



Monitoring report form for CDM project activity
(Version 09.0)

MONITORING REPORT

Title of the project activity	VGL - Waste Heat based 4 MW Captive Power Project at Raipur		
UNFCCC reference number of the project activity	0432 ¹		
Version number of the PDD applicable to this monitoring report	03		
Version number of this monitoring report	01		
Completion date of this monitoring report	10/11/2021		
Monitoring period number	03		
Duration of this monitoring period	15/08/2007 to 31/03/2015 (first and last dates included)		
Monitoring report number for this monitoring period	NA		
Project participants	M/s Vandana Global Limited - India Bunge Emissions Fund Limited - Switzerland		
Host Party	India		
Applied methodologies and standardized baselines	ACM0004 Version 2 ² - Consolidated methodology for waste gas and/or heat for power generation Standardized baseline: Not Applicable		
Sectoral scopes	Sectoral scope 01: Energy Industries (renewable/non-renewable sources)		
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 until 31 December 2020	Amount achieved from 1 January 2021
	139,519 tCO ₂ e	51,570 tCO ₂ e	0
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	144,759 tCO ₂ e		

¹ <https://cdm.unfccc.int/Projects/DB/SGS-UKL1147179019.14/view>

² https://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_XIXYIGMQQIJ65GY3UJCP3R90X4TG75

SECTION A. Description of project activity

A.1. General description of project activity

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The project activity aims to utilize the heat content of the flue gas released during sponge iron manufacturing process, for generating clean power. Prior to the project activity, power was imported from grid to meet the entire electricity demand of the sponge iron plant while the hot waste flue gas from the Direct Reduction Iron (DRI) kiln of the plant was released to the atmosphere after treatment.

By implementing the project activity, the project proponent has reduced import of power from grid and hence indirectly reduce greenhouse gas (GHG) emissions that would have occurred, in its absence, at the thermal power plants connected to the grid.

Silent features of the project:

The project proponent Vandana Global Limited (VGL) is a sponge iron and steel manufacturing industry that belongs to the 'Vandana Group of Industries' of Chhattisgarh State, India. The other companies belonging to the Group are Vandana Rolling Mills Limited, Vandana Udyog Limited, Vandana Ispat Limited, Vandana Industries Limited and Vandana Vidyut Limited. VGL produces around 60000 tonnes of Sponge Iron and 30000 tonnes of Steel ingots per annum. The plant is connected to Chhattisgarh State Electricity Board (CSEB) grid, which is a part of the Western Regional grid network of India.

The project generates 4MW of power [equivalent to around 25 million kWh (MkWh)] utilizing the sensible heat from process flue gas of the DRI kiln. The power generated is used to meet the captive power requirement of VGL plant and the surplus is wheeled through CSEB grid for supply to group companies. The net result is a reduction in electricity demand from the grid supply.

Therefore, the project fundamentally achieves the following goals:

- Utilization of heat energy of waste gas.
- Reduction in GHG emissions
- Reduction in Transmission & Distribution (T& D) losses of the grid.
- Technological up gradation and sustainable industrial growth in the state.
- Conserves natural resources and betterment of working environment.

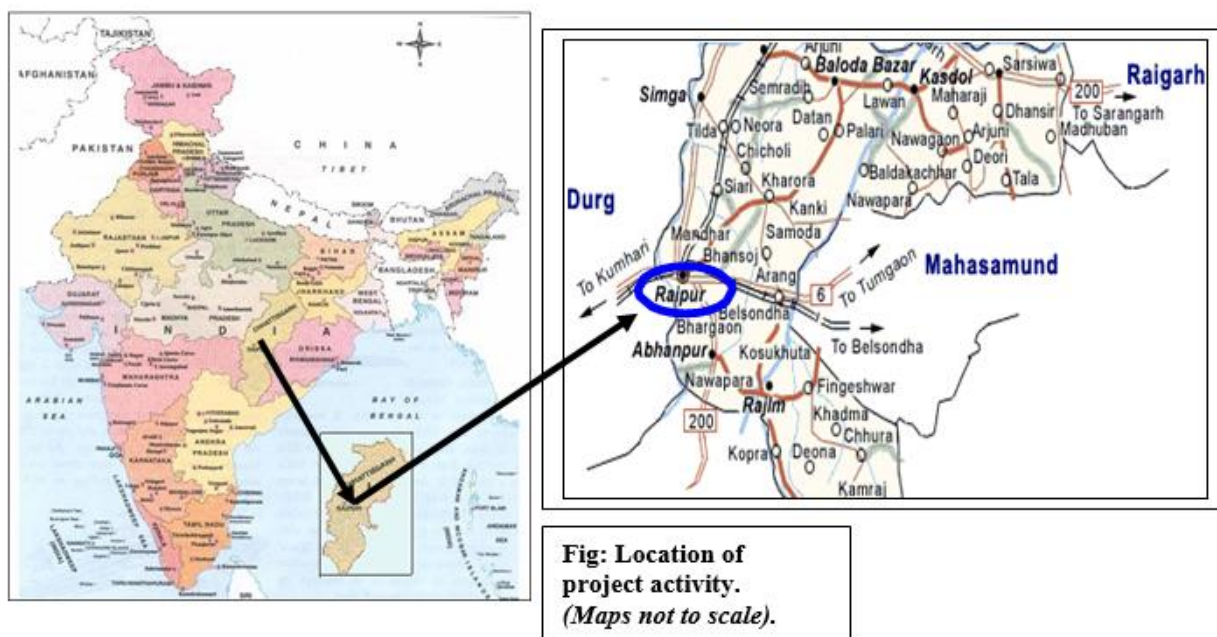
During the present monitoring period from 15/08/2007 to 31/03/2015 (first and last dates included) the project has reduced 191,089 tCO₂ into the atmosphere.

A.2. Location of project activity

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Host Party	: India
Region/state/province	: Chhattisgarh
City/town/community	: Raipur

The project activity has been implemented in the VGL Sponge Iron Manufacturing plant located in Siltara Industrial area in Raipur district of Chhattisgarh state of India. Raipur is well connected with road, rail and airport infrastructure. The region is abundant with coal and mineral deposits. The geographical location of Raipur is detailed in the maps shown below.



A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India	M/s Vandana Global Limited (Private Entity)	No
Switzerland	Bunge Emissions Fund Limited	No

A.4. References to applied methodologies and standardized baselines

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Title :Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation

Reference :Approved consolidated baseline methodology ACM0004/ Version 02³, Sectoral Scope:01, 03 March 2006

A.5. Crediting period type and duration

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Type of crediting period : Fixed Crediting Period
Crediting period : 01/04/2005 – 31/03/2015

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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VGL sponge iron plant has a 200 tonnes per day (tpd) capacity DRI kiln and is currently producing around 60000 tonnes per annum (tpa) of sponge iron. The Waste Heat Recovery (WHR) based captive power plant at VGL utilizes the sensible heat content of waste flue gas from DRI kiln to generate electricity for its captive requirement. The exhausted flue gas of the sponge iron kiln enters the After- Burning Chamber (ABC) inlet at a temperature of around 900°C. The waste gases

³ https://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_XIXYIGMQQIJ65GY3UJCP3R90X4TG75

are burnt in ABC to remove traces of carbon monoxide. After secondary combustion the hot flue gases leave the ABC at a temperature of around 950°C which is finally introduced to the WHRB through a hot gas duct.

The flue gas is circulated through two passes in the WHRB to transfer the sensible heat energy of the waste gas to water and generate 30 tonnes per hour (tph) of steam at 67kg/cm², 510°C. Finally, the gas is passed through economiser bundles for optimum recovery of heat from the hot exhaust.

The high pressure steam is fed into fully condensing steam turbo-generator of 8MW capacity. The steam turbine is coupled with an electric generator which converts the mechanical energy of the turbine into electrical energy. The turbine is of single cylinder, single exhaust, condensing type with uncontrolled extraction for the de-aerator, designed for high operating efficiencies and maximum reliability. The generator is a three phase, four pole, synchronous type with brushless excitation.

The waste gases after maximum heat transfer in the WHRB is led to exhaust stack through Electrostatic Precipitator (ESP) which reduces Suspended Particulate Matter (SPM) load to a large extent. SPM is collected in the hoppers of the ESP. The particulate matter collected in the hoppers is conveyed to existing ash silo by a conveyor belt. The project generates around 25 M kWh per annum, excluding auxiliary consumption.

Relevant dates for the project activity:

The 4 MW Waste Heat Recovery (WHR) Project at Vandana Global Limited (VGL) in Raipur, Chhattisgarh, India has started commercial production from 1st April 2005. The plant is in operation continuously (with outages – forced & planned) since 1st April 2005.

B.2. Post-registration changes

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

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Not applicable for the present monitoring period

B.2.2. Corrections

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Not applicable for the present monitoring period

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

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Not applicable for the present monitoring period

B.2.4. Inclusion of monitoring plan

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Not applicable for the present monitoring period

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

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Not applicable for the present monitoring period

B.2.6. Changes to project design

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Not applicable for the present monitoring period

B.2.7. Changes specific to afforestation or reforestation project activity

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Not applicable for the present monitoring period

SECTION C. Description of monitoring system

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The approved consolidated monitoring methodology is designed and used in conjunction with the approved consolidated baseline methodology. The applicability conditions of the monitoring methodology are identical with those for the baseline methodology. The project activity meets all the applicability conditions of the approved consolidated baseline methodology.

VGL monitored the electricity generated using the waste gases of the DRI kiln in the WHR based power plant. The project activity's financial benefits under CDM are based on this parameter. The project activity is utilizing the heat energy in the waste gas for power generation and thereby displacing the grid electricity. The amount of electrical energy generated and substituted in the grid is directly controlled by the project proponent and under the purview of monitoring plan. Thus a detailed monitoring plan is developed by VGL in the line with the approved consolidated monitoring methodology.

The monitoring plan developed in order to determine the baseline emissions and the project emissions (if any) over the entire credit period. The net units of electricity generated monitored by power meters at the plant. The instrumentation and control system for the power plant is designed with adequate instruments to control and monitor the various operating parameters for safe and efficient operation of the waste heat recovery boiler and the turbo generator unit. The project activity has employed the state-of-the-art monitoring and control equipment. That measured, recorded, reported, monitored and controlled various key parameters like total power generated, power used for auxiliary consumption.

The instrumentation system comprises of microprocessor-based instruments of reputed make with the best accuracy available. All instruments are calibrated and marked at regular intervals so that the accuracy of measurement are ensured all the time. The calibration frequency too is a part of the monitoring and verification parameters.

Project Parameters affecting Emission Reduction Claims:**Monitoring:**

The CDM mechanism stands on the quantification of emission reduction and keeping the track of the emissions reduced. The project activity reduced the carbon dioxide whereas an appropriate monitoring system ensure this reduction is quantified and helps maintaining the required level. Also a monitoring system brings about the flaws in the system if any are identified and opens up the opportunities for improvement.

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and Reporting

Frequency of Monitoring:

Since the emission reduction units from the project activity are determined by the number of electrical units generated, it becomes important for the project activity to monitor the net electricity production on the real time basis. An on-line monitoring system is in place to monitor and record the net electricity generated. This to ensure the smooth operation of the plant.

Reliability:

The amount of emission reduction units is proportional to the net energy generation from the project activity. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result.

- All measuring instruments are calibrated by third party/ government agency once in a year for ensuring reliability of the system.
- The standard testing laboratory (under Central / state Government) verifies the reliability of the meter reading, thereby ensuring the monitored results are highly reliable.

According to the state electricity board's (grid operator) regulations also, the annual calibration and verification of electricity meters is mandatory for all power generating units.

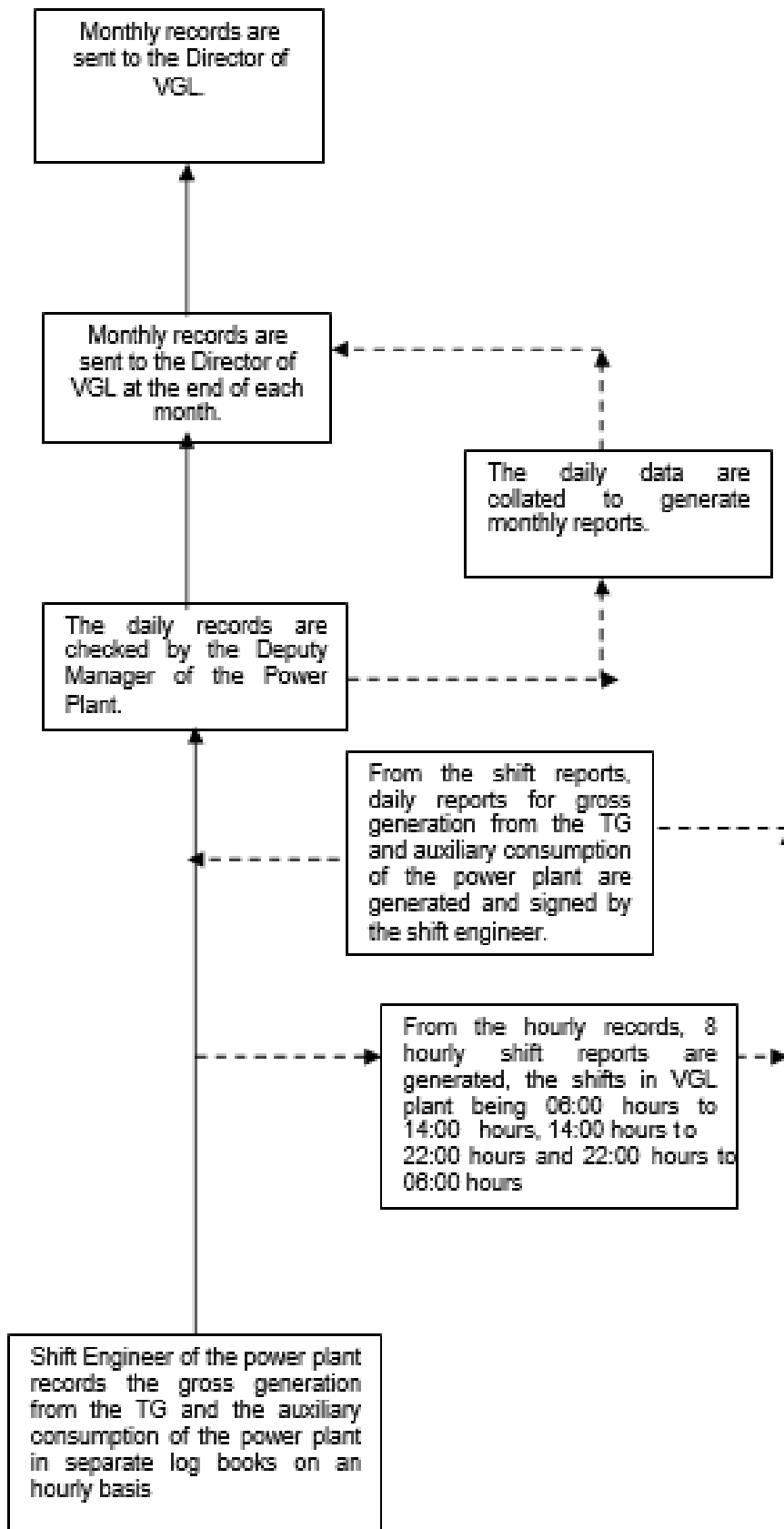
Registration and Reporting:

Registration of data is monitored on-line in the control cabin through a microprocessor. However, hourly data logging is there in addition to software memory. Daily, weekly and monthly reports would be prepared stating the generation.

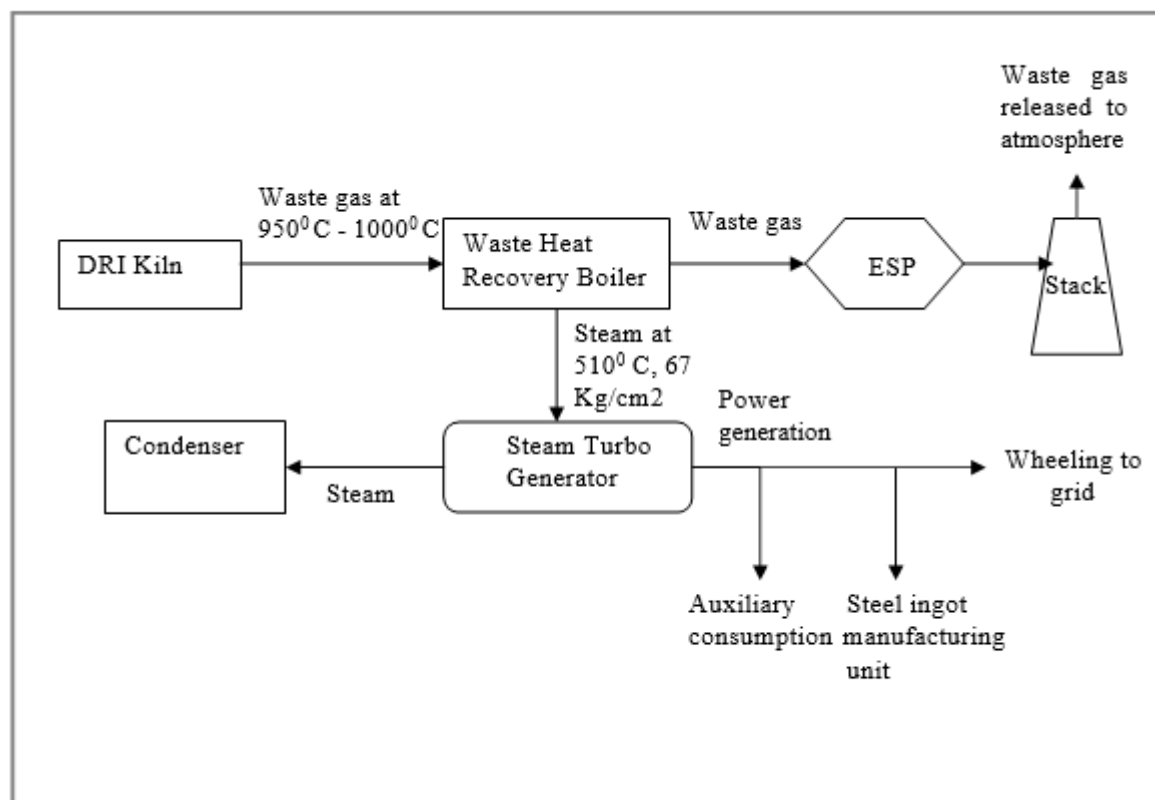
Roles & Responsibilities:

In the complete implementation and monitoring plan referred above, VGL is the sole agency responsible for implementation and monitoring.

Flow diagram for the process of recording and archiving of relevant data for the project activity:



The schematic line diagram for the project activity is provided below:



SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	EF _y
Unit	tCO ₂ / MWh
Description	CO ₂ emission factor of the grid
Source of data	CO ₂ Baseline Database, Version 2.0 (21/06/2007)
Value(s) applied	0.759
Choice of data or measurement methods and procedures	Calculated as weighted sum of OM and BM emission factors
Purpose of data/parameter	For calculation of baseline emission
Additional comments	Fixed ex-ante

Data/Parameter	EF _{OM,y}
Unit	tCO ₂ / MWkh
Description	CO ₂ operating margin emission factor of the grid
Source of data	CO ₂ Baseline Database, Version 2.0 (21/06/2007)
Value(s) applied	864.16
Choice of data or measurement methods and procedures	Average of most recent 3 years (2002-2003, 2003-2004 & 2004-2005) values
Purpose of data/parameter	For calculation of baseline emission
Additional comments	Fixed ex-ante

Data/Parameter	EF _{BM,y}
Unit	tCO ₂ / MkWh
Description	CO ₂ Build Margin emission factor of the grid
Source of data	CO ₂ Baseline Database, Version 2.0 (21/06/2007)
Value(s) applied	653.06
Choice of data or measurement methods and procedures	Values of the base year i.e. 2004-2005
Purpose of data/parameter	For calculation of baseline emission
Additional comments	Fixed ex-ante

Data/Parameter	F _{i,j,y}
Unit	t or m ³ /year
Description	Amount of each fossil fuel consumed by each power source/plant
Source of data	CO ₂ Baseline Database, Version 2.0 (21/06/2007)
Value(s) applied	Refer Annex 3 (Baseline information) of registered CDM PDD , Table no. 7 & 9 Ref. https://cdm.unfccc.int/Projects/DB/SGS-UKL1147179019.14/view
Choice of data or measurement methods and procedures	Calculated
Purpose of data/parameter	For calculation of OM & BM
Additional comments	Fixed ex-ante

Data/Parameter	COEF _{i,k}
Unit	t CO ₂ / t or m ³
Description	CO ₂ emission coefficient of each fuel type
Source of data	CO ₂ Baseline Database, Version 2.0 (21/06/2007)
Value(s) applied	Refer Annex 3 (Baseline information) of registered CDM PDD , Table no. 7 & 9 Ref. https://cdm.unfccc.int/Projects/DB/SGS-UKL1147179019.14/view
Choice of data or measurement methods and procedures	Calculated
Purpose of data/parameter	For calculation of OM & BM
Additional comments	Fixed ex-ante

Data/Parameter	GEN _{j,y}
Unit	MWh/year
Description	Electricity generation of each power source/plant
Source of data	CO ₂ Baseline Database, Version 2.0 (21/06/2007)
Value(s) applied	Refer Annex 3 (Baseline information) of registered CDM PDD , Table no. 7 & 9 Ref. https://cdm.unfccc.int/Projects/DB/SGS-UKL1147179019.14/view
Choice of data or measurement methods and procedures	Calculated
Purpose of data/parameter	For calculation of OM & BM
Additional comments	Fixed ex-ante

D.2. Data and parameters monitored

Data/Parameter	EG_{Gen}
Unit	MWh/year
Description	Total Electricity Generated
Measured/calculated/default	Measured
Source of data	The data is monitored hourly in the generation log book and also eight hourly shift reports are compiled. The daily data of the same parameter is also recorded in daily reports.
Value(s) of monitored parameter	282,210.85
Monitoring equipment	DIG Generation Meter (Tri Vector Meter) Class of accuracy: 0.5
Measuring/reading/recording frequency	Hourly measurement, daily reading, monthly recording
Calculation method (if applicable)	Not applicable
QA/QC procedures	The energy meter is calibrated regularly according to the calibration schedule (once a year). The calibration certificate of the energy meter as well as of the master calibrator is available at the project site.
Purpose of data/parameter	For baseline emission calculation
Additional comments	Data will be achieved for credit period + 2 years

Data/Parameter	EG_{Aux}
Unit	MWh/year
Description	Auxiliary consumption of Electricity
Measured/calculated/default	Measured
Source of data	Data is measured by meters at plant and DCS.
Value(s) of monitored parameter	30,444.98
Monitoring equipment	Auxiliary meter of the power plant Class of accuracy: 0.5
Measuring/reading/recording frequency	Hourly measurement, daily reading, monthly recording
Calculation method (if applicable)	Not applicable
QA/QC procedures	The energy meter is calibrated regularly according to the calibration schedule (once a year). The calibration certificate of the energy meter as well as of the master calibrator is available at the project site.
Purpose of data/parameter	For baseline emission calculation
Additional comments	Data will be achieved for credit period + 2 years

Data/Parameter	EG_y
Unit	MWh/year
Description	Net Electricity supplied
Measured/calculated/default	Calculated
Source of data	Calculated from the above measured parameters
Value(s) of monitored parameter	251,765
Monitoring equipment	Not applicable
Measuring/reading/recording	Continuously

frequency	
Calculation method (if applicable)	(EG _{GEN} - EG _{AUX})
QA/QC procedures	-
Purpose of data/parameter	For baseline emission calculation
Additional comments	Data will be achieved for credit period + 2 years

D.3. Implementation of sampling plan

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Sampling is not required for the given project activity

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

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Net units of electricity substituted in the grid (EG_y) = (Total electricity generated-Auxiliary Consumption)

$$= (EG_{GEN,y} - EG_{AUX,y})$$

Where,

EG_{GEN,y} is the total Electricity generated for year y

EG_{AUX,y} is auxiliary consumption for year y

For monitoring period from 15/08/2007 to 31/12/2012

$$EG_y = 205,799.21 \text{ MWh} - 21,978.64 \text{ MWh}$$

$$EG_y = 183,820 \text{ MWh (Round down value)}$$

For monitoring period from 01/01/2013 to 31/03/2015

$$EG_y = 76,411.65 \text{ MWh} - 8,466.34 \text{ MWh}$$

$$EG_y = 67,945 \text{ MWh (Round down value)}$$

Therefore the Baseline Emission is calculated as,

$$BE_y = EG_y * EF_y$$

Where,

BE_y = Baseline Emissions due to displacement of electricity during the year y (in tons of CO₂)

EG_y = Net units of electricity substituted in the grid during the year y (in MWh)

EF_y = Emission Factor of the grid (in tCO₂/ MWh) and y is any year within the crediting period of the project activity.

For monitoring period from 15/08/2007 to 31/12/2012

$$BE_y = 183,820 \text{ MWh} * 0.759 \text{ tCO}_2\text{e}$$

$$BE_y = 139,519 \text{ tCO}_2\text{e (Round down value)}$$

For monitoring period from 01/01/2013 to 31/03/2015

$$BE_y = 67,945 \text{ MWh} * 0.759 \text{ tCO}_2\text{e}$$

$BE_y = 51,570 \text{ tCO}_2\text{e}$ (Round down value)

Total $BE_y = 139,519 + 51,570$

$BE_y = 191,089 \text{ tCO}_2\text{e}$ (Round down value)

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

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As per the methodology, project emissions are applicable only if auxiliary fuels are fired for generation start up, in emergencies, or to provide additional heat gain before entering the WHRBs. For the project activity, there is no provision for auxiliary fuel firing before the Waste Heat Recovery Boilers. Hence, there are no project emissions due to auxiliary fuel firing which means that no data needs to be monitored for this purpose.

$PE_y = 0$

E.3. Calculation of leakage emissions

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The leakage emissions due to project activity are emissions arising due to activities such as “power plant construction and associated activities” and “transportation of equipment to the site”. As per the methodology these emissions may be considered as very negligible as compared to the baseline scenario and occur only during the setting up of the project infrastructure. Hence, there is no leakage associated with the project activity.

$LE_y = 0$

Hence, the emission reduction ER_y by the project activity during this monitoring period is the difference between the baseline emissions through substitution of electricity generation with fossil fuels (BE_y) and project emissions (PE_y), as follows -

$ER_y = BE_y - PE_y$

$ER_y = 191,089 - 0$

$ER_y = 191,089 \text{ tCO}_2\text{e}$ (Round down value)

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

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)			
				Before 01/01/2013	From 01/01/2013 until 31/12/2020	From 01/01/2021	Total amount
Total	191,089	0	0	139,519	51,570	0	191,089

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 ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
191,089	144,759

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

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Estimated Emission Reduction according to PDD = 18,965 tCO₂e per annum

Total number of days in this monitoring period = 2786 days

The ex-ante estimated ER for the current monitoring period has been calculated by factorizing the annualized projected ER value for the equivalent days of the current monitoring period.

$$= (18,965 * 2786) / 365 = 144,759 \text{ tCO}_2\text{e}$$

E.6. Remarks on increase in achieved emission reductions

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During the present monitoring period, actual emission reductions achieved are 191,089 tCO₂e whereas estimated emission reductions was 144,759 tCO₂e.

E.7. Remarks on scale of small-scale project activity

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The installed capacity of the project is 4 MW which is less than 15 MW. The project activity is a small-scale project activity.

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
09.0	8 October 2021	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 03.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN).
08.0	6 April 2021	Revision to: <ul style="list-style-type: none"> • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.

<i>Version</i>	<i>Date</i>	<i>Description</i>
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.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		