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

MONITORING REPORT

Title of the project activity	Lawley Fuel Switch Project
Reference number of the project activity	0177
Version number of the monitoring report	1
Completion date of the monitoring report	22/06/2012
Registration date of the project activity	06/03/2006
Monitoring period number and duration of this monitoring period	Monitoring period number: 02 Duration of monitoring period: 01/01/2007 – 31/12/2011
Project participant(s)	Corobrik (Pty) Ltd Statkraft Markets BV
Host Party(ies)	Republic of South Africa
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope: 04 Methodology: AM0008 Version 1.0
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	206,220 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	157,615 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The project entails the conversion from coal to natural gas in the brick baking kilns at Lawley Brick Factory (hence forth referred to as 'Lawley'). Lawley is wholly owned by Corobrik (Pty) Ltd South Africa, the largest supplier of bricks in South Africa, and one of the largest brick producers in the world.

(a) Purpose of the project activity

The purpose of the project activity is to reduce greenhouse gas emissions by replacing coal with natural gas (as thermal fuel) in the clay brick baking kilns at Lawley. The measures taken to reduce greenhouse gas emissions are listed below:

- The reduction of coal used at the factory reduces the fugitive methane emissions associated with coal mining and post mining activities, as well as the transport related emissions from the carrying of coal to the site.
- The conversion from coal to natural gas improves the environmental health conditions at the plant as there is a reduction in the airborne particulate levels (that result from the combustion of coal).
- Using natural gas as a thermal fuel increases the efficiency of the brick baking process and, as such there is a reduction in energy demand at the factory.

(b) Description of the installed technology and equipment

The conversion of coal to natural gas in the brick baking kilns involved the replacement of the kiln coal burners with their natural gas equivalents. An automated and integrated control system was also installed, and Lawley was connected to the local natural gas network.

(c) Relevant dates for the project activity

The conversion from coal to natural gas took place in December 2004. Due to an increase in the demand for bricks in 2005, Corobrik decided to increase the output of the Lawley plant in order to meet this demand. This was achieved by increasing the drying capacity of the plant by 6 more dryers; however the capacity of the kiln remained the same. The plant can theoretically produce approximately 106 million brick equivalents[1] per annum.

(d) Total GHG emission reductions

This monitoring period is from 01/01/2007 to 31/12/2011. The total emission reductions achieved in this monitoring period is 157,615 metric tonnes of CO_2 equivalent.

A.2. Location of project activity

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(a) Host Party

The host party of the project activity is the Republic of South Africa.

(b) Region/State/Province

The project activity is located in the Gauteng Province.

[1] The term 'brick equivalent' is used to refer to both bricks and pavers. The term brick equivalent is used in the national standards. A paver is a type of brick with different dimensions and is used for paving.

(c) City/Town/Community

The project activity is located on an industrial site near Lenasia, within the greater Johannesburg area.

(d) Physical/Geographical Location

The plant's physical address is:
Plot 147
Main Lawley Road
Lawley
Johannesburg.

The GPS coordinates are: 26° 21' 07" S, 27° 49' 17" 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 (host)	Corobrik (Pty) Ltd (private entity)	No
The Netherlands	Statkraft Markets BV (private entity)	No

A.4. Reference of applied methodology

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(a) The applied baseline and monitoring methodology is AM0008: 'Industrial fuel switching from coal and petroleum fuels to natural gas without extension of capacity and lifetime of the facility', (Version 01).

(b) No tools are referred to by the applied baseline and monitoring methodology.

A.5. Crediting period of project activity

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01/01/2005 – 31/12/2014 (fixed ten year crediting period)

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The section is written in accordance with version 01.0 of the 'Clean Development Mechanism Project Standard'.

(a) Description of the installed technology, technical processes and equipments

The Lawley kiln is a Transverse Arch Kiln (TVA), with 25 chambers per side, 50 in total. There are 22 firing ports and three thermocouple ports per chamber. The kiln was originally fired with D Grade duff coal. The coal was fed into the kiln via the firing ports, by means of mechanically driven stoker pots. The stoker pots were manually fed by operators, who shovelled the coal into the stoker pots on a continual basis, 24 hours a day, 365 days a year.

The conversion of coal to natural gas involved the replacement of these stoker pots with gas burners, installed at each firing port. Lawley was also connected to the local natural gas network for this project activity.

(b) Information on the implementation and actual operation of the project activity.

The conversion from coal to natural gas at Lawley took place in December 2004.

(c) Description of events or situations that occurred during the monitoring period that may impact the applicability of the applied methodology and how these issues were addressed.

No events or situations occurred during the monitoring period that impacted the applicability of the applied methodology.

(d) Request for prior approval by the Board of changes to the registered PDD.

This project activity was initially registered by the UNFCCC on 06/03/2006. The PDD was titled 'Lawley Fuel Switch Project, Version 4, dated 15 December 2005'. This PDD used a conservative manner to estimate the emission reductions by introducing a cap on brick production and using pro-rata factors, which was not fully in line with methodology AM0008 and the VVM. Since project registration, the project participant has been issued with Certified Emission Reductions for the years of 2005 and 2006 (18,098 and 17,032 tCO2e respectively).

During the second verification, the verifying DOE raised a Corrective Action Request regarding the conservative calculation of the emission reductions. This CAR could only be addressed by revising the PDD to reflect the emission reduction calculation approach of AM0008 more accurately (as described in this PDD, Version 8, 01/12/2010). This was achieved by removing conversion factors and the fixed capped baseline.

The Board approved these changes to the registered PDD on 02/03/2012.

B.2. Post registration changes

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

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Not applicable. There are no temporary deviations from the registered monitoring plan or applied methodology.

B.2.2. Corrections

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As described in section B.1 above, the emission reduction calculation approach was corrected post PDD registration. The conversion factors and the fixed capped baseline were removed from the emission reductions calculations in line with version 01.0 of AM0008. The board approved these changes on 02/03/2012. This monitoring report is written based on the revised PDD, dated 01/12/2010, version 08.

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

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Not applicable. There are no permanent changes from the registered monitoring plan or applied methodology.

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

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Not applicable. There are no changes to the project design of the registered project activity.

B.2.5. Changes to start date of crediting period

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Not applicable. There are no changes to the start date of the crediting period.

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

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Not applicable. This is not an afforestation or reforestation project.

SECTION C. Description of monitoring system

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The purpose of the monitoring system is to ensure that emission reductions are accurately reported. At the beginning of the project activity, the monitoring system was integrated as far as possible into the existing plant operating procedures.

(a) Data collection procedures

Data is collected on a daily basis and consolidated on a monthly basis. The actual measured data is entered into the "Emission Reduction Spreadsheet" to calculate the emission reductions for the monitoring period.

The data is also checked for quality control purposes against an independently measured value. Should there be any discrepancies in the data, the source of the variation is identified, and be it the main measured value or the quality control value. The incorrect value will be deleted and the measured data compared to historical and predicted values before being finally recorded.

The data is consolidated by the factory based Administration Controller, who also draws up the monthly and annual emission reduction monitoring reports. The bulk of data required for the monitoring of the emission reductions comes from data already collected as part of the plant's operations.

(b) Day-to-day record handling procedures

Day-to-day record keeping is done according to a fixed programme indicating what measurements are taken, who is responsible, and how the data is processed, as outlined in the table below:

Variable	Monitoring interval	Monitoring methodology	Responsible person	Quality control	Data storage procedure
Natural gas consumption	Daily	Automatic reading of flow rate meters	Production manager (Backup: Kiln supervisor)	Compare with Sasol gas invoices	Data is manually recorded and entered into a spreadsheet table
Brick and paver production volumes	Monthly	Manual recording of brick and paver production	Production manager (Backup: Admin controller)		Data is manually recorded and entered into a spreadsheet table

(c) Organisational structure

The Lawley Plant has a clear and well defined management structure as indicated in the management structure organogram below (Figure 1). This management structure has been developed over the 20 years that the plant has been in operation and is based on Corobrik's extensive experience in running brick plants. Other Corobrik plants using similar management structures have been ISO certified.

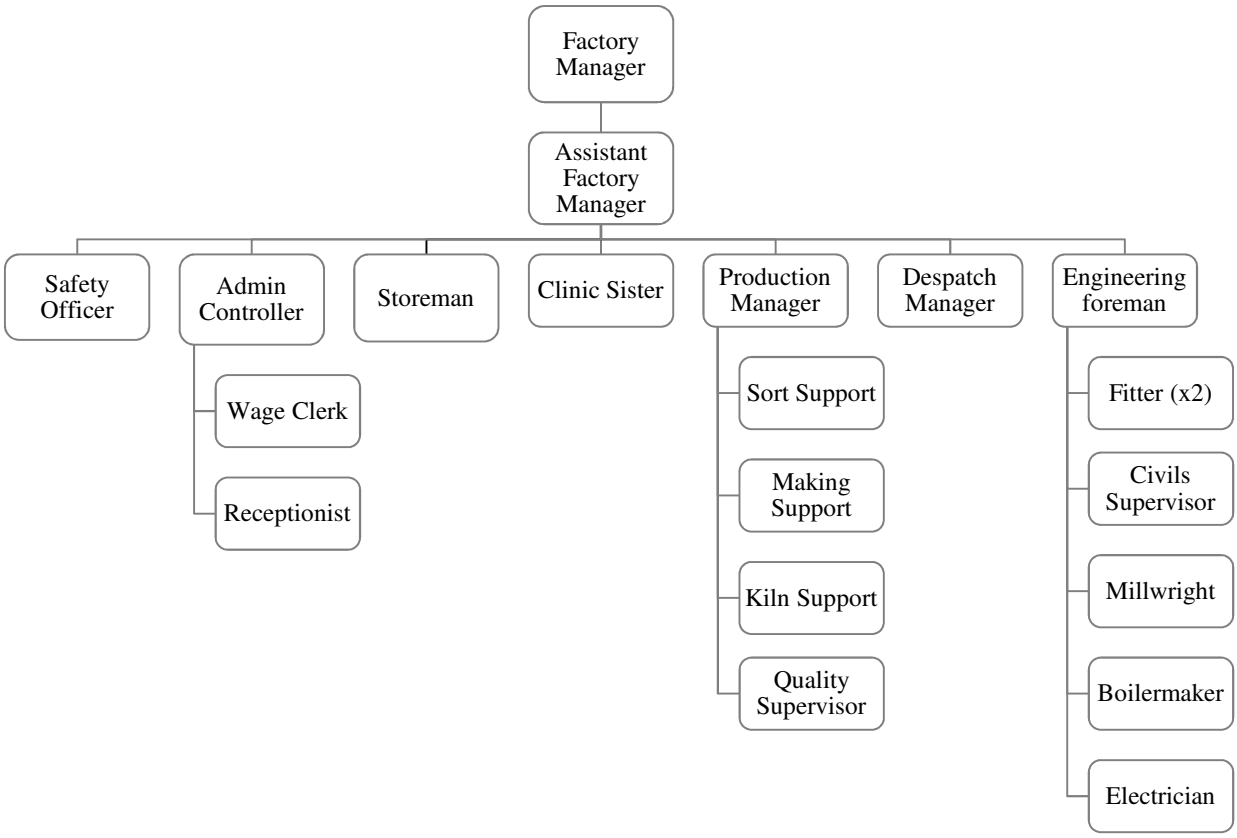

Figure 1: Lawley Factory Management Structure

(d) Roles and responsibilities of personnel

Overall responsibility at the plant lies with the factory manager who also has final responsibility for the CDM project at the Lawley plant. The management structure is flat with the factory manager and the production manager having direct and personal day to day responsibilities in the running of the plant. A production manager oversees a kiln supervisor and production supervisors. Maintenance is the responsibility of the maintenance foreman. The factory manager has final responsibility for all aspects relating to data measurements, monitoring of data recording and emissions and will sign off all reports on monitoring.

Data and project performance is reviewed by the admin controller and the factory manager on a monthly basis against predicted and historical values. The consolidated annual project emission reduction report is reviewed by Corobrik's auditors for compliance, before being submitted for verification.

(e) Emergency procedures for the monitoring system

The following emergency events can be foreseen which could have an impact on the project's emission reductions or the data collection procedures:

- Unscheduled plant shutdown.

- Leakage in the natural gas supply and distribution system.

In the case of an unforeseen plant shut down due to power outages or production problems, the data monitoring procedure as described in the monitoring plan will be able to pick up any resulting increase or reduction in fuel use. The impact of the unforeseen stoppage will therefore be reflected in the monthly emission reduction reports.

A check of the gas tightness of the flexible gas supply couplings to the burner lances is carried out on a periodic basis. A solution of soapy water is sprayed onto the joint area, and any gas seepage shows up as bubbling. This gas seepage is recorded and rectified immediately at the time of undertaking the test.

In the event of a rupture, or break or blockage of the gas pipe line distribution system on the kiln, the resulting decrease or increase in pressure, the EN746:2:1997 compliant multi-valve pipe train supplying natural gas to the kiln distribution system automatically shuts of the gas supply.

Resumption of the gas supply will only take place once the cause of the pressure loss or increase has been corrected and the built in leak detection sequence automatically initiates at the gas supply re-start phase confirms zero gas leakage.

(f) Calibration of monitoring equipment

The only relevant monitoring equipment for this project relates to the consumption of natural gas. Two measuring stations have been installed on site and are operated respectively by the natural gas supplier (Sasol) and by Corobrik. The control equipment and flow rate measurement equipment at each metering station has been installed and compliance tested according to the relevant installation and safety codes (EN 746-2:1997). The metering equipment was calibrated by Sasol. The metering equipment is calibrated at a minimum of every three years basis by Sasol, in accordance with Sasol's protocol.

(g) Maintenance of monitoring equipment and installations

The monitoring equipment at the Sasol customer meter station is operated and maintained by Sasol, the natural gas provider. The monitoring equipment at the TVA kiln is operated by Corobrik. Routine maintenance is conducted as specified by the relevant industrial safety acts and at regular intervals and includes:

- Daily visual inspection of the integrity and soundness of all piping, joints and valves.
- Daily cross check of the supply gas pressure reading at the PC VDU and the incoming gas supply meter.
- Daily recording of the Sasol GJ supplied readout and the customer supply station GJ usage readout for the previous 24 hours.
- Monthly recording of both m^3 and GJ consumption from both the Sasol station, and customer meter station.

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

Data/Parameter	$\eta_{n\_}F_i$
Unit	1000 brick equivalents/GJ
Description	Fuel efficiency for use of fuel i (baseline) scenario, where i is coal
Source of data	Plant records
Value(s) applied	0.151
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF\_F_{i.}CO_{2y}$
Unit	tCO_2/MJ
Description	CO_2 emission factor per unit combustion coal
Source of data	IPCC guidelines for National GHG Inventories: Ref. Manual vol 3, 1996. Table 1-1 Default value
Value(s) applied	0.00009607
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$FC\_F_i\_CH_4$
Unit	tCH_4/MJ
Description	CH_4 emission factor of coal associated with fuel combustion
Source of data	IPCC guidelines for Nat. GHG Inventories: Ref. Manual vol 3, 1996. Table 1-6
Value(s) applied	0.00000000110
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	GWP_CH_4
Unit	tCO_2e/tCH_4
Description	Global warming potential of CH_4
Source of data	Default value as specified by version 01.0 of AM0008
Value(s) applied	21
Purpose of data	Calculation of baseline and project emissions
Additional comment	-

Data/Parameter	$FC\_F_i\_N_2O$
Unit	tN_2O/MJ
Description	N_2O emission factor of coal associated with fuel combustion
Source of data	IPCC guidelines for Nat. GHG Inventories: Ref. Manual vol 3, 1996. Table 1-16
Value(s) applied	0.0000000016
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	GWP_N_2O
Unit	tCO_2e/tN_2O
Description	N_2O
Source of data	Global warming potential of N_2O
Value(s) applied	310
Purpose of data	Calculation of baseline and project emissions
Additional comment	-

Data/Parameter	EF_NG
Unit	tCO_2/MJ
Description	CO_2 emission factor per unit of natural gas associated with fuel combustion
Source of data	Natural gas supplier (Sasol Model Calculation: 0.023959473 m^3 CO_2/MJ x 1.9772 kg/m^3= 47.37 kg CO_2/GJ)
Value(s) applied	0.00004737
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	$FC\_NG\_CH_4$
Unit	tCH_4/MJ
Description	CH_4 emission factor per unit of natural gas associated with fuel combustion
Source of data	IPCC default value
Value(s) applied	0.00000000110
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	$FC\_NG\_N_2O$
Unit	$tonN_2O/MJ$
Description	N_2O emission factor of natural gas associated with fuel combustion
Source of data	IPCC default value
Value(s) applied	0.00000000230
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	$FE\_NG\_CH_4$
Unit	tCH_4/MJ
Description	CH4 emission factor of natural gas associated with fugitive emissions
Source of data	IPCC guidelines for Nat. GHG Inventories: Ref. Manual vol 3, 1996. Table 1-64
Value(s) applied	0.0000003
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	$FE\_F_i\_CH_4$
Unit	tCH_4/MJ
Description	CH_4 emission factor of coal associated with fugitive emissions
Source of data	Boschmans Colliery
Value(s) applied	0.00000000578
Purpose of data	Calculation of project emissions
Additional comment	-

Data/Parameter	EF_TF_k
Unit	tCO_2/MJ
Description	CO2 emission factor concerning the transportation of coal in the baseline scenario
Source of data	Corobrik and South Africa Road Freight Association 2004
Value(s) applied	0.000072098
Purpose of data	Calculation of leakage emissions
Additional comment	-

D.2. Data and parameters monitored

Data/Parameter	Q_NG_y
Unit	GJ
Description	Total quantity of natural gas in the project scenario for replacing coal all of the coal used in the TVA kiln in the baseline scenario.
Measured/Calculated /Default	Calculated.
Source of data	Sasol gas invoices.
Value(s) of monitored parameter	Year / Q_NG_y: 2007: 468,450; 2008: 466,402; 2009: 290,938; 2010: 287,031; 2011: 389,449
Monitoring equipment	Sasol metering equipment for quantity of gas consumed and the energy content of the natural gas.
Measuring/Reading/ Recording frequency	Daily recording of the Sasol GJ supplied readout and the customer supply station GJ usage readout for the previous 24 hours.
Calculation method (if applicable)	The quantity of natural gas consumed is calculated by multiplying the energy content of the natural gas by the volume of gas consumed.
QA/QC procedures	Daily cross check of the supply gas pressure reading at the PC VDU and the incoming gas supply meter.
Purpose of data	Calculation of project emissions.
Additional comment	-

Data/Parameter	*Brick equivalents produced*
Unit	-
Description	Quantity of brick equivalents produced.
Measured/Calculated /Default	Measured.
Source of data	Plant records
Value(s) of monitored parameter	See table below
Monitoring equipment	Not applicable. Manual recording of brick and paver production
Measuring/Reading/ Recording frequency	Monthly
Calculation method (if applicable)	Not applicable.
QA/QC procedures	-
Purpose of data	Calculation of baseline and project emissions.
Additional comment	-

Year	Quantity of brick equivalents produced
2007	103,630,558
2008	91,279,954
2009	65,559,689
2010	68,389,885
2011	79,764,592

D.3. Implementation of sampling plan

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Not applicable. The parameters in section D.2 are not determined by a sampling approach.

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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As per methodology ACM0008 (Version 01.0), the baseline emissions BE_y (measured in ton of CO_2 equivalents (tCO_2e/yr) during year (*y*) is expressed as:

$$BE_y = \sum_i Q\_F_{i,y} \times \left(EF\_F_i CO_{2y} + FC\_F_i CH_4 \times GWP\_CH_4 + FC\_F_i N_2O \times GWP\_N_2O\right)$$

Where:

$Q\_F_{i,y}$ Quantity of fuel *i* used in the baseline scenario, measured in energy units (e.g., Joule).

EF_F_i CO_2 equivalent emission factor per unit of energy of fuel *i* (e.g., tCO_2e/Joule).

$FC\_F_i CH_4$ The IPCC default CH_4 emission factor of fuel *i* associated with fuel combustion, measured in tCH_4/Joule.

$FC\_F_i N_2O$ The IPCC default N_2O emission factor of fuel *i* associated with fuel combustion, measured in tN_2O /Joule.

GWP_CH_4 The global warming potential of CH_4 set as 21 tCO_2e/tCH_4 for the first commitment period.

GWP_N_2O The global warming potential of N_2O set as 310 tCO_2e/tN_2O for the first commitment period.

Year	BE_y	$Q\_F_{i,y}$	$EF\_F_i\_CO_2$	$FC\_F_i\_CH_4$	GWP_CH_4	$FC\_F_i\_N_2O$	GWP_N_2O
	tCO_2e/y	GJ	tCO_2e/MJ	tCH_4/MJ	tCO_2e/tCH_4	tN_2O/MJ	tCO_2e/tN_2O
2007	66,212	685,519	9.607E-05	1.0E-09	21	1.6E-09	310
2008	58,321	603,817	9.607E-05	1.0E-09	21	1.6E-09	310
2009	41,888	433,679	9.607E-05	1.0E-09	21	1.6E-09	310
2010	43,696	452,400	9.607E-05	1.0E-09	21	1.6E-09	310
2011	50,963	527,646	9.607E-05	1.0E-09	21	1.6E-09	310

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

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As per methodology ACM0008 (Version 01), the project emissions PE_y (measured in ton of CO_2 equivalents (tCO_2e/yr) during year (y) is expressed as:

$$PE_y = \left(\sum_i Q_i\_NG_y\right) \times (EF\_NG + FC\_NG\_CH_4 \times GWP\_CH_4 + FC\_NG\_N_2O \times GWP\_N_2O)$$

Where:

$Q_i\_NG_y$ Quantity of natural gas used in the project scenario for replacing $Q\_F_{i,y}$ quantity of fuel i used in the baseline scenario, measured in energy units (e.g., Joule).

$Q\_NG_y = (\sum_i Q_i\_NG_y)$ Total quantity of natural gas in the project scenario for replacing all quantity of fuel i used in some element process in the baseline scenario.

EF_NG The IPCC default CO_2 emission factor per unit of natural gas associated with fuel combustion (e.g., tCO_2/Joule).

$FC\_NG\_CH_4$ The IPCC default CH_4 emission factor per unit of natural gas associated with fuel combustion (e.g., tCH_4/Joule).

$FC\_NG\_N_2O$ The IPCC default N_2O emission factor per unit of natural gas associated with fuel combustion (e.g., t N_2O/Joule).

Year	PE_y	$Q_i\_NG_y$	EF_NG	$FC\_NG\_CH_4$	GWP_CH_4	$FC\_NG\_N_2O$	GWP_N_2O
	tCO_2e/y	GJ	tCO_2e/MJ	tCH_4/MJ	tCO_2e/tCH_4	tN_2O/MJ	tCO_2e/tN_2O
2007	22,535	468,450	4.737E-05	1.1E-09	21	2.3E-09	310
2008	22,437	466,402	4.737E-05	1.1E-09	21	2.3E-09	310
2009	13,996	290,938	4.737E-05	1.1E-09	21	2.3E-09	310
2010	13,808	287,031	4.737E-05	1.1E-09	21	2.3E-09	310
2011	18,735	389,449	4.737E-05	1.1E-09	21	2.3E-09	310

E.3. Calculation of leakage

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As per methodology ACM0008 (Version 01), the leakage LE_y (measured in ton of CO_2 equivalents (tCO_2e/yr) during year (y) is expressed as:

$$LE_y = \left[Q\_NG_y \times FE\_NG\_CH_4 - \sum_i (Q\_F_{i,y} \times FE\_F_i\_CH_4)\right] \times GWP\_CH_4 + \left[\sum_j (Q\_TF_{j,y} \times EF\_TF_j) - \sum_k (Q_{TF_{k,y}} \times EF_{TF_k})\right]$$

Where $FE\_NG\_CH_4$ and $FE\_F_i\_CH_4$ are the IPCC default CH4 emission factors of natural gas and fuel *i* associated with fugitive emissions.

Year	LE_y	Q_NG_y	$FE\_NG\_CH_4$	$Q\_F_{i,y}$	$FE\_F_i\_CH_4$	EF_{TF_k}
	tCO_2e/y	GJ	tCH_4/MJ	GJ	tCH_4/MJ	tCO_2e/MJ
2007	2,433	468,450	3.0E-07	685,519	1.0E-09	7.21E-05
2008	4,495	466,402	3.0E-07	603,817	1.0E-09	7.21E-05
2009	1,505	290,938	3.0E-07	433,679	1.0E-09	7.21E-05
2010	1,466	287,031	3.0E-07	452,400	1.0E-09	7.21E-05
2011	2,055	389,449	3.0E-07	527,646	1.0E-09	7.21E-05

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

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	261,080	91,511	11,954	157,615

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 (tCO_2e)	206,220	157,615

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

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The actual emission reductions realised are smaller than the values applied in the ex-ante calculation in the PDD. This is due to zero brick equivalent production in the months of December 2008, January 2009, November 2009, December 2009, January 2010, November 2010 and December 2010. No bricks were produced during this period due to lack of demand in the construction and building industries.

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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		