



Monitoring report form (Version 03.1)

Monitoring report

Title of the project activity	Power generation by utilizing Blast Furnace Gas at Mukand Limited, Ginigera, Karnataka
Reference number of the project activity	4249
Version number of the monitoring report	01.1
Completion date of the monitoring report	12/04/2013
Registration date of the project activity	07/10/2011
Monitoring period number and duration of this monitoring period	1 st Monitoring Period; 01/12/2011 – 31/08/2012 (first and last days included)
Project participant(s)	M/s Mukand Limited
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	Sectoral scope 1,4
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	53,685 t CO ₂
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	29,512 t CO ₂

SECTION A. Description of project activity**A.1. Purpose and general description of project activity**Purpose of the project activity and Greenhouse Gas (GHG) abatement measures taken:

Mukand Limited in association with Kalyani Steels Limited has entered into a Joint Venture in the name of Hospet Steels Limited for production of special and alloy steel through Mini Blast Furnace and Energy Optimising Furnace route. In order to expand the steel production capacity, a new Mini Blast Furnace (i.e. MBF-3) has been installed at their manufacturing facility in Karnataka. The Blast Furnace Gas (BFG), generated from the operation of MBF-3, is passed through a Gas Cleaning Plant (GCP) for dust removal. A part of the clean gas is consumed in the Hot Blast Stoves for supplying hot blast for MBF-3 operation. The surplus BFG does not have any consumption in the steel plant and would have been flared under normal operational conditions. The project activity, undertaken by Mukand Limited, entails utilization of the surplus BFG for power generation. The electricity generated is consumed in-house for catering to the electrical energy requirement of the steel plant and therefore replaces the import of an equivalent quantum of electrical energy from the Southern Regional Grid. The project activity power plant also has the provision for Furnace Oil firing as back up fuel to supplement the heat content of the surplus BFG.

Brief description of installed technology and equipments:

The project activity is based upon the concept of effective utilization of waste energy for generation of power. The surplus Blast Furnace Gas (BFG) of MBF-3 is utilized for the purpose of generation electrical energy under the project activity. Under normal operational condition, Blast Furnace Gas (BFG) generated from MBF-3 is first sent to the Gas Cleaning Plant (GCP) for dust removal. A part of the clean gas, emanating from the Gas Cleaning Plant (GCP), is directed to the Hot Blast Stoves for supplying hot blast for MBF-3 operation. The project activity entails utilization of the surplus BFG in a boiler for generation of steam which is subsequently fed into a Steam-Turbo Generator (STG) set for power generation. The boiler also has a provision for firing of Furnace Oil (FO) as a back up fuel to supplement the energy content of the surplus BFG.

The turbine is coupled with the Turbo-Generator and Alternator which can generate up to 15 MW of power. The power plant operation is monitored through a Programmable Logic Control (PLC) system. The technical specifications of the Boiler and the Steam-Turbo Generator (STG) set are provided below:

Technical Specifications of Boiler	
Parameter	Details
Number of Boilers	One
Type	BF Gas/FO fired water tube boiler, bottom supported, bi-drum, non-reheat, naturally circulated, outdoor type unit.
Life of Boiler	More than 15 years
Steam output from boiler at outlet of main steam stop valve	55 tph
Superheated steam pressure at outlet of M.S. stop valve	67 kg/cm ²
Superheated steam temperature at outlet of MS stop valve	485+5°C
Feed Water temperature at Economizer inlet	145°C
Flue Gas temperature leaving air heater	140°C
Boiler Efficiency	86.1% (With 100% BF Gas firing) 87.9% (With 100% FO firing)
Technical Specifications of Steam Turbine	
Parameter	Details (100% load)
Quantity	One
Installation	Indoor
Model of Steam Turbine	N15-6.275
Rated Power	15 MW
Rated Revolution	3000r/min
Hand of Rotation	CKW, seeing in the direction of steam flow
Rated Inlet Pressure	64 ata
Rated Inlet Temperature	480°C
Inlet steam flow (excluding ejector, GSC steam consumption)	60.9 tph
Exhaust pressure at rated condition	0.0098 ata
Layout manner	Double-tier

Stage number for Feed-Water Regenerative Heating	1 Deaerator + 1 LP Heater
Feed Water temperature at Deaerator outlet	145 °C
Guaranteed steam rate under rated condition	4.06 kg/kWh
Guaranteed Heat Rate under rated condition	11209 kJ/kWh
Vibration amplitude at rated speed	≤0.03mm (Double amplitudes)
Vibration amplitude at critical speed	≤0.15mm (Double amplitudes)
Elevation of operating floor	8m
Speed variation	+10%
Speed regulation	4.5%, adjustable
Insensitivity of speed governing	≤0.50%
Trip speed	3300-3360rpm
Expected lifespan of turbine	More than 15 years, subjected to proper operation and maintenance.
Technical Specifications of Generator	
Parameter	Details
Mode of Generator	QF-15
Rated Power	15 MW
Rated Speed	3000r/min
Voltage at Generator Terminals	11 KV±10%
Rated Current	984.15 A
Frequency	50Hz +5%
Power Factor	0.8 (lagging)
Poles	2
Phases	3
Excitation type	Brushless
Efficiency	97.4 %
Type of Generator Cooling	CACW
Connection of phases	Star
Insulation Class	Resin Rich
Temperature Rise	B Class

Relevant dates for the project activity: The power plant was commissioned on 04/01/2011.

Period of continued operation: During the monitoring period, the power plant had a continued operation except on some minor occasions when it was shut down. From 02/07/2012-04/07/2012, 21/07/2012 – 23/07/2012 and from 30/07/2012 – 15/08/2012, the power plant was in shut down mode. The exact details of the power plant records on a per day basis has been submitted to the DOE.

Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period:

The monitoring period is from 01/12/2011 to 31/08/2012 (both days included) and the net emission reductions achieved by the project activity during the period is 29,512 t CO₂.

A.2. Location of project activity

The project activity is implemented within the steel plant premise of Mukand Limited. The steel plant is located at Hospet, Koppal Road, Ginigera-538 228, Taluka and District: Koppal, Karnataka. The site is located at 15°20'11" N Latitude and 76°15'00" E Longitude. The plant is very well connected by road, rail and airways. The nearest railway station is at Ginigera at a distance of 1 km and the airport is located at Hubli, which is about 130 km away from the project site. National highways NH-13 and NH-63 are the connecting roadways to the plant.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ministry of Environment and Forests, Government of India	Mukand Limited (Private)	No

A.4. Reference of applied methodology

Title: Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects

Reference: Approved consolidated baseline methodology ACM0012/ Version 02, Sectoral Scope: 01, 04 ; EB 51

Tools used:

1. Tool for the demonstration and assessment of additionality (Version 05.2)
2. Tool to calculate the emission factor for an electricity system (Version 02)

A.5. Crediting period of project activity

Type of crediting period: Fixed crediting period of 10 years 00 months.

Start date of the credit period: 01/12/2011

End date of the credit period: 30/11/2021

Please refer to the following web-link:

<http://cdm.unfccc.int/Projects/DB/LRQA%20Ltd1292497985.99/view>

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

1. The commercial operation of the project activity started on 04/01/2011. The crediting period for the project activity is from 01/12/2011 to 30/11/2021. This is a single site project activity and so multiple starting dates are not applicable
2. Project activity had mostly a continued operation during the Monitoring Period. From 02/07/2012-04/07/2012, 21/07/2012 – 23/07/2012 and from 30/07/2012 – 15/08/2012, the power plant was in shut down mode. The detail of the shut downs can be found out from the electronic spreadsheet provided to the DOE. No exchange of equipment within the project boundary is reported during the monitored period.
3. No change in configuration has taken place in the project during the monitoring period. Also, no event has taken place which might affect the applicability of the methodology and the monitoring plan.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

There has been no request for deviation applied to this first Monitoring Period, i.e. from 01/12/2011- 31/08/2012.

B.2.2. Corrections

There has been no request for any corrections applied to the Registered PDD (Version 07; Dated 27/08/2011) during this first Monitoring Period, i.e. from 01/12/2011- 31/08/2012.

B.2.3. Permanent changes from registered monitoring plan or applied methodology

There has been no request for any changes from registered monitoring plan or applied methodology applied to this first Monitoring Period.

B.2.4. Changes to project design of registered project activity

There have been no changes to the project design that has occurred during this first Monitoring Period.

B.2.5. Changes to start date of crediting period

There has been neither change nor a request for a change in the crediting period during this first Monitoring Period.

B.2.6. Types of changes specific to afforestation or reforestation project activity

This is not applicable for the project activity under consideration as the project is not related to afforestation or reforestation.

SECTION C. Description of monitoring system

The power plant operation is monitored through a Programmable Logic Control (PLC) system. All the parameters can be tracked in the PLC system and instantaneous data for all of them can be obtained from it. The values of the respective monitored parameters are noted in the log book. These daily data from the log books are collated in excel sheets and from the collated sheets the emission reduction is calculated.

Electricity emission factor of SOUTH Grid (EF_y): The emission factor for the SOUTH grid is kept constant and the same is as per the Registered PDD. The value of the emission factor is 0.8546 t CO₂/MWh.

Electrical Energy Meters:

The electrical energy meters at the plant site are calibrated on an annual basis. The PP monitors the total generation, the auxiliary consumption as well as the individual feeders where the net electricity is supplied to the Sinter Plant and the SMS units.

Other Monitoring Points:

The PP monitors the BFG consumption, the FO consumption and their instantaneous flow can also be viewed from the PLC system. The PP also ensures that these meters are calibrated according to

the guidelines stated in the Registered PDD.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	$EF_{elec,i,j,y}$
Unit:	tCO ₂ /MWh
Description:	CO ₂ emission factor for the electricity source i (i.e. the Southern Regional Grid), displaced due to the project activity during the year y
Source of data:	'Baseline Carbon Dioxide Emission Database/Version 03', published by Central Electricity Authority (CEA), Government of India
Value(s) applied:	0.8546
Purpose of data:	Baseline emission calculation
Additional comment:	The parameter is calculated following the tool approved by UNFCCC by the Central Electricity Authority (CEA), Government of India. Consideration of the data from a government database will ensure the reliability of the parameter.

D.2. Data and parameters monitored

Data / Parameter:	$Q_{WCM,y}$
Unit:	Nm ³ /annum
Description:	Quantity of WECM i.e. surplus BFG used for energy generation during year y
Measured/ Calculated / Default:	Measured
Source of data:	Plant records
Value(s) of monitored parameter:	220393154

Monitoring equipment:	Make: Yokogawa Serial No.91H318906 Type: Venturi flow element Accuracy: +/- 2% Date of last calibration:13/03/2012 Date of previous calibrations:12/09/2012
Measuring/ Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The flow meter is calibrated on an annual basis. The Head (Power Plant) is responsible for regular calibration of the flow meter.
Purpose of data:	Baseline emission calculation
Additional comment:	The uncertainty level of the parameter is low since the same is be monitored with calibrated meter. Furthermore the parameter can be crosschecked with the difference between the 'BFG generation (from MBF-3) data' and the 'BFG consumption (from MBF-3) data' at other consumption areas in the steel plant.
Data / Parameter:	$Q_{i,h}$
Unit:	Nm ³ /h and ton/h
Description:	Amount of individual fuel (WECM i.e. surplus BFG and other fuel) I consumed at the energy generation unit i.e. the power plant during hour h
Measured/ Calculated / Default:	Log books
Source of data:	
Value(s) of monitored parameter:	BFG: 220393154 Nm ³ Furnace oil: 506987 litres LPG: 0

Monitoring equipment:	Make: Rockwin Serial No.211203 Type: Turbine flow Accuracy: +/-2 % Date of last calibration:05/08/2011 Date of previous calibrations:04/08/2012 No Flow meter for LPG
Measuring/ Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The flow meters are calibrated on an annual basis.
Purpose of data:	Baseline emission calculation
Additional comment:	The uncertainty level of the parameter is low since the same is monitored with calibrated flow meter.

Data / Parameter:	NCV _i
Unit:	TJ/Nm ³ and TJ/ton
Description:	Net Calorific Value (annual average) of individual fuel (WECM i.e. surplus BFG and other fuel) i consumed at the energy generation unit i.e. the power plant
Measured/ Calculated / Default:	Measured
Source of data:	BFG: Plant records Furnace Oil: 2006 IPCC Guidelines for National Greenhouse Gas Inventories LPG: 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Value(s) of monitored parameter:	<table border="1"> <thead> <tr> <th colspan="2">BFG GCV</th></tr> <tr> <th>Month</th><th>Kcal/Nm³</th></tr> </thead> <tbody> <tr><td>Dec-11</td><td>654</td></tr> <tr><td>Jan-12</td><td>655</td></tr> <tr><td>Feb-12</td><td>655</td></tr> <tr><td>Mar-12</td><td>649</td></tr> <tr><td>Apr-12</td><td>653</td></tr> <tr><td>May-12</td><td>656</td></tr> <tr><td>Jun-12</td><td>662</td></tr> <tr><td>Jul-12</td><td>655</td></tr> <tr><td>Aug-12</td><td>671</td></tr> <tr><td>Average</td><td>657</td></tr> </tbody> </table> <p>Furnace Oil: 40.4 TJ/Gg</p>	BFG GCV		Month	Kcal/Nm ³	Dec-11	654	Jan-12	655	Feb-12	655	Mar-12	649	Apr-12	653	May-12	656	Jun-12	662	Jul-12	655	Aug-12	671	Average	657
BFG GCV																									
Month	Kcal/Nm ³																								
Dec-11	654																								
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Apr-12	653																								
May-12	656																								
Jun-12	662																								
Jul-12	655																								
Aug-12	671																								
Average	657																								
Monitoring equipment:	<p>Serial No.CG544705003</p> <p>Type: Orsat Apparatus</p> <p>Accuracy: +/- 1%</p> <p>Date of last calibration:10.01.2012</p> <p>Date of previous calibrations:10.01.2013</p>																								
Measuring/ Reading/ Recording frequency:	BFG's GCV is monitored in house once in a month.																								
Calculation method (if applicable):	Not applicable																								
QA/QC procedures:	Not applicable																								
Purpose of data:	Baseline emission calculations																								
Additional comment:																									
Data / Parameter:	EG _{tot,y}																								
Unit:	TJ/year																								
Description:	Total annual energy (electricity) produced at the power plant																								
Measured/ Calculated / Default:	Measured																								
Source of data:	Plant log books																								
Value(s) of monitored parameter:	This value is monitored in kWh. The value is 39688886 kWh.																								

Monitoring equipment:	Make: Allen Bradley SI No.: AW0ET8MX – 015 Class: 0.5 Date of last calibration: 18/11/2011 Calibration was also done on 02/01/2011. Therefore, the calibration schedule covers the entire Monitoring Period.
Measuring/ Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The energy meter will be calibrated on an annual basis. The Head (Power Plant) will be responsible for regular calibration of the energy meter.
Purpose of data:	Baseline emission calculation
Additional comment:	The parameter is measured continuously with energy meter. The generation figure is noted down into the daily log books. The same is also available in the power plant Programmable Logic Control (PLC) System and will be integrated to determine the annual electricity generation at the power plant.

Data / Parameter:	H _r
Unit:	-
Description:	Average heat rate of the power plant where electricity is produced
Measured/ Calculated / Default:	Calculated
Source of data:	Plant records
Value(s) of monitored parameter:	4.37
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Annual basis

Calculation method (if applicable):	<p>The parameter is calculated on an annual basis following the guidance of the methodology based on the following parameters:</p> <ul style="list-style-type: none"> • Amount of individual fuel (WECM i.e. surplus BFG and other fuel) i consumed at the energy generation unit i.e. the power plant during hour h ($Q_{i,h}$) • Net Calorific Value (annual average) of individual fuel (WECM i.e. surplus BFG and other fuel) i consumed at the energy generation unit i.e. the power plant (NCV_i) and • Total annual energy (electricity) produced at the power plant ($EG_{tot,y}$)
QA/QC procedures:	-
Purpose of data:	Baseline emission calculation
Additional comment:	The uncertainty level of the parameter will be low since the same will be calculated with parameters of lower uncertainty levels.

Data / Parameter:	$EG_{i,j,y}$
Unit:	MWh
Description:	Quantity of electricity supplied to the recipient j by generator, that in the absence of the project activity would have been sourced from the i^{th} source (i.e. the Southern Regional Grid) during the year y
Measured/ Calculated / Default:	Measured
Source of data:	Plant log books
Value(s) of monitored parameter:	35646.271

Monitoring equipment:	<p>Meter: SMS Meter Make: Rishabh SI No.: 10/05/00322 Class: 1.0 Date of last calibration: 17/11/2011 Calibration was also done on 07/10/2010. Therefore, the calibration schedule covers the entire Monitoring Period.</p> <p>Meter: Sinter Meter Make: Rishabh SI No.: 08/06/1314 Class: 1.0 Date of last calibration: 17/11/2011 Calibration was also done on 07/10/2010. Therefore, the calibration schedule covers the entire Monitoring Period.</p>
Measuring/ Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The energy meter will be calibrated on an annual basis. The Head (Power Plant) will be responsible for regular calibration of the energy meter.
Purpose of data:	Baseline emission calculation
Additional comment:	The parameter is measured continuously with energy meter. The generation figure is noted down into the daily log books. The same is also available in the power plant Programmable Logic Control (PLC) System and will be integrated to determine the annual electricity generation at the power plant.
Data / Parameter:	$FF_{i,y}$
Unit:	tonnes
Description:	Quantity of fossil fuel type i combusted in the project activity during the year y

Measured/ Calculated / Default:	Measured
Source of data:	Plant log books
Value(s) of monitored parameter:	0
Monitoring equipment:	Not applicable as the number of cylinders is counted
Measuring/ Reading/ Recording frequency:	As and when purchased
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Not applicable
Purpose of data:	Project emission calculation
Additional comment:	

Data / Parameter:	NCV _{Supplementary,i}
Unit:	TJ/ton
Description:	Net calorific value of the fossil fuel type i combusted as supplementary fuel
Measured/ Calculated / Default:	Measured
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) of monitored parameter:	0.0473 (for LPG)
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Not applicable
Calculation method (if applicable):	Not applicable
QA/QC procedures:	IPCC values have been used to ensure the reliability of the parameter
Purpose of data:	Project emission calculation
Additional comment:	

Data / Parameter:	EF _{CO₂,i}
Unit:	tCO ₂ /TJ
Description:	CO ₂ emission factor per unit of energy of the fuel type i

Measured/ Calculated / Default:	Default
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) of monitored parameter:	63.1 (considering LPG) 77.4 (considering Furnace Oil)
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	It is a fixed parameter
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Not applicable
Purpose of data:	Baseline emission calculation
Additional comment:	

Data / Parameter:	EC _{PJ,y}
Unit:	MWh
Description:	Additional electricity consumed in year y as a result of the implementation of the project activity
Measured/ Calculated / Default:	Measured
Source of data:	Plant log books
Value(s) of monitored parameter:	0
Monitoring equipment:	Energy meters
Measuring/ Reading/ Recording frequency:	Continuously
Calculation method (if applicable):	Not applicable since the above is a monitored parameter
QA/QC procedures:	The meter readings are measured with the help of regularly calibrated energy meters
Purpose of data:	Project emission calculation
Additional comment:	

D.3. Implementation of sampling plan

The data and parameters to be monitored for this project activity have all been elaborated in section D.2 of this Monitoring Report. There is no sampling approach being followed by the Project Participant. Hence, this is not applicable for the project activity.

SECTION E. Calculation of emission reductions or GHG removals by sinks**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

The emission reductions have been computed in accordance with the guidance provided in the methodology ACM 0012/Version 03.2.

The baseline emission has been calculated as

$$BE_y = BE_{En,y} = BE_{elec,y} = f_{cap} \times f_{wcm} \times \sum_j \sum_i (EG_{i,j,y} \times EF_{elec,i,j,y})$$

Where:

- $BE_{elec,y}$ = Baseline emissions due to displacement of electricity during the year y (tCO₂)
- $EG_{i,j,y}$ = The quantity of electricity supplied to the recipient j by generator, which in the absence of the project activity would have been sourced from source i (the grid or an identified source) during the year y in MWh
- $EF_{elec,i,j,y}$ = The CO₂ emission factor for the electricity source i (gr for the grid, and is for an identified source), displaced due to the project activity, during the year y (tCO₂/MWh)
- f_{wcm} = Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy.
- f_{cap} = Factor that determines the energy that would have been produced in project year y using waste energy generated at a historical level, expressed as a fraction of the total energy produced using waste source in year y .

Determination of f_{cap} :

The f_{cap} is determined as given below:

$$f_{cap} = \frac{Q_{WCM,BL}}{Q_{WCM,y}}$$

$$Q_{WCM,BL} = Q_{BL,product} \times q_{wcm,product}$$

Where:

- $Q_{WCM,BL}$ = Quantity of waste energy generated prior to the start of the project
- $Q_{WCM,y}$ = Quantity of WECM used for energy generation during year y
- $Q_{BL,product}$ = Production associated with the relevant waste energy generation as it occurs in the baseline scenario.
- $q_{wcm,product}$ = Amount of waste energy per unit of product generated by the process (that generates waste energy) in the facility

$Q_{WCM,BL}$ = Quantity of waste energy i.e. Surplus BFG generated prior to the start of the project activity

$$= 489345789 \times 9/12$$

$$= 367009342 \text{ Nm}^3$$

Calculation of F_{cap}

Quantity of waste energy i.e. Surplus BFG generated prior to the start of the project activity (Nm^3)	$Q_{\text{WCM, BL}}$	448566973.3
Quantity of WECM i.e. surplus BFG used for energy generation during the period (October 2011 to August 2012)	$Q_{\text{WCM, Y}}$	220393154
Calculated Value of F_{cap}	F_{cap}	2.04
Effective value of F_{cap}	F_{cap}	1

Determination of f_{wcm} :

$$f_{\text{WCM}} = \frac{\sum_{h=1}^{8760} Q_{\text{WCM}, h} \times \text{NCV}_{\text{WCM}, y}}{H_r \times \text{EG}_{\text{tot}, y}}$$

Where,

$$H_r = \frac{\sum_{h=1}^{8760} \sum_{i=1}^I Q_{i, h} \times \text{NCV}_i}{\text{EG}_{\text{tot}, y}}$$

$$= \frac{(Q_{\text{WCM}, h} \times \text{NCV}_{\text{WCM}, y} + Q_{i, h} \times \text{NCV}_i)}{\text{EG}_{\text{tot}, y}}$$

Where,

$Q_{\text{WCM}, h}$ = Quantity of WECM, i.e., surplus BFG recovered in hour h

$\text{NCV}_{\text{WCM}, y}$ = Net calorific value of WECM, i.e. surplus BFG in year y

$\text{EG}_{\text{tot}, y}$ = Total annual energy produced at the power plant

H_r = Average heat rate of the power plant where electricity is produced

$Q_{i, h}$ = Amount of individual fuel i, i.e. furnace oil consumed at the energy generation unit i.e. the power plant during hour h

NCV_i = Net calorific value (annual average) of individual fuel (WECM, i.e. surplus BFG and other fuel) i.e. furnace oil consumed at the energy generation unit, i.e. the power plant

Calculation of F_{wcm}

Particulars	Unit	Value
Quantity of WECM, i.e. surplus BFG recovered in an hour (Summation of the hourly figures)	Nm^3	220393154

Total electricity generated from the Captive Power plant	kWh	39688886
Total electricity generated from the Captive Power plant	TJ	142.88
Average heat rate of the power plant where electricity is produced (1/efficiency),		4.37
Average NCV of BFG	kCal/Nm ³	656.6666667
F_{wcm}		0.9695

$EG_{i,j,y}$: Quantity of electricity supplied to the recipient j by generator, that in the absence of the project activity would have been sourced from the ith source (i.e. the Southern Regional Grid) during the year y (in MWh)

$$EF_{elec,i,y} = 0.8546 \text{ tCO}_2/\text{MWh}$$

The baseline emission has been calculated as

$$\begin{aligned}
 BE_y &= BE_{En,y} = BE_{elec,y} = f_{cap} \times f_{wcm} \times \sum_j \sum_i (EG_{i,j,y} \times EF_{elec,i,j,y}) \\
 &= (1) \times (0.96) \times (35646) \times (0.8546) \\
 &= 29,534 \text{ t CO}_2 \text{ e}
 \end{aligned}$$

Project Emissions:

$$PE_y = PE_{AF,y} + PE_{EL,y} \quad (1)$$

Where:

- PE_y = Project emissions due to the project activity (tCO₂)
- $PE_{AF,y}$ = Project activity emissions from on-site consumption of fossil
- $PE_{EL,y}$ = Project activity emissions from on-site consumption of electricity for gas cleaning equipment or other supplementary electricity consumption

$$PE_{AF,y} = \sum FF_{i,y} \times NCV_i \times EF_{CO_2,i}$$

Where,

$PE_{AF,y}$ = Project activity emissions from on-site consumption of fossil fuels by the power plant, in case they are used as supplementary fuels, due to non-availability of waste energy i.e. surplus BFG to the project activity or due to any other reason

$FF_{i,y}$ = Quantity of fossil fuel type i combusted to supplement waste energy in the project activity during the year y

NCV_i = Net calorific value of the fossil fuel type i combusted as supplementary fuel

$EF_{CO_2,i}$ = CO₂ emission factor per unit of energy of the fuel type i

There was no supplemental consumption of fossil fuels as $FF_{i,y}$ as zero. Hence, $PE_{AF,y}$ is zero.

Determination of $PE_{EL,y}$

$PE_{EL,y}$ is determined as given below:

$$PE_{BL,y} = EC_{PJ,y} \times EF_{CO_2,BL,y}$$

Where,

$PE_{EL,y}$ = Project activity emissions from other supplementary electricity consumption

$EC_{PJ,y}$ = Additional electricity consumed in year y as a result of the implementation of the project activity

$EF_{CO_2,BL,y}$ = CO₂ emission factor for electricity consumed by the project activity in year y

No supplemental electricity consumption is present for the power plant. $EC_{PJ,y} = 0$.

Therefore, the project emissions is zero. There is no leakage emissions from this project activity.

Emission reduction calculation:

$$ER_y = (BE_y - PE_y)$$

$$= 35,561 \text{ t CO}_2 \text{ e for the entire crediting period of 11 months, i.e from October 2011 to August 2012.}$$

E.2. Calculation of project emissions or actual net GHG removals by sinks

For the project activity under consideration, neither there is any auxiliary fuel consumption.

So there is no project emission.

i.e. project emissions , $PE_y = 0$

E.3. Calculation of leakage

There is no leakage in this project activity.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	29,534	0	0	29,534

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO₂e)	53,685	29,534

E.6. Remarks on difference from estimated value in registered PDD

The emission reduction actually achieved is less than the quantum as stated in the Registered PDD. This is majorly due to lower electricity generation by the captive power plant.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO₂e)	29,534	0

Document information

<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 anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, 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).
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