MONITORING REPORT FORM (F-CDM-MR)
Version 02.0

MONITORING REPORT

Title of the project activity	Tugela Mill Fuel Switching Project
Reference number of the project activity	0795
Version number of the monitoring report	01
Completion date of the monitoring report	12/12/2012
Registration date of the project activity	12/02/2007
Monitoring period number and duration of this monitoring period	Monitoring period number: 02 Duration: 01/03/2009 – 31/03/2012
Project participant(s)	Sappi Southern Africa (Pty) Ltd
Host Party(ies)	Republic of South Africa
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope: 01 Methodology: AMS-I.C. – "Thermal Energy for the User" Version 8
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	166,941 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	79,828 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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1. Purpose of the project activity and the measures taken to reduce greenhouse gas emissions;

The project activity involves the conversion of a coal fired boiler to enable co-firing of biomass (bark) with coal and gas at boiler number 10 in Sappi's Tugela paper Mill. The biomass will directly replace the use of coal for steam production in the boiler. The project also uses a small amount of gas during start up and occasionally to stabilise the boiler bed condition.

The project activity reduces greenhouse gas emissions by the reduction of coal consumption due to the increased utilisation of biomass as fuel for on-site thermal energy production. The biomass used as an alternative fuel offsets GHG emissions from non-renewable resources (coal) that would have been used in the absence of the project activity.

Further background on this project can be found in the PDD - Tugela Mill Fuel Switching Project, version 2.2 dated 17/02/2010 and associated documents, which are available on the UNFCCC website: http://cdm.unfccc.int/Projects/DB/DNV-CUK1165398206.69/view

2. Brief description of the installed technology and equipment;

The project involves a fuel switch from coal to biomass at boiler 10 in the Tugela Mill. The Tugela Mill is an integrated unbleached kraft and semi-chemical pulp and kraft paper mill producing pulp for own consumption. The pulp is used to produce kraft linerboard, corrugated medium, and other kraft packaging. See flowchart (Figure 1.) below for an overview of the mill process.

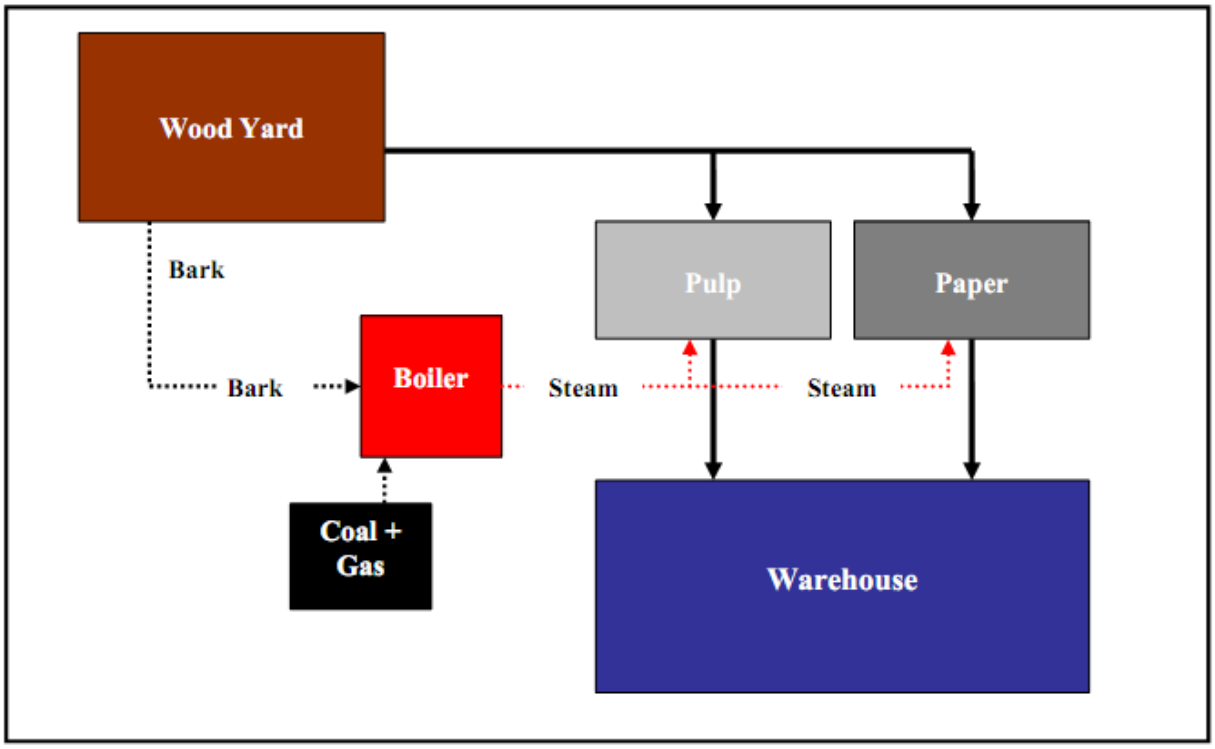

Figure 1: Flowchart of the mill process at Tugela Mill

The technical changes that were made in order to implement the biomass fuel switch include:

- removal of chain grate and stokers,

- installation of new fluidized bed combustor,
- start-up gas burners (occasionally used during operation also to stabilise the boiler bed condition if necessary) and bed management system,
- modifications to rear furnace wall tubes, refractories, casing, and framing.
- installation of a new bark conveying system, and
- installation of cyclonic wet gas scrubber and water recycling

3. Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.).

The construction of the project (modifications in systems to enable co-firing biomass) started on 12/1/2006. The operation of the project started on 14/01/2008. Emission reductions were monitored from the 16/01/2008. The project was originally registered by the UNFCCC on the 12/02/2007.

As gas usage was not included in the original PDD version, the PDD was revised. The revised PDD was accepted on the 20/08/2010.

The first monitoring report covered the period 16/01/2008 - 28/02/2009, for which credits were issued on the 21 April 2011.

Due to process changes outside the project boundary, bark availability was reduced. For that reason, the converted boiler (boiler 10) has not been used since April 2012.

4. Total emission reductions achieved in this monitoring period.

The total emission reductions achieved in the second monitoring period (01/03/2009 to 31/03/2012) are 79,828 tCO_2e.

A.2. Location of project activity

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Ndondakasuka Municipality (District of Dukusa)
City: Mandini
Country: South Africa

Tugela Mill is located in the town of Mandini, which is in the Province of Kwazulu Natal, South Africa. The mill is located on the northern bank of the Tugela River about 10 km's inland from the coast and approximately 100 km north from the city of Durban.

Geographical Coordinates
Latitude: 29° 9' 7.66" S, Longitude: 31° 24' 29.10" E

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)
Republic of South Africa	Private entity-Sappi Southern Africa (Pty) Ltd	No

A.4. Reference of applied methodology

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AMS-I.C. – "Thermal Energy for the User" Version 8

A.5. Crediting period of project activity

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The crediting period of the project activity has been revised to 16/01/2008 – 15/01/2015 (seven years renewable). Originally the crediting period was from 12/02/2007 – 11/02/2014, but the monitoring systems only became fully operational on 16/01/2008.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The commissioning of the equipment was done in December 2007. However, the monitoring system became operational from 16 January 2008. The crediting period was revised accordingly as specified in section A.7 above to start from 16 January 2008.

As per the PDD, the boiler was run primarily on gas and on coal when no bark was available. Bark and coal usage was monitored as per the monitoring system. Boiler shutdowns for maintenance and in case of technical problems were recorded.

No events or situations occurred in the monitoring period which impacts the applicability of the methodology.

B.2. Post registration changes

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

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Not applicable.

B.2.2. Corrections

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Not applicable.

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

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The construction of the project (modifications in systems to enable co-firing biomass) started on 12/1/2006. The operation of the project started on 14/01/2008. Emission reductions were monitored from the 16/01/2008. The project was originally registered by the UNFCCC on the 12/02/2007.

As gas usage was not included in the original PDD version, the PDD was revised. The revised PDD was accepted on the 20/08/2010.

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

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Not applicable.

B.2.5. Changes to start date of crediting period

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The crediting period of the project activity has been revised to 16/01/2008 – 15/01/2015 (seven years renewable). Originally the crediting period was from 12/02/2007 – 11/02/2014, but the monitoring systems only became fully operational on 16/01/2008.

B.2.6. Types of changes specific to afforestation or reforestation project activity
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Not applicable.

SECTION C. Description of monitoring system
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Data Collection Procedures

Data information flow:

The weighing instruments used for direct and continuous measurement of parameters like tonnes of biomass, coal, steam and flow of gas in the project are equipped with DCS. The raw/monitored data is recorded in a DCS interface.

Data from the DCS is downloaded and recorded in the PI interface. If the PI interface fails, the data from the DCS is recorded manually in log-sheets. If there is no DCS output, this means that there is no boiler output.

Raw data is also recorded manually in operator log-sheets by the monitoring staff on the site per shift basis.

Other monitoring data, such as coal lab test reports, are collected and manually recorded.

Data generation, aggregation, recording, calculation and reporting

All monitored data are included in an Excel document (Monitoring Workbook) to calculate the emission reductions. See section D.2 and section E for further information.

Electronic copies and hardcopies of the data are stored for 2 years after the crediting period.

Organizational structure

Roles and responsibilities of personnel

Internal monitoring procedures have been developed to describe the roles and responsibilities of Sappi personnel with regard to data monitoring and collection.

Drafting of the first monitoring report (16/01/2008 - 28/02/2009) was outsourced to EcoSecurities.
Drafting of the second monitoring report (01/03/2009 - 31/03/2012) was outsourced to Promethium Carbon.

Emergency Preparedness

Any system failure and boiler shutdowns are recorded along with the monitored data in the electronic work sheets. In case of a DCS system failure, data is backed up by the hardcopy log-sheets. The data is stored in hard copy and electronically as a consolidated workbook on site.

Line diagram

The following figure represents the line diagram of the project activity, including metering points:

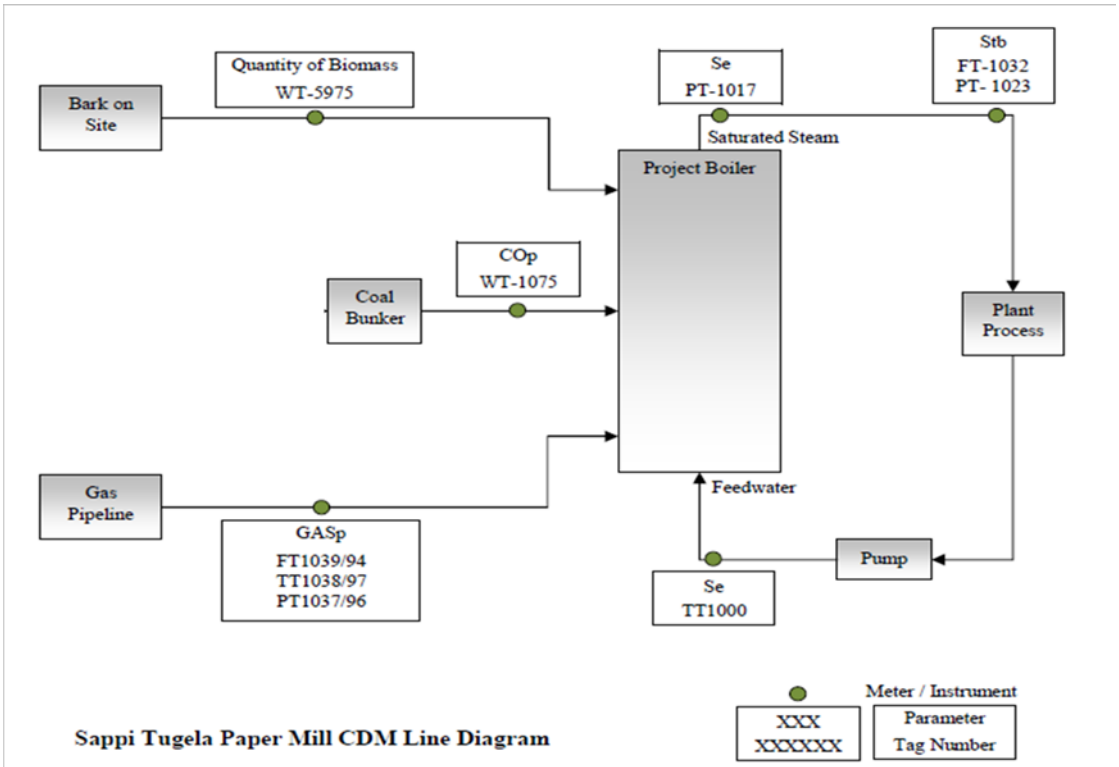

Figure 2: monitoring line diagram

SECTION D. Data and parameters

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

(Copy this table for each piece of data and parameter.)

Data/Parameter	**Eb_b**
Unit	%
Description	The efficiency of the original boiler (old boiler)
Source of data	Steinmuller
Value(s) applied	72
Purpose of data	Calculation of baseline emissions
Additional comment	

Data/Parameter	**EF_Co**
Unit	tCO_{2e}/tonnes of coal
Description	CO2 emission factor per unit of coal associated with fuel combustion (Carbon dioxide Emission Factor of coal)
Source of data	Derived from IPCC default values and Sappi (see page 26 of the registered PDD)
Value(s) applied	2.56
Purpose of data	Calculation baseline emissions and project emissions
Additional comment	

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data/Parameter	$Q_{biomass}$
Unit	Tonne
Description	Quantity of biomass combusted in the project plant
Measured/Calculated /Default	Measured
Source of data	Log Sheets / DCS
Value(s) of monitored parameter	261,352
Monitoring equipment	Instrument type: Weightometer Manufacturer: Ohmart/Vega Model: W4800 Serial Number: 13532422 Tag Number: WT-5975 Maximum Error: 2% Calibration frequency: once in three years Calibration date: - 07-09-2011 - 07-09-2010 - 08-05-2009
Measuring/Reading/ Recording frequency	Measured continuously by a weightometer that is part of the Distributed Control System (DCS).
Calculation method (if applicable)	
QA/QC procedures	The measuring equipment has been maintained in accordance with the user manual.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data/Parameter	**St_b**
Unit	Tonne
Description	Net quantity of steam generated in project activity
Measured/Calculated /Default	Measured
Source of data	DCS
Value(s) of monitored parameter	354,584
Monitoring equipment	Instrument type: Orifice plate flow meter/ Pressure gauge Manufacturer: Endress+Hauser Model: Deltabar S PMD75 / Cerabar S PMP71 Serial Number: 97091D0109D / 95040A0109C Tag Number: FT-1032/109 / PT-1023/102 Maximum Error: 0.5% / 1 kPa Calibration frequency: Once in three years Calibration date (Orifice plate flow meter): - 24-08-2011 - 26-05-2010 - 10-03-2009 Calibration date (Pressure gauge): - 24-08-2011 - 26-05-2010 - 10-03-2009
Measuring/Reading/ Recording frequency	Measured continuously by an orifice plate flow meter through a DCS System. The data is automatically saved daily to a database and extracted monthly to be used in the excel workbook.
Calculation method (if applicable)	
QA/QC procedures	The measuring equipment has been maintained in accordance with the user manual.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data/Parameter	Co_p
Unit	Tonne
Description	Quantity of coal combusted in the project plant
Measured/Calculated /Default	Measured
Source of data	Log Sheets / DCS
Value(s) of monitored parameter	9,648
Monitoring equipment	Instrument type: Weightometer (w.e.f 08/08/2008) Manufacturer: Process Automation (PTY) Ltd. respectively Model: EMB 220 Serial Number: 33437 Tag Number: WT-1075 Maximum Error: 1% Calibration frequency: Once in three years Calibration date: - 10-06-2011 - 10-06-2010 - 12-06-2009
Measuring/Reading/ Recording frequency	The data was automatically saved daily to a database and extracted monthly to be used in the reported data.
Calculation method (if applicable)	
QA/QC procedures	The measuring equipment has been maintained in accordance with the user manual.
Purpose of data	Calculation of project emissions.
Additional comment	

Data/Parameter	CV_c
Unit	MJ/kg
Description	Net Calorific Value of coal
Measured/Calculated /Default	Indicated + calculated
Source of data	Lab Test / IPCC 2006 Guidelines
Value(s) of monitored parameter	27.03 (average over the monitoring period)
Monitoring equipment	Instrument type: N/A (indicated by supplier)
Measuring/Reading/ Recording frequency	The NCV will be indicated by the coal provider. If only GCV is available, NCV will calculated as per method explained in the IPCC 2006 Guidelines, Chapter 1, p.1.17 – Box 1.1
Calculation method (if applicable)	"Conversion between Gross and NCV" with the formula NetCV = GrossCV − 0.212*Hydrogen − 0.0245*Moisture − 0.008*Oxygen
QA/QC procedures	
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data/Parameter	**Se**
Unit	KJ/kg
Description	Energy content of steam
Measured/Calculated /Default	Measured + calculated
Source of data	Log Sheets / DCS
Value(s) of monitored parameter	2,308 (weighted average over the monitoring period)
Monitoring equipment	Instrument type: Thermocouple / Pressure Gauge Manufacturer: Endress+Hauser Serial Number: 7500AC04126 / 9504090109C Tag Number: TT1000 / PT1017 Maximum Error: 2.5ºC / 1kPa Calibration frequency: Once in three years Calibration date (Thermocouple): - 10-05-2011 - 27-08-2010 - 27-07-2009 Calibration date (Pressure Gauge): - 24-08-2011 - 26-05-2010 - 10-03-2009
Measuring/Reading/ Recording frequency	Steam pressure at the outlet of the boiler and temperature of the feed water after the pump (inlet) are measured continuously respectively by a pressure and a temperature gauge through the DCS. The data is automatically saved daily to a database and extracted monthly to be used in the reported data. The log sheets are now used as a back-up.
Calculation method (if applicable)	
QA/QC procedures	The measuring equipment has been maintained as per the user manual.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data/Parameter	**GAS_p**
Unit	Nm^3
Description	Quantity of Gas
Measured/Calculated /Default	Measured + calculated
Source of data	Log Sheets / DCS
Value(s) of monitored parameter	1,759,474
Monitoring equipment	Instrument type: Normalised flow meter Manufacturer: Endress+Hauser Model: PROWIRL72F/ TR10/ Cerebar S PMP71 Serial Number: 9A10E602000/ A9090E14152/ A907400109C Tag Number: FT1039/94 / TT1038/97 / PT1037/96 Maximum Error: 1% / 2°C/ 5 kPa Calibration frequency: Once in three years Calibration date (FT1039): - 15-09-2011 - 23-09-2010 - 23-09-2009 Calibration date (TT1038): - 19-09-2011 - 22-09-2010 - 23-09-2009 Calibration date (PT1037): - 15-09-2011 - 22-09-2010 - 16-11-2009
Measuring/Reading/ Recording frequency	Measured continuously by a normalised flow meter that is part of the DCS. FT1039 receives automatically input from TT1038 and PT1037 and therefore gives the normalised flow as output.
Calculation method (if applicable)	
QA/QC procedures	The measuring equipment has been maintained as per the user manual.
Purpose of data	Calculation of project emissions.
Additional comment	

Data/Parameter	**NCV_{GAS}**
Unit	MJ/Nm^3
Description	Net Calorific Value of Gas
Measured/Calculated /Default	Indicated + calculated
Source of data	Gas Supplier Invoice
Value(s) of monitored parameter	30.501
Monitoring equipment	Instrument type: N/A (indicated by supplier)
Measuring/Reading/ Recording frequency	The gross calorific value for gas is a contractual parameter and is indicated in the monthly invoices by the gas supplier. The net calorific value is obtained as 90% of gross, as explained in the registered PDD.
Calculation method (if applicable)	
QA/QC procedures	This is a contractual parameter with the supplier.
Purpose of data	Calculation of project emissions.
Additional comment	

Data/Parameter	**EF_{GAS}**
Unit	$kgCO_2/TJ$
Description	Emission factor of gas
Measured/Calculated /Default	Indicated + calculated
Source of data	Monthly invoices/IPCC 2006 guidelines
Value(s) of monitored parameter	60,010
Monitoring equipment	Instrument type: N/A (indicated by supplier)
Measuring/Reading/ Recording frequency	
Calculation method (if applicable)	The emission factor of fossil fuel based gas is conservatively derived from the composition which is a contractual element from the supplier.
QA/QC procedures	The composition is a contractual element with the gas supplier.
Purpose of data	Calculation of project emissions.
Additional comment	

D.3. Implementation of sampling plan

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N/A

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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The formula used to calculate the amount of energy required for the amount of steam produced in the baseline is:

(2) $Er_b = St_b * (Se/Eb_b)$

Er$_b$ = 354,584 * (2,308/0.72)
= 1,144,556,999 MJ

Where:
Er_b= the quantity of energy required to produce the estimated amount of steam per year (in TJ/year).
St_b= the total estimated steam produced in the baseline (t/year).
Se= the energy content of the steam required (kJ/kg).
Eb_b= the efficiency of the original boiler.

The formula used to calculate the quantity of coal used in the baseline scenario:
(3) Co$_b$ = Er$_b$/CVc

Co$_b$ = 1,144,556,999 / 27.03
= 44,920 t

Where:
Co_b= the quantity of Coal used in the baseline (in tonnes) per year.
Er_b= the quantity of energy required to produce the estimated amount of steam per year (in TJ/year).
CVc = the net calorific value of coal utilised in the baseline (in TJ/kiloton).

The formula used to calculate the Baseline Emissions is:
(4) BE = Co$_b$ * EF_Co

BE = 44,920 * 2.56
= 107,719

Where:
BE = the Baseline Emissions (in t CO_2/year).
Co_b= the quantity of Coal used in the baseline scenario (in tonnes) per year.
EF_Co = the CO_2 emission factor per unit of coal associated with fuel combustion (e.g., CO_2/t).

E.2. Calculation of project emissions or actual net GHG removals by sinks
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The formula used to calculate the Project Activity Emissions is:
(1) PE = Co$_p$ * EF_Co + *GAS$_p$* * NCV$_{GAS}$ * EF$_{GAS}$ / 10^9

PE = 9,648 * 2.56 + 1,759,474 * 30.501 * 61,010 / 10^9
PE = 27,892

Where:
PE = the Project Activity Emissions (in t CO_2/year).
Co_p = the quantity of Coal used in the project scenario (in tonnes) per year. (Please note that this has been estimated for this calculation, but will be directly measured during the project activity).
EF_C = the CO_2 emission factor per unit of coal associated with fuel combustion (e.g., CO_2/t).
GAS_p = the quantity of Gas used in the project scenario (in Nm^3) per year. For the purpose of the estimations, the yearly consumption will be based on 2008 monitored data.
EF_{GAS} = the CO_2 emission factor per unit of Gas (in Kg_{CO2}/TJ). For the purpose of the estimations, the yearly consumption will be based on 2008 monitored data.
NCV_{GAS} = the net calorific value of Gas (in MJ/Nm^3). For the purpose of the estimations, the yearly consumption will be based on 2008 monitored data.

E.3. Calculation of leakage

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As per the registered PDD and methodology, there are no sources of leakage expected from the project.

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

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Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)	Project emissions or actual net GHG removals by sinks (tCO_{2e})	Leakage (tCO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)
Total	107,719	27,892	0	79,828

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

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This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-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 (tCO_2e)	166,941 tCO_2e/year	79,828 tCO_{2e}

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

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Less emission reductions have been achieved during the monitoring period than estimated ex-ante in the registered PDD.

The decrease in CERs is primarily attributed to lower steam generation due to technical problems with the boiler, bark shortage and planned maintenance work.

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History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Form **Business Function**: Issuance		