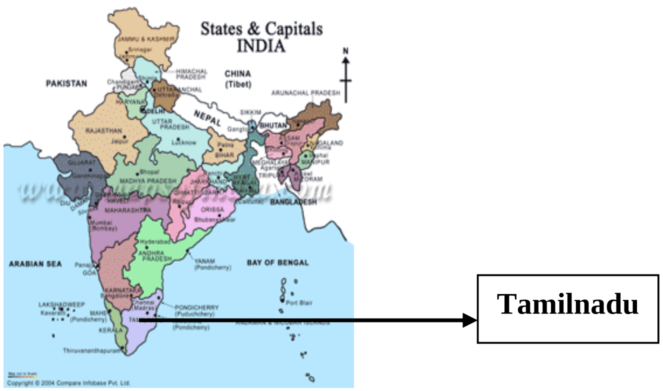
Years	**Estimation of annual emission reductions in tonnes of Co_2e**
2006-2007	43,179
2007-2008	43,179
2008-2009	43,179
2009-2010	43,179
2010-2011	43,179
2011-2012	43,179
2012-2013	43,179
2013-2014	43,179
2014-2015	43,179
2015-2016	43,179
Total estimated reductions (tonnes of CO_2e)	431,790
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period(tCO_2 e)	43,179

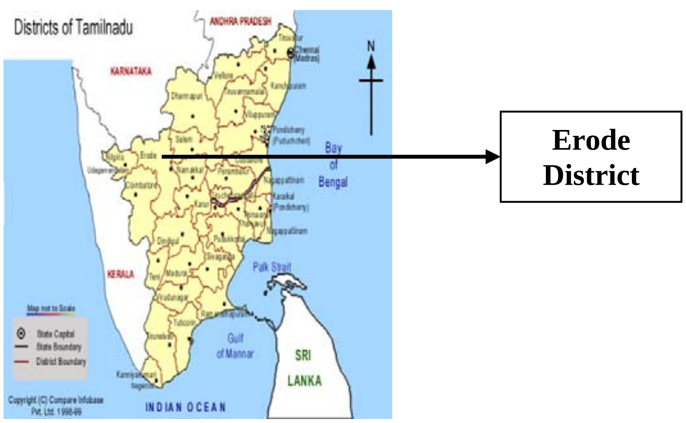
1.4 A brief description of the project:

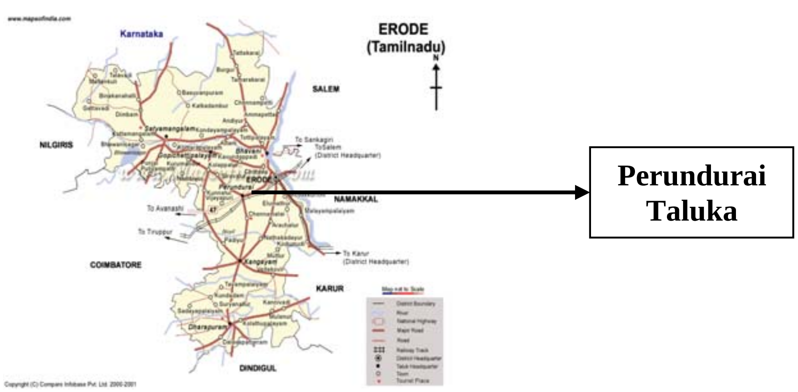
Sree Rengaraaj Power India Private Limited (SRPIPL) is operating a Sponge Iron Plant with an annual capacity of 350 Tons/day. Flue gas with high heat content is generated in the Rotary kiln in the Sponge iron plant during Sponge iron conversion from iron ore. The total flue gas generated from this kiln is 84,000 Nm3/hr and this rotary kiln is directly connected to the WHR Boiler with a steam generation capacity of 36 TPH. The total waste flue gas generated is ducted to the WHR boilers to generate steam at 64 Kg/cm2 and 485°C.The generated steam is then fed in to the 8 MW bleed cum condensing Turbo Generator for power generation.

The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid. If the absence of this project activity both Rengaraaj steel and its sister concern will import power from southern regional grid.Net Electricity generated from this project is 50,458 MWh/yr. Electricity generated from waste heat projects being GHG neutral, the annual GHG emission reduction through this project activity is estimated to be 43,179 tonnes of Carbon dioxide equivalent.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:







The spatial extent of the project boundary comprises the waste heat gas source, captive power generating equipment, any equipment used to provide auxiliary heat and the power plants connected physically to the electricity grid that the proposed project activity will affect. At the project site there is captive power generating equipment but there is no injection of fuel into the after burning chamber to provide auxiliary heat. We therefore limit the spatial extent to the captive power generating equipment and the power plants connected to the grid.

Latitude (N)	:	$11^0$14'15''
Longitude (E)	:	$77^0$32'53''
Taluka	:	Perundurai Taluka
District	:	Erode
State	:	Tamilnadu

1.6 Duration of the project activity/crediting period:

Project start date :	21/12/2005 (Grid parallel connection date)
Crediting period start date:	28/03/2006 (The date on which the first monitoring period starts)
VCS project crediting period:	Fixed crediting period of 10 years which may be renewed once.

1.7 Conditions prior to project initiation:

There are five regional grids in India namely, Northern, Western, Southern, Eastern and North Eastern regions. All the States in India are connected to one of these five regional grids.The southern regional grid supplies electricity for southern states namely Andhra Pradesh, Karnataka, Kerala, Tamilnadu and one union territory Pondicherry. The project is located in the state of Tamilnadu and connected to the Southern regional Grid.

This 8MW Waste Heat Recovery Based Power project is located in Erode District in Tamilnadu. The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid. So even in absence of this project activity the power generation would continue to be by the existing and/or new grid connected power plants in the southern region grid. According to the current scenario in southern regional grid, the power generation by fossil fuel based thermal power plants are dominating the grid

Type of power plants and their net power generation in 2005-06

Type of Power Plant	GWh	%
Thermal Power Plant	1,08,236	73.90
Hydro Power Plant	33,505	22.87
Nuclear Power Plant	4,713	3.21
Total	**1,46,455**	**100**

Reference: http://www.cea.nic.in/god/opm/Monthly_Generation_Report/18CT0307.pdf

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

This project activity generates 8MW power from the waste heat of flue gases generated in DRI Kilns of Sponge iron plants. The Plant Load Factor for this project activity is 80%. Net Electricity generated from this project is 50,458 MWh/yr. Electricity generated from waste heat projects being GHG neutral, the annual GHG emission reduction through this project activity is estimated to be 43,179tonnes of Carbon dioxide equivalent.

The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid dominated by the fossil fuel based power Generation.

1.9 Project technologies, products, services and the expected level of activity:

Rankine Cycle Technology is selected for this power plant, wherein waste gas of sponge iron kiln is used in steam generator to produce high pressure steam, which is then expanded in a steam turbine to generate power. Rankine Technology is efficient and mostly practised in many power plants.

This Project activity has installed a waste heat recovery boiler along with a turbo generator in the sponge iron manufacturing facility for recovering the heat energy from waste gas generated from the direct Reduction iron kiln to generate power. The installed capacity of this project is 8MW.

The Major equipment of this 8MW captive power plant is:

- Waste heat recovery boiler (WHRB)
- Steam turbine generated (STG) rating 8MW.

Waste Heat Recovery Boiler: Steam pressure and temperature at the outlet of the WHRB is fixed at the optimum level of 64 ata and 485^{0}C respectively. As per engineering specification the WHRB is of unfired, single drum, top supported and natural circulation type.

Major Technical Parameters of Waste Heat Recovery Boiler

Steam output, Max. Continuous rating (MCR)- 36 TPH

Steam pressure at super heater outlet - 64 ksca

Steam temperature super heater outlet - 485 deg C

Feed water temperature at the economizer outlet- 200 deg C

Waste gas inlet condition

Gas flow rate, (max.) - 85,000 Nm3/hr

Gas flow rate (normal)- 75,000 Nm3 /hr

Gas temperature, - 900 – 1000 deg C

Dust content - 35 g/ Nm3

Exit temperature of the waste gas - 180 deg C

Normal steam generating capacity of the WHRB- 36 TPH

Steam Turbine: The steam turbine is an impulse-reaction type, straight condensing type machine with uncontrolled extraction for regenerative feed heating.

Major Technical Parameters of Steam Turbine

Rated capacity of turbine- 8000 KW

Steam conditions at turbine inlet pressure (abs) – 64 ata

Temperature- 480 deg C

1.10 Compliance with relevant local laws and regulations related to the project:

- The Project Proponent made an agreement with Tamilnadu Electricity board for Parallel operation of 8MW with TNEB Grid at 33KV Level.

  Lr No.CE/Comml/EET/AE1/F.Rangaraj/CR.1226/2005 Dt 21.12.05.
- Tamilnadu Pollution Control Board (TNPCB) has issued the consent for operation for this WHR project under section 21 of the air (Prevention and control of Pollution) Act .1981 as amended. Consent Order No-16768 and proceedings no-T7/TNPCB/F27171/ERD/RL/A/2006, dated 11/10/2006.
- Tamilnadu Pollution Control Board (TNPCB) has issued the consent for operation for this WHR project under section 25/26 of the water (Prevention and control of Pollution) Act .1974 as amended. Consent Order No-20733 and proceedings no-T7/TNPCB/F27171/ERD/RL/W/2006, dated 11/10/2006.

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

The project faces some operational risks that could substantially reduce the project's GHG emission reduction. These operational barriers are detailed in section 2.5 of this PD.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The project activity involves power generation from waste heat of flue gases generated in DRI Kiln of sponge iron plant. Hence power generated from WHR plant reducing corresponding electricity consumption from grid, which ultimately results less GHG emissions. Thus the project activity was not primarily implemented to create GHG emissions.

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

This project activity has not created any other form of environmental credit. The supporting document was submitted to the validator.

1.14 Project rejected under other GHG programs (if applicable):

The project activity has not rejected by any GHG programs.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

Organization:	Sree Rengaraaj Power India Private Limited
Street/P.O.Box:	No 99, Sankagiri Main Road,
Building:	
City:	Salem
State/Region:	Tamilnadu
Postfix/ZIP:	636 002
Country:	India
Telephone:	+91 427 2270235
FAX:	
E-Mail:	sripl05@yahoo.co.in
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	
Middle Name:	
First Name:	S.Shyam Sundar
Department:	
Mobile:	+91 9842442105
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	ABI Energy Consultancy Services Private Limited.
Street/P.O.Box:	22,Subramaniyanagar 2nd Street ,Rengarajapuram, ,Kodambakkam
Building:	
City:	Chennai
State/Region:	Tamilnadu
Postfix/ZIP:	600024
Country:	India
Telephone:	+91 44 6538 3966
FAX:	+91 44 2480 2416
E-Mail:	info@abienergy.com
URL:	www.abienergy.com
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	
Middle Name:	
First Name:	K.Vijayarajan
Department:	
Mobile:	+91 94444 81041
Direct FAX:	
Direct tel:	
Personal E-Mail:	vijay@abienergy.com

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, Sectoral, social, environmental, geographic, site-specific and temporal information.):

The project participants obtained all clearances from stakeholders hence no legal risks are found. The project activities contribution towards sustainable development in terms of society, environment and economy (both direct and indirect impacts) are stated below:

Socio-Economic Impacts:

- Creates employment opportunities in the project vicinity during erection & commissioning
- Employment creation both temporary and permanent
- Improved power supply
- Promotes self employment among the unemployed youth (eg., spare parts shops);

Environmental Impacts:

- In India most of the power generation is based on the fossil fuel like coal, oil and gas but the proposed project activity generates the electricity from the waste flue gas and thereby reducing the GHG Emissions from the fossil fuel based power generation in the regional grid.

- The Project activity utilizes the enthalpy of the hot flue gas, which will protect the environment from thermal pollution.

1.17 List of commercially sensitive information (if applicable):

There is no commercially sensitive information for this project activity.

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

Sectoral Scope : 1 & 4

Category : **ACM0012**“Consolidated baseline methodology for GHG Emission Reduction from waste energy recovery projects”.

Version : **3.1**

Reference : http://cdm.unfccc.int/UserManagement/FileStorage/FI2PAALEOP8XPVOS2NVDFSQ8RVMUBS

The methodology ACM0012 refers to the latest approved versions of the following tools:

- ✓ Tool to calculate the emission factor for an electricity system, Version 1.1

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

S. No.	Applicability Conditions As per ACM0012	Applicability to this project activity
1	Type-1: All the waste energy in identified Waste Energy Carrying Medium (WECM) stream/s that will be utilized in the project activity, is, or would be flared or released to atmosphere in the absence of the project activity at the existing or new facility. The waste energy is 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); or • For generation of mechanical energy	The project activity generates electricity from waste heat. In the absence of the project activity waste flue gas will be released to the atmosphere.
2	If the project activity is based on the use of waste pressure to generate electricity, electricity generated using waste gas pressure should be measurable;	Project activity generates electricity from waste heat not from waste gas pressure.

3	Energy generated in the project activity may be used within the industrial facility or exported from the industrial facility;	The Energy generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid.
4	The electricity generated in the project activity may be exported to the grid or used for captive purposes;	The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid.
5	Energy in the project activity can be generated by the owner of the industrial facility producing the waste energy or by a third party (e.g. ESCO) within the industrial facility.	Energy in the project activity is generated by the SRPIPL.
6	Regulations do not constrain the industrial facility that generates waste energy from using fossil fuels prior to the implementation of the project activity;	There is no regulation constrain for this industrial facility to generate waste energy from fossil fuels prior to the implementation of the project activity.
7	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 new facilitiy.
8	The emission reductions are claimed by the generator of energy using waste energy;	The emission reductions are claimed by the generator of energy using waste energy.
9	In cases where the energy is exported to other facilities, an official agreement exists between the owners of the project energy generation plant 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 electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus electricity is exported to southern Regional grid. The exported power is wheeled to sister concern but the emission reduction is claimed by the generation plant not by the recipient plant.
10	For those facilities and recipients included in the project boundary, that prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods: • The remaining lifetime of equipments currently being used; and • Credit period.	The industrial facility and the power generation units are new projects. If the absence of this project activity power will be import from grid. Southern regional grid is the baseline for this project activity. The emission reduction claimed for entire crediting period of 10 year.
11	Waste energy that is released under abnormal operation (for example, emergencies, shut-down) of the plant shall not be accounted for.	The emission reduction will be claimed for net power generated by this project activity. Waste energy that is released under abnormal operation is not considered for

		emission reduction.
12	This methodology is not applicable to projects where the waste gas/heat recovery project is implemented in a single-cycle power plant (e.g. gas turbine or diesel generator) to generate power.	The project activity is generating electricity from waste flue gas of sponge iron kiln and not from waste gas/heat recovery in a single-cycle power plant.
13	Demonstration of use of waste energy in absence of project activity: The waste energy utilized in the project activity was flared or released into the atmosphere in the absence of the project activity at the existing facility.	All the Electricity required for the process before the implementation of the project activity was imported from TNEB grid. The waste energy from the industrial facility was released in to the atmosphere. Electricity bills from TNEB was submitted to the DOE.

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

	Source	**Gas**	**Included ?**	**Justification/Explanation**
Baseline	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.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	Supplemental fossil fuel consumption at the project activity	CO2	Excluded	This project activity recovers the heat content of waste gases emitted from the sponge iron Kiln and this heat is utilized to produce steam which is further used to generate electricity Hence there is no fossil fuel consumption due to the project activity.
		CH4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification.

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

Identification of the baseline scenario:

The project activity uses the approach described in the ACM0012/ Version 03.1- "Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects" for determining the baseline scenario

The baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s).

This industrial facility is a sponge iron manufacturing unit. There is no mechanical energy usage. Hence Mechanical energy generation is not a alternatives for this project activity.

Realistic and credible alternatives should be determined for:

- Waste energy use in the absence of the project activity
- Power generation in the absence of the project activity

The project participant shall exclude baseline options that:

- Do not comply with legal and regulatory requirements; or
- Depend on fuels (used for generation of heat, power or mechanical energy), that are not available at the project site.

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

The baseline candidates should be considered for the following facilities:

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

For the use of waste energy, the realistic and credible alternative(s) may include, *inter alia:*

Alternatives	Alternatives for use of Waste gas	Yes/No	Explanation
W1	WECM is directly vented to atmosphere without incineration or waste heat is released to the atmosphere or waste pressure energy is not utilized;	No	This project activity generates electricity from waste heat not from waste gas or waste pressure. This is not a alternatives for this Project activity.
W2	WECM is released to the atmosphere (for example after incineration) or waste heat is released to the atmosphere or	Yes	In absence of this project activity, waste heat is released to the atmosphere.

	waste pressure energy is not utilized;		
W3	Waste energy is sold as an energy source;	No	This project activity generates electricity from waste heat only. Before the commissioning of this project activity between march 2005 to January 2006 project proponent released the waste heat to the atmosphere and it is not sold as an energy source. Hence in the absence of this project activity, waste heat is released to the atmosphere.
W4	Waste energy is used for meeting energy demand;	No	This industrial facility is a sponge iron manufacturing unit. There is no waste energy demand for this industrial facility. Hence this is not a realistic alternative.
W5	A portion of the waste gas produced at the facility is captured and used for captive electricity generation, while the rest of the waste gas produced at the facility is vented/flared;	No	This project activity generates electricity from waste heat not from waste gas. This is not an alternative for the project proponent.
W6	All the waste gas produced at the industrial facility is captured and used for export electricity generation.	No	This project activity generates electricity from waste heat not from waste gas. This is not an alternative for the project proponent.

For power generation, the realistic and credible alternative(s) may include, *inter alia:*

Alternatives	**Realistic and Credible alternatives**	**Yes/No**	**Explanation**
P1	Proposed project activity not undertaken as a CDM project activity.	No	This is not a possible baseline alternative because the project activity faces many technological barriers as detailed in section 2.5 of this PD.
P2	On-site or off-site existing/new fossil fuel fired cogeneration plant.	No	This industrial facility is a sponge iron manufacturing unit. There is no steam requirement for this process. Therefore this is not a alternative for this project activity.
P3	On-site or off-site existing/new	No	This industrial facility is a sponge iron

	renewable energy based cogeneration plant.		manufacturing unit. There is no steam requirement for this process. Therefore this is not a alternative for this project activity.
P4	On-site or off-site existing/new fossil fuel based existing captive or identified plant.	No	This is a sponge iron manufacturing industrial facility. The electricity required for this industrial facility is less than 1400KVA. Before the commissioning of this project activity between march 2005 to January 2006 project proponent import 1400 KVA demand side power from the southern regional grid. Commissioning of coal and diesel power plant for this capacity was not a feasible option, because these two option was economically not viable. Letter from Technical consultant was submitted**.** Hence (On-site or off-site existing/new fossil fuel based existing captive or identified plant) this is not a alternatives for this project activity. **Source:** High tension Bills from the Tamilnadu Electricity Board, Erode Circle.
P5	On-site or off-site existing/new renewable energy or other waste energy based existing captive or identified plant.	No	Installation of new renewable energy based power plants like wind[1], hydro power[2] is found not to be a plausible alternative also project promoter doesn't have any previous experience in renewable energy sector and this project activity is the first of its kind in the states of southern region such as Tamilnadu, Kerala and Karnataka. Therefore this is not an alternative for this project activity. **Source:** Letter from Sponge Iron India limited dated

[1] Wind energy being seasonal power generation source does not cater to the process requirements of SIIL.

[2] There is no plausibility of hydro power in the nearby locality

			18th November 2006.
P6	Sourced Grid-connected power plants.	Yes	This is a sponge iron manufacturing industrial facility. The electricity required for this industrial facility is less than 1400KVA. Before the commissioning of this project activity between march 2005 to January 2006 project proponent **import 1400 KVA demand side power from the southern regional grid.** Hence this is the realistic and credible alternative for this project activity. **Source:** High tension Bills from the Tamilnadu Electricity Board, Erode Circle.
P 7	Captive Electricity generation using waste energy (if project activity is captive generation using waste energy, this scenario represents captive generation with lower efficiency than the project activity.)	No	This is a new waste heat recovery based power project and not a replacement for existing power generating units. Hence this is not an alternative for this project activity.
P8	Cogeneration using waste energy (if project activity is cogeneration with waste energy, this scenario represents cogeneration with lower efficiency than the project activity)	No	This project activity is not a cogeneration project. Therefore this is not a credible alternative for this project activity.
P9	Existing power generating equipment (used previous to implementation of project activity for captive electricity generation from a captured portion of waste gas) is either decommissioned to build new more efficient and larger capacity plant or modified or expanded (by installing new equipment), and resulting in higher efficiency, to produce and only export electricity generated from waste gas. The electricity generated by existing equipment for	No	This is a new waste heat recovery based power project and not a replacement for existing power generating units. Hence this is not an alternative for this project activity.

	captive consumption is now imported from the grid;		
P10	Existing power generating equipment (used previous to implementation of project activity for captive electricity generation from **a captured portion** of waste gas) is either decommissioned to build a new more efficient and larger capacity plant or modified or expanded (by installing new equipment), and resulting in higher efficiency, to produce electricity from waste gas (already utilized portion plus the portion flared/vented) for own consumption and for export;	No	This is a new waste heat recovery based power project and not a replacement for existing power generating units. Hence this is not an alternative for this project activity.
P11	Existing power generating equipment is maintained and additional electricity generated by grid connected power plants.	No	This is a new waste heat recovery based power project and not an addition of power in the existing one. Hence this is not a alternative for this project activity.

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

Power generation alternatives	Identified fuel for the energy source
P6: Sourced Grid-connected power plants.	If the absence of the project activity the power will be supplied by the southern regional grid.

The identified baseline for this project activity are listed & explained below:

Alternative: Import of electricity from Southern regional grid

Alternative: Import of electricity from southern regional grid

In the absence of this project activity, SRPIPL and their sister concern was import of electricity from southern regional grid .TNEB monthly bill for Sree Rengaraaj steel and their sister concern was submitted to the validator. This alternative(**Import of electricity from**

southern regional grid) is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline.

Step 3: Step 2 and/or Step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" shall be used to identify the most plausible baseline scenarios by eliminating non-feasible options (e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive).

Evaluation of alternatives for baseline selection:

To evaluate the appropriate baseline scenario for this project activity, the alternative is discussed below

Alternative baseline scenario	Operation Costs per unit	Source	Comments
1) Import of electricity from local grid	Industrial consumption Rs 3.50	TNEB Monthly Bill	• Initial investment is very less • Easily available source • Technical difficulties are very less. • Regulatory issues are very less

Step 4: If more than one credible and plausible alternative scenario remain, the alternative with the lowest baseline emissions shall be considered as the most likely baseline scenario

From the above discussions it is clear that "Import of electricity from the grid" be the option for the baseline scenario. In the absence of the project activity the power will be continuously supplied by the southern regional grid. There is no technical risk involved in supply from grid. Hence "Import of electricity from the grid" is selected as the baseline scenario.

Combinations of baseline options and Scenarios applicable to this methodology

Project Scenario: Generation of Electricity only			
Scenario 1	**Baseline Options**		**Description of Project activity**
	Waste Energy	**Power / Heat/ Mechanical**	

		Energy	
As per Methodology ACM0012	WECM is released to the atmosphere (for example after incineration) or waste heat is released to the atmosphere or waste pressure energy is not utilized (W2)	Sourced Grid-connected power plants. (P6)	The electricity is obtained from the grid
As per the project activity	In absence of this project activity the waste flue gas is released to the atmosphere.	The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid. If the absence of this project activity both Rengaraaj steel and its sister concern will import power from southern regional grid.	In absence of this project activity between March 2005 to January 2006 project proponent import 1400 KVA demand side power from the southern regional grid. Hence for this project activity southern regional grid is the baseline scenario.

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

The project activity meets the VCS program approved Methodology as explained in the above sections of the VCS PD.The project additionality is demonstrated below:

Test 1- The project test:

Step 1: Regulatory Surplus

The alternatives for this project are in line with the applicable legal and regulatory requirements. If the absence of this project activity continuation of current practise where in the equivalent amount of energy would have been produced by the southern regional grid by its currently running power plants and by new capacity additions .This is the chosen baseline scenario which would have happened in the absence of the proposed project activity. Thus project shall not be mandated by any enforced law, statute or other regulatory framework. For power generation, the Electricity Act 2003 does not restrict or empower any authority to restrict the fuel choice, the applicable environmental regulations do not restrict the use of waste energy and there is no legal requirement on the choice of a particular technology.

Step 2: Implementation barriers

In this step, as per the VCS 2007.1 it is required to show that the project faces one or more distinct barriers compared with barriers faced by alternative projects. The barriers analysed for this project is

The barriers analysed for this project is

a) Technological barrier

b) Barrier due to Air-cooled Condenser

The above barriers are analysed below.

a) Technological Barriers

Operational Barriers due to sponge iron kiln.

1. The waste heat from sponge iron kiln is the source for power generation in this project activity. The quantity and quality of steam generated from the WHRB is not constant over the year. Thus the power generated from this project not mach the captive requirements of the Plant. From the daily log sheets we will be able to see the variation in the power generation on an hourly basis. The power generation depends upon the parameters such as temperature and volume of hot flue gases. The low temperature of hot flue gases affects the temperature of steam generated at the Superheater coils resulting in low temperature steam going into the turbine than the rated steam temperature of 485 deg C, this results in complication such as turbine blades erosion, increased the wear and tear of turbine components, and lower efficiency.

2. This is the first of its kind in the southern regional area such as Kerala, Karnataka and Tamilnadu. (As said above the 350 Tons per day (TPD) capacity Sponge Iron Plant is the first of its kind in all the four states. The other sponge iron plants are of 100 TPD capacity only, which is nearly 3.5 times smaller than the above plant. The majority of the Sponge iron plants located in all the three States is of only 100 TPD production capacity. The size of the Rotary kiln (i.e. processing equipment) decides the capacity of the plant, hence for a 350 TPD Sponge iron it is much bigger and difficult to operate due to its size and requires unique operating skills. The Process oriented technical personnel having experience in running 100 TPD will not be able to run the above 350 TPD Sponge iron plant because the material lead time inside the 100 TPD

is 8 hrs only. But in case of 350_TPD Rotary kiln it is 14 hrs. Further varies critical factors also affect the operation of the Power plant.

3. There is no control in exit temperature of sponge iron kiln. If the temperature of the sponge iron kiln increases more than 1000 degC it will affect the WHRB. This is a major technological barrier for this technology.As combustion inside the Rotary kiln for

   Sponge Iron manufacturing takes place with the help of coal, changes in the quality of coal parameters suddenly increases the temperature of the hot gases thereby affecting the boiler tubes, hence continuous process monitoring is always required.

   The above picture shows you the effect of high temperature on the boiler tubes, the weakest portion in the tube gets bulges.

4. The WHRB water tubes was affected by NOx and iron dust in the waste flue gas from Sponge iron kiln. The maintenance of the boiler is done periodically by means of manual inspection during the plant shut down period. It is observed during the above period that the variation in the parameters of the operation has resulted in NOx generation at High temperatures which results in erosion of boiler tube and plates. Further as Iron ore and coal are feed into the rotary kiln for processing. The dust particles from the Iron ore gets accumulated at the junctions of the boiler tubes, thereby causing erosion.

Operational Barriers in project activity.

5. This is the first WHRB power plant in sponge iron unit in Tamil Nadu; hence the availability of skilled and trained man power to operate WHRB is a major problem for this plant. (The operation of the above Power plant entirely depends upon the Operation of the Boiler plant. As the Sponge iron plant is subjected to lots of variation such as Accretion formation (i.e. fusion of Iron ore particles at a very high temperature inside the rotary kiln thereby blocking the flow of material. A photo has been annexed for you kind information)

The above photo clearly shows you that inside a rotary kiln iron particles gets fused together forming a ring shaped structure, thereby blocking the flow of air, coal and Iron ore.

This kind of ring formation due to accretion results in greater difficulties in operating the Rotary kiln and the Power plant as temperatures are not properly attained.

6. The well trained boiler operators and electrical operators are necessary for this project because of complication in operating parameters. Due to larger variation in the operating parameters of Sponge iron plant, it results in variation in the temperature of hot gases, which is entirely different when compared with the Coal based boiler. As

in a Coal based boiler the operator has entire control of the operation thereby adjusting the quantity of coal, fed into the boiler thereby controlling the operating parameters.

7. The change in draft of waste flue gas will affect the draft in sponge iron kiln will lead to low quality sponge iron.

The above picture shows you the effect of accretion which happens in the sponge iron plant due to the fusion of iron particles at the high temperature. This blocks the flow of air and coal into the Rotary kiln thereby affecting the entire process and reducing the quality of the finished product.

8. The breakdowns in WHRB affect the captive power generation and it will affect the sponge iron production. As the Boiler is totally connected with the rotary kiln of the Sponge iron Plant, hence any problem in the Waste Heat Recovery based boiler WHRB, the entire power generation will be stopped and the sponge iron plant also has to be stopped as there is no other alternative for letting the hot gases.
9. The raw material and coal is stored in the open atmosphere. The change in atmosphere condition like rain and winter will directly affect the raw material and coal which will create impact on sponge iron and WHRB plant operation. This is

common phenomenon, during monsoon season the coal and iron are affected by rain causing moisture addition to them. This results in large amount of smaller particles getting accumulated with the larger once instead of getting separated. This accumulation affects the operating parameters of the kiln resulting in variation in temperature and pressure inside the rotary kiln thereby affecting the parameters of the hot gases.

10. The inlet temperature of Electrostatic Precipitator (ESP) has to be maintained between 150-170 deg C. If any change in the performance of WHRB will affect the ESP. The above operating parameters has been specified by the suppliers, hence variation in the temperature of the hot gases will impact the operating parameters of the Electro Static Precipitator(ESP) resulting malfunctioning of the electrical equipment, wear and tear of the components inside the ESP.

b) Barrier due to Air-cooled Condenser

This captive power project is located in Perundurai taluka of Erode district in Tamil Nadu. The technology used in this project activity is Rankine cycle technology. The Rankine cycle technology with the conventional cooling towers requires huge quantity of water. Generally, for power project capacity of 8 MW with conventional cooling systems, which is a common practice in India, it is estimated that a very substantial quantity of water (about 35 m^3/ hr or 8, 40,000 litres /day) is required. Due to the water scarcity in the region surrounding the project, implementing the project with conventional cooling tower is difficult. Hence as an alternative, an air-cooled condenser (ACC) which is considered as a water conservation equipment (as it reduces use of water only for service applications), was found essential for the operation of the proposed plant. The cost of the air cooling system is about 3 to 4 times more than conventional water cooling system. Dry cooling systems are the least used systems as they have a much higher capital cost, higher operating temperatures, and lower efficiency than wet cooling systems*. Further the ACC results in additional steam requirements at the turbine inlet. This has a spiralling effect leading to increased auxiliary power consumption. Thus the addition of the air cooling system increases the capital investment cost and the operational costs of the project.

*Source: http://www.rerc.gov.in/Order/Final%20order_NES_Chairman.pdf

Barrier due to Prevailing Practice

The Sponge Iron manufacturers release the high temperature flue gas into atmosphere through high rising stack, which is the prevailing practice in India. There is no existing law prohibiting discharge of hot flue gases in to atmosphere from the sponge iron plant. Most of the entrepreneurs have preferred to draw the required power from the grid, as it offers them enormous operating comforts and freedom in the manufacturing activities. As per prevailing practice not many entrepreneurs have put up the WHR based power plant. A few of them who have put up the WHR are mainly due to the additional revenue from carbon credits.

In order to generate eco friendly power from the Waste heat of the flue gas from the sponge iron plant and to displace the power drawn from grid the project promoter has to overcome the above barriers (by seeking the revenue from carbon credits support).The proposed project activity is not a common practice in India, because only 16 sponge iron plants out of 147 plants have captive power generation as per JPC * (Joint Plant Committee, a Government of India body) survey on Indian sponge iron industry. Only a few large capacity sponge iron plants have WHR based CPP and Smaller companies have not been able to install the WHR power project because of high capital cost and running risk. If the absence of this project activity the power will be drawn from the TNEB grid. Hence the implementation of WHRB in sponge iron unit will displace the fossil fuel dominated electricity purchased from the TNEB grid.

http://cdm.unfccc.int/UserManagement/FileStorage/QVQE67X4FRQB9FSE4SMYXP9J4IVRHP

Step 3: Common Practice

Table 1: Indian sponge iron industry summarised table given in JPC report

	Indian Sponge Iron Industry : Both Coal & Gas Segments					
	Data Collected		Additional / Industry/ Field Sources^		Total	
	No of Units	Capacity (Unit :mt)	No. of units	Capacity# (unit:mt)	No. of units	Capacity (unit:mt)
Operating						
Coal	147	11	56	2	203	13
Gas	3	6	-	-	3	6
Total	150	17	56	2	206	19
Under commissioning (Coal)	58	6	167	12*	225	18
^=State DI Offices; #=Estimated, *=included units in proposal/ planning stage						

Source:http://cdm.unfccc.int/UserManagement/FileStorage/QVQE67X4FRQB9FSE4SMYXP9J4IVRHP

This project activity is the first of its kind in the states of southern region such as Tamilnadu, Kerala and Karnataka. In India 203 sponge iron plants are in operation and 225 plants are under commissioning. Chhattisgarh, Orissa, Jharkhand and West Bengal are the leading sponge iron producing states in India. In Tamilnadu only four plants are in operation. Out of these four projects Rengaraaj Steel project is the first project in Tamilnadu. This indicates a very low penetration (Out of 448 plants in India only 4 sponge iron plants are in Tamilnadu) of this technology in this region. Hence this project activity is not a common practice in this region.

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

Sectoral Scope : 1 & 4

Category : **ACM0012**"Consolidated baseline methodology for GHG Emission Reduction from waste energy recovery projects".

Version : **3.1**

Reference :

http://cdm.unfccc.int/UserManagement/FileStorage/FI2PAALEOP8XPVOS2NVDFSQ8RVMUBS

Justification of choice of methodology was explained in the section 2.2.

The methodology ACM0012 refers to the latest approved versions of the following tools:

Tool to calculate the emission factor for an electricity system, Version 1.1

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

- Purpose of monitoring
  The purpose of monitoring the project is to verify the annual emission reductions in tonnes of CO2 that the project activity has achieved as per the requirements of VCS.

- Types of data and information to be reported, including units of measurement

  Energy Meter - Measurement of generated electricity in MWh.
  Auxiliary Energy Meter -Measurement of auxiliary consumption.
  Energy Meter - Measurement of electricity consumed by the Industrial facility.
  TNEB Energy Meter Measurement of Electricity Import from grid.

- Origin of the data

Monthly report and Central Electricity Authority – CDM - Carbon Dioxide baseline database

- Monitoring, including estimation, modelling, measurement or calculation approaches
  Calculation for monitoring will be made on Gross generation data and auxiliary generation data and current - Central Electricity Authority baseline data version 4.0 .

- Monitoring times and periods, considering the needs of intended users;
  Monitoring will be done on daily basis for entire crediting period and recorded monthly.

- Monitoring roles and responsibilities
  Project proponent and O&M service provider together will be involved for collecting the monitoring information.

- Managing data quality
  All the meters and equipment which measures data will be calibrated on regular basis(Calibration is done at once in a year.). The data of electricity generation is recorded both log book and electronic form.

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Data / Parameter:	**EG_{gross}**
Data unit:	MWh
Description:	Total quantity of electricity generated by the project activity during the year y
Source of data to be used:	Monthly Report
Value of data applied for the purpose of calculating expected emission reductions	56,064
Description of measurement methods and procedures to be applied:	Monitoring: Trivector meter will be used for monitoring Data Type: Measured Frequency: daily measured Recording: Monthly Report Archiving Policy: Paper & Electronic Responsibility: General Manager would be responsible for regular calibration of the meter. Calibration Frequency: Once in a year.
QA/QC procedures to be applied:	The energy meter is calibrated once in a year.
Any comment:	Data will be archived during the whole crediting period + 2 years.

Data / Parameter:	$EG_{Aux – from CPP}$
Data unit:	MWh
Description:	Auxiliary consumption of electricity by the project activity from its own generation during the year y
Source of data to be used:	Monthly Report
Value of data applied for the purpose of calculating expected emission reductions	5,606
Description of measurement methods and procedures to be applied:	Monitoring: Trivector meter will be used for monitoring Data Type: Measured Frequency: daily measured Recording: Monthly Report Archiving Policy: Paper & Electronic Responsibility: General Manager would be responsible for regular calibration of the meter. Calibration Frequency: Once in a year.
QA/QC procedures to be applied:	The energy meter is calibrated once in a year.
Any comment:	Data will be archived during the whole crediting period + 2 years.

Data / Parameter:	$EG_{Aux – from Grid}$
Data unit:	MWh
Description:	Import of power from TNEB grid
Source of data to be used:	Monthly Report
Value of data applied for the purpose of calculating expected emission reductions	0
Description of measurement methods and procedures to be applied:	Monitoring: Trivector meter will be used for monitoring Data Type: Measured Frequency: daily measured Recording: Monthly Report Archiving Policy: Paper & Electronic Responsibility: General Manager would be responsible for regular calibration of the meter. Calibration Frequency: Once in a year.
QA/QC procedures to be applied:	The meters used are calibrated periodically by state electricity board.
Any comment:	Data will be archived during the whole crediting period + 2 years.

Data / Parameter:	EG_{Aux}
Data unit:	MWh
Description:	Auxiliary consumption of electricity from the Project activity and the Grid. Calculated from $EG_{Aux – from CPP}$ **and** $EG_{Aux – from Grid}$
Source of data to be used:	Monthly Report
Value of data applied for the purpose of	5,606

calculating expected emission reductions	
Description of measurement methods and procedures to be applied:	Monitoring: Trivector meter will be used for monitoring Data Type: calculated Frequency: daily Recording: Monthly Report Archiving Policy: Paper & Electronic Responsibility: General Manager would be responsible this data. Calibration Frequency: Once in a year.
QA/QC procedures to be applied:	----
Any comment:	Data will be archived during the whole crediting period + 2 years.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net quantity of electricity generated by the project activity. Calculated from EG_{gross} and EG_{Aux}
Source of data to be used:	Monthly Report
Value of data applied for the purpose of calculating expected emission reductions	50,458
Description of measurement methods and procedures to be applied:	Monitoring: Trivector meter will be used for monitoring Data Type: calculated Frequency: daily Recording: Monthly Report Archiving Policy: Paper & Electronic Responsibility: General Manager would be responsible this data. Calibration Frequency: Once in a year.
QA/QC procedures to be applied:	----
Any comment:	Data will be archived during the whole crediting period + 2 years.

Data / Parameter:	D
Data unit:	Days/year
Description:	No of operating days per year
Source of data to be used:	Production records
Value of data applied for the purpose of calculating expected emission reductions	300
Description of measurement methods and procedures to be applied:	Based on Production records
QA/QC procedures to be applied:	----

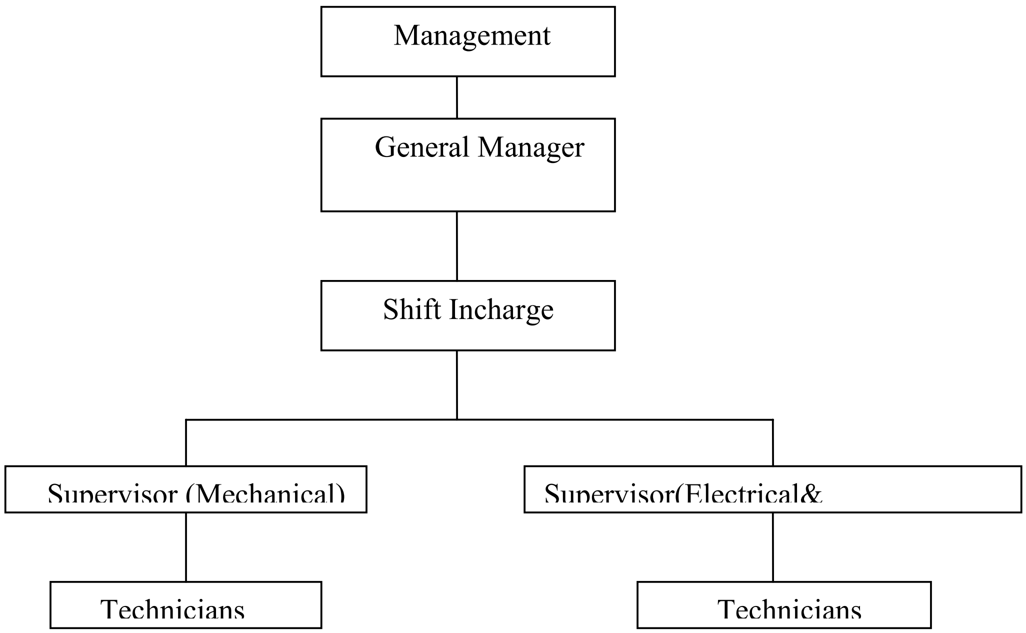
Any comment:	Data will be archived during the whole crediting period + 2 years.

Data / Parameter:	$Q_{BL,Product}$
Data unit:	Tons/year
Description:	Production associated with the relevant waste energy generation
Source of data to be used:	Production records
Value of data applied for the purpose of calculating expected emission reductions	105000
Description of measurement methods and procedures to be applied:	Based on Production records
QA/QC procedures to be applied:	----
Any comment:	Data will be archived during the whole crediting period + 2 years.

Data / Parameter:	$q_{wcm,product}$
Data unit:	Nm3/ton
Description:	Specific waste energy production per unit of product (departmental or plant product which most logically relates to waste energy generation) generated as per manufacturer's or external expert's data. This parameter should be analysed for each modification in process which can potentially impact the waste energy quantity.
Source of data to be used:	Manufacturer's specification (or) External expert assessment
Value of data applied for the purpose of calculating expected emission reductions	5143
Description of measurement methods and procedures to be applied:	From manufacturer's specification (or) Assessment of external expert
QA/QC procedures to be applied:	----
Any comment:	Data will be archived during the whole crediting period + 2 years.

3.4 Description of the monitoring plan

To address all O&M issues, the management signed a contract with the O&M service providers. The O&M service provider for this project activity is OEG. The service provider has formed a team of Technicians, Supervisors headed by the site engineer to effectively control and monitor the complete process in the plant area. The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid. The Monitoring data of the equipments are recorded by the labours/ supervisors and the data are submitted to the shift incharges. The shift incharges report daily to the general manager of the OEG. The general manager submits a monthly report to the management which will be documented and stored in the project office. The monitored parameters have low level of uncertainty. Therefore the possible monitoring data adjustments are not envisaged for the project.



4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

The project uses methodology ACM0012, version 03.1 for the purpose of calculating the Emission Reductions. The methodological choices considered in order to calculate the Emission Reductions has been explained below.

Baseline Emissions

The baseline emissions for the year *y* shall be determined as follows:

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

BEy = The total baseline emissions during the year *y* in tons of CO2

$BE_{En,y}$ = The baseline emissions from energy generated by project activity during the year *y* in tons of CO2

$BE_{flst,y}$ = Baseline emissions from steam generation, if any, using fossil fuel that would have been used for flaring the waste gas in absence of the project activity (tCO2e per year), calculated as per equation 1c. This is relevant for those project activities where in the baseline steam is used to flare the waste gas

This project activity is generating electricity from waste flue gas generated from sponge iron plant. If the absence of this project activity the captive power will be import from southern grid. There is no fossil fuel consumption in this project activity. The power will be generated from waste flue gas from sponge iron plant. Hence $BE_{flst,y}$ is not applicable for this project activity. The above equation will be simplified in to

$BE_y \quad = \quad BE_{En\,y}$

For the calculation of baseline emissions ($BE_{En,y}$) the following baseline scenarios has been identified:

Project Scenario: Generation of Electricity only			
Scenario 1	**Baseline Options**		**Description of Project activity**
	Waste Energy	**Power / Heat/ Mechanical Energy**	
As per Methodology ACM0012	WECM is released to the atmosphere (for example after incineration) or waste heat is released to the atmosphere or waste pressure energy is not utilized (W2)	Sourced Grid-connected power plants. (P6)	The electricity is obtained from the grid
As per the project activity	In absence of this project activity the waste flue gas is released to the atmosphere.	The electricity generated by this project activity is used within the industrial facility for captive usage and the remaining surplus power is wheeled to its sister concern through southern regional grid. If the absence of this project activity both Rengaraaj steel and its sister concern will import power from southern regional grid.	In absence of this project activity between march 2005 to January 2006 project proponent **import 1400 KVA demand side power from the southern regional grid.** Hence for this project activity southern regional grid is the baseline scenario.

As per the methodology the project activity generating electricity

$BE_{Eny} \quad = \quad BE_{Elec\,y} + BE_{Ther\,y}$

$BE_{Elec,y}$ = Baseline emissions from electricity during the year *y* in tons of CO2

$BE_{Ther,y}$ = Baseline emissions from thermal energy (due to heat generation by element process) during the year *y* in tons of CO2

This project activity is generating electricity from waste flue gas from sponge iron plant. Other than that there is no thermal energy application in this project activity. Hence baseline emission from thermal energy ($BE_{Ther,y}$) is not applicable for this project activity.

BE_{Eny} = $BE_{Elec\ y}$

Baseline emissions from electricity ($BE_{electricity,y}$) Type-1 activities:

Case 1: Waste energy is used to generate electricity

$BE_{Elec\ y}$ = $f\ cap * f\ wcm * \sum_j \sum_I (EG_{i,j,y} * EF_{i,j,y})$

$BE_{elec,y}$ = Baseline emissions due to displacement of electricity during the year *y* in tons of CO_2

$EG_{i,j,y}$ = The quantity of electricity supplied to the recipient *j* by generator, that in the Absence of the project activity would have been sourced from i th source (i can be either grid or identified source) during the year *y* in MWh,

f_{wcm} = Fraction of total electricity generated by the project activity using waste energy. (This fraction is 1 if the electricity generation is purely from use of waste energy)

f_{cap} = Energy that would have been produced in project year *y* using waste energy generated in base year expressed as a fraction of total energy produced using waste source in year *y*. The ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base year.

If the absences of this project activity Rengaraaj steel and its sister concern will import power from southern regional grid. Hence southern regional grid is the baseline for this project activity.

The CO_2 emission factor of the electricity $EF_{elec,\ gr,j,y}$ shall be determined by following guidance provided in the "Tool to calculate the emission factor for an electricity system".

The following steps to be used to calculate the baseline emission factor.

Step 1. Identify the relevant electric power system.

The project activity is located in the Southern Region of India and the electricity generated by this project displaces the electricity from southern regional grid. Due to the displacement of electricity the project activity would have impact on the southern grid, serving the four southern states and one union territory namely Pondicherry. Hence the project also has an impact on all the generation facilities in the southern grid. Thus all the power generation facilities connected to this grid form the boundary for the purpose of baseline estimation. For the baseline calculation a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) are used. The southern grid is also connected with other regional grids, however, the net exchange of energy within the regional grids is very small and negligible and hence other regional grids are not included in the boundary for estimation of baseline emissions.

Step 2 Select an operating margin (OM) method

In the southern regional grid the power generation is dominated by fossil fuel based power plants and the power generation by low cost/must run resources constitute (average of the five most recent years) less than 50% of total grid generation, so simple operating margin method is used for operating margin emission factor calculation. According to the current scenario in southern regional grid, the power generation by fossil fuel based thermal power plants are dominating the grid

The simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

• *Ex ante* option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the PD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period,

Or

• *Ex post* option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Step 3 Calculate the Operating Margin emission factor according to the selected method.

The simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,\ OMsimple,y} - \frac{\Sigma\ FC_{i,y} * NCV_{i,y} * EF_{CO2,i,y}}{\Sigma EG_{m,y}}$$

Where:

$EF_{grid,\ OMsimple,y}$ - Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)

$FC_{i,\ m,y}$ - Amount of fossil fuel type i consumed by power plant/unit m in year y (mass or volume unit)

$NCV_{i,y}$ - Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)

$EF_{CO2,i,y}$ - CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)

$EGm,_{y}$ - Net electricity generated and delivered to the grid by power plant/ unit m in year y (MWh)

m - All power plants/units serving the grid in year except low cost must run power plants/units

i - All fossil fuel types combusted in power plant/unit m in year y

y - Either the three most recent years for which data is available at the time of submission of the PD to the DOE for validation.

The Operating Margin (including imports) calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units using the CEA[3] data base for the Southern Grid (for the years 2005-06, 2006-07 and 2007-08) the value is 0.998157296 tCO_2e/ MWh.

Step 4 Identify the cohort of power units to be included in the build margin

Project participants can choose between one of the following two options:

Option 1

For the first crediting period the Build Margin emission factor EFBM, y **ex-ante** based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

[3] Source: CDM Carbon Dioxide Baseline Data base, Version 4.0, September'08 (www.cea.nic.in)

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

Option 2

For the first crediting period, the Build Margin emission factor EFBM,y must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, EFBM,y should be calculated ex-ante, as described in option 1 above. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

Step 5 Calculate the Build Margin Emission factor

Option 1 as described above is chosen in the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PD and is fixed for the entire crediting period.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} - \frac{\Sigma EG_{m,y} * EF_{EL,m,y}}{\Sigma EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ - Build margin CO_2 emission factor in year y (tCO_2/MWh).

$EG_{m,y}$ - Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh).

$EF_{EL,m,y}$ - CO_2 emission factor of power unit m in year y (tCO_2/MWh)

m - Power units included in the build margin.

y - Most recent historical year for which power generation data is available.

http://cdm.unfccc.int/methodologies/Tools/EB32_repan09_Tool_proj_emiss.pdf.

"Tool to calculate the emission factor for an electricity system" Version -01.1, Page No 14.

The Build Margin emission factor will be

EF_{BM} = *0.71331778* ***tCO2****/MWh*

Source: Central Electricity Authority: CO2 Baseline Database.

Version: 4, Dated Sep 2008

http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Step 6 Calculate the combined margin emission factor

The combined margin emissions factor is calculated as follows:

$EF_{grid,CM,y}$ - $EF_{grid,OM,y} * w_{OM} + EF_{grid,OM,y} * w_{BM}$

Where:

$EF_{grid,BM,y}$ - Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ - Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} - Weighting of operating margin emissions factor (%)

w_{BM} - Weighting of build margin emissions factor (%)

The following default values should be used for w_{OM} and w_{BM}

$w_{OM} = 0.50$ and $w_{BM} = 0.50$

EF_{OM} - 0.998157296 tCO2/MWh

w_{OM} - 0.50

EF_{BM} - 0.71331778 tCO2/MWh

w_{BM} - 0.50

$EFy = 0.50 * 0.998157296 + 0.50 * 0.71331778$

Baseline emission factor will be (EFy) = 0.85573754 tCO2/MWh

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

Baseline emissions from electricity ($BE_{electricity,y}$) Type-1 activities:

Case 1: Waste energy is used to generate electricity

$BE_{Elec\,y} = f\,cap * f\,wcm * EG_{i,j,y} * EF_{i,j,y}$

$BE_{elec,y}$ - Baseline emissions due to displacement of electricity during the year *y* in tons of CO_2

$EG_{i,j,y}$ - The quantity of electricity supplied to the recipient *j* by generator, that in the Absence of the project activity would have been sourced from i [th] source (i can be either grid or identified source) during the year *y* in MWh,

f_{wcm} - Fraction of total electricity generated by the project activity using waste energy. (This project activity is generating electricity from only waste flue gas, hence this fraction is 1)

f_{cap} - Energy that would have been produced in project year *y* using waste energy generated in base year expressed as a fraction of total energy produced using waste source in year *y*. The ratio is 1for this project activity.

Determination of f_{cap}

In accordance with the guidance of the methodology (please refer to Method 2 of "Capping of baseline emissions"), the baseline emissions will be capped using the manufacturer's data for the industrial facility which shall be used to estimate the amount of waste energy the industrial facility generates per unit of product generated by the process that generates waste energy (either product of departmental process or product of entire plant, whichever is more justifiable and accurate). With this consideration, fcap will be determined as given below:

$$f_{cap}=Q_{WCM,BL}/Q_{WCM,Y}$$

Where:

$Q_{WCM,BL}$ = Quantity of waste gas generated prior to the start of the project activity (Nm3)

$Q_{WCM,y}$ = Quantity of waste gas used for energy generation during year y (Nm3)

'y' is any year within the proposed crediting period of the project activity.

The quantity of waste gas that would have been generated prior to the start of the proposed project activity

i.e. $Q_{WCM,BL}$ will be calculated as:

$$Q_{WCM,BL}=Q_{BL,product}*q_{wcm,product}$$

Where,

$Q_{WCM,BL}$ *=Quantity of waste gas generated prior to the start of the proposed project activity (Nm3)*

$Q_{BL,product}$ *=Production by process that most logically relates to waste gas generation in baseline (in tonnes)*

$q_{wcm,product}$ *=Amount of waste energy per unit of product generated by the process that generates waste gas (Nm3/ton)*

Production capacity ($Q_{BL, product}$)

Production capacity sponge iron plant – 350 TPD

Working days per year - 300 days

Total production capacity - 300*350

$Q_{BL, product}$ - 105000 tons/year

Quantity of waste energy generated ($q_{wcm, product}$)

Quantity of waste energy generated in the industrial facility - 75000Nm^3/hr

Quantity of waste energy

generated per unit - (75000*24*300)/105000

$q_{wcm, product}$ - 5143 Nm^3/ton

Quantity of waste gas generated prior to the start of the project activity ($Q_{WCM,BL}$)

$Q_{WCM, BL}$ - $Q_{BL, product}$ * $q_{wcm, product}$

- 105000 * 5143

- 540000000 Nm^3

Quantity of waste gas used for energy generation ($Q_{WCM, y}$)

All the waste energy generated from the sponge iron plant was recovered in the Waste heat recovery boiler and used for steam generation.

Quantity of waste gas used for energy generation $Q_{WCM, y}$ - 540000000 Nm^3

Estimated Baseline Cap (f_{cap})

All the waste energy generated from the sponge iron plant was recovered in the Waste heat recovery boiler and used for steam generation.

Hence f_{cap} - $Q_{WCM, BL}$/ $Q_{WCM, y}$

- 540000000 Nm^3/540000000 Nm^3

- 1

All the waste energy generated from the sponge iron plant was recovered hence fcap for this project activity is 1

Baseline Emission are calculated by multiplying the net quantity of electricity supplied by this project activity ($EG_{i,j,y}$) with the CO2 baseline emission factor for the electricity displaced due to the project ($EF_{i,j,y}$) as follows:

$$BE_{Elec\,y} = EG_{i,j,y} * EF_{i,j,y}$$

Where:

$EF_{i,j,y}$ = Baseline emission factor

= 0.855895239 tCO_2/MWh

$EG_{i,j,y}$ = Net quantity of electricity supplied to the recipient j by generator

$EG_{i,j,y}$ = 50,458 MWh/year

Putting $EG_{i,j,y}$ and $EF_{i,j,y}$

$BE_{Elec\,y}$ = 50,458*0. 0.85573754

= 43,179tCO2/year

Baseline emission ($BE_{Elec\,y}$) = 43,179 tCO2/year

4.3 Quantifying GHG emissions and/or removals for the project:

$$PE_y = PE_{AF\,y} + PE_{ELy} + PE_{ELyImport,y}$$

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

PE_{Ely} - Project activity emissions from on-site consumption of electricity for gas cleaning equipment or other supplementary electricity consumption (as per Table 1: Summary of gases and sources included in the project boundary).

$PE_{ELyImport,y}$ - Project activity emissions from import of electricity replacing captive electricity generated in the absence of the project activity for Type-2 project activities

This project activity is not a cogeneration project. This project activity is generated electricity from Waste flue gas only, other than that there is no fossil fuel combustion and captive power generation from this project activity. Hence there is no project emission from the project activity.

PE_Y = 0 tCO2/year

Leakage Emissions (LEy)

There is no leackage from this project activity.

LEy = 0

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

Emission reduction by this project is

ER_Y = BE_Y - PE_Y - LE_Y

PE_Y = Emissions from the project activity during the year *y* in tons of CO_2

LEy = Leakage emissions in year *y* (t CO2/yr)

ER_Y = 43,179 tCO2/year

5 Environmental Impact:

The danger caused to the environment due to the emission of green house gases can be reduced to desirable limit by implementing WHR based electricity generation in industries. Due to the implementation of WHR based CPP in the sponge iron unit of this project activity there is no major impact upon the surrounding environment. Even though the CPP is eco-friendly in nature, the waste hot flue gas utilised in the CPP consists of pollutants and it must be removed before vented to the environment. So the project promoter carried out an Environmental Impact Assessment study to ascertain the impact of the pollutants from various parts of CPP on the environment.

The pollutants monitored in the Environmental Impact Assessment studies are as follows

- **DUST AND PARTICULATE MATTER**

The waste flue gas generated during the iron ore reduction process in kiln consists of dust, particulate matter and high heat content. After the utilization of heat content of flue gas in the WHR boiler it consists of only dust and particulate matter. The dust and suspended particulate matter (SPM) in the flue gas are trapped by a well designed Electrostatic Precipitator (ESP) in order to achieve concentration level below the permissible limit as per the Pollution control board norms.

- **THERMAL POLLUTION REDUCTION**

The reason for thermal pollution is due to liberation of waste hot flue gas directly into the atmosphere without utilizing the heat content. But in the case of SRPIPL the heat content of waste flue gas generated in their sponge iron kiln has been utilized in the WHR boiler for steam generation and thereby reduces thermal pollution.

- **GREEN HOUSE GAS (GHG) EMISSION REDUCTION**

In SRPIPL, the waste flue gas generated from sponge iron kiln contains more heat content and this is utilized in the WHR boiler of the CPP to generate electricity. By displacing the procurement of electricity from the state grid, SRPIPL has reduced the emission of green house gases since the fossil fuel based thermal power plants are the major power sources for TNEB grid.

- **SOx AND NOx EMISSIONS**

The chimney of appropriate height has been erected within the boundary of CPP to reduce SOx emissions and hence controlled within the TNPCB norms. NOx emissions will be controlled by appropriate firing adjustments in the boiler.

- **EFFLUENT FROM WATER TREATMENT PLANT**

In order to neutralize (pH 7.0) the water drained from the water treatment plant after regeneration, it is pumped to a neutralization pit. The neutralization pit will have acid resistant brick lining. Depending on the quality of water collected in the pit, either an alkaline medium or acidic medium will be pumped into the pit to neutralize the water.

- **BOILER WATER BLOW DOWN**

In order to maintain the solids concentration in the boiler water, blow down is employed in the boiler. The blow down water will be at a temperature of 100^0C. The quantity of blow down will be around 1.44 tph. This water can be taken to the effluent pond, where it will get cooled naturally.

- **SEWAGE FROM THE POWER PLANT BUILDINGS**

The sewage from the power plant building will be taken to a common septic tank through trenches. The sewage from the septic tank will be disposed off through soak pit/concrete dispersion trenches. As the sewage is taken in trenches the soil will not get contaminated.

- **NOISE POLLUTION**

The noise level in the plant has been maintained as per TNPCB standards by installing silencers, sound proof walls etc.

6 Stakeholders comments:

The project promoters conducted a stakeholder consultation meeting at their project site on 7th September 2006 with the local people and residents of the neighbouring villages, Local employees, Representative from TNEB, Consultants and equipment suppliers. The stakeholders were invited to the meeting through invitation letters sent to them as earlier. Thereafter, a meeting was held between the stakeholders and the project proponents. The gathering was explained about the greenhouse gases, their impact on the environment and the efforts undertaken by the company to reduce the emission of such gases. The project participants explained that they had obtained all necessary approvals for setting up this waste heat based power project, and meets all regulatory requirements as mandated by Government agencies (i.e. TNEB). The project promoter explained the various features, benefits and the eco-friendly nature of the project. In that meeting project promoter distributed the questionnaire to all participants and there is no negative comment received from the stakeholders. The local people also agreed that due to this project activity the employment opportunities have increased. The project proponent has already established good relationship with local people who ensure co-operation for the successful and continuous operation of this project. There was no negative comment received from the stakeholders

7 Schedule:

S.No	Details	Date
1	Turbine Purchase Order	23.01.2004
2	Pollution Consent to establish	25.10.2004
3	Machinery Erection Completion date	24.10.2005
4	Wheeling Agreement Date	12.12.2005
5	Approval Letter for Parallel Operation	21.12.2005

Frequency of Monitoring : Daily measured

Recording of monitored data: Monthly from joint meter

Project Life time : 20 years

Duration of crediting period: 10 years fixed

The Project Proponent will monitor all the parameters as explained in Section 3.3. The Project Proponent plans to conduct annual verifications to quantify the emission reductions (VCUs) from the project activity and report them in a transparent manner.

8 Ownership:

8.1 Proof of Title:

The Parallel connection agreement is considered as the evidence for the proof of title of the project activities. The same are provided to the DOE for verification.

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Not Applicable