Monitoring report form for CDM project activity
(Version 06.0)

MONITORING REPORT		
Title of the project activity	Shri Bajrang WHR CDM Project	
UNFCCC reference number of the project activity	0528	
Version number of the PDD applicable to this monitoring report	11	
Version number of this monitoring report	1.0	
Completion date of this monitoring report	25/10/2018	
Monitoring period number	11	
Duration of this monitoring period	01/09/2014 to 31/08/2015 (inclusive of both day)	
Monitoring report number for this monitoring report	NA	
Project participants	1. Shri Bajrang Power and Ispat Ltd.(India) 2. Agrinergy Ltd.(United Kingdom of Great Britain and Northern Ireland) 3. Noble Carbon Credits Limited .(United Kingdom of Great Britain and Northern Ireland) 4. Agrinergy Ltd.(Switzerland) 5. Bunge Emissions Holdings SARL (Switzerland)	
Host Party	India	
Sectoral scopes	1: Energy industries (Renewable -/ Non-renewable sources)	
Applied methodologies and standardized baselines	ACM0004- Version 02, Consolidated methodology for waste gas and/or heat for power generations. Standardized baseline not applicable	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	NA	65,730 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	113,351 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

The project activity takes place at a sponge iron plant and involves the generation of electrical power through the installation of waste heat recovery boilers and turbine generators. The waste heat produced during the manufacture of sponge iron is being passed through boilers and the resultant steam will be utilised to generate electrical power. The electricity generated by the plant is wheeled over the grid to a sister company and supplied to the state electricity company, Chhattisgarh State Electricity Board.

The project activity involves the installation of waste heat recovery boilers (2 × 38 TPH, 62 bar) and two condensing turbines (8 MW and 10 MW).

The project activity was commissioned in two phases

8 MW turbine	12/07/2005
10 MW turbine	31/08/2005

The total emission reductions achieved in the current monitoring period are 65,730 tCO_2

A.2. Location of project activity

Host Party (ies): India
Region/ State/ Province, etc.: Chhattisgarh
City/ Town/ Community, etc.: Borjhara village of Raipur district
Physical/ Geographical location: 21º18'30.8" N (21.3085) and 81º35'6.8"E (81.5852)

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	Shri Bajrang Power and Ispat Ltd.	No
United Kingdom of Great Britain and Northern Ireland	Agrinergy Pte Ltd.	No
	Noble Carbon Credits Limited	No
Switzerland	Agrinergy Ltd.	No
	Bunge Emissions Holdings SARL	No

A.4. Reference to applied methodologies and standardized baselines

"Consolidated methodology for waste gas and/or heat for power generation" ACM0004, Version 02.

Reference: http://cdm.unfccc.int/methodologies/view?ref=ACM0004

A.5. Crediting period type and duration

Crediting Period: 01/09/2005 – 31/08/2015 (fixed)
Length of crediting period: 10 years 0 months
Start date: 01/09/2005
Current monitoring period: 01/09/2014 to 31/08/2015 (inclusive of both days)

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The project activity is installation of waste heat recovery boilers and turbine generators to generate electrical power from the waste heat gases produced during the manufacture of sponge iron.

The sponge iron manufacturing process (direct reduction 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 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.

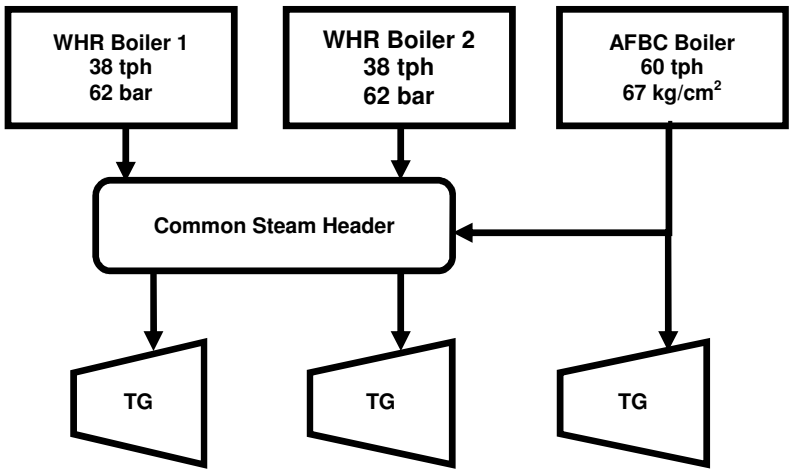
Apart from the waste heat recovery boilers, steam from an AFBC boiler is also added to the common steam header (post September 2008) however, CERs are not claimed for the increased generation due to the additional steam source.

The project activity has been implemented as planned. The power plant consists of two waste heat recovery boilers each having capacity of 38 tons per hour steam generation at 62 bar pressure. The boilers have been manufactured by Thermax India. There are two turbines of capacity 8 MW and 10 MW each.
The project activity was commissioned in two phases. The first turbine was commissioned on 12/07/2005 and the second on 31/08/2005.

The list of equipments is as follows:

Sr. No	Turbine Details	Make
1.	8 MW condensing TG	Triveni, India
2.	10 MW condensing TG	Triveni, India

Sr. No	Boiler Details	Make
1	2 x 38 TPH, 62 bar, 485 ± 5^{0} C	Thermax India



There are no events or situations that occurred during the monitoring period which may impact the applicability of the methodology.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

There are no deviations from the registered monitoring plan or applied methodology.

B.2.2. Corrections

There are no corrections.

B.2.3. Changes to the start date of the crediting period

There is no change to the start date of crediting period.

B.2.4. Inclusion of monitoring plan

Not Applicable

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

There are no permanent changes from registered monitoring plan or applied methodology.

B.2.6. Changes to project design

The notification or request of approval of changes from the project activity as described in the registered CDM-PDD was approved on 26/11/2010. The change was occurred on 13/08/2008, when adjacent biomass based AFBC boiler and power plant was commissioned & steam from AFBC boiler as been supplied to the present project activity though the AFBC boiler & power plant has been separately registered under CDM project activity (CDM reference no. 2128): however the commercial operation of the same was started from 01/09/2008. Thus the design change was effective from 01/09/2008 onwards.

However apart from above approved changes to project design, no any other project design change requested in this monitoring period.

SECTION C. Description of monitoring system

The project activity is implemented as mentioned in the registered PDD. No new technology measure or retrofits have been added during this verification period.

The information regarding the actual operation of the project activity during this monitoring period is given below,

MONTH	Operating Days				Shut Down Days				Dates & Reason for Shut Down
	WHRB-1	WHRB-2	TG-1	TG-2	WHRB-1	WHRB-2	TG-1	TG-2	
September-14	30	30	30	30	0	0	0	0	NIL
October-14	31	16	31	31	0	15	0	0	WHRB-2 Shut Down from 10th to 24th due to maintenance
November-14	16	30	30	30	14	0	0	0	WHRB-1 Shut Down from 7th to 20th due to maintenance

December-14	31	9	31	31	0	22	0	0	WHRB-2 Shut Down from 10th to 31st due to maintenance
January-15	31	27	31	31	0	4	0	0	WHRB-2 Shut Down from 1st to 2nd and 13th to 14th due to maintenance
February-15	28	28	28	28	0	0	0	0	NIL
March-15	25	31	31	27	6	0	0	4	WHRB-1 Shut Down from 9th to 14th and TG-2 Shut Down from 11th to 14th due to maintenance
April-15	26	25	26	25	4	5	4	5	WHRB-1 Shut Down from 24th to 27th, WHRB-2 Shut Down from 24th to 28th, TG-1 Shut Down from 24th to 27th and TG-2 Shut Down from 24th to 28th due to maintenance
May-15	31	31	31	11	0	0	0	20	TG-2 Shut Down from 1st to 19th & 22nd due to maintenance
June-15	22	30	23	30	8	0	7	0	WHRB-1 Shut Down from 23rd to 30th and TG-1 Shut Down from 24th to 30th due to maintenance
July-15	27	31	0	31	4	0	31	0	WHRB-1 Shut Down from 1st to 4th and TG-1 Shut Down from 1st to 31st due to maintenance/capital repair
August-15	31	31	30	31	0	0	1	0	TG-1 Shut Down on 1st due to maintenance/capital repair
TOTAL	**329**	**319**	**322**	**336**	**36**	**46**	**43**	**29**	

The management of the plant designated one person responsible for the collation of data required to conduct the monitoring plan and report to the General Manager (GM), Projects of Shri Bajrang Power & Ispat Ltd. The overall responsibility for the timely reporting is with the GM.

The management of the plant put in place monthly reporting of electricity generation. This data is part of the management information systems for the power plant and also provided to Agrinergy to calculate the emission reductions generated. The GM also reports any consumption of fossil fuel that has been used to start the power plant or for emergencies. The emission reductions are calculated monthly, reported back to the management of Shri Bajrang and incorporated into existing management information systems.

Metering is provided for all the data within the monitoring plan and regular calibration of the meters is carried out. The calibration of the main energy meter for the supply of electricity to the grid is undertaken by CSEB every year. The other internal meters are checked and calibrated every year. Monitoring of fossil fuel consumption is based on the basis of purchase receipts for fuel which are cross checked against the running hours of the DG sets from the Department of Energy cess reports.

In addition, for the purpose of not accounting the steam from the AFBC boilers, the temperature, pressure and flow of feed water and steam for all the three boilers (2 WHR boilers and 1 AFBC boiler) is also monitored to calculate the corresponding energy contents of the steam from each of the boilers. The respective transmitters are calibrated annually. The total quantity of the steam

generated by the AFBC boiler and the quantity of the steam entering the 8 MW turbine is also monitored.

Roles and responsibilities

Designation	Responsibility
Director	Overall responsibility of CDM Project
General Manager	Co-ordination of day to day CDM activities
General Manager (Electrical)	Recording of Electricity Generation & Auxiliary Consumption Data including Consumption of Fossil Fuel, if any.
General Manager (Inst & control)	Monitoring of Process Data through DCS

Emergency procedures

The plant maintains the data in both hard and soft copy formats; the same is also stored in the MIS. Agrinergy also receives the monthly CDM related data from the plant and if any discrepancies are observed, questions are raised and corrective action taken as required.

However, no emergencies occurred during the period under verification which could have given rise to emissions.

QA/QC procedures

The management of the plant has put in place monthly reporting of electricity generation. This data is a part of the management information systems for the power plant and is also provided to Agrinergy to calculate the emission reductions generated. The GM also reports any consumption of fossil fuel that has been used to start the power plant or for emergencies. The emission reductions are calculated monthly, reported back to the management of Shri Bajrang and incorporated into existing management information systems. The management also conducts internal audit and the date for the last internal audit was 22/09/2015. All monitored data will be kept for a minimum of two years after the end of the crediting period.

The single line diagram showing all relevant electricity monitoring points is given in Annex 1

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	EFy
Unit	tCO_2/MWh
Description	CO_2 baseline emission factor for the electricity displaced due to the project activity during the year y
Source of data	Central electricity Authority (CEA) database
Value(s) applied	0.972
Choice of data or measurement methods and procedures	The value used has been fixed ex-ante and will be used throughout the first crediting period of the project activity
Purpose of data/parameter	Baseline emission calculations
Additional comments	-

D.2. Data and parameters monitored

Data/parameter:	Q_i
Unit	Tonnes
Description	Mass of fossil fuel consumed (Diesel in DG sets)
Measured/calculated/default	Measured
Source of data	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
Value(s) of monitored parameter	19.19
Monitoring equipment	Type: Calibrated tank **Calibrated on**: 12/06/2013; **Valid till**: 11/06/2018; **Calibration agency**: Govt. of Chhattisgarh, Office of the Controller of Legal Metrology
Measuring/reading/recording frequency:	Monthly
Calculation method (if applicable):	litre*0.00086 tonnes/litre
QA/QC procedures:	Data is taken from purchase records, adjustments made for stock of fuel on-site
Purpose of data:	Project emissions calculations
Additional comments:	-

Data/parameter:	CO_{EFi}
Unit	tCO_2/TJ
Description	Emission factor of fossil fuel combusted (Diesel in DG sets)
Measured/calculated/default	Measured
Source of data	IPCC 2006 (Table 1.4, page 1.23)
Value(s) of monitored parameter	74.80 20. 2 =20.2 * 44/12 =74.1 tCO_2/TJ For calculation of project emission the upper value (95% confidence level) i.e. 74.80 is taken
Monitoring equipment	-
Measuring/reading/recording frequency:	Annually
Calculation method (if applicable):	-
QA/QC procedures:	Data is taken from IPCC
Purpose of data:	Project emissions calculations
Additional comments:	-

Data/parameter:	NCV_i
Unit	TJ/kt
Description	Net calorific value of fossil fuel combusted (Diesel in DG sets)
Measured/calculated/default	Measured
Source of data	IPCC value has been used since Indian National communication refers to IPCC. . IPCC 2006 (Table 1.2, page 1.18)

Value(s) of monitored parameter	43.3
Monitoring equipment	-
Measuring/reading/recording frequency:	Monthly
Calculation method (if applicable):	-
QA/QC procedures:	Data is taken from IPCC
Purpose of data:	Project emissions calculations
Additional comments:	-

Data/parameter:	OXID
Unit	%
Description	Oxidation factor (Diesel in DG sets)
Measured/calculated/default	Measured
Source of data	IPCC 2006 (Table 1.4, page 1.23)
Value(s) of monitored parameter	100
Monitoring equipment	-
Measuring/reading/recording frequency:	Annually
Calculation method (if applicable):	-
QA/QC procedures:	Data is taken from IPCC
Purpose of data:	Project emissions calculations
Additional comments:	-

Data/parameter:	EG_{Gen}
Unit	MWh
Description	Total electricity generated
Measured/calculated/default	Measured
Source of data	Plant Records
Value(s) of monitored parameter	103,686.774
Monitoring equipment	Type: Energy meter, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibration Agency
8 MW				
34120540812	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
34133841017	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
34120540812 replaced with 34133841017 on 02/04/2015				
10 MW				
34120540813	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
34133841018	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
34120540813 replaced with 34133841018 on 02/04/2015				
CSPDCL: Chhattisgarh State Power Distribution Company Limited				

Measuring/reading/recording frequency:	Continuously

Calculation method (if applicable):	-
QA/QC procedures:	Metered electricity
Purpose of data:	Baseline emissions calculations
Additional comments:	-

Data/parameter:	EG_{Aux}
Unit	MWh
Description	Auxiliary electricity
Measured/calculated/default	Measured
Source of data	Plant Records
Value(s) of monitored parameter	10,408.378
Monitoring equipment	Type: Energy meter, Calibration frequency: Annually

Location	Serial No	Accuracy class/make	Calibration date	Valid till	Calibration Agency
CWP-1	150554/1-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	213797/3737-2411	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/1-2008 replaced with 213797/3737-2411 on 02/04/2015					
CWP-2	150554/3-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	213797/3742-2411	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/3-2008 replaced with 213797/3742-2411 on 02/04/2015					
CWP-3	150554/5-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	126752/231-2907	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/5-2008 replaced with 126752/231-2907 on 02/04/2015					
CWP-4	150554/6-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	213797/3746-2411	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/6-2008 replaced with 213797/3746-2411 on 02/04/2015					
CWP-5	150554/8-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	120445/20103-1707	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/8-2008 replaced with 120445/20103-1707 on 02/04/2015					
BFP-1	150554/9-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	213797/3739-2411	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/9-2008 replaced with 213797/3739-2411 on 02/04/2015					
BFP-2	150554/10-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	213797/3740-2411	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/10-2008 replaced with 213797/3740-2411 on 02/04/2015					
BFP-3	150554/11-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	213797/3743-2411	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/11-2008 replaced with 213797/3743-2411 on 02/04/2015					
AC-1	150554/12-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	214017/3835-2511	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/12-2008 replaced with 214017/3835-2511 on 02/04/2015					
AC-2	150554/13-2008	0.5 Conzerv	02/04/2014	01/04/2015	CSPDCL
	213797/3744-2411	0.5 Conzerv	31/03/2015	30/03/2016	CSPDCL
150554/13-2008 replaced with 213797/3744-2411 on 02/04/2015					

	<table><tr><td rowspan="2">TA-1</td><td>150554/14-2008</td><td>0.5 Conzerv</td><td>02/04/2014</td><td>01/04/2015</td><td>CSPDCL</td></tr><tr><td>34133820512</td><td>0.5 Conzerv</td><td>31/03/2015</td><td>30/03/2016</td><td>CSPDCL</td></tr><tr><td colspan="6">150554/14-2008 replaced with 34133820512 on 02/04/2015</td></tr><tr><td rowspan="2">TA-2</td><td>120445/20117-1707</td><td>0.5 Conzerv</td><td>02/04/2014</td><td>01/04/2015</td><td>CSPDCL</td></tr><tr><td>34133841020</td><td>0.5 Conzerv</td><td>31/03/2015</td><td>30/03/2016</td><td>CSPDCL</td></tr><tr><td colspan="6">120445/20117-1707 replaced with 34133841020 on 02/04/2015</td></tr><tr><td rowspan="2">CTM</td><td>34122740238</td><td>0.5 Schneider</td><td>07/04/2014</td><td>06/04/2015</td><td>CSPDCL</td></tr><tr><td>120445/20097-1707</td><td>0.5 Conzerv</td><td>31/03/2015</td><td>30/03/2016</td><td>CSPDCL</td></tr><tr><td colspan="6">34122740238 replaced with 120445/20097-1707 on 06/04/2015</td></tr><tr><td rowspan="2">DMP</td><td>213797/3745-2411</td><td>0.5 Conzerv</td><td>02/04/2014</td><td>01/04/2015</td><td>CSPDCL</td></tr><tr><td>213797/3741-2411</td><td>0.5 Conzerv</td><td>31/03/2015</td><td>30/03/2016</td><td>CSPDCL</td></tr><tr><td colspan="6">213797/3745-2411 replaced with 213797/3741-2411 on 02/04/2015</td></tr><tr><td rowspan="2">MOV</td><td>120445/20094-1707</td><td>0.5 Conzerv</td><td>07/04/2014</td><td>06/04/2015</td><td>CSPDCL</td></tr><tr><td>34120540821</td><td>0.5 Conzerv</td><td>31/03/2015</td><td>30/03/2016</td><td>CSPDCL</td></tr><tr><td colspan="6">120445/20094-1707 replaced with 34120540821 on 06/04/2015</td></tr></table> CSPDCL: Chhattisgarh State Power Distribution Company Limited
Measuring/reading/recording frequency:	Continuously
Calculation method (if applicable):	-
QA/QC procedures:	Metered electricity
Purpose of data:	Baseline emissions calculations
Additional comments:	-

Data/parameter:	**EG_y**
Unit	MWh
Description	Net electricity supplied
Measured/calculated/default	Calculated
Source of data	Plant Records
Value(s) of monitored parameter	93,278.396
Monitoring equipment	-
Measuring/reading/recording frequency:	Computed daily on the basis of continuous measurement
Calculation method (if applicable):	$EG_{Gen} - EG_{Aux}$
QA/QC procedures:	Metered electricity
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	ST_{whr}
Unit	kCal
Description	Energy content of steam from waste gas boilers fed to common steam header
Measured/calculated/default	Calculated
Source of data	Plants records
Value(s) of monitored parameter	252,183,604,536.328

Monitoring equipment	-
Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
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
QA/QC procedures:	Calculated parameter
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	ST_{other}
Unit	kCal
Description	Energy content of steam from AFBC boiler fed to common steam header
Measured/calculated/default	Calculated
Source of data	Plants records
Value(s) of monitored parameter	89,407,179,566.638
Monitoring equipment	-
Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
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.
QA/QC procedures:	Calculated parameter
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Temp_{whr}$
Unit	^0C
Description	Temperature of steam from waste heat boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	481.29
Monitoring equipment	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
11 TT - 1730	± 0.7°C	07/08/2014	06/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		06/08/2015	05/08/2016	
22 TT - 1730	± 0.7°C	04/08/2014	03/08/2015	
		03/08/2015	02/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	
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.

Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Press_{whr}$
Unit	kg/cm^2
Description	Pressure of steam from waste heat boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	64.40
Monitoring equipment	Type: Pressure transmitter, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
11 PT - 1726	± 0.075%	07/08/2014	06/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		06/08/2015	05/08/2016	
22 PT - 1726	± 0.075%	04/08/2014	03/08/2015	
		03/08/2015	02/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-
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
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Quantity_{whr}$
Unit	Tonnes
Description	Quantity of steam from waste heat boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	362,699.80
Monitoring equipment	Type: Differential pressure transmitter, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
11 FT - 1729	± 0.075%	06/08/2014	05/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		05/08/2015	04/08/2016	
22 FT - 1729	± 0.075%	04/08/2014	03/08/2015	
		03/08/2015	02/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-

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
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Temp_{other}$
Unit	°C
Description	Temperature of steam from AFBC boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	487.32
Monitoring equipment	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
33 TT - 0204	± 0.7°C	08/08/2014	07/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		07/08/2015	06/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-
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.
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Press_{other}$
Unit	kg/cm^2
Description	Pressure of steam from AFBC boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	63.01
Monitoring equipment	Type: Pressure transmitter, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
33 PT - 0202	± 0.075%	08/08/2014	07/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		07/08/2015	06/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-

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.
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Quantity_{other}$
Unit	Tonnes
Description	Quantity of steam from AFBC boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	339,066.62
Monitoring equipment	Type: Differential pressure transmitter, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
33 FT - 0202	± 0.065%	07/08/2014	06/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		06/08/2015	05/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-
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.
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Quantity_{8MW}$
Unit	Tonnes
Description	Quantity of steam going to new 8 MW turbine from AFBC boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	211,468.99
Monitoring equipment	Type: Differential pressure transmitter, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
33 FT - 0100	± 0.065%	07/08/2014	06/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		06/08/2015	05/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-
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.

Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Quantity_{csh}$
Unit	Tonnes
Description	Quantity of steam entering the common steam header from AFBC boiler
Measured/calculated/default	Calculated
Source of data	Plants records
Value(s) of monitored parameter	127,597.63
Monitoring equipment	-
Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	$Quantity_{other}$- $Quantity_{8MW}$
QA/QC procedures:	Calculated parameter
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Temp_{fw,whr}$
Unit	^0C
Description	Temperature of feedwater to waste heat boiler
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	109.42
Monitoring equipment	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
11 TT - 1710	± 0.7°C	07/08/2014	06/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		06/08/2015	05/08/2016	
22 TT - 1710	± 0.7°C	06/08/2014	05/08/2015	
		05/08/2015	04/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-
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.
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Temp_{fw,other}$
Unit	^0C
Description	Temperature of feedwater to AFBC
Measured/calculated/default	Measured

Source of data	Plants records
Value(s) of monitored parameter	107.99
Monitoring equipment	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
33 TT - 0101	± 0.7°C	08/08/2014	07/08/2015	SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter
		07/08/2015	06/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-
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.
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Temp_{8MW}$
Unit	°C
Description	Temperature of steam from AFBC boiler to new 8 MW turbine
Measured/calculated/default	Measured
Source of data	Plants records
Value(s) of monitored parameter	479.72
Monitoring equipment	Type: Temperature transmitter with thermocouple, Calibration frequency: Annually

Serial No	Accuracy class	Calibration date	Valid till	Calibrating Agency
33 TT - 0103	± 0.7°C	08/08/2014	07/08/2015	SBPIL (Internal calibration) Refer Anne 2 for Calibration details of master meter
		07/08/2015	06/08/2016	

Measuring/reading/recording frequency:	Monthly (from the collation of the daily data)
Calculation method (if applicable):	-
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.
Purpose of data:	Baseline emission calculations
Additional comments:	-

Data/parameter:	$Press_{8MW}$
Unit	kg/cm^2
Description	Pressure of steam from AFBC boiler to new 8 MW turbine
Measured/calculated/default	Measured

<table>
<tr><td>Source of data</td><td>Plants records</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>61.73</td></tr>
<tr><td>Monitoring equipment</td><td>Type: Pressure transmitter, Calibration frequency: Annually
<table>
<tr><th>Serial No</th><th>Accuracy class</th><th>Calibration date</th><th>Valid till</th><th>Calibrating Agency</th></tr>
<tr><td rowspan="2">33 PT - 0100</td><td rowspan="2">± 0.065%</td><td>08/08/2014</td><td>07/08/2015</td><td rowspan="2">SBPIL (Internal calibration) Refer Annex 2 for Calibration details of master meter</td></tr>
<tr><td>07/08/2015</td><td>06/08/2016</td></tr>
</table></td></tr>
<tr><td>Measuring/reading/recording frequency:</td><td>Monthly (from the collation of the daily data)</td></tr>
<tr><td>Calculation method (if applicable):</td><td>-</td></tr>
<tr><td>QA/QC procedures:</td><td>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.</td></tr>
<tr><td>Purpose of data:</td><td>Baseline emission calculations</td></tr>
<tr><td>Additional comments:</td><td>-</td></tr>
</table>

D.3. Implementation of sampling plan

>>
Not Applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

>>
The formulae used to calculate the baseline emissions are:

$$BE_y = f_{WCM} * EG_y * EF_y$$

Where:

EG_y: net quantity of electricity supplied to the manufacturing facility by the project during the year y in MWh

$EF_{,y}$: CO_2 baseline emission factor for the electricity displaced due to the project activity during the year y (tCO_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

EF_y = 0.972 tCO_2/MWh (fixed *ex-ante*)

Month	ST_{whr} Kcal	ST_{other} kcal	f_{WCM}	EG_y	BE_y

				MWh	tCO_2
Sep-14	22549438661	11936511385	0.6539	9928.743	6310.36
Oct-14	18179305132	12973125178	0.5836	8961.032	5082.88
Nov-14	19105775256	10526343372	0.6448	8342.903	5228.60
Dec-14	16011146197	12375905418	0.5640	7960.873	4364.45
Jan-15	20128603197	7871351509	0.7189	7697.475	5378.62
Feb-15	21415498937	5111528000	0.8073	7381.518	5792.31
Mar-15	22620507182	3905089693	0.8528	7226.195	5989.81
Apr-15	20831933814	17582403	0.9992	6198.697	6020.05
May-15	28233897089	1274015149	0.9568	5817.328	5410.31
Jun-15	21096152480	8252799666	0.7188	8862.400	6191.96
Jul-15	22653165979	1090234258	0.9541	4489.397	4163.32
Aug-15	19358180613	14072693535	0.5791	10411.835	5860.17
Total				**93278.396**	**65792.84**

BE_y = 65,792.84 tCO_2e

E.2. Calculation of project emissions or actual net removals

>>
The project emissions due to the usage of fossil fuel are calculated as follows:

$$PE_y = Q_i \cdot COEF_i \cdot NCV_i \cdot OXID$$

= 19.19 * 74.80* 0.043 * 100%
= 62.14 tCO_2

Where:

PE_y	project emissions in year y, tCO_2e
Q_i	mass of fossil fuel combusted, t
$COEF_i$	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 = 62.14 tCO_2

E.3. Calculation of leakage emissions

>>
In line with the baseline methodology no leakage is considered.
L_y = 0 tCO_2e

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals ($t CO_2e$)	Project GHG emissions or actual net GHG removals ($t CO_2e$)	Leakage GHG emissions ($t CO_2e$)	GHG emission reductions or net anthropogenic GHG removals ($t CO_2e$)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	65,792.84	62.14	0	0	65,730.70	65,730 (round down to nearest integer)

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

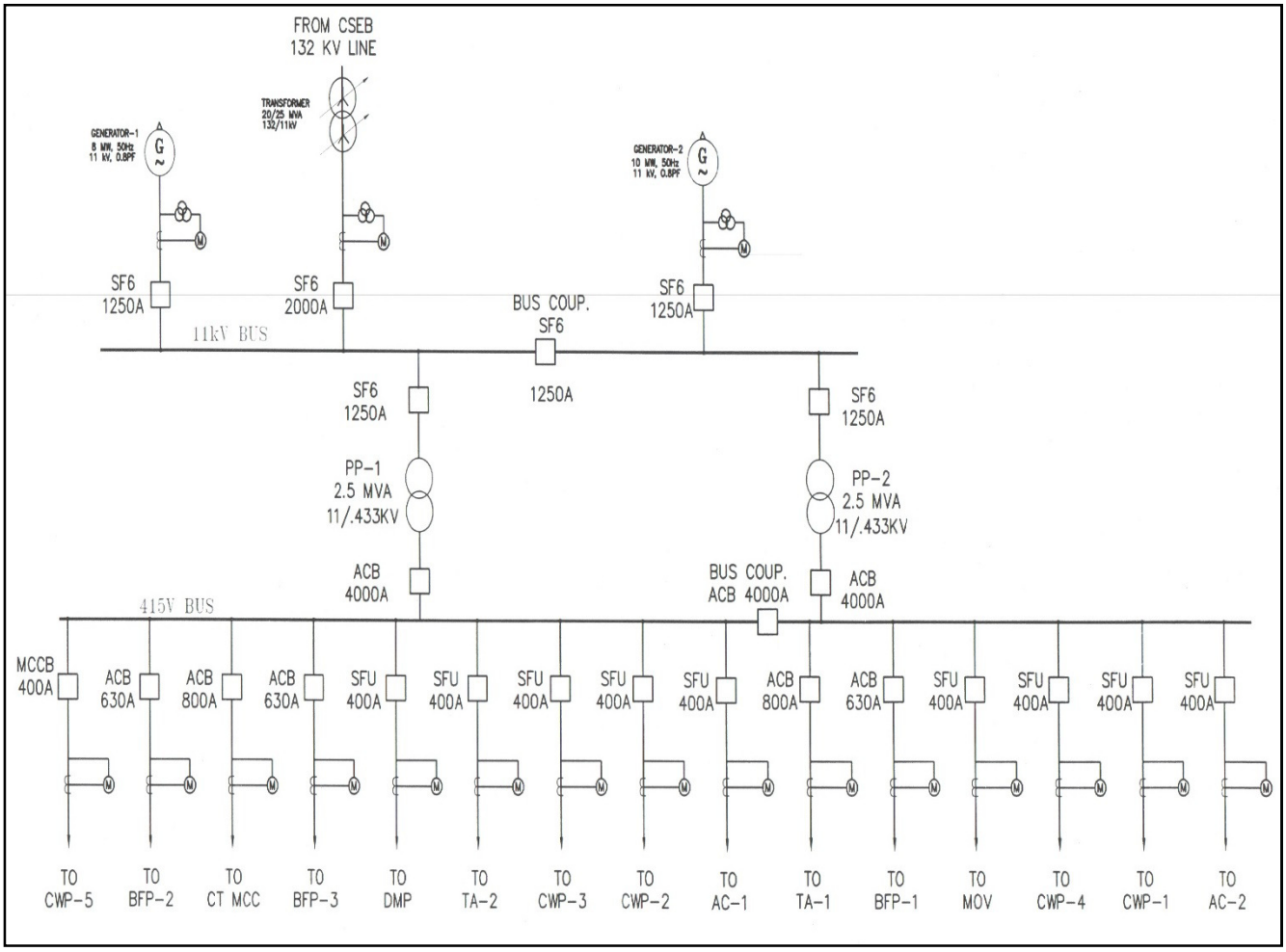
Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
65,730	113,351

E.6. Remarks on increase in achieved emission reductions

There is no increase in the emission reductions during the current monitoring period relative to the estimation in the registered CDM-PDD. The emission reductions achieved during the monitoring period are less than the estimated in the registered PDD for following reasons,

- There has been a change in the project activity that has reduced the CERs achievable by the project (Fraction of total electricity generated by the project activity using waste gas i.e. f_{WCM} was assumed as 1, whereas the actual values observed during the monitored period was less than 1). (http://cdm.unfccc.int/Projects/DB/TUEV-SUED1152883936.57/view)
- In the change of the project activity the auxiliary consumption was assumed at 8% of total generation whereas during the monitoring period the auxiliary consumption was 10.04% as a result CERs got reduced.

Appendix 1. SINGLE LINE DIAGRAM – ELECTRICAL MONITORING POINTS



Appendix 2. 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

Differential Pressure Transmitters calibrated with following master instruments,

1. digital multimeter
2. pressure gauge

Make/Serial no	Accuracy class	Calibration date	Valid till	Calibrating agency
Digital pressure gauge Make:Nagman S.No: MPCE 05039355	± 0.1%	21/08/2014	20/08/2015	Nagman Instruments & Electronics (P) Ltd[1].

Serial no	Accuracy class	Calibration date	Valid till	Calibrating agency
Digital Multimeter Make: RISH S.No: 092729	-	22/08/2014	21/08/2015	Nagman Instruments & Electronics (P) Ltd.

Serial no	Accuracy class	Calibration date	Valid till	Calibrating agency
Loop Calibrator Make: Masibus S.No.: 12092132	0.03% mV mode 0.05% mA mode	21/08/2014	20/08/2015	Nagman Instruments & Electronics (P) Ltd.

Serial no	Accuracy class	Calibration date	Valid till	Calibrating agency
Yantrika pressure gauge Make: Ravika S.No.: REE0057	0.25%	27/08/2014	26/08/2015	Nagman Instruments & Electronics (P) Ltd.

[1] Nagman Instruments & Electronics (P) Ltd. is an NABL Accredited Laboratory.

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Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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