MONITORING REPORT

CARBON OFFSET UNIT (CoU) PROJECT

Title: SBPIL Waste Heat to Power Project, Borjhara, India

UCR PROJECT ID: 400

MR Version 1.0

MR Date: 16/02/2024

UCR Monitored Period: 01

1st CoU Issuance Period: 01/09/2015-31/12/2022 (07 years 04 months)

1st Crediting Period: 01/09/2015-31/12/2022 (07 years 04 months)

8 DECENT WORK AND ECONOMIC GROWTH

13 CLIMATE ACTION

7 AFFORDABLE AND CLEAN ENERGY

Monitoring Report (MR)
CARBON OFFSET UNIT (CoU) PROJECT

BASIC INFORMATION

Title of the project activity	**SBPIL Waste Heat to Power Project, Borjhara, India**
Scale of the project activity	Large Scale
Completion date of the MR	16/02/2024
Project participants	**Project Proponent**: Shri Bajrang Power and Ispat Limited (SBPIL) **UCR Aggregator**: Carbon Equalizers, Katni **UCR ID** : 660687753
Host Party	India
Type	Type III (Energy Efficiency)
Applied methodologies and standardized baselines	**UNFCCC Methodology *ACM0012*** Waste energy recovery Version 6.0 UCR Protocol Standard Baseline
Sectoral scopes	01 Energy industries (Renewable/NonRenewable Sources) 04. Manufacturing industries
SDG Impacts:	SDG 7 Affordable and Clean energy SDG 8 Decent work and economic growth SDG 13 Climate Action
Calculated amount of total GHG emission reductions per year	See table below
Estimated total amount GHG emission reductions for the entire monitoring period (2013-2022)	**502989** tCO_2 (**502989** CoUs)

DD/MM/YYYY- DD/MM/YYYY	tCO_{2eq} (CoUs)
01/09//2015-31/12/2015	24382
01/01/2016-31/12/2016	75194
01/01/2017-31/12/2017	65941
01/01/2018-31/12/2018	71590
01/01/2019-31/12/2019	60993
01/01/2020-31/12/2020	54482
01/01/2021-31/12/2021	71703
01/01/2022-31/12/2022	78704

SECTION A. Description of project activity

A.1. Purpose and general description of Carbon offset Unit (CoU) project activity >>

The project activity titled, **SBPIL Waste Heat to Power Project, Borjhara, India** is located in Urla Industrial Area, Village: Borjhara, District: Raipur, State: Chhattisgarh, Country: India.

Purpose of the project activity:

GOEL GROUP of Industries is one of the leading business houses in the State of Chhattisgarh, India. The group has entered into the business of Iron & Steel with a Re-Rolling Mill in the name of M/s Shri Bajrang Alliance Ltd. (formerly known as M/s Shri Bajrang Alloys Ltd). M/s Shri Bajrang Power & Ispat Ltd belongs to this group has also entered in the business of TMT Bars, which is selling the product under the brand name Goel TMT.

The group has been further strengthened by establishing Shri Bajrang Power and Ispat Limited ("SBPIL") which has emerged as one of the leading integrated steel companies based out of central India and is one of the top 10 players in India in terms of capacity for iron ore pellets, iron ore beneficiation and sponge iron. The plant was commissioned in 2005 (also called Unit I) manufactures TMT Bars, Ferro alloys, steel billets, sponge iron and fly ash bricks. The project activity takes place at a sponge iron plant (Unit I) and involves the generation of electrical power through the installation of waste heat recovery boilers and steam turbine generators (STGs).

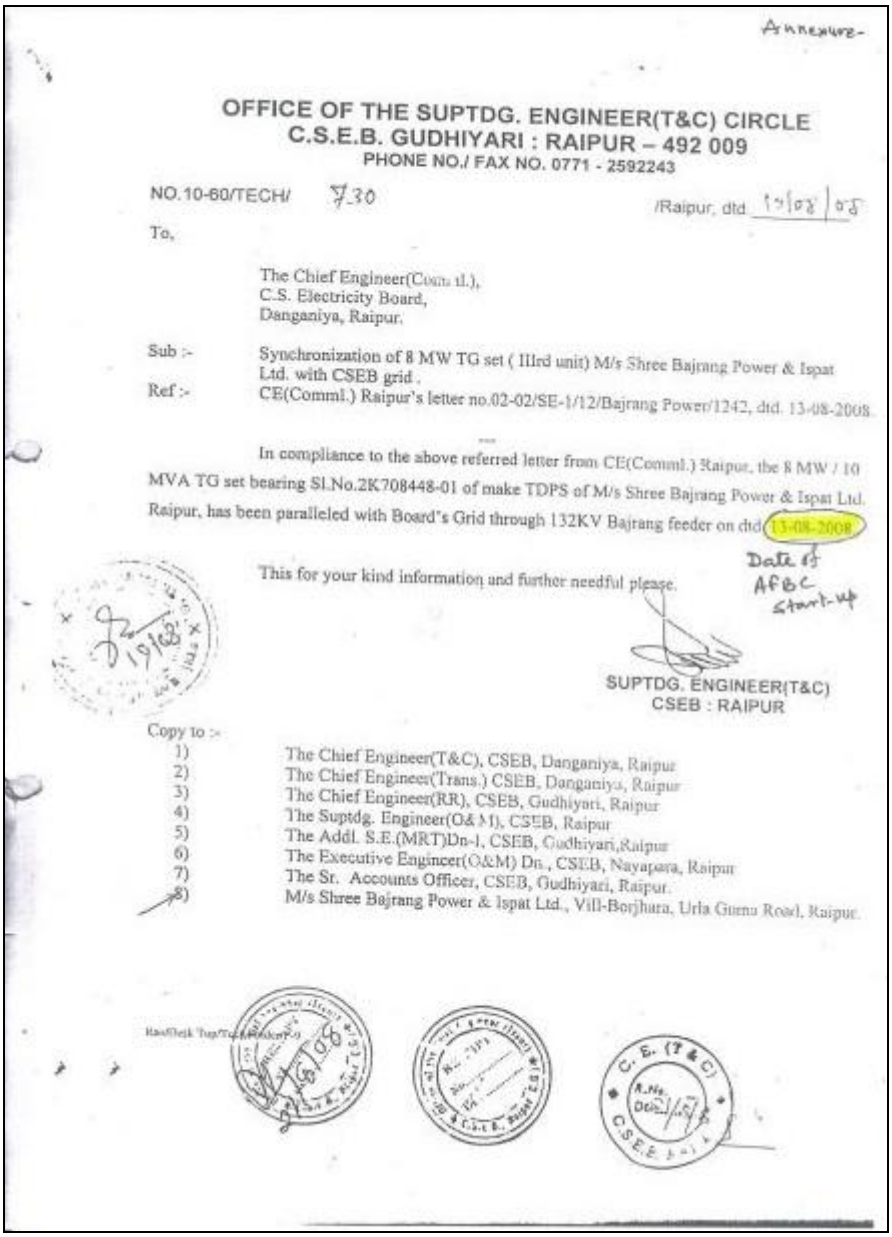
The waste heat produced during the manufacture of sponge iron is passed through boilers and the resultant steam is utilised to generate electrical power. The power generated from two condensing turbines (**8 MW and 10 MW**) is consumed in captive requirements and surplus is exported to the grid via Chhattisgarh State Electricity Board (CSEB).

The energy generated in the project is measured by meters installed at both STGs in the power plant. The project activity was commissioned in phase wise wherein the 8 MW STG started operating on **12/07/2005** and 10 MW STG started operating on 31/08/2005 and has been operating till date on regular basis.

Documents on file for verification	Date
Factory's License	15/07/2005
Electrical Inspector's Report of the Installations	16/06/2005
Permission for running 18 MW TG set captive power plant	2005
Copy of Purchase Order for Boiler placed on M/s Thermax Limited	19/04/2004
Copy of Purchase Order for Turbine placed on M/s Triveni Engineering Industries Ltd	19/04/2004
Boilers Inspection Report	29/06/2005 and 12/09/2005

The electricity is generated at 11 kV which is then stepped up to 132 kV in the plant before being fed through a 132 kV sub-station (Urla substation). Apart from the waste heat recovery boilers, steam from an AFBC boiler is also added to the common steam header (from September 2008 onwards), however carbon credits or CoUs are not being claimed for the increased generation due to the additional steam source (this additional steam source has been added as the turbines cannot run at their rated capacity with the steam from the waste heat recovery boilers only). This apportioning of generation based on steam supply is in line with the tool in the methodology. The project activity thus entails utilisation of waste heat of flue gases generated in Direct Reduced Iron (DRI) kilns of sponge iron plants of SBPIL (Project Proponent or PP hereafter) in power generation. DRI, is a

type of kiln used in the production of sponge iron, where iron ore is reduced to sponge iron using coal & Iron ore through a rotary Kiln at high temperature (1000 ^{0}C).



Annexure-

OFFICE OF THE SUPTDG. ENGINEER(T&C) CIRCLE
C.S.E.B. GUDHIYARI : RAIPUR – 492 009
PHONE NO./ FAX NO. 0771 - 2592243

NO.10-60/TECH/ 7430 /Raipur, dtd. 13/08/08

To,

The Chief Engineer(Comm tl.),
C.S. Electricity Board,
Danganiya, Raipur.

Sub :- Synchronization of 8 MW TG set (IIIrd unit) M/s Shree Bajrang Power & Ispat Ltd. with CSEB grid .

Ref :- CE(Comml.) Raipur's letter no.02-02/SE-1/12/Bajrang Power/1242, dtd. 13-08-2008

In compliance to the above referred letter from CE(Comml.) Raipur, the 8 MW / 10 MVA TG set bearing Sl.No.2K708448-01 of make TDPS of M/s Shree Bajrang Power & Ispat Ltd. Raipur, has been paralleled with Board's Grid through 132KV Bajrang feeder on dtd 13-08-2008

Date of AFBC start-up

This for your kind information and further needful please.

SUPTDG. ENGINEER(T&C)
CSEB : RAIPUR

Copy to :-
1) The Chief Engineer(T&C), CSEB, Danganiya, Raipur
2) The Chief Engineer(Trans.) CSEB, Danganiya, Raipur
3) The Chief Engineer(RR), CSEB, Gudhiyari, Raipur
4) The Suptdg. Engineer(O& M), CSEB, Raipur
5) The Addl. S.E.(MRT)Dn-I, CSEB, Gudhiyari,Raipur
6) The Executive Engineer(O&M) Dn., CSEB, Nayapara, Raipur
7) The Sr. Accounts Officer, CSEB, Gudhiyari, Raipur.
8) M/s Shree Bajrang Power & Ispat Ltd., Vill-Borjhara, Urla Gurna Road, Raipur.

Commissioning Date Certificate

The reduction process yields carbon di-oxide and carbon monoxide. This waste heat of flue gases is utilised in the generation of steam in (WHRB), which is further expanded in two turbines with total installed capacity **18MW (08 MW+ 10 MW)** to generate power. The **8MW** turbine generator was synchronised with the grid on **12/07/2005**, while the **10MW** turbine generator was synchronised with the grid on **31/08/2005**. After these synchronisations, the turbines were tested and trials were undertaken on **01/09/2005** and this would be the *earliest commissioning date* that the project activity could evacuate electricity to the grid.

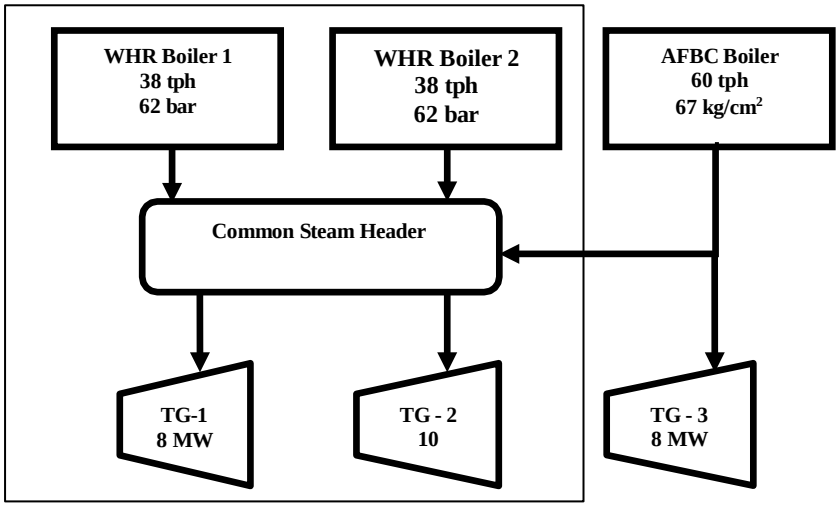
Type of GHG emissions mitigation action	**Energy efficiency: Waste energy recovery in order to displace more-carbon intensive energy/technology.**

This power, from the WHRB plant, displaces an equivalent amount of power from the Chhattisgarh State Electricity Board (CSEB) grid, which is part of Western Region (WR) grid in India and is primarily fossil fuel based. The project activity results in reduced carbon emissions by avoiding generation of this power in grid connected power stations. The grid emission factor for WR grid is as the recommended UCR conservative estimate for the years 2015-2022.

The electricity generated by the project activity displaces electricity generation from fossil fuels in the electricity grid as it is wheeled over the grid to a steel manufacturing company which has historically purchased electricity from the grid. There will be no fuel switch in the sponge iron process after implementation of the project activity.

The total auxiliary consumption as per the requirement of the auxiliary equipment at the WHRB plant **1.8 MW** (approx. 10% Auxiliary). There are a total of **2 (two) WHRBs each of 38 TPH** capacity working at 62 bar pressure. Steam from 02 nos. WHRBs is taken to the turbines through a common header.

The DRI gas, as it comes out after burning chamber, contains sufficient quantity of heat energy that if not recovered would be wasted. A 350 TPD DRI Kiln for sponge iron production emits normally around 90,000 Nm^3 /hour of hot gas at a temperature of 950^0C -1000^0C.



The project activity is the installation of WHRBs and turbine generators to generate electrical power from the waste heat gases produced during the manufacture of sponge iron. In the absence of the project activity, SBPIL would draw power from CSEB grid, which in turn generates power from fossil fuel power plants. The project activity thus displaces equivalent amount of power generation in WR grid connected power stations.

As per the approved UNFCCC CDM methodology, the useful energy generated from the utilization of waste energy carried in the project activity is for:

(a) Generation of electricity

The project activity is an approved positive activity as per the revised guidelines and updates of UCR, (source of update). Regulations do not require the PP to recover and/or utilize the waste energy prior to the implementation of the project activity

The project activity has displaced ~**890577 MW_h** in net electricity over the monitored period generation from the Indian grid system, which otherwise would have been generated by the operation of fossil fuel-

based grid-connected power plant.

The calculated CO_{2e} emission reductions by the project activity is **502989 tCO_{2e}**, during the first CoU period.

UCR Monitoring Period Number	01
UCR Crediting Start Date for this Period	01/09/2015
UCR Crediting End Date for this Period	31/12/2022
Total Emission Reductions over the monitoring period	502989 **tCO_2**

Project's Contribution to Sustainable Development

Steelmaking is a highly raw material and logistics intensive business, with one tonne of steel requiring the movement of four tonnes of raw materials. For a secondary steel producer, raw materials account for around 70.0% of the cost of steelmaking. Iron ore and coal are the two most critical steel making ingredients, and proximity to iron ore and coal mines give considerable competitive advantage to a steel player due to lower logistics costs for raw material procurement. As per Indian Minerals Yearbook 2019, Chhattisgarh recorded the second highest production of 34.94 MnT of iron ore, i.e., about 16.9% of the country's total production among all states in 2018-19.

Chhattisgarh being rich in minerals, steel players in the region have per tonne logistics costs 50.0% to 90.0% lower as compared to other steel plants in southern states. Chhattisgarh is also one of the few power surplus states in the country. Korba district in Chhattisgarh is known as the power capital of India. The state's huge coal reserves present a large opportunity for electricity generation. Steel companies having their own captive power plant in Chhattisgarh not only ensures more regular and uninterrupted power supply but also helps in reducing power and fuel cost providing competitive advantage.

The project activity is innovative in the steel manufacturing sector and has adopted the use of direct rolling process for manufacturing of re-rolled products. Direct rolling process is a technical evolution of hot charging, where continuous cast billet is directly pushed to the rolling mill, without the need of an intermediate process of re-heating. This process eliminates the need for re-heating the ingots/ billets and results in savings in fuel as well as reduction in emission of GHGs. (source).

The project activity is close to coal mines and coal can be easily procured for power generation. Char, a by-product from sponge iron kilns having good fuel properties and can also be used in power generation in the absence of the project activity. Despite such advantages, the PP chose to use WHRB for power generation, thus promoting sustainable development within the industry.

Thermal power plants are the major consumers of coal in India and yet the basic electricity needs of a large section of population are not being met. This results in excessive demands for electricity and places immense stress on the environment.

The Government of India has stipulated following indicators for sustainable development in the interim approval guidelines for such projects which are contributing to GHG mitigations. The Ministry of Environment, Forests & Climate Change, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. It has been envisaged that the project shall contribute to sustainable development using the following ways:

Social well being:

 Social well being is assessed by contribution by the project activity towards improvement in living

standards of the local community.
 The project activity has resulted in increased job opportunities for the local population on temporary and permanent basis.

Economic well being

 The project activity has created direct and indirect job opportunities to the local community. The project activity has a positive impact in terms of employment, infrastructure facilities and enhancement of per capita income of the village.
 The investment for the project activity has increased the economic activity of the local area.
 The project activity also contributes in economic well being of the nation's economy by reducing import of fossil fuel for electricity generation in hard currency.

Environmental well being

 The project activity helps reducing GHG emission in power generation in the grid, which is primarily fossil fuel based.
Reduced emissions of NOx and SOx in power generation.
Green belts are all around the project boundary complex to reduce dust and smoke, assuring healthy environment.

Technological well being

 It provides the necessary impetus to other industries to come up with similar projects and become self-sustainable for their power needs
With many similar project activities coming up, technology suppliers/manufacturers will put in more efforts/ funds in further improvement of equipment/ machinery and help in removing existing technological barriers to implementation of such project activities.

Do no harm or Impact test of the project activity>>

The PP has an online environmental monitoring database and reporting facility related to fugitive emissions, water quality, groundwater use and other environmental factors that are monitored regularly and free to access (link).

The Unit I site is supported by in-house captive power generating facilities with an installed capacity of **18MW** from waste heat recovery boilers ("WHRB"), and **8 MW** from biomass. This non-conventional source of 'green' power through WHRB and biomass reduces the PPs dependence on thermal power using additional fossil fuel, which helps control carbon emissions.

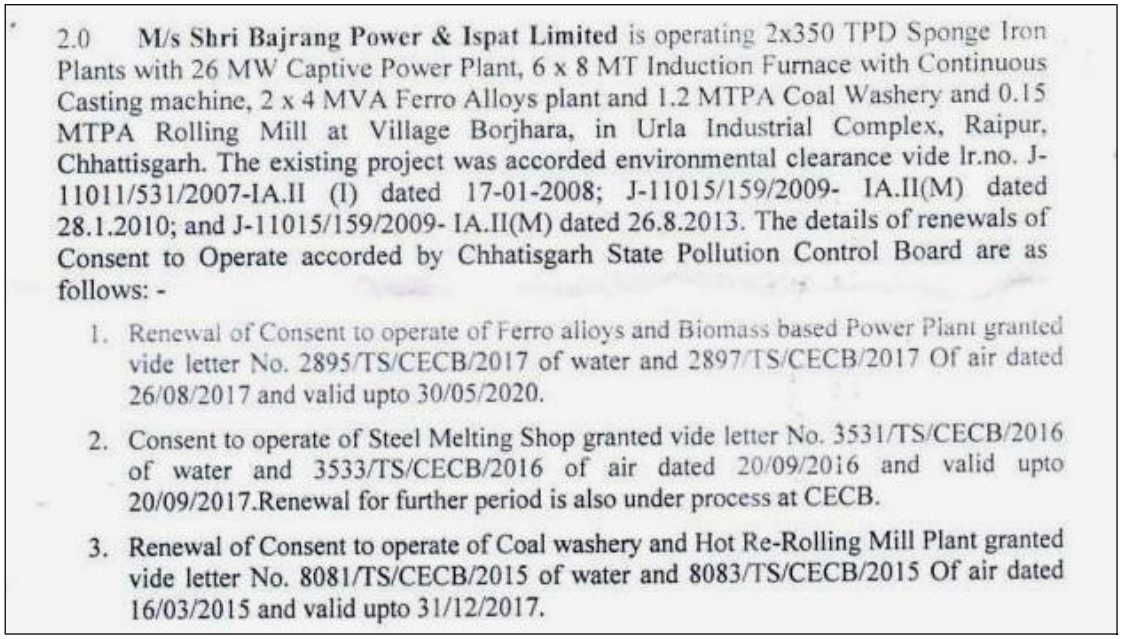
These operating divisions are fully equipped with machineries and plants with high technical specifications such as: two rotary kilns, each having diameter of 4.30 meter and length of 76-meter, steam turbines, sub merge arc furnace, furnace transformers, 80 ton pressing capacity mould, waste heat recovery boilers, biomass based boilers, solar panels, fly ash brick making machines, induction furnace, furnace transformer, hot billet transfer mechanism, and other accessories.

Unit I is ISO 45001:2018 certified in connection of health and safety management system for manufacturing of sponge iron, ferrous billet and blooms, ferro alloys, dry beneficiation of coal, rolled steel TMT Bars, and facility management operation and maintenance of 18MW WHRB power plants and 8 MW biomass power plant.

Ecological and Environmental Sensitivity (Within 10 Km):- WLS-Wild Life Sanctuaries; NPA-Notified Protected Area; ESAs-Eco Sensitive Areas; ESZs-Eco Sensitive Zones	
Details of Ecological Sensitivity	
ESA	None within 10 km radius
Wildlife Corridors	None within 10 km radius
Corridors	None within 10 km radius
WLS	None within 10 km radius
ESZs	None within 10 km radius
Forest	None within 10 km radius

Source: https://environmentclearance.nic.in/auth/ECGeneral_Report.aspx?pid=41811

All the Integrated steel plants are listed at S. No. 3(a) under Category "A" of the Schedule of EIA Notification 2006 and appraised at the Central level. An Environment Impact assessment study for the project activity and facility was done prior to operations commencement. The impact of project activity was considered on the environment.



2.0 **M/s Shri Bajrang Power & Ispat Limited** is operating 2x350 TPD Sponge Iron Plants with 26 MW Captive Power Plant, 6 x 8 MT Induction Furnace with Continuous Casting machine, 2 x 4 MVA Ferro Alloys plant and 1.2 MTPA Coal Washery and 0.15 MTPA Rolling Mill at Village Borjhara, in Urla Industrial Complex, Raipur, Chhattisgarh. The existing project was accorded environmental clearance vide lr.no. J-11011/531/2007-IA.II (I) dated 17-01-2008; J-11015/159/2009- IA.II(M) dated 28.1.2010; and J-11015/159/2009- IA.II(M) dated 26.8.2013. The details of renewals of Consent to Operate accorded by Chhatisgarh State Pollution Control Board are as follows: -

1. Renewal of Consent to operate of Ferro alloys and Biomass based Power Plant granted vide letter No. 2895/TS/CECB/2017 of water and 2897/TS/CECB/2017 Of air dated 26/08/2017 and valid upto 30/05/2020.
2. Consent to operate of Steel Melting Shop granted vide letter No. 3531/TS/CECB/2016 of water and 3533/TS/CECB/2016 of air dated 20/09/2016 and valid upto 20/09/2017.Renewal for further period is also under process at CECB.
3. Renewal of Consent to operate of Coal washery and Hot Re-Rolling Mill Plant granted vide letter No. 8081/TS/CECB/2015 of water and 8083/TS/CECB/2015 Of air dated 16/03/2015 and valid upto 31/12/2017.

The Ministry of Environment and Forests has given the project activity an environmental clearance under the provisions of EIA Notification dated 14th September, 2006 (source).

Present Water Consumption: 2442m^3/day

Source: River Kharun

PP has obtained consent for drawl of surface water since beginning through Kharun River from Water Resources Department, Govt. of Chhattisgarh, vide letter No. 5010/302/JS/TS/AJP/03-D-4, Raipur dated 26/10/2004.

There will be no impact on groundwater as close circuit water circulation system has been designed so as to minimize make-up water requirement. All wastewater generated is recycled through thickener and residue water is treated in the effluent treatment plant and after treatment is utilized for green belt development and water spraying on raw material stacks / roads.

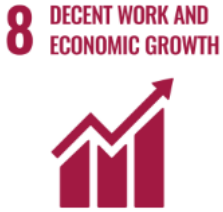
United Nations Sustainable Development Goals:

The project activity displaces CSEB grid power, part of WR grid, which is predominantly fossil fuel based.

In the absence of the project activity equivalent amount of power generation would have taken place through fossil fuel dominated power generating stations.

Positive contribution of the project to the following Sustainable Development Goals:

- SDG13: Climate Action
- SDG 7: Affordable and Clean Energy
- SDG 8: Decent Work and Economic Growth

Development Goals	Targeted SDG	Target Indicator (SDG Indicator)
 SDG 13: Climate Action	13.2: Integrate climate change measures into national policies, strategies and planning Target: **502989 tCO_2** for this monitored period	13.2.1: Number of countries that have communicated establishment or operationalization of an integrated policy/ strategy/ plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)
 SDG 7: Affordable and Clean Energy	By 2030, increase substantially the share of non fossil energy in the global energy mix Target: **890577 MW_h** supplied for this monitored period	The project activity helps reducing GHG emission in power generation in the grid, which is primarily fossil fuel based
 SDG 8: Decent Work and Economic Growth	8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value Target: Training, O&M staff	8.5.1: Average hourly earnings of female and male employees, by occupation, age and persons with disabilities The project activity provides direct employment to over **1250** people. The employment involves tribal people also who are more than 40% in population and also are now well qualified as well as competent to take the employment in the steel industry

A.2. Location of project activity >>

Urla Industrial Area,
Village: Borjhara,
District: Raipur,
State: Chhattisgarh,
Country: India.

Physical/ Geographical location:

Latitude: 21º18’30.8” N (21.3085) and Longitude: 81º35’6.8”E (81.5852)

A.3. Technologies/measures >>

In the project activity two turbo Generators (TG) having a combined capacity of 18 MW were linked with two WHRBs attached to each sponge iron kiln. Due to inadequate steam generation in WHRBs the full capacity of the WHR project as envisaged could not be utilised. After the implementation of the AFBC boiler, the excess steam available from the same is being diverted to the WHR project to achieve full generation capacity of **18 MW** turbine. Electricity generated from this diverted steam on account of the AFBC boiler is however not claimed as emission reductions (CoUs) in the current project activity.

The majority of sponge iron in India is manufactured through the direct reduction process. This process involves passing coal and iron ore through a rotary kiln at high temperatures (over 1000^{o}C) to reduce the iron ore to sponge iron. The reduction process yields carbon dioxide and carbon monoxide. These gases leave the kiln at high temperature (950^{o}C) and may be utilised to generate power. After leaving the kiln the hot gases are passed through an after burner chamber 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 then drawn through electrostatic precipitators and ultimately released via the stack.

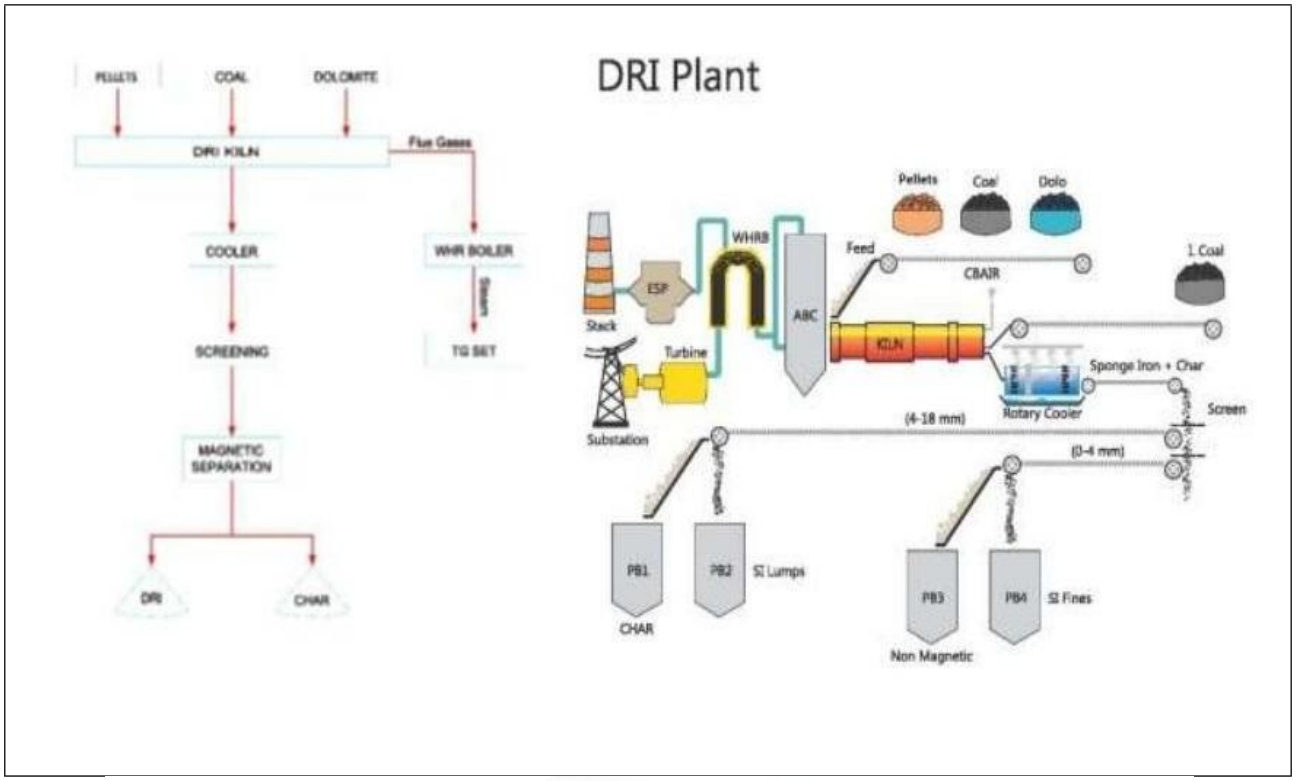
Sr. No	Turbine Details	Make	Date Commissioned
1.	8 MW condensing TG -1	Triveni, India	12/07/2005
2.	10 MW condensing TG-2	Triveni, India	31/08/2005

Sr. No	Boiler Details	Make
1	2 x 38 TPH, 66 Kg/cm2, 490 ± 5^{0} C	Thermax India

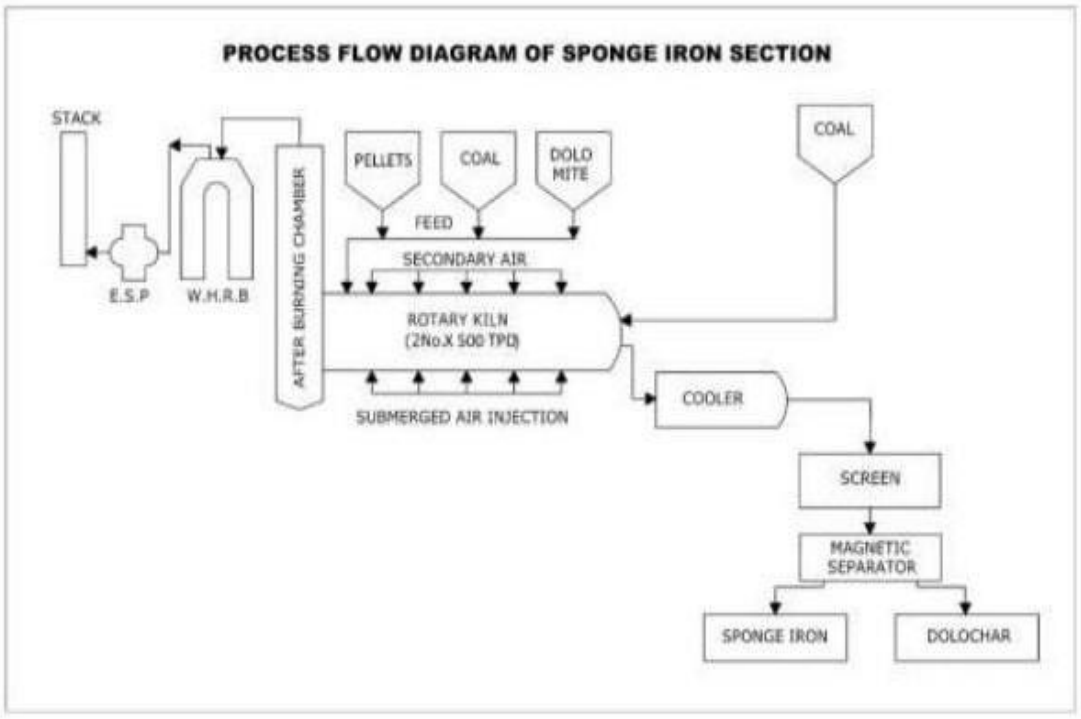
The project activity (also known as Unit I within the group of facilities operated and owned by the PP) comprises of two WHRBs, one compatible for 38TPH of steam generation installed at the tail end of second number 350TPD DRI Kiln and another WHRB of 38TPH capacity at the tail end of

first number of 350 TPD Kiln along with one AFBC Boiler of 60 TPH steam generation capacity equipped with Water Cooled Condenser.

Flue gases temp and pressure: 950 ^{o}C, -1 to -5 mmWC (Inlet)
Steam generated pressure and temp: 66 **ATA, 490 ± 5 ^{o}C**



Process Flow of Sponge Iron Plant

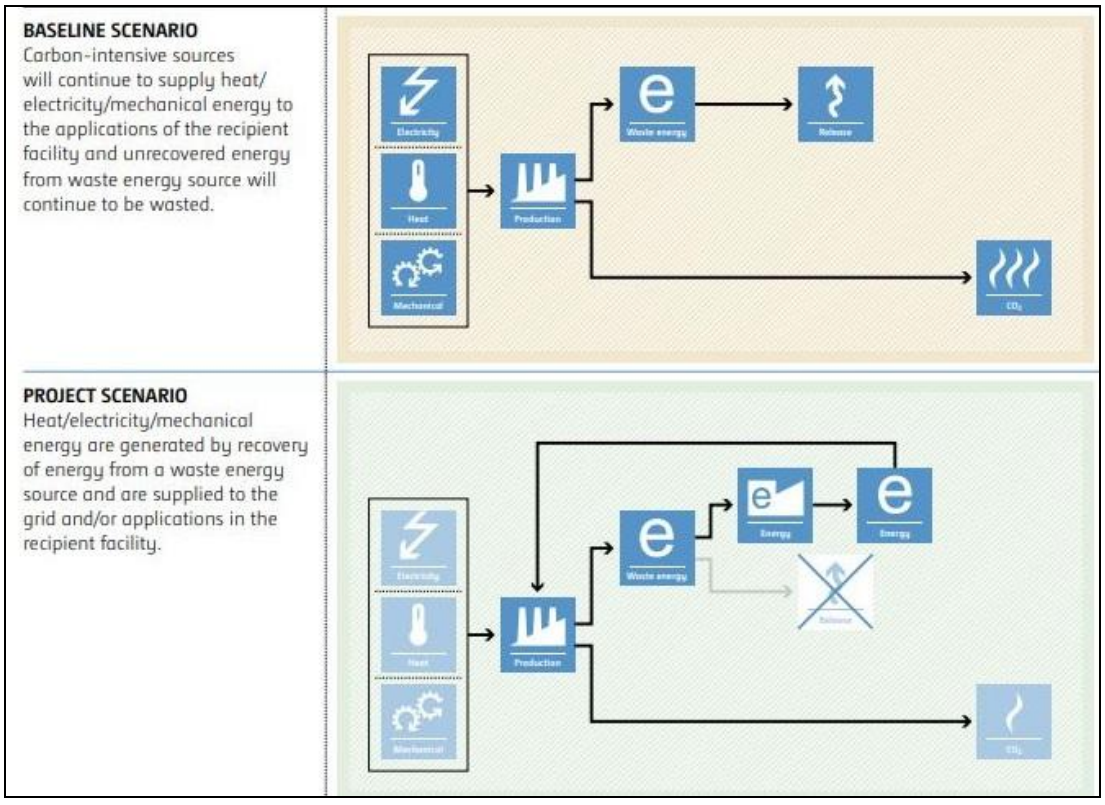


Heat that is extracted from the hot gas is utilized in the transforming water to high temperature to high pressure steam, to run conventional condensing type Steam Turbo Generator for generation of electricity as a part of forward and backward integration process.

A.4. Parties and project participants >>

Party (Host)	Participants
India	**Project Proponent**: Shri Bajrang Power and Ispat Limited (SBPIL) **Aggregator:** Carbon Equalizers, KATNI **UCR ID** : 660687753 **Contact:** Mr Vikas Chamadia **Email**: vikaschamadia@rediffmail.com

A.5. Baseline Emissions>>



UNFCCC CDM (CLEAN DEVELOPMENT MECHANISM) approved methodology ***ACM0012*** *Large-scale Consolidated Methodology* **Waste energy recovery** *Version 06.0*

Typical projects approved to use the methodology

Energy from waste heat, waste gas or waste pressure in an existing or new industrial facility is recovered and used for in-house consumption or for export, by installation of a new power and/or heat and/or mechanical energy generation equipment, by installation of a more-efficient useful energy generation equipment than already existing, or by upgrade of existing equipment but with better efficiency of recovery.

Type of GHG emissions mitigation action

Energy efficiency: Waste energy recovery in order to displace more-carbon intensive energy/technology.

In the absence of the project activity, the equivalent amount of electricity would have been imported from the regional grid (which is connected to the unified Indian Grid system). Hence, baseline scenario of the project activity is

"(a) the electricity obtained from the grid."

Baseline emissions from electricity (BE $_{Elec,y}$)

The baseline emissions corresponding to electricity supplied by the project activity to recipient facilities shall be estimated for each recipient facility in accordance with the case it belongs to as follows:

(a) Case 1a: recipients whose project level electricity consumption is less than or up to the maximum capacity of the existing pre-project equipment at the recipient facility to use Equation 4

$$BE_{EL,j,y} = \sum_{i} (EG_{i,j,y} \times EF_{Elec,i,j,y}) \qquad \text{Equation (4)}$$

Where:

$EG_{i,j,y}$	=	The power supplied by the project activity to the recipient facility *j*, which in the absence of the project activity would have been sourced from baseline source *i* (e.g. '*gr*' for the grid or '*is*' for an identified source) during the year *y* as per the identified baseline scenario for recipient facility *j* (MWh)
$EF_{Elec,i,j,y}$		The CO_2 emission factor for the baseline electricity source *i* (e.g. '*gr*' for the grid, and '*is*' for an identified source), corresponding to baseline scenario for the recipient facility *j*, during the year *y* (t CO_2/MWh)

Since extra steam has been added in the project activity from one AFBC based boiler, Thus fraction of total electricity generated by the project activity using waste gas has been multiplied with the total electricity generation by the project activity and that electricity has been considered for baseline emission.

Thus *equation 4* is as follows:

$$BE_{EL,j,y} = f_{WCM} \sum_{i} (EG_{i,j,y} \times EF_{Elec,i,j,y})$$

Where:

$EG_{i,j,y}$	=	The power supplied by the project activity to the recipient facility *j*, which in the absence of the project activity would have been sourced from baseline source *i* (e.g. '*gr*' for the grid or '*is*' for an identified source) during the year *y* as per the identified baseline scenario for recipient facility *j* (MWh)
$EF_{Elec,i,j,y}$		The CO_2 emission factor for the baseline electricity source *i* (e.g. '*gr*' for the grid, and '*is*' for an identified source), corresponding to baseline scenario for the recipient facility *j*, during the year *y* (t CO_2/MWh)

f_{WCM} = Fraction of total electricity generated by the project activity using waste gas.

A.6. Debundling>>

This project activity is not a debundled component of a larger carbon or GHG registered project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines >>

SECTORAL SCOPE - 01 Energy industries (Renewable/NonRenewable Sources)
04. Manufacturing industries

TYPE III – Energy Efficiency

CATEGORY- ***ACM0012*** Large-scale Consolidated Methodology

Waste energy recovery Version 06.0

The consolidated methodology is applicable to project activities implemented in an existing or Greenfield waste energy generation (WEG) facility converting waste energy carried in identified waste energy carrying medium (WECM) stream(s) into useful energy (i.e. power, mechanical or thermal) consumed in an existing or Greenfield recipient facility(ies) and/or supplied to the grid in the case of electricity generation. The WEG facility may be one of the recipient facilities.

B.2 Applicability of methodologies and standardized baselines >>

This project is included under this methodology since it applies to project activities that generate electricity from waste heat or the combustion of waste gases in industrial facilities. It's also included within the UCR Standard Positive List of technologies (updated) and is within the large -scale CDM thresholds under the applied methodology
Project activity involves power generation with installed capacity of 18 MW (8 MW+10 MW). Regulations do not require the project activity to recover and/or utilize the waste energy prior to the implementation of the project activity; The methodology is applicable where waste pressure is used to generate electricity only and the electricity generated from waste pressure is measurable;
The proposed project activity is a power generation project from waste heat from DRI kilns in a sponge iron plant. The project activity displaces Chhattisgarh State Electricity Board (CSEB) grid power, part of WR grid, which is predominantly fossil fuel based.
The methodology allows for the recipient facility to be same as the waste energy generation facility. The project site is the waste energy generation facility and the facility itself receives useful energy generated using waste energy under the project activity.

B.3 Applicability of double counting emission reductions >>

There is no double accounting of emission reductions in the project activity due to the following reasons:

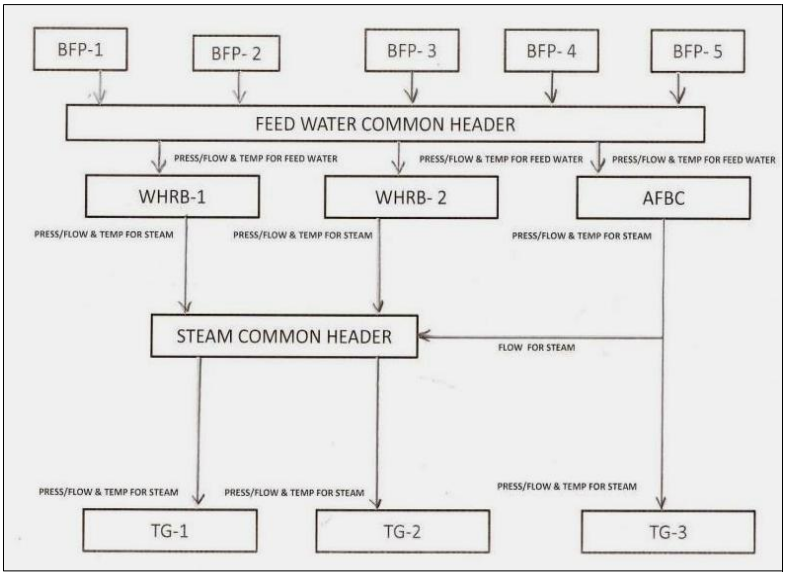
- Project is uniquely identifiable based on its location coordinates,
- Project has dedicated commissioning certificate and connection point and plant operation data on power generation in project activity is taken from energy meters installed at project site
- Project is associated with distinct and unique energy meters which are dedicated to the consumption point for PP.

B.4 Project boundary, sources and greenhouse gases (GHGs)>>

The spatial extent of the project boundary comprises the waste heat or gas sources, captive power generating equipment, any equipment used to provide auxiliary heat to the waste heat recovery process, and the power plants connected physically to the electricity grid that the proposed project activity will affect. In line with the methodology the project boundary encompasses emissions of the project activity associated with the CO_2 emissions from the combustion of auxiliary fossil fuels and baseline emissions associated with the CO_2 emissions from fossil fuel fired power plants connected to the electricity system.

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. The project boundary is hence the spatial extent to the captive power generating equipments and the power plants connected to the grid.

	Source	GHG	Included?	Justification/Explanation
Baseline	Grid-connected electricity	CO_2	**Included**	Major source of emission
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	On-site fossil fuel consumption due to project activity Combustion of waste gas for electricity generation	CO_2	Excluded	Project activity entails use of waste heat of the flue gases from DRI kilns for power generation. Project activity does not entail use of fossil fuels in the project activity. ***However, the minor emissions from on-site diesel consumption negligible and are included***. This is conservative and will be monitored at verification.
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative



From the above boundary diagram the steam source from the AFBC boiler has not been considered within the boundary as the steam from this source will be apportioned in line with the methodology so that the CoUs are claimed only for the electricity produced from the steam generated by the waste heat recovery boilers. The monitoring of the project activity will ensure that this is implemented in line with the monitoring methodology. The back-up diesel generators only have the capacity to rotate the kiln. The system is not designed to operate the sponge iron plant.

PE_y = Project emissions in year y (tCO2/y)

The project emissions, if any, due to the usage of fossil fuel (diesel) are calculated as follows:
$PE_y = Q_i \cdot CO_{EFi} \cdot NCV_i \cdot OXID$

Where:

PE_y = project emissions in year y, tCO_{2e}

Q_i = mass of fossil fuel combusted, t

CO_{EFi} = emissions factor of fossil fuel combusted, tCO_2/TJ

NCV_i = net calorific value of fossil fuel combusted, TJ/t

OXID = oxidation factor, %

PE_y = 91.62 tCO_2 over the monitored period

Month/YY	PE_y tCO_2	Month/YY	PE_y tCO_2	Month/YY	PE_y tCO_2	Month/YY	PE_y tCO_2
Sep-15	0.17	Jan-17	0.14	Jan-19	0.14	Jan-21	0.23
Oct-15	0.17	Feb-17	0.08	Feb-19	0.17	Feb-21	0.13
Nov-15	4.93	Mar-17	0.14	Mar-19	0.14	Mar-21	0.15
Dec-15	0.17	Apr-17	0.14	Apr-19	0.17	Apr-21	0.18
Total	**5.43**	May-17	0.17	May-19	3.24	May-21	4.04
Jan-16	0.33	Jun-17	0.14	Jun-19	0.17	Jun-21	0.18
Feb-16	0.17	Jul-17	0.14	Jul-19	0.17	Jul-21	0.17
Mar-16	0.25	Aug-17	0.17	Aug-19	39.32	Aug-21	0.16
Apr-16	0.17	Sep-17	0.14	Sep-19	0.17	Sep-21	0.20
May-16	0.17	Oct-17	0.14	Oct-19	0.17	Oct-21	0.20
Jun-16	0.17	Nov-17	0.17	Nov-19	0.17	Nov-21	0.19
Jul-16	0.17	Dec-17	0.11	Dec-19	0.20	Dec-21	2.81
Aug-16	0.17	**Total**	**1.67**	**Total**	**44.22**	**Total**	**8.65**
Sep-16	0.11	Jan-18	0.89	Jan-20	0.32	Jan-22	0.19
Oct-16	0.14	Feb-18	0.17	Feb-20	4.72	Feb-22	0.19
Nov-16	0.17	Mar-18	0.17	Mar-20	1.00	Mar-22	0.19
Dec-16	0.17	Apr-18	0.14	Apr-20	10.78	Apr-22	0.19
Total	**2.17**	May-18	4.65	May-20	2.20	May-22	0.40
Grand Total = 91.62 tCO_2		Jun-18	0.15	Jun-20	0.28	Jun-22	0.10
		Jul-18	0.17	Jul-20	0.23	Jul-22	0.10
		Aug-18	0.15	Aug-20	0.16	Aug-22	0.20
		Sep-18	0.17	Sep-20	0.16	Sep-22	0.10
		Oct-18	0.14	Oct-20	0.16	Oct-22	0.10
		Nov-18	0.17	Nov-20	0.16	Nov-22	0.10
		Dec-18	0.17	Dec-20	0.17	Dec-22	0.13
		Total	**7.13**	**Total**	**20.33**	**Total**	**2.02**

Thus, ERy = BEy – PEy – LEy

Where:

ERy = Emission reductions in year y (tCO2/y)

BEy = Baseline Emissions in year y (t CO2/y)

LEy = Leakage emissions in year y (tCO2/y)

B.5. Establishment and description of baseline scenario (Adapted CDM Methodology using UCR Protocol) >>

Baseline emissions include only CO_2 emissions from electricity generation in power plants that are displaced due to the project activity. The case established for the power required by the project activity, since it requires **1.8 MW_h for its auxiliary use**, is less than the installed capacity of the equipment as per the methodology and its associated emissions quantification formula to be selected.

The baseline emissions corresponding to electricity supplied by the project activity to recipient facilities is estimated for each recipient facility in accordance with the case established as above and in the case of the project activity is as follows:

(a) *Case 1a: recipients whose project level electricity consumption is less than or up to the maximum capacity of the existing pre-project equipment at the recipient facility to use the following modified Equation*

$$BE_{EL,j,y} = f_{WCM} \sum_{i} (EG_{i,j,y} \times EF_{Elec,i,j,y})$$

Where:

$EG_{i,j,y}$	=	The power supplied by the project activity to the recipient facility *j*, which in the absence of the project activity would have been sourced from baseline source *i* (e.g. '*gr*' for the grid or '*is*' for an identified source) during the year *y* as per the identified baseline scenario for recipient facility *j* (MWh)
$EF_{Elec,i,j,y}$		The CO_2 emission factor for the baseline electricity source *i* (e.g. '*gr*' for the grid, and '*is*' for an identified source), corresponding to baseline scenario for the recipient facility *j*, during the year *y* (t CO_2/MWh)

f_{WCM} = Fraction of total electricity generated by the project activity using waste gas.

And

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

Where:

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

$ST_{other,y}$ = Energy content of steam generated in other boiler (AFBC) fed to turbine via common steam header

(b) If the electricity displaced by the project activity in the recipient facility is supplied by a connected grid system, the CO_2 emission factor of the electricity is modified from the UNFCCC CDM methodology and instead shall be determined following the guidance provided by the UCR CoU protocol for conservativeness.

Power Gen Cap Capacity	MW	18
Auxiliary Power Consumption	%	10%

Estimated Annual Baseline Emission Reductions: $BE_{EL,j,y} = \mathbf{f_{WCM}} \ (EG_{BL,y} \times EF_{,CO2,GRID,y)}$

$BE_{EL,j,y}$ = Baseline emission reductions in a year y at project site/recipient plant (j).

where:

$EG_{BL,y}$ is calculated based on daily gross power generation and auxiliary power consumption in the power generation plant (recipient plant)

$EG_{BL,y} = EG_{GEN,y} - EG_{AUX,y}$.

where,

$EG_{BL,y}$ = Net power generation from turbine in year y (MWh/yr)

$EG_{GEN,y}$= Gross power generation from turbine in year y (MWh/yr)

$EG_{AUX,y}$= Auxiliary power consumption in power generation plant in year y (MWh/yr)

f_{WCM} = Fraction of total electricity generated by the project activity using waste gas.

$EF_{Grid,CO2,y}$ = CO_2 emission factor of the grid in year y (t CO_2/MWh) as determined by the UCR Standard for the 2015-2022 period.A "grid emission factor" refers to a CO_2 emission factor (tCO2/MWh) which will be associated with each unit of electricity provided by an electricity system.

The UCR recommends an emission factor of 0.9 tCO_2/MW_h for the 2015-2021 years as a fairly conservative estimate for Indian projects not previously verified under any GHG program.

Also, for the vintage 2021-22, the combined margin emission factor calculated from CEA database in India results into same emission factors as that of the default value. Hence, the same emission factor

has been considered to calculate the emission reduction.

No leakage is applicable under this methodology, hence, LEy= 0

Month	Total electricity generated	Auxiliary electricity	Net electricity supplied	ST_{whr}	ST_{other}	f_{WCM}
	MWh	MWh	MWh			
	EG_{Gen}	EG_{Aux}	EG_y			
Sep-15	9,974	946.146	9,028.278	21804426039	7425307973	0.7460
Oct-15	11,509	987.290	10,522.073	25760040235	7519924016	0.7740
Nov-15	10,991	926.681	10,064.009	22943805856	10029752610	0.6958
Dec-15	10,327	953.107	9,374.111	16831198755	13408415192	0.5566
Total	**42,802**	**3,813**	**38,988.471**			
Jan-16	12,451	988.341	11,462.340	25090310848	11347872668	0.6886
Feb-16	9,096	883.887	8,212.243	14634053745	12036771391	0.5487
Mar-16	11,969	988.843	10,979.889	26146048079	8830814382	0.7475
Apr-16	11,553	950.609	10,602.005	24974770629	8961162533	0.7359
May-16	12,123	979.639	11,143.155	28866262830	6518838469	0.8158
Jun-16	12,031	949.096	11,081.520	26732400507	8763439498	0.7531
Jul-16	11,576	970.096	10,605.663	23563228664	10521756667	0.6913
Aug-16	8,528	809.627	7,718.624	14383706310	11174788008	0.5628
Sep-16	8,547	865.659	7,681.527	14300890077	10947604403	0.5664
Oct-16	11,390	969.217	10,421.108	21103425859	12222151568	0.6333
Nov-16	12,374	953.312	11,420.477	25297706461	11015569519	0.6967
Dec-16	11,897	981.838	10,915.542	22989990868	12207466115	0.6532
Total	**1,33,534**	**11,290**	**1,22,244.093**			
Jan-17	12,430	989.337	11440.186	25504101087	11383422962	0.6914
Feb-17	9,038	854.346	8183.593	13445346184	13256255802	0.5035
Mar-17	11,255	981.183	10274.261	21216127202	11899664179	0.6407
Apr-17	9,445	900.974	8543.783	21329292223	6514267873	0.7660
May-17	11,787	990.499	10796.372	22317333142	12464848407	0.6416
Jun-17	11,433	959.408	10473.597	21087197911	12910434737	0.6203
Jul-17	10,616	978.879	9636.638	15661883622	15862393350	0.4968
Aug-17	10,121	970.294	9150.888	14168635656	15896069130	0.4713
Sep-17	10,808	951.668	9855.981	18817532666	13338020354	0.5852
Oct-17	11,915	969.371	10945.846	22212916503	12915143154	0.6323
Nov-17		911.370	10783.680	20872781125	13638359888	0.6048

	11,695					
Dec-17	11,055	879.584	10175.076	20506567748	12175087390	0.6275
Total	**1,31,597**	**11,337**	**1,20,259.901**			
Jan-18	11,830	917.151	10913.242	24121716846	10850811390	0.6897
Feb-18	9,716	779.051	8936.495	19571476969	9222692546	0.6797
Mar-18	12,039	892.655	11146.212	23854719333	11718802410	0.6706
Apr-18	11,973	887.736	11084.786	24338605344	11357596972	0.6818
May-18	12,137	938.008	11199.111	28191077695	8165949672	0.7754
Jun-18	11,714	899.435	10815.012	24007944316	11135652559	0.6831
Jul-18	8,727	783.712	7943.156	17761404266	8141025405	0.6857
Aug-18	11,709	872.238	10836.675	21013736879	13986027787	0.6004
Sep-18	10,124	826.140	9297.714	16176533578	14088207635	0.5345
Oct-18	11,320	899.747	10420.622	17402657283	16489704253	0.5135
Nov-18	11,259	863.012	10395.776	20335618577	13002388102	0.6100
Dec-18	11,383	893.851	10489.369	20323317962	13834530382	0.5950
Total	**1,33,931**	**10,453**	**1,23,478.170**			
Jan-19	10,517	868.235	9648.838	21295868070	10416425854	0.6715
Feb-19	8,652	730.731	7921.674	14617625668	11281645549	0.5644
Mar-19	11,849	899.484	10949.134	23005440313	12189931698	0.6536
Apr-19	11,009	871.981	10137.469	20580029845	12228877602	0.6273
May-19	11,645	918.894	10726.077	20898090118	13933825748	0.6000
Jun-19	10,433	846.520	9586.010	19182413994	12404044947	0.6073
Jul-19	10,965	894.926	10069.632	18595776933	14796827841	0.5569
Aug-19	8,806	707.813	8098.223	15751757464	11038946239	0.5880
Sep-19	8,958	752.427	8205.517	11377041507	15397026123	0.4249
Oct-19	11,864	855.427	11008.465	20534030656	15012468336	0.5777
Nov-19	11,150	829.937	10319.945	19315230994	13916633056	0.5812
Dec-19	11,107	831.961	10275.425	15969825534	17591596496	0.4758
Total	**1,26,955**	**10,008**	**1,16,946.409**			
Jan-20	11,592	792.216	10799.496	19146931783	15588658602	0.5512
Feb-20	10,787	728.354	10058.928	18297487724	14524291028	0.5575
Mar-20	8,750	612.640	8137.064	14503255913	12224447918	0.5426
Apr-20	2	18.836	0.000	0	0	0.0000
May-20	11,361	793.738	10567.616	16401950098	17356650559	0.4859
Jun-20		736.949	10081.141	17372731909	15004503672	0.5366

	10,818					
Jul-20	10,703	773.900	9928.690	16761581514	15587349838	0.5181
Aug-20	11,723	783.292	10939.860	18103362618	17171515544	0.5132
Sep-20	11,706	775.951	10929.944	21678261559	13310263308	0.6196
Oct-20	11,892	813.311	11079.104	20384805357	15236175162	0.5723
Nov-20	10,803	763.163	10039.980	16516634351	15720151864	0.5124
Dec-20	10,796	786.358	10010.047	16351322994	16199789376	0.5023
Total	**1,20,934**	**8,379**	**1,12,571.870**			
Jan-21	12,122	855.540	11266.028	22069543297	14412169664	0.6049
Feb-21	10,625	719.210	9906.183	20263188881	11720357341	0.6336
Mar-21	11,882	888.671	10993.174	23410208078	12450089259	0.6528
Apr-21	11,313	857.201	10456.020	20590980987	13506865984	0.6039
May-21	7,175	503.569	6671.508	12301703260	9058249835	0.5759
Jun-21	11,797	786.987	11010.394	23368982295	11645704688	0.6674
Jul-21	12,286	829.345	11456.320	25714030315	11094012570	0.6986
Aug-21	11,478	848.612	10629.519	22921355903	11534704050	0.6652
Sep-21	11,484	772.574	10711.484	22128143266	12531309217	0.6384
Oct-21	12,245	799.715	11444.925	21426967430	15313381543	0.5832
Nov-21	11,773	774.404	10998.375	20036387418	14928423764	0.5730
Dec-21	12,194	795.192	11398.801	22303071396	13900551970	0.6160
Total	**1,36,374**	**9,431**	**1,26,942.731**			
Jan-22	12,590	822.027	11768.381	27694027788	9675572833	0.7411
Feb-22	9,757	666.258	9091.234	17397232774	11923789609	0.5933
Mar-22	11,300	761.320	10538.712	19572145898	14601557789	0.5727
Apr-22	11,343	752.529	10590.159	23990627396	10125987042	0.7032
May-22	12,673	779.589	11893.046	27406456320	10621304166	0.7207
Jun-22	12,236	755.976	11479.802	26885277255	9967400050	0.7295
Jul-22	9,985	720.098	9265.336	27647492980	2691874177	0.9113
Aug-22	12,359	785.999	11572.870	27253347679	9736758283	0.7368
Sep-22	9,553	715.029	8838.009	12766176968	16562760971	0.4353
Oct-22	11,948	784.224	11163.456	21419529115	14370614845	0.5985
Nov-22	11,925	766.168	11159.043	23402460906	12493553850	0.6520
Dec-22	12,573	786.485	11786.216	26244511973	11757491006	0.6906
Total	**1,38,242**	**9,096**	**1,29,146.264**			
Grand Total	**9,64,368**	**73,807**	**8,90,577.91**			

	Steam from WHR boiler #1		
	Temperature	Pressure	Quantity
Month-YY	°C	kg/cm^2	tonnes
	$Temp_{whr}$	$Press_{whr}$	$Quantity_{whr}$
Sep-15	492.84	65.38	15530.25
Oct-15	493.83	66.05	17448.60
Nov-15	494.08	66.53	13451.10
Dec-15	493.64	66.39	5039.00
Jan-16	495.16	65.34	17768.65
Feb-16	494.25	65.95	17715.80
Mar-16	483.65	65.70	15232.40
Apr-16	495.23	66.01	18050.35
May-16	494.89	66.26	21345.60
Jun-16	492.81	65.66	19015.75
Jul-16	493.55	65.88	16727.45
Aug-16	491.23	65.36	16027.55
Sep-16	493.80	64.80	8629.70
Oct-16	492.00	66.10	11626.65
Nov-16	497.00	65.60	17345.90
Dec-16	495.60	66.10	12448.20
Jan-17	494.50	64.90	14195.70
Feb-17	488.40	64.90	9748.75
Mar-17	494.70	66.10	13038.15
Apr-17	490.10	65.90	15729.90
May-17	496.50	66.10	15978.25
Jun-17	494.80	65.70	16845.75
Jul-17	493.60	65.00	6805.10
Aug-17	496.00	64.90	14181.85
Sep-17	497.80	65.70	10829.20
Oct-17	496.20	65.60	15310.80
Nov-17	498.90	65.80	13470.10
Dec-17	492.00	66.40	11058.40
Jan-18	497.60	66.10	14884.15
Feb-18	496.80	66.30	17735.65
Mar-18	496.70	66.20	15166.85
Apr-18	498.80	65.70	14663.30
May-18	499.30	66.20	18974.80
Jun-18	482.10	65.60	15215.75
Jul-18	486.80	65.40	6492.10
Aug-18	497.10	65.30	10901.75
Sep-18	493.60	65.20	13328.95
Oct-18	499.90	65.10	10891.80
Nov-18	494.90	66.10	12797.05
Dec-18	499.10	65.20	11094.70
Jan-19	495.10	65.70	10935.20
Feb-19	498.60	65.20	10295.55
Mar-19	494.90	65.20	15366.15
Apr-19	500.30	66.20	12986.15
May-19	494.70	65.20	11958.20
Jun-19	490.10	65.80	10448.15

Jul-19	503.30	66.60	10752.65
Aug-19	506.10	65.30	11498.60
Sep-19	504.30	66.00	2668.75
Oct-19	493.70	66.20	16565.15
Nov-19	494.00	65.30	10762.45
Dec-19	502.30	65.80	10878.20
Jan-20	500.00	65.70	13330.95
Feb-20	500.50	65.40	11759.95
Mar-20	496.30	65.40	9747.00
Apr-20	0.00	0.00	0.00
May-20	500.00	65.40	11842.60
Jun-20	497.70	65.60	12739.75
Jul-20	496.30	65.70	12584.60
Aug-20	501.30	66.50	14781.20
Sep-20	498.50	66.80	18739.60
Oct-20	498.70	66.70	16454.40
Nov-20	491.20	66.50	15154.30
Dec-20	492.30	66.90	9504.60
Jan-21	502.20	66.50	15928.20
Feb-21	499.20	66.00	13648.30
Mar-21	496.00	66.70	15732.50
Apr-21	493.20	66.30	14405.40
May-21	499.30	66.40	8886.55
Jun-21	490.10	67.40	17056.80
Jul-21	498.50	67.80	19352.60
Aug-21	500.70	68.20	15091.00
Sep-21	498.80	67.20	18950.50
Oct-21	502.10	67.20	15943.00
Nov-21	498.10	67.20	14858.70
Dec-21	497.50	68.50	16551.60
Jan-22	500.50	68.40	19597.60
Feb-22	499.00	67.40	7351.20
Mar-22	501.30	66.70	16761.10
Apr-22	499.20	68.40	16122.50
May-22	497.50	67.50	18824.80
Jun-22	494.90	68.80	19053.50
Jul-22	497.30	68.78	20199.00
Aug-22	498.50	69.40	21247.70
Sep-22	486.20	68.10	8122.00
Oct-22	497.10	68.50	14168.60
Nov-22	499.30	68.60	15092.40
Dec-22	504.10	69.20	19121.90
Total	**490.57**	**65.55**	**1226563.35**

	Steam from WHR boiler #2		
	Temperature	Pressure	Quantity
Month-YY	°C	kg/cm^2	tonnes
	$Temp_{whr}$	$Press_{whr}$	$Quantity_{whr}$
Sep-15	493.95	65.54	15432.90
Oct-15	493.39	65.91	19093.55
Nov-15	491.74	66.21	19111.85

Dec-15	495.19	66.01	18821.95
Jan-16	487.64	65.63	17875.20
Feb-16	493.33	65.79	3032.35
Mar-16	492.50	66.39	21970.85
Apr-16	493.41	65.49	17338.30
May-16	492.13	65.96	19590.75
Jun-16	493.09	65.85	19145.85
Jul-16	494.29	65.71	16884.75
Aug-16	487.88	65.33	4553.80
Sep-16	487.40	65.10	11819.35
Oct-16	493.40	65.80	18464.05
Nov-16	494.50	65.90	18634.90
Dec-16	493.20	66.40	20293.05
Jan-17	490.20	65.60	21985.15
Feb-17	488.90	65.20	9384.20
Mar-17	491.30	65.90	17197.65
Apr-17	491.10	65.00	14716.05
May-17	493.40	65.90	15778.40
Jun-17	491.30	65.00	13139.00
Jul-17	490.10	65.10	15492.40
Aug-17	490.00	65.00	5968.50
Sep-17	489.10	65.40	15933.10
Oct-17	493.80	65.40	16212.70
Nov-17	493.70	65.60	16126.80
Dec-17	495.90	66.00	18087.15
Jan-18	467.00	65.60	19723.00
Feb-18	494.40	65.40	9946.40
Mar-18	494.40	66.40	18576.05
Apr-18	494.50	66.30	19724.20
May-18	487.90	65.50	20955.35
Jun-18	493.90	65.90	18931.95
Jul-18	492.90	65.80	18729.20
Aug-18	498.50	65.60	18739.35
Sep-18	490.50	65.80	9606.15
Oct-18	491.80	65.20	13707.35
Nov-18	498.30	65.40	15941.25
Dec-18	496.40	65.20	17593.30
Jan-19	493.00	66.10	19224.45
Feb-19	498.70	65.00	10316.70
Mar-19	490.20	65.30	17236.75
Apr-19	495.10	66.00	16059.05
May-19	490.10	65.60	17653.05
Jun-19	494.90	65.70	16725.90
Jul-19	469.20	65.60	15733.20
Aug-19	486.20	65.30	10754.90
Sep-19	498.00	65.30	13349.50
Oct-19	497.90	65.30	12460.05
Nov-19	485.90	65.10	16668.40
Dec-19	496.80	65.10	11622.65
Jan-20	493.80	65.00	13879.50
Feb-20	499.00	64.80	14102.75
Mar-20	499.90	65.20	10751.10

Apr-20	0.00	0.00	0.00
May-20	496.80	64.90	11282.65
Jun-20	494.80	64.60	11787.70
Jul-20	495.90	64.60	11091.70
Aug-20	487.20	64.90	10829.00
Sep-20	495.30	65.50	11876.10
Oct-20	497.70	65.00	12298.80
Nov-20	500.60	65.70	8201.90
Dec-20	498.70	65.40	13625.80
Jan-21	501.00	65.50	15135.20
Feb-21	497.90	65.50	14930.20
Mar-21	496.50	65.90	17348.60
Apr-21	494.00	65.40	14739.10
May-21	498.40	65.20	8455.80
Jun-21	495.50	65.80	16060.70
Jul-21	497.20	65.80	16928.40
Aug-21	497.50	66.00	17239.10
Sep-21	499.40	65.00	12248.60
Oct-21	498.10	65.20	14237.80
Nov-21	496.30	64.90	13444.30
Dec-21	497.60	65.80	14955.60
Jan-22	495.10	66.10	19488.40
Feb-22	491.10	65.30	17266.20
Mar-22	484.00	64.70	10980.90
Apr-22	496.00	66.80	17758.90
May-22	497.10	65.70	19850.20
Jun-22	494.80	66.60	19019.00
Jul-22	493.10	66.00	18906.20
Aug-22	495.80	66.00	17273.60
Sep-22	488.30	65.70	10058.40
Oct-22	497.20	65.50	16098.50
Nov-22	496.20	65.50	17961.20
Dec-22	464.00	65.90	18381.10
Total	**487.43**	**64.81**	**1330555.70**

		ST_{other}					
	Steam from Afbc boiler				**Steam going to new 8 MW turbine from AFBC boiler**		
	Temperature	**Pressure**	**Quantity**			**Temperature**	**Pressure**
Month-YY	**°C**	**kg/cm²**	**tonnes**		**tonnes**	**°C**	**kg/cm²**
	$Temp_{other}$	**$Press_{other}$**	**$Quantity_{other}$**		**$Quantity_{8MW}$**	**$Temp_{8MW}$**	**$Press_{8MW}$**
Sep-15	498.16	65.26	10500.58		0.00	0.00	0.00
Oct-15	500.53	65.28	24518.27		13905.27	492.23	64.20
Nov-15	502.14	65.42	35604.28		21457.94	493.34	64.05
Dec-15	494.23	65.86	39682.92		20648.08	485.28	64.73
Jan-16	503.14	65.43	39657.22		23667.13	495.15	64.17
Feb-16	504.83	65.51	37678.24		20745.53	496.18	64.47
Mar-16	510.36	65.73	35843.74		23475.24	501.18	64.30
Apr-16	506.41	64.91	36159.50		23574.22	497.32	63.87
May-16	499.02	65.38	29125.82		19915.37	489.69	64.38
Jun-16	500.59	65.71	35664.94		23220.12	491.35	64.40
Jul-16	496.17	65.93	35170.76		20172.73	486.96	64.68
Aug-16	499.96	65.64	39646.77		23785.19	489.37	64.58

Sep-16	501.63	65.26	34404.83		18988.83	491.15	63.88
Oct-16	498.00	65.63	41313.69		23928.55	487.34	64.42
Nov-16	508.57	65.62	38992.88		23455.73	497.95	64.41
Dec-16	511.83	65.14	39834.83		22686.95	499.04	64.21
Jan-17	512.41	65.13	39884.78		23956.97	502.26	63.82
Feb-17	509.93	65.54	39000.75		20414.14	499.06	64.19
Mar-17	511.23	65.89	40009.78		23266.61	501.02	64.73
Apr-17	495.83	65.50	21406.03		12131.01	485.71	64.23
May-17	499.62	65.87	40898.80		23209.51	490.13	64.74
Jun-17	500.48	65.94	40929.67		22659.30	489.37	64.66
Jul-17	495.45	65.32	43527.89		20973.30	484.85	64.05
Aug-17	501.49	65.59	43572.67		21082.59	490.56	64.19
Sep-17	497.14	65.68	41117.24		22179.31	486.84	64.38
Oct-17	496.06	65.68	40550.87		22215.07	483.97	64.46
Nov-17	497.69	65.67	42088.88		22747.10	486.02	64.54
Dec-17	496.94	65.61	39137.16		21862.68	484.05	64.47
Jan-18	501.08	65.48	38549.63		23202.65	489.65	64.47
Feb-18	502.84	65.37	34238.28		21260.33	489.00	64.37
Mar-18	502.04	65.57	40392.56		23896.13	488.95	64.55
Apr-18	495.89	65.63	38438.94		22368.88	483.90	64.48
May-18	495.25	65.13	35179.49		23624.73	484.23	64.12
Jun-18	499.34	65.81	38716.50		23009.68	487.64	64.56
Jul-18	495.55	65.79	34581.52		23062.16	482.59	64.43
Aug-18	499.09	65.86	43041.24		23314.07	486.56	64.49
Sep-18	499.61	65.49	40896.91		21013.97	485.43	64.22
Oct-18	499.37	65.38	44359.48		21088.70	486.94	64.07
Nov-18	498.65	65.58	40013.33		21651.57	486.51	64.39
Dec-18	499.53	65.73	41850.08		22321.23	487.22	64.53
Jan-19	499.03	65.44	30886.48		16181.25	486.62	64.38
Feb-19	499.61	65.64	34464.73		18548.17	487.33	64.41
Mar-19	498.99	65.56	39804.44		22595.38	486.25	64.17
Apr-19	495.71	65.78	37513.20		20210.73	484.34	64.71
May-19	497.03	65.49	42374.77		22678.36	484.91	64.36
Jun-19	496.14	65.74	36929.88		19385.97	484.29	64.52
Jul-19	502.52	65.78	41868.83		21058.56	490.01	64.76
Aug-19	499.02	65.42	28826.17		13248.76	485.61	64.39
Sep-19	498.26	65.91	37324.73		15579.05	493.92	64.54
Oct-19	497.99	65.67	43545.47		22333.92	493.85	64.31
Nov-19	499.34	65.51	41693.69		22053.77	494.67	64.33
Dec-19	499.51	65.63	44538.84		19728.98	494.32	64.40
Jan-20	498.79	65.68	43621.63		21467.77	494.16	64.50
Feb-20	499.33	65.81	40514.84		19945.69	494.71	64.56
Mar-20	499.39	65.76	32555.25		15270.71	494.90	64.46
Apr-20	0.00	0.00	0.00		0.00	0.00	0.00
May-20	499.51	65.71	43333.09		18845.83	494.41	64.42
Jun-20	497.92	65.48	38789.68		17598.80	493.58	64.17
Jul-20	498.07	65.61	40419.24		18405.51	493.34	64.29
Aug-20	497.13	65.55	44119.34		19834.48	492.78	64.30
Sep-20	495.25	65.67	38136.68		19227.21	490.27	64.72
Oct-20	497.87	65.52	41085.65		19535.23	493.27	64.43
Nov-20	495.88	65.53	39899.28		17577.60	492.32	64.53

Dec-20	496.48	65.84	42540.77		19512.14	493.02	64.74
Jan-21	497.90	65.68	40788.56		20376.78	493.75	64.52
Feb-21	495.21	65.54	36462.13		19863.82	490.80	64.45
Mar-21	496.81	65.62	39975.76		22374.93	491.74	64.65
Apr-21	495.72	65.75	38828.18		19713.53	491.59	64.47
May-21	495.88	65.64	25050.77		12235.75	491.60	64.47
Jun-21	494.70	65.45	38485.37		22001.39	491.22	64.49
Jul-21	494.89	65.80	39688.90		23992.05	490.88	64.54
Aug-21	494.65	65.45	36663.42		20330.92	491.06	64.51
Sep-21	494.88	65.74	39429.71		21682.58	491.38	64.36
Oct-21	498.56	65.73	43823.11		22197.11	494.12	64.47
Nov-21	497.95	65.60	42182.32		21077.05	493.72	64.38
Dec-21	498.12	65.91	41854.86		22203.09	493.43	64.87
Jan-22	492.32	65.78	37636.37		23898.62	489.80	64.77
Feb-22	497.53	65.83	32625.70		15768.20	493.87	64.52
Mar-22	497.07	65.54	42478.23		21826.67	492.97	64.24
Apr-22	498.38	66.26	35990.91		21690.52	493.96	65.20
May-22	496.52	65.79	38621.25		23605.51	493.41	64.52
Jun-22	496.21	65.91	36909.81		22810.87	489.99	64.98
Jul-22	496.24	65.73	21864.58		18060.36	492.55	64.68
Aug-22	491.59	65.55	37609.53		23798.29	487.48	64.74
Sep-22	496.65	65.71	41500.69		18099.20	492.44	64.44
Oct-22	493.87	65.49	42863.46		22519.10	498.48	64.23
Nov-22	494.62	65.91	40811.52		23136.11	491.30	64.68
Dec-22	496.30	65.38	39796.62		23185.22	491.43	64.31
Total	**493.18**	**64.87**	**3312910.19**		**20425.11**	**479.79**	**5541.78**

Quantity of steam entering the common steam header from AFBC boiler	
Month-YY	**tonnes**
	$Quantity_{csh}$
Sep-15	10500.58
Oct-15	10613.00
Nov-15	14146.34
Dec-15	19034.84
Jan-16	15990.09
Feb-16	16932.71
Mar-16	12368.50
Apr-16	12585.28
May-16	9210.45
Jun-16	12444.82
Jul-16	14998.03
Aug-16	15861.58
Sep-16	15416.00
Oct-16	17385.14
Nov-16	15537.15
Dec-16	17147.88
Jan-17	15927.81
Feb-17	18586.61
Mar-17	16743.17
Apr-17	9275.02
May-17	17689.29
Jun-17	18270.37

Jul-17	22554.59
Aug-17	22490.08
Sep-17	18937.93
Oct-17	18335.80
Nov-17	19341.78
Dec-17	17274.48
Jan-18	15346.98
Feb-18	12977.95
Mar-18	16496.43
Apr-18	16070.06
May-18	11554.76
Jun-18	15706.82
Jul-18	11519.36
Aug-18	19727.17
Sep-18	19882.94
Oct-18	23270.78
Nov-18	18361.76
Dec-18	19528.85
Jan-19	14705.23
Feb-19	15916.56
Mar-19	17209.06
Apr-19	17302.47
May-19	19696.41
Jun-19	17543.91
Jul-19	20810.27
Aug-19	15577.41
Sep-19	21745.68
Oct-19	21211.55
Nov-19	19639.92
Dec-19	24809.86
Jan-20	22153.86
Feb-20	20569.15
Mar-20	17284.54
Apr-20	0.00
May-20	24487.26
Jun-20	21190.88
Jul-20	22013.73
Aug-20	24284.86
Sep-20	18909.47
Oct-20	21550.42
Nov-20	22321.68
Dec-20	23028.63
Jan-21	20411.78
Feb-21	16598.31
Mar-21	17600.83
Apr-21	19114.65
May-21	12815.02
Jun-21	16483.98
Jul-21	15696.85
Aug-21	16332.50
Sep-21	17747.13

Oct-21	21626.00
Nov-21	21105.27
Dec-21	19651.77
Jan-22	13737.75
Feb-22	16857.50
Mar-22	20651.56
Apr-22	14300.39
May-22	15015.74
Jun-22	14098.94
Jul-22	3804.22
Aug-22	13811.24
Sep-22	23401.49
Oct-22	20344.36
Nov-22	17675.41
Dec-22	16611.40
Total	**1515500.08**

Month/YY	BE_y	PE_y	ER_y
	tCO_2	tCO_2	tCO_2
Sep-15	6061.32	0.17	6,061.00
Oct-15	7330.06	0.17	7,329.00
Nov-15	6302.50	4.93	6,297.00
Dec-15	4695.82	0.17	4,695.00
Jan-16	7103.38	0.33	7,103.00
Feb-16	4055.39	0.17	4,055.00
Mar-16	7386.96	0.25	7,386.00
Apr-16	7022.18	0.17	7,022.00
May-16	8181.27	0.17	8,181.00
Jun-16	7511.08	0.17	7,510.00
Jul-16	6598.60	0.17	6,598.00
Aug-16	3909.47	0.17	3,909.00
Sep-16	3915.77	0.11	3,915.00
Oct-16	5939.25	0.14	5,939.00
Nov-16	7160.49	0.17	7,160.00
Dec-16	6416.75	0.17	6,416.00
Jan-17	7118.79	0.14	7,118.00
Feb-17	3708.70	0.08	3,708.00
Mar-17	5924.12	0.14	5,923.00
Apr-17	5890.39	0.14	5,890.00
May-17	6234.56	0.17	6,234.00
Jun-17	5846.67	0.14	5,846.00
Jul-17	4308.90	0.14	4,308.00
Aug-17	3881.30	0.17	3,881.00
Sep-17	5190.98	0.14	5,190.00
Oct-17	6229.36	0.14	6,229.00
Nov-17	5869.90	0.17	5,869.00
Dec-17	5746.05	0.11	5,745.00
Jan-18	6774.50	0.89	6,773.00
Feb-18	5466.74	0.17	5,466.00
Mar-18	6726.94	0.17	6,726.00
Apr-18	6802.11	0.14	6,801.00
May-18	7815.37	4.65	7,810.00
Jun-18	6649.34	0.15	6,649.00
Jul-18	4901.99	0.17	4,901.00

Aug-18	5855.67	0.15	5,855.00
Sep-18	4472.67	0.17	4,472.00
Oct-18	4815.59	0.14	4,815.00
Nov-18	5707.12	0.17	5,706.00
Dec-18	5616.89	0.17	5,616.00
Jan-19	5831.57	0.14	5,831.00
Feb-19	4023.91	0.17	4,023.00
Mar-19	6441.21	0.14	6,441.00
Apr-19	5723.03	0.17	5,722.00
May-19	5791.79	3.24	5,788.00
Jun-19	5239.41	0.17	5,239.00
Jul-19	5046.85	0.17	5,046.00
Aug-19	4285.26	39.32	4,245.00
Sep-19	3138.08	0.17	3,137.00
Oct-19	5723.30	0.17	5,723.00
Nov-19	5398.40	0.17	5,398.00
Dec-19	4400.50	0.20	4,400.00
Jan-20	5357.60	0.32	5,357.00
Feb-20	5046.89	4.72	5,042.00
Mar-20	3973.87	1.00	3,972.00
Apr-20	0.00	10.78	-10.00
May-20	4620.94	2.20	4,618.00
Jun-20	4868.34	0.28	4,868.00
Jul-20	4630.09	0.23	4,629.00
Aug-20	5052.98	0.16	5,052.00
Sep-20	6094.80	0.16	6,094.00
Oct-20	5706.21	0.16	5,706.00
Nov-20	4629.62	0.16	4,629.00
Dec-20	4525.49	0.17	4,525.00
Jan-21	6133.83	0.23	6,133.00
Feb-21	5648.46	0.13	5,648.00
Mar-21	6458.88	0.15	6,458.00
Apr-21	5682.76	0.18	5,682.00
May-21	3458.05	4.04	3,454.00
Jun-21	6613.55	0.18	6,613.00
Jul-21	7203.03	0.17	7,202.00
Aug-21	6364.01	0.16	6,363.00
Sep-21	6154.82	0.20	6,154.00
Oct-21	6007.21	0.20	6,007.00
Nov-21	5672.30	0.19	5,672.00
Dec-21	6319.96	2.81	6,317.00
Jan-22	7849.23	0.19	7,849.00
Feb-22	4854.74	0.19	4,854.00
Mar-22	5432.21	0.19	5,432.00
Apr-22	6702.25	0.19	6,702.00
May-22	7714.14	0.40	7,713.00
Jun-22	7537.41	0.10	7,537.00
Jul-22	7598.94	0.10	7,598.00
Aug-22	7673.93	0.20	7,673.00
Sep-22	3462.27	0.10	3,462.00
Oct-22	6012.95	0.10	6,012.00
Nov-22	6547.64	0.10	6,547.00
Dec-22	7325.70	0.13	7,325.00

Year	BEy (tCO2)	PEy (tCO2)	ERy (tCO2)
2015	24389.70	5.431535	24382
2016	75200.60	2.172614	75194
2017	65949.71	1.67	65941.00
2018	71604.94	7.13063	71590
2019	61043.31	44.21548	60993
2020	54506.84	20.33	54482
2021	71716.85	8.65146	71703
2022	78711.42	2.016631	78704
Grand Total	**5,03,123.37**	**91.62**	**5,02,989.00**

Total Emission Reductions (ER_y) over the entire monitored period = **502989** CoUs (**502989** tCO_{2eq})

B.6. Prior History>>

The project activity has **been** registered as a UNFCCC **CDM** and other elements as **VCS** project activity in the past as follows:

As noted earlier, from 01/09/2008 onwards, steam generated from adjacent CDM project (UNFCCC #2128) is fed into a common header to which the steam from the **UCR project activity is currently fed.**

Title	**Shri Bajrang RE Project**
UNFCCC reference No	2128
Sectoral scopes	1 : Energy industries (renewable - / non-renewable sources)
Activity Scale	Small Scale
Methodologies Used	AMS-I.D. ver. 18 - Grid connected renewable electricity generation
Registration Date	30/09/2016
Crediting Period	**27/02/2016 to 30/06/2019 (Awaiting Issuance)**
Last MR Date	22/07/2019
Type of crediting period	07 Years Renewable
Length of the Crediting Period	07 Years
Crediting period from	2702/2016-26/02/2023 (Renewable)

The biomass based boiler/turbine has also been registered for carbon credits (UNFCCC CDM#2128) next to the existing UCR project activity. This biomass project activity generates power by utilizing the steam generated by using renewable biomass, rice husk as fuel in the boiler. Dolochar has also been co fired with rice husk. The electricity generated by this biomass (RE) project has been used for captive purpose and the surplus electricity exported to the CSEB grid. **Emission reductions have been claimed for the electricity displaced by the RE project activity only.**

The RE project has been registered as a CDM project on 27/02/2009. Some months in 2008- 2009 were also registered for carbon credits under the **VCS** program as follows:

Title	**Shri Bajrang RE Project**
VCS Reference No	1167
Sectoral scopes	1 : Energy industries (renewable - / non-renewable sources)
Activity Scale	Small Scale
Methodologies Used	AMS-I.D.

Crediting Period	01/09/2008-31/12/2008
VCUs issued	13459 tCO2
Crediting Period	01/01/2009-26/02/2009
VCUs issued	6543 tCO2
MR Date	23/08/2010

The project activity is seeking CoUs under the UCR CoU Standard for the period **01/09/2015-31/12/2022** and hence there is no double counting issue of carbon credits for the said vintage period.

B.7. Changes to start date of crediting period >>

There is no change in the start date of crediting period. The start date of crediting under UCR is considered as 01/09/2015.

B.8. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

There are no temporary deviations from the registered monitoring plan, the applied adapted methodologies, the applied standardized baselines or the other applied methodological regulatory documents during this monitoring period. There is no UCR post-registration change to include in this monitoring plan.

B.9. UCR Monitoring period number and duration>>

UCR Monitored Period: 01
1st UCR Monitoring Period: 01/09/2015-31/12/2022 (07 years 04 months)

B.10. Monitoring plan>>

Various departments at SBPIL are headed by respective HOD (Head of Department) supported by shift- in-charges & support staff. Departments are mainly divided into projects, mechanical, electrical & instrumentation, production, QC and administration. Mechanical & electrical department are responsible for the overall upkeep of plant, plant machinery and instruments.

To ensure that the data is reliable and transparent, the PP has established Quality Assurance and Quality Control (QA&QC) measures to effectively control and manage data reading, recording, auditing as well as archiving data and all relevant documents. The data is monitored on a daily basis and is submitted to PPs on a daily basis.

Key Data Monitored: • Net power supplied to manufacturing facility due to waste heat recovery

1 Monitoring Plan Objective and Organization

PP is the project implementer and monitors the electricity generated from the turbines within the project activity. The data is already archived electronically and is stored since 2015.

Director is responsible for the overall functioning of the sponge iron plant. SBPIL has adopted the following procedures to assure the completeness and correctness of the data needed to be monitored for the UCR project activity. On a monthly basis, the monitoring reports are checked and discussed by the senior project activity team members. In case of any irregularity observed by any of the team members, it is informed to the concerned person for necessary actions. Further these reports are then forwarded to the management on a monthly basis.

- Unit Head: Overall responsibility of compliance with the project activity monitoring plan.

- Power plant In-charge: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation
- Shift In-charge: Responsibility of data monitoring & recording day to day data collection and record keeping:

Plant data collected on operation under the supervision of the respective Shift-in-charge and records are kept in daily logs.

Reliability of data collected

Documents pertaining to testing of meters are maintained. PPs have implemented QA&QC measures to calibrate and ensure the accuracy of metering and safety aspects of the project operation. The metering devices are calibrated and inspected properly and periodically, according to state electricity board's specifications and requirements to ensure accuracy in the readings.

Calibration of instruments:

SBPIL procedures defined for the calibration of instruments. A log of calibration records is maintained. Electrical & Instrumentation department in the company is responsible for the upkeep of instruments in the plant. Maintenance of instruments and equipment's used in data monitoring: The process department is responsible for the proper functioning of the equipment's/ instruments and informs the concerned department for corrective action if found not operating as required. Corrective action is taken by the concerned department and a report on corrective action taken is maintained as done time to time along with the details of problems rectified.

All the measured parameters will be monitored on daily basis. All the flow meters, temperature and pressure gauges will be calibrated annually. The accuracy classes of the temperature gauge and pressure gauge are $\pm 7^{o}$ C and ±0.075% respectively. The accuracy classes of the steam flow meters are ±0.075% and ±0.065% for WHRB and AFBC respectively.

Emergency preparedness

The project activity does not lead to any unintentional emissions. So, there is no need for any emergency preparedness in project activity.

In line with the monitoring plan the PP will make available all relevant data including, but not limited to, the following to the verifying UCR auditor:

- Monthly generation from the power plant
- Monthly auxiliary consumption of the power plant
- Monthly feedwater temperature to WHR boilers
- Monthly steam temperature of WHR boilers
- Monthly steam pressure of WHR boilers
- Monthly steam flow from WHR boilers
- Monthly feedwater temperature to AFBC boiler
- Monthly steam temperature of AFBC boiler
- Monthly steam pressure of AFBC boiler
- Monthly steam flow from AFBC boiler
- Monthly usage of fossil fuel
- Monthly steam flow from AFBC boiler to new 8 MW turbine
- Monthly steam temperature from AFBC boiler to new 8 MW turbine

- Monthly steam pressure from AFBC boiler to new 8 MW turbine

2 Data and Parameters to be monitored

Data / Parameter:	**Qi**
Data unit:	Tonnes
Description:	Mass of fossil fuel consumed (Diesel in DG sets)
Source of data:	Measured
Measurement procedures (if any):	Diesel stock register The fossil fuel consumed is measured in litres which are then converted to tonnes using the density of diesel as 0.00086 tonnes/litre Source of density: http://www.iocl.com/Products/DieselSpecifications.pdf
Monitoring frequency:	Recording frequency: Monthly litre*0.00086 tonnes/litre
QA/QC procedures:	Data is taken from purchase records, adjustments made for stock of fuel onsite. Quantity of diesel is measured in calibrated tank. The calibration was done by the office of the controller of Legal Metrology, Government of Chattisgarh which is a government organization.

Calibrated on	Valid till	Calibration agency
12/06/2013	11/06/2018	Govt. of Chhattisgarh, Office of the Controller of Legal Metrology

Purpose of Data	-Calculation of Project emissions

Data / Parameter:	**$Quantity_{other}$**
Data unit:	Tonnes
Description:	Quantity of steam from AFBC boiler
Source of data:	Measured
Measurement procedures (if any):	Plant Records
Monitoring frequency:	Type: Differential pressure transmitter, Calibration frequency: Annually
QA/QC procedures:	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS

Serial No	Accuracy class	Calibration date (DD/MM/YYY)	Valid till DD/MM/YYY)	Calibration Agency
33FT-0202	± 0.065%	06.08.2015	05.08.2016	SBPIL
		06.08.2016	05.08.2017	
		10.06.2019	09.06.2020	
		16.04.2020	15.04.2021	
		12.04.2021	11.04.2022	
		14.07.2022	13.07.2023	

Purpose of Data	-Calculation of Baseline emissions

Data / Parameter:	**$Quantity_{whr}$**
Data unit:	Tonnes
Description:	Quantity of steam from waste heat boiler
Source of data:	Measured
Measurement procedures (if any):	Plant Records
Monitoring frequency:	Type: Differential pressure transmitter, Calibration frequency: Annually

QA/QC procedures:	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS

Serial No	Accuracy class	Calibration date	Valid till	Calibration Agency
11 FT - 1729	± 0.075%	05.08.2015	04.08.2016	SBPIL
		05.08.2016	04.08.2017	
		07.06.2019	06.06.2020	
		14.04.2020	13.04.2021	
		08.04.2021	07.04.2022	
		11.07.2022	10.07.2023	

22 FT - 1729	± 0.075%	03.08.2015	02.08.2016	SBPIL
		03.08.2016	02.08.2017	
		07.06.2019	06.06.2020	
		15.04.2020	14.04.2021	
		09.04.2021	08.04.2022	
		12.07.2022	11.07.2023	

Purpose of Data	-Calculation of Baseline emissions

Data / Parameter:	**Quantity$_{8MW}$**
Data unit:	Tonnes
Description:	Quantity of steam from AFBC boiler to 8MW boiler
Source of data:	Measured
Measurement procedures (if any):	Plant Records
Monitoring frequency:	Type: Differential pressure transmitter, Calibration frequency: Annually
QA/QC procedures:	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS

Serial No	Accuracy class	Calibration date	Valid till	Calibration Agency
33FT-0100	± 0.065%	06.08.2015	05.08.2016	SBPIL
		06.08.2015	05.08.2017	
		10.06.2019	09.06.2020	
		16.04.2020	15.04.2021	
		12.04.2021	11.04.2022	
		11.07.2022	10.07.2023	

Purpose of Data	-Calculation of Baseline emissions

Data / Parameter:	**Quantity$_{csh}$**
Data unit:	Tonnes
Description:	Quantity of steam entering the common steam header from AFBC boiler
Source of data:	Calculated
Measurement procedures (if any):	The value can be checked through plant records, emission reduction sheet
Monitoring frequency:	Monthly
QA/QC procedures:	The data can be verified from the DCS log book for the parameters and the difference between the Quantity$_{other}$ and Quanatity8MW Calculated as **Quantity $_{other}$ – Quantity $_{8MW}$**
Purpose of Data	-Calculation of Baseline emissions

Data / Parameter:	**CO$_{EFi}$**
Data unit:	tCO2/TJ

Description:	Emission factor of fossil fuel combusted (Diesel in DG sets)
Source of data:	Measured
Value/Measurement procedures (if any):	IPCC 2006 (Table 1.4, page 1.23) 74.80 20. 2 =20.2 * 44/12 =74.1 tCO2/TJ For calculation of project emission the upper value (95% confidence level) i.e. 74.80 is taken
Monitoring frequency:	Yearly
QA/QC procedures:	Data from IPCC. This value is taken from IPCC 2006 (Table 1.4, page 1.23) which as per the monitoring plan.
Purpose of Data	-Calculation of Project emissions

Data / Parameter:	**NCV_i**
Data unit:	TJ/kt
Description:	Net calorific value of fossil fuel combusted (Diesel in DG sets)
Source of data:	IPCC value has been used since Indian National communication refers to IPCC. . IPCC 2006 (Table 1.2, page 1.18)
Value/Measurement procedures (if any):	43.3
Monitoring frequency:	Monthly
QA/QC procedures:	Data from IPCC
Purpose of Data	-Calculation of Project emissions

Data / Parameter:	***EG*** $_{,y}$
Data unit:	MWh
Description:	Net power supplied in project activity
Source of data:	The parameter is calculated by subtracting auxiliary consumption from the electricity generated
Measurement procedures (if any):	Plant operation data on power generation in project activity
Monitoring frequency:	Frequency of measurement - Continuous
QA/QC procedures:	The data is calculated from values which are recorded daily in log book. The monthly values are calculated.
Purpose of Data	-Calculation of baseline emissions = **EG** $_{GEN}$**-EG AUX**

Data/Parameter	***ST*** $_{whr}$
Data unit	kCal
Description	Energy content of steam from waste gas boilers fed to common steam header
of data Value(s) applied	Calculated
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Calculated parameter
Calculation method (if applicable):	Energy in the steam (using steam tables for the temperature and pressure of steam) multiplied by the measured amount of the steam from the waste heat recovery boilers
Purpose of data	To estimate baseline emissions

Data / Parameter:	$EG_{AUX,y}$
Data unit:	MWh
Description:	Auxiliary power consumption in project activity
Source of data:	Auxiliary power consumption in the project activity is measured directly.
Measurement	Plant operation data on power generation in project activity

procedures (if any):	
Monitoring frequency:	Frequency of measurement - Continuous
QA/QC procedures:	Energy meter is calibrated as per schedule.

Serial No	Accuracy class	Calibration date (DD/MM/YYY)	Valid till DD/MM/YYY)	Calibration Agency
CWP1				
213797/3737-2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
CWP2				
213797/3742-2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
CWP3				
126752/231-2907	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
CWP4				
213797/3746-2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
CWP5				
120445/20103-1707	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
BFP-1				
213797/3739-2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
BFP-2				
213797/3740-2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
BFP-3				
213797/3743-2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
AC-1				
214017/3835-2511	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
540420019099	0.5 Conzerv	25.06.2018	24.06.2019	Scheneider Test Report
214017/3835 -2511 replaced with 540420019099 in January 2019				
AC-2				
213797/3744-2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
TA-1				
34133820512	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
TA-2				
34133841020	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
CTM				
120445/20097- 1707	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
DMP				
213797/3741 - 2411	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
MOV				
34120540821	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL

Purpose of Data	-Calculation of baseline emissions

Data / Parameter:	$EG_{,GEN}$
Data unit:	MWh
Description:	Total power generated in project activity
Source of data:	Measured
Measurement procedures (if any):	Type: Energy Meter, Calibration Frequency: Annually Plant operation data on power generation in project activity
Monitoring frequency:	Frequency of measurement - Continuous
QA/QC procedures:	

Serial No	Accurac	Calibration date	Valid till	Calibration

	y class	(DD/MM/YYY)	DD/MM/YYY)	Agency
8MW				
34133841017	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
10 MW				
34133841018	0.5 Conzerv	31.03.2015	30.03.2016	CSPDCL
CSPDCL: Chhattisgarh State Power Distribution Company Limited				

The accuracy of all the energy meters are 0.5 and Calibration frequency is annual

Purpose of Data	-Calculation of baseline emissions

Data/Parameter	$ST_{\backslash other}$
Data unit	kCal
Description	Energy content of steam from AFBC boiler fed to common steam header
of data Value(s) applied	Calculated
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Calculated parameter
Calculation method (if applicable):	Energy in the steam (using steam tables for the temperature and pressure of steam) multiplied by the measured amount of the steam from the AFBC boiler.
Purpose of data	To estimate baseline emissions

Data/Parameter	$Temp_{whr}$
Data unit	^0C
Description	Temperature of steam from waste heat boiler
of data Value(s) applied	Measured
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS. DCS records actual temperature (for steam and feed water) every second. The calibration has been performed internally by SBPIL with the help of master meter calibrated by a NABL accredited institution.

Serial No	Accuracy class	Calibration date	Valid till	Calibration Agency
11 TT - 1730	± 0.7°C	06.08.2015	05.08.2016	SBPIL
		05.08.2016	04.08.2017	
		05.06.2019	04.06.2020	
		16.04.2020	15.04.2021	
		08.04.2021	07.04.2022	

			20.07.2022	19.07.2023	
	22 TT - 1730	± 0.7°C	03.08.2015	02.08.2016	SBPIL
			03.08.2016	02.08.2017	
			06.06.2019	05.06.2020	
			17.04.2020	16.04.2021	
			09.04.2021	08.04.2022	
			18.07.2022	17.07.2023	
Purpose of data	To estimate baseline emissions				

Data/Parameter	**$Temp_{other}$**
Data unit	^0C
Description	Temperature of steam from AFBC boiler
of data Value(s) applied	Measured
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS.

Serial No	Accuracy class	Calibration date	Valid till	Calibration Agency
33 TT - 0204	± 0.7°C	07.08.2015	06.08.2016	SBPIL
		06.08.2016	05.08.2017	
		11.06.2019	10.06.2020	
		20.04.2020	19.04.2021	
		12.04.2021	11.04.2022	
		19.07.2022	18.07.2023	

Purpose of data	To estimate baseline emissions

Data/Parameter	**$Temp_{fw,whr}$**
Data unit	^0C
Description	Temperature of feedwater to waste heat boiler
of data Value(s) applied	Measured
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS. Calibration of Temperature transmitter with thermocouple is carried out annually

Serial No	**Accuracy class**	**Calibration date**	**Valid till**	**Calibration Agency**
11 TT -	± 0.7°C	06.08.2015	05.08.2016	SBPIL

	1710		05.08.2016	04.08.2017	
			05.06.2019	04.06.2020	
			16.04.2020	15.04.2021	
			08.04.2021	07.04.2022	
			20.07.2022	19.07.2023	
	22 TT - 1710	± 0.7°C	05.08.2015	04.08.2016	SBPIL
			04.08.2016	03.08.2017	
			06.06.2019	05.06.2020	
			17.04.2020	16.04.2021	
			09.04.2021	08.04.2022	
			18.07.2022	17.07.2023	
Purpose of data	To estimate baseline emissions				

Data/Parameter	**Temp $_{fw,other r}$**				
Data unit	^{0}C				
Description	Temperature of feedwater to AFBC				
of data Value(s) applied	Measured				
Measurement methods and procedures	Plants records				
Monitoring frequency	Monthly (from the collation of the daily data)				
QA/QC procedures:	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually				
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS.				
	Serial No	**Accuracy class**	**Calibration date**	**Valid till**	**Calibration Agency**
	33 TT - 0101	± 0.7°C	07.08.2015	06.08.2016	SBPIL
			06.08.2016	05.08.2017	
			11.06.2019	10.06.2020	
			20.04.2020	19.04.2021	
			12.04.2021	11.04.2022	
			19.07.2022	18.07.2023	
Purpose of data	To estimate baseline emissions				

Data/Parameter	**Temp$_{8MW}$**
Data unit	^{0}C
Description	Temperature of steam from AFBC boiler to new 8 MW turbine
of data Value(s) applied	Measured
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feedwater) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS.

	Serial No	**Accuracy class**	**Calibration date**	**Valid till**	**Calibration Agency**
	33 TT - 0103	± 0.7°C	07.08.2015	06.08.2016	SBPIL
			06.08.2016	05.08.2017	
			11.06.2019	10.06.2020	
			20.04.2020	19.04.2021	
			12.04.2021	11.04.2022	
			19.07.2022	18.07.2023	
Purpose of data	To estimate baseline emissions				

Data/Parameter	**$Press_{8MW}$**
Data unit	kg/cm^2
Description	Pressure of steam from AFBC boiler to new 8 MW turbine
of data Value(s) applied	Measured
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Type: Pressure transmitter, Calibration frequency: Annually
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feed water) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS.

Serial No	**Accuracy class**	**Calibration date**	**Valid till**	**Calibration Agency**
33 PT - 0100	± 0.065%	07.08.2015	06.08.2016	SBPIL
		06.08.2016	05.08.2017	
		04.06.2019	05.06.2020	
		15.04.2020	14.04.2021	
		12.04.2021	11.04.2022	
		13.07.2022	12.07.2023	

Purpose of data	To estimate baseline emissions

Data/Parameter	**$Press_{other}$**
Data unit	kg/cm^2
Description	Pressure of steam from AFBC boiler
of data Value(s) applied	Measured
Measurement methods and procedures	Plants records
Monitoring frequency	Monthly (from the collation of the daily data)
QA/QC procedures:	Type: Pressure transmitter, Calibration frequency: Annually
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feed water) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS.

Serial No	**Accuracy class**	**Calibration date**	**Valid till**	**Calibration Agency**
33 PT - 0202	± 0.075%	07.08.2015	06.08.2016	SBPIL
		06.08.2016	05.08.2017	
		04.06.2019	05.06.2020	

			15.04.2020	14.04.2021	
			12.04.2021	11.04.2022	
			13.07.2022	12.07.2023	
Purpose of data	To estimate baseline emissions				

Data/Parameter	**Press*whr***				
Data unit	kg/cm^2				
Description	Pressure of steam from WHR boiler				
of data Value(s) applied	Measured				
Measurement methods and procedures	Plants records				
Monitoring frequency	Monthly (from the collation of the daily data)				
QA/QC procedures:	Type: Pressure transmitter, Calibration frequency: Annually				
Calculation method (if applicable):	Taken from calibrated meters through the DCS system. DCS records actual temperature (for steam and feed water) and pressure (for the steam only) every second and this data is archived for the verifier to test the results of the DCS.				
	Serial No	**Accuracy class**	**Calibration date**	**Valid till**	**Calibration Agency**
	11 PT - 1726	± 0.075%	06.08.2015	05.08.2016	SBPIL
			05.08.2016	04.08.2017	
			03.06.2019	02.06.2020	
			13.04.2020	12.04.2021	
			08.04.2021	07.04.2022	
			15.07.2022	14.07.2023	
	22 PT - 1726	± 0.075%	03.08.2015	02.08.2016	SBPIL
			03.08.2016	02.08.2017	
			03.06.2019	02.06.2020	
			14.04.2020	13.04.2021	
			09.04.2021	08.04.2022	
			19.07.2022	18.07.2023	
Purpose of data	To estimate baseline emissions				

MASTER METER CALIBRATION DETAILS

Pressure Transmitters calibrated with following master instruments,

1. digital multimeter
2. pressure gauge

Temperature Transmitters calibrated with following master instruments,

1. digital multimeter
2. loop calibrator

S.No.	Make/Serial no	Accuracy class	Calibration date	Valid till	Calibrating agency
1	Digital Multimeter Make: RISH S.No: 092729	-	31.08.2015	30.08.2016	Nagman Instruments & Electronics (P) Ltd. (NABL Accredited Lab)
			06.05.2019	05.05.2020	
			31.07.2020	30.07.2021	
			01.09.2021	31.08.2022	

			29.08.2022	28.08.2023	
2	Master Pressure Guage (Yantrika pressure gauge) Make: Ravika S.No.: REE0057	± 0.25%	31.08.2015	30.08.2016	Nagman Instruments & Electronics (P) Ltd. (NABL Accredited Lab)
			08.05.2019	07.05.2020	
			31.07.2020	30.07.2021	
			24.08.2021	23.08.2022	
			01.09.2022	31.08.2023	
3	Portable Loop Calibrator Make: Masibus	-	31.08.2015	30.08.2016	Nagman Instruments & Electronics (P) Ltd. (NABL Accredited Lab)
			07.05.2019	06.05.2020	
			01.08.2020	31.07.2021	
			01.09.2021	31.08.2022	
			29.08.2022	28.08.2023	
4	Pressure Calibrator (Digital pressure gauge) Make:Nagman S.No: MPCE 05039355	± 0.1%	29.08.2015	28.08.2016	Nagman Instruments & Electronics (P) Ltd. (NABL Accredited Lab)
			08.05.2019	07.05.2020	
			31.07.2020	30.07.2021	
			24.08.2021	23.08.2022	
			31.10.2022	30.10.2023	
5	Pressure Transmitter Make - Yokogawa Sr. No. - 91 G138106-703	± 0.075%	31.08.2015	30.08.2016	Nagman Instruments & Electronics (P) Ltd. (NABL Accredited Lab)
			08.05.2019	07.05.2020	
			31.07.2020	30.07.2021	
			24.08.2021	23.08.2022	
			01.09.2022	31.08.2023	
6	Very Low Pressure Calibrator Make - Nagman Sr. No. VLP 0502 9294	± 0.25%	29.08.2015	28.08.2016	Nagman Instruments & Electronics (P) Ltd. (NABL Accredited Lab)
			31.07.2020	30.07.2021	
			24.08.2021	23.08.2022	
			01.09.2022	31.08.2023	

Data/Parameter	$EF_{CO2, GRID, y}$
Data unit	tCO_2 /MWh
Description	0.9
of data Value(s) applied	UCR Standard Protocol As per Standard
Measurement methods and procedures	Fixed
Monitoring frequency	NA
Purpose of data	To estimate baseline emissions

Month	Total WHR steam	Enthalpy (Steam of WHR)	Feedwater Enthalpy	Enthalpy gain	STwhr (steam* Enthalpy* 1000)
	Tonnes	kcal/kg	kcal/kg	kcal/kg	kcal
Sep-15	30963.15	812.07	107.86	704.21	21804426039
Oct-15	36542.15	812.05	107.11	704.94	25760040235
Nov-15	32562.95	811.53	106.93	704.60	22943805856
Dec-15	23860.95	812.45	107.07	705.39	16831198755
Jan-16	35643.85	810.91	107.00	703.92	25090310848

Feb-16	20748.15	812.18	106.86	705.32	14634053745
Mar-16	37203.25	808.84	106.05	702.79	26146048079
Apr-16	35388.65	812.52	106.79	705.73	24974770629
May-16	40936.35	811.95	106.80	705.15	28866262830
Jun-16	38161.60	811.73	111.22	700.51	26732400507
Jul-16	33612.20	812.28	111.24	701.03	23563228664
Aug-16	20581.35	809.89	111.02	698.87	14383706310
Sep-16	20449.05	810.61	111.26	699.34	14300890077
Oct-16	30090.70	811.53	110.20	701.33	21103425859
Nov-16	35980.80	813.34	110.25	703.09	25297706461
Dec-16	32741.25	812.43	110.25	702.17	22989990868
Jan-17	36180.85	811.53	106.62	704.91	25504101087
Feb-17	19132.95	809.46	106.72	702.73	13445346184
Mar-17	30235.80	811.69	110.00	701.69	21216127202
Apr-17	30445.95	810.46	109.90	700.56	21329292223
May-17	31756.65	812.81	110.05	702.76	22317333142
Jun-17	29984.75	811.90	108.64	703.26	21087197911
Jul-17	22297.50	811.30	108.89	702.41	15661883622
Aug-17	20150.35	811.99	108.84	703.15	14168635656
Sep-17	26762.30	812.08	108.94	703.14	18817532666
Oct-17	31523.50	812.98	108.34	704.65	22212916503
Nov-17	29596.90	813.67	108.44	705.24	20872781125
Dec-17	29145.55	812.18	108.59	703.59	20506567748
Jan-18	34607.15	805.55	108.54	697.02	24121716846
Feb-18	27682.05	813.23	106.22	707.01	19571476969
Mar-18	33742.90	813.07	106.12	706.96	23854719333
Apr-18	34387.50	813.79	106.02	707.77	24338605344
May-18	39930.15	812.08	106.07	706.01	28191077695
Jun-18	34147.70	808.88	105.82	703.06	24007944316
Jul-18	25221.30	809.99	105.77	704.22	17761404266
Aug-18	29641.10	814.60	105.66	708.94	21013736879
Sep-18	22935.10	811.28	105.97	705.32	16176533578
Oct-18	24599.15	813.57	106.12	707.45	17402657283
Nov-18	28738.30	813.83	106.22	707.61	20335618577
Dec-18	28688.00	814.64	106.22	708.43	20323317962
Jan-19	30159.65	812.32	106.22	706.10	21295868070
Feb-19	20612.25	815.19	106.02	709.17	14617625668
Mar-19	32602.90	811.64	106.02	705.63	23005440313
Apr-19	29045.20	814.37	105.82	708.55	20580029845
May-19	29611.25	811.51	105.77	705.75	20898090118
Jun-19	27174.05	811.47	105.56	705.91	19182413994
Jul-19	26485.85	807.77	105.66	702.10	18595776933
Aug-19	22253.50	813.70	105.87	707.83	15751757464
Sep-19	16018.25	816.47	106.22	710.25	11377041507
Oct-19	29025.20	813.37	105.92	707.46	20534030656
Nov-19	27430.85	810.16	106.02	704.14	19315230994
Dec-19	22500.85	815.61	105.87	709.74	15969825534
Jan-20	27210.45	814.12	110.46	703.66	19146931783
Feb-20	25862.70	815.82	108.34	707.49	18297487724
Mar-20	20498.10	814.82	107.28	707.54	14503255913
Apr-20	0.00	0.00	0.00	0.00	0
May-20	23125.25	815.03	105.77	709.27	16401950098
Jun-20	24527.45	813.81	105.51	708.30	17372731909
Jul-20	23676.30	813.71	105.77	707.95	16761581514
Aug-20	25610.20	812.50	105.61	706.88	18103362618
Sep-20	30615.70	813.89	105.82	708.08	21678261559

Oct-20	28753.20	814.72	105.77	708.96	20384805357
Nov-20	23356.20	813.33	106.17	707.16	16516634351
Dec-20	23130.40	813.09	106.17	706.92	16351322994
Jan-21	31063.40	816.64	106.17	710.47	22069543297
Feb-21	28578.50	814.95	105.92	709.04	20263188881
Mar-21	33081.10	813.48	105.82	707.66	23410208078
Apr-21	29144.50	812.08	105.56	706.51	20590980987
May-21	17342.35	815.11	105.77	709.34	12301703260
Jun-21	33117.50	811.40	105.77	705.64	23368982295
Jul-21	36281.00	814.26	105.51	708.75	25714030315
Aug-21	32330.10	814.90	105.92	708.98	22921355903
Sep-21	31199.10	815.17	105.92	709.26	22128143266
Oct-21	30180.80	815.72	105.77	709.95	21426967430
Nov-21	28303.00	814.09	106.17	707.92	20036387418
Dec-21	31507.20	813.99	106.12	707.87	22303071396
Jan-22	39086.00	814.11	105.56	708.54	27694027788
Feb-22	24617.40	812.77	106.07	706.70	17397232774
Mar-22	27742.00	811.57	106.07	705.51	19572145898
Apr-22	33881.40	813.89	105.82	708.08	23990627396
May-22	38675.00	814.00	105.36	708.63	27406456320
Jun-22	38072.50	812.28	106.12	706.16	26885277255
Jul-22	39105.20	812.57	105.56	707.00	27647492980
Aug-22	38521.30	813.61	106.12	707.49	27253347679
Sep-22	18180.40	808.11	105.92	702.19	12766176968
Oct-22	30267.10	813.80	106.12	707.68	21419529115
Nov-22	33053.60	814.13	106.12	708.02	23402460906
Dec-22	37503.00	806.07	106.27	699.80	26244511973
Total	**2557119.05**	**803.41**	**105.70**	**697.71**	**1804516096371**

AFBC Steam (Diff. to CH Total)	Enthalpy (Steam of AFBC)	Feedwater Enthalpy	Enthalpy gain	STother (steam* Enthalpy* 1000)
Tonnes	**kcal/kg**	**kcal/kg**	**kcal/kg**	**kcal**
10500.58	814.86	107.73	707.13	7425307973
10613.00	816.22	107.66	708.56	7519924016
14146.34	817.10	108.10	709.00	10029752610
19034.84	812.44	108.02	704.41	13408415192
15990.09	817.68	107.99	709.68	11347872668
16932.71	818.62	107.76	710.86	12036771391
12368.50	821.73	107.75	713.98	8830814382
12585.28	819.69	107.65	712.04	8961162533
9210.45	815.33	107.56	707.77	6518838469
12444.82	816.13	111.95	704.18	8763439498
14998.03	813.53	111.99	701.54	10521756667
15861.58	815.79	111.27	704.52	11174788008
15416.00	821.63	111.49	710.15	10947604403
17385.14	814.67	111.65	703.02	12222151568
15537.15	820.73	111.75	708.98	11015569519
17147.88	822.72	110.83	711.89	12207466115
15927.81	823.06	108.37	714.69	11383422962
18586.61	821.53	108.32	713.22	13256255802
16743.17	822.18	111.47	710.72	11899664179
9275.02	813.46	111.11	702.35	6514267873
17689.29	815.54	110.88	704.66	12464848407
18270.37	816.01	109.38	706.63	12910434737

22554.59	813.29	110.00	703.29	15862393350
22490.08	816.68	109.88	706.80	15896069130
18937.93	814.16	109.86	704.30	13338020354
18335.80	813.54	109.17	704.37	12915143154
19341.78	814.48	109.36	705.12	13638359888
17274.48	814.07	109.26	704.80	12175087390
15346.98	816.48	109.45	707.03	10850811390
12977.95	817.52	106.87	710.64	9222692546
16496.43	817.01	106.62	710.38	11718802410
16070.06	813.46	106.70	706.76	11357596972
11554.76	813.23	106.51	706.72	8165949672
15706.82	815.39	106.42	708.97	11135652559
11519.36	813.22	106.49	706.73	8141025405
19727.17	815.23	106.26	708.97	13986027787
19882.94	815.63	107.08	708.56	14088207635
23270.78	815.53	106.92	708.60	16489704253
18361.76	815.06	106.93	708.12	13002388102
19528.85	815.52	107.11	708.42	13834530382
14705.23	815.31	106.96	708.35	10416425854
15916.56	815.59	106.79	708.80	11281645549
17209.06	815.26	106.91	708.34	12189931698
17302.47	813.31	106.54	706.77	12228877602
19696.41	814.15	106.72	707.43	13933825748
17543.91	813.57	106.54	707.03	12404044947
20810.27	817.22	106.19	711.03	14796827841
15577.41	815.31	106.66	708.65	11038946239
21745.68	814.74	106.69	708.05	15397026123
21211.55	814.65	106.90	707.75	15012468336
19639.92	815.47	106.88	708.59	13916633056
24809.86	815.54	106.48	709.06	17591596496
22153.86	815.11	111.46	703.65	15588658602
20569.15	815.38	109.26	706.12	14524291028
17284.54	815.43	108.19	707.25	12224447918
0.00	0.00	0.00	0.00	0
24487.26	815.52	106.71	708.80	17356650559
21190.88	814.67	106.60	708.06	15004503672
22013.73	814.72	106.64	708.07	15587349838
24284.86	814.19	107.11	707.09	17171515544
18909.47	813.08	109.18	703.89	13310263308
21550.42	814.65	107.65	707.00	15236175162
22321.68	813.48	109.22	704.25	15720151864
23028.63	813.74	110.27	703.46	16199789376
20411.78	814.60	108.53	706.07	14412169664
16598.31	813.09	106.97	706.12	11720357341
17600.83	813.99	106.63	707.36	12450089259
19114.65	813.33	106.70	706.62	13506865984
12815.02	813.45	106.60	706.85	9058249835
16483.98	812.81	106.32	706.49	11645704688
15696.85	812.83	106.07	706.77	11094012570
16332.50	812.79	106.55	706.24	11534704050
17747.13	812.85	106.74	706.10	12531309217
21626.00	814.96	106.86	708.10	15313381543
21105.27	814.65	107.32	707.33	14928423764
19651.77	814.66	107.32	707.34	13900551970
13737.75	811.36	107.06	704.31	9675572833
16857.50	814.34	107.02	707.33	11923789609

20651.56	814.16	107.12	707.04	14601557789
14300.39	814.71	106.62	708.09	10125987042
15015.74	813.78	106.43	707.34	10621304166
14098.94	813.56	106.60	706.96	9967400050
3804.22	813.63	106.03	707.60	2691874177
13811.24	811.01	106.02	704.99	9736758283
23401.49	813.87	106.11	707.77	16562760971
20344.36	812.34	105.97	706.37	14370614845
17675.41	812.65	105.82	706.83	12493553850
16611.40	813.76	105.97	707.80	11757491006
1515500.08	**805.95**	**106.63**	**699.32**	**1071935522218**