PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Fuel Switch at Corobrik's Driefontein Brick Factory in South Africa
Version number of the PDD	05
Completion date of the PDD	27/11/2014
Project participant(s)	Corobrik (Pty) Ltd
Host Party(ies)	South Africa
Sectoral scope(s) and selected methodology(ies)	Sectoral scope: 04 Methodology: AMS-III.Z (version 04.0)
Estimated amount of annual average GHG emission reductions	37,944 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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A complete fuel switch was implemented in December 2007 at Driefontein Brick Factory, which is an existing brick factory wholly owned by Corobrik (Pty) Ltd, (hereafter refer to as Corobrik) South Africa. This fuel switch entailed the conversion of the thermal fuel used in the clay brick-firing tunnel kiln at Driefontein Brick Factory. The fuel conversion was from coal to natural gas and involved the extension of the Sasol-owned natural gas pipeline and the installation of a combustion system.

Corobrik is the largest manufacturer, distributor and exporter of bricks and allied building products in Africa. Corobrik was established in Durban in 1902. Corobrik owns factories in Avoca, Driefontein, Glencoe, Lawley, Midrand, Odendaalsrus, Phesantekraal, Polokwane, Rietvlei, Springs, and Witbank, and employs over two thousand people countrywide.

The decision to develop the project under the CDM was made at the Board Meeting on 28 March 2007 where the project activity received the final approval from the Directors. The Driefontein conversion took place in December 2007 so the tunnel kiln has been operating on natural gas since the year of 2008. Validation of the project was held back in order to incorporate the lessons learnt in a similar fuel switch project at their Lawley factory (Project no. 0177). The Lawley fuel switch was registered on 6 March 2006 and was the first project in South Africa to receive carbon credits (13 June 2008).

The Driefontein project commenced with validation of this project on 09 February 2010 (as being the first day of the Global Stakeholder Comment Period). However, the project was rejected by the EB of the UNFCCC based on the applicability of methodology AMS-III.B. Hence, the project is reapplying for registration using AMS-III-Z: Fuel Switch, Process Improvement Efficiency in Brick Manufacture, Version 4.0.

The project has led to a reduction in greenhouse gas emissions and a more reliable fuel supply. The estimated annual average emission reductions resulting from the project activity are 37,944 tCO_2e, with a total of 265,610 tCO_2e of GHG emission reductions estimated over the project's seven year renewable crediting period.

The project makes positive contributions to sustainable development. The South African Designated National Authority (DNA) evaluates sustainability in three categories: economic, environmental and social. The contribution of the project towards sustainable development is discussed in terms of these three categories:

Economic:
Once registered, the project will contribute to foreign reserve earnings for South Africa via the carbon credit sales revenue.

Environmental:
The project resulted in a healthier work environment as coal and its associated negative impacts were eliminated. The project led to a reduction in airborne particulate levels at the plant resulting from the combustion of coal. Furthermore, the burning of coal also resulted in sulphur emissions, which have been eliminated in this fuel switch. The gasifiers used to combust the coal and generate the producer gas were decommissioned and demolished on 08/11/2010, with the steel sold as scrap metal.

Social:
The Corobrik employees have benefited by the creation of a healthier work environment. Eighteen employees were affected by the fuel switch. They were re-deployed to the furnaces and there were no job losses. They received on-the-job training. The training included familiarisation and training on the gas line and total gas system in the factory. This included normal operation, maintenance and emergency

procedures. These training sessions were held during the month of March 2009. All the operators and maintenance personnel were included in these training sessions.

A.2. Location of project activity

A.2.1. Host Party(ies)

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The Host Party is South Africa.

A.2.2. Region/State/Province etc.

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Driefontein is located in the North West Province.

A.2.3. City/Town/Community etc.

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Driefontein is located 15 km from Carletonville. Driefontein falls within the Ramotshere Moiloa Local Municipality within the Ngaka Modiri Molema District Municipality.

A.2.4. Physical/ Geographical location

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The physical address of the plant is:
Portion 23/27
Driefontein Farm
District Ngaka Modiri Molema
North West Province

The Provincial Location of Corobrik Driefontein (http://www.id.org.za/policies/adopted-policies/policy-images/rsa_map.jpg)

The GPS co-ordinates of the site are:
Latitude: -26.352219

Longitude: +27.528611

A.3. Technologies and/or measures

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This project involves a fuel switch at the Corobrik Driefontein Brick Factory. Prior to the fuel switch, coal was combusted in onsite gasifiers to generate producer gas, which was then used in the tunnel kiln for brick firing. The gasifiers at Driefontein were commissioned in 1969 and 1973 and were well maintained. According to an independent external assessor, these gasifiers would have been able to remain operational and deliver producer gas to the kiln for a period exceeding the crediting period. The original coal gasifiers (used prior to project implementation) were decommissioned and demolished on 08/11/2010.

The conversion from coal to natural gas involved the extension of the Sasol-owned natural gas pipeline and the installation of kiln burners and a fire control system. This system consists of:

- 50 kiln burner plates;
- 124 burner plates;
- 16 burner spigots;
- 20 nozzles and 2 ignition transformers;
- 20 flaming electrodes for furnace zone burners;
- 20 ignition electrodes for preheat zone burners;
- 20 flaming electrodes for preheat zone burners; and an
- ICS burner control unit.

The project activity also involves the:

- Installation of an air, gas and electrical reticulation system;
- Installation of new thermocouples and compensating cables;
- Upgrade of the kiln transformer, switchgear and cable;
- Installation of a new instrumentation panel.

The primary aim of this project activity was to switch from coal to natural gas. This fuel switch was based on a similar project that was implemented (and successfully registered under the CDM) at Corobrik's Lawley Brick Factory.

There have been no changes to the design of the tunnel kiln, and the kiln capacity remained the same before and after the fuel switch. Even through brick production is driven by supply and demand, the brick production was relatively constant in the baseline and project cases (138 million bricks were produced annually in the baseline (2005-2007), and 115 million bricks were produced annually in the project case (2008)). As such, there is no energy efficiency improvement as a result of the fuel switch.

In terms of monitoring the emission reductions generated by the project activity:

- The natural gas flow rate is measured by a Sasol-owned gas meter, which is temperature and pressure corrected. Sasol averages the energy content of this gas on a monthly basis and provides an invoice to Corobrik Driefontein. This invoice includes the quantity of gas consumed (in normal cubic meters) and the calorific value of the gas. Corobrik compares the Sasol meter readings on a daily basis with the meter readings from a Corobrik-owned meter. The Corobrik-owned gas meter is not pressure and temperature corrected, so there are always slight discrepancies in the readings.
- The quantity of bricks produced each day are manually recorded and collated monthly by the assistant factory manager.

A.4. Parties and project participants

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	No

A.5. Public funding of project activity

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No public funding has been or will be used in the project activity.

A.6. Debundling for project activity

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As per the '*Guidelines on assessment of debundling for SSC Project Activities, Version 03*' (EB54, Annex 13), the project activity is not a debundled large scale project since it does not meet the criteria for a debundled component of a large project activity:

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:	**Project activity**
(a) With the same project participants	Corobrik has one registered project; which is the Lawley Fuel Switch and is a large scale project.
(b) In the same project category and technology/measure; and	There is no registered small-scale CDM project activity in the same project category and technology/measure.
(c) Registered within the previous 2 years, and	There is no registered small-scale CDM project activity that was registered within the previous two years.
(d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.	There is no small-scale activity within 1km of this project's boundary.

Hence, the project is not a debundled component of a large scale project activity.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

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AMS- III.Z. Fuel Switch, process improvement and energy efficiency in brick manufacture (version 04.0)

Applied Methodological Tools:

- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" Version 02, Annex 11, EB 41.
- "Tool for the demonstration and assessment of additionality", Version (07.0.0), Annex 08, EB70

B.2. Project activity eligibility

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Criteria	Justification
1.The methodology comprises one or more technology/measures listed below in brick production facilities: - *Shift to an alternative brick production technology/process; or* - *Complete/Partial substitution of fossil fuels with renewable biomass (including solid biomass residues such as sawdust and food industry organic liquid residues); or* - *Complete/partial substitution of high carbon fossil fuels with low carbon fossil fuels*	The project activity entails a complete substitution of high carbon fossil fuels (coal) with low carbon fossil fuels (natural gas). The project activity therefore meets this applicability criterion.
2. Complete or partial fuel substitution and associated activities may also result in improved energy efficiency of existing facility; however project activities primarily aimed at emission reductions from energy efficiency measures shall apply AMS-II.D "Energy efficiency and fuel switching measures for industrial facilities". Thus, the methodology is applicable for the production of: *(a) Bricks that are the same in the project and baseline cases; or* *(b) Bricks that are different in the project case versus the baseline case due to a change(s) in raw materials, use of different additives, and/or production process changes resulting in reduced use or avoidance of fossil fuels for forming, sintering (firing) or drying or other applications in the facility as long as it can be demonstrated that the service level of the project brick is comparable to that of the baseline brick (see paragraph 11). Examples include pressed mud blocks (soil blocks) with cement or lime stabilization[5] and other 'unburned' bricks that attain strength due to fly ash, lime/cement and gypsum chemistry.*	The primary aim of this project activity was to switch from coal to natural gas. This fuel switch was based on a similar project that was implemented (and successfully registered under the CDM) at Corobrik's Lawley Brick Factory. There have been no changes to the design of the tunnel kiln, and the kiln capacity remained the same before and after the fuel switch. Even through brick production is driven by supply and demand, the brick production was relatively constant in the baseline and project cases (138 million bricks were produced annually in the baseline (2005-2007), and 115 million bricks were produced annually in the project case (2008)). As such, there is no energy efficiency improvement as a result of the fuel switch. The fuel switch did not cause a difference in the brick characteristics, as the production process remains the same, and only the fuel source was changed. The bricks that are produced at Corobrik's Driefontein Brick Factory are the same in project and baseline cases. Therefore criterion (a) is applicable.
3. The measures may replace, modify, retrofit[6] systems or add capacity to systems in existing facilities or be installed in a new facility.	As part of the project activity, the onsite coal gasifier was decommissioned. Instead of the producer gas produced by the gasifier, natural gas, obtained via a natural gas pipeline is used. There is no change in the brick kiln capacity. The measure modifies the existing system and therefore meets this applicability criterion.

4. New facilities (Greenfield projects) and project activities involving capacity additions are only eligible if they comply with the requirements for Greenfield projects and capacity increase projects specified in the "General Guidelines for SSC CDM methodologies".	The project activity does not consist of a Greenfield project or a capacity addition. The project activity therefore meets this applicability criterion.
5. The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General Guidelines for SSC CDM methodologies". If the remaining lifetime of the affected systems increases due to the project activity, the crediting period shall be limited to the estimated remaining lifetime, i.e. the time when the affected systems would have been replaced in the absence of the project activity.	In accordance with the UNFCCC tool for equipment lifetime "Tool to determine the remaining lifetime of equipment (EB 50, Annex 15)" an expert input was obtained to review the ongoing capital expenditure on the gasifier prior to the fuel switch, the maintenance record and actual state of the equipment. The production records for the last 20 years are used as proof that no industrial incident occurred that shortened the remaining technical lifetime of the gasifiers. The original coal gasifiers, used in the project baseline, have been decommissioned and are no longer operational. The expert concluded that the expected lifetime of the decommissioned gasifiers exceeds the project lifetime as the gasifiers could produce gas indefinitely if maintained in a reasonable manner. The independent expert expanded on the term 'reasonable manner' by stating that if the gasifiers continued to be adequately maintained, as was evident in the condition of the plant on inspection, the plant would be able to operate and perform for more than 50 years.
6. For existing facilities, it shall be demonstrated, with historical data, that for at least three years immediately prior to the start date of the project implementation, only fossil fuels (no renewable biomass) were used in the brick production systems that are being modified or retrofitted. In cases where small quantities of biomass were used for experimental purposes this can be excluded.	The fuel switch at the Corobrik-Driefontein facility took place in December 2007. Historical data showing fossil fuel use for the previous three years is made available as supporting documentation. The project activity therefore meets this applicability criterion.
7. The renewable biomass utilized by the project activity shall not be chemically processed(e.g. esterification to produce biodiesel, degumming and/or neutralization by chemical reagents) prior to the combustion but it may be processed mechanically (e.g. pressing, filtering)/thermally (e.g. gasification to produce syngas).[7]	Not applicable, as no biomass is used in the fuel switch.

8. In cases where the project activity uses crops from renewable biomass origin as fuel, the crops should be cultivated at dedicated plantations and the following conditions shall be met: *(a) The project activity does not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed project activity can continue to provide at least the same amount of goods and services as it would in the absence of the project;* *(b) The plantations are established on land that:* *(i) Was classified as degraded or degrading at the start of the project implementation, as per the "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities"; or* *(ii) Is included in the project boundary of one or several registered A/R CDM project activities;* *(c) Plantations established on peatlands are not eligible even if qualifying under condition (i) or (ii) above.*	Not applicable, as no biomass is used in the fuel switch.
9. In cases where the project activity utilizes charcoal produced from renewable biomass as fuel, the methodology is applicable provided that: *(a) Charcoal is produced in kilns equipped with a methane recovery and destruction facility; or* *(b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered.*	Not applicable, as no charcoal is used in the fuel switch.
10. In the case of project activities involving changes in raw materials (including additives), it shall be demonstrated that additive materials are abundant in the country/region, according to the following procedures: ***Step 1****: using relevant literature and/or interviews with experts, a list of raw materials to be utilized is prepared based on the historic and/or present consumption of such raw materials.* ***Step 2****: the current supply situation for each type of raw material to be utilized is assessed and their surplus availability is demonstrated using one of the approaches below:* • *Approach 1: demonstrate that the raw*	The project does not involve process or raw material changes. The kiln operates the same and utilizes the same raw materials in the project activity as in the baseline. Ash with a calorific value of 7.3 GJ/ton is used as an additive (body coal) for its visual impact. The same amount of ash was added to the bricks before and after the fuel switch. Therefore, the 'body coal' was excluded from both the baseline and the project emissions. There is enough ash on site to last for approximately 30 years of brick production. Ash was produced as a by-product of the gasification process in the baseline.

materials to be utilized, in the region of the project activity, are not fully utilized. For this purpose, demonstrate that the quantity of material is at least 25% greater than the demand for such materials or the availability of alternative materials for at least one year prior to the project implementation; ・ *<u>Approach 2</u>: demonstrate that suppliers of the raw materials to be utilized, in the region of the project activity, are not able to sell all of their supply of these materials. For this purpose, project participants shall demonstrate that a representative sample of suppliers of the raw materials to be utilized, in the region, had a surplus of materials (e.g. at the end of the period during which the raw material is sold) that they could not sell and that is not utilized.*	As the project activity doesn't involve a change in raw materials, this applicability criterion is complied with.
11. This methodology is applicable under the following conditions: *(a) The service level of project brick shall be comparable to or better than the baseline brick, i.e. the bricks produced in the brick production facility during the crediting period shall meet or exceed the performance level of the baseline bricks (in terms of, for example dry compressive strength, wet compressive strength, density). An appropriate national standard shall be used to identify the strength class of the bricks; bricks that have compressive strengths lower than the lowest class bricks in the standard are not eligible under this methodology. Project bricks are tested in nationally approved laboratories at six-month intervals (at a minimum) and test certificates on compressive strength are made available for verification;* *(b) The existing facilities involving modification and/or replacement shall not influence the production capacity beyond ±10% of the baseline capacity unless it is demonstrated that the baseline for the added capacity is the same as that for the existing capacity in accordance with paragraph 4 above;* *(c) Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.*	a) The bricks produced by Corobrik's Driefontein Factory are tested against SANS 227-2007. This standard provides a list of requirements for burnt clay masonry units (bricks). These requirements include shape, appearance, texture, colour, dimensions, warpage, compressive strength, efflorescence and soundness, methods of test for water absorption, water-soluble salts, and moisture expansion and information on compressive strength of engineering units, and the usage rate of units per square metre of walling. Corobrik's bricks have passed all SANS 227-2007 since the fuel switch, showing that project scenario bricks meet the performance levels required in South Africa. These performance levels were also met in the baseline. b) Brick production is driven by supply and demand, the brick production was relatively constant in the baseline and project cases (138 million bricks were produced annually in the baseline (2005-2007), and 115 million bricks were produced annually in the project case (2008)). c) Ex-ante emission reductions are calculated to be 37,944 tCO_2 per year, which is less than the 60 kt CO_2 limit for small scale methodologies.

12. This methodology is not applicable if local regulations require the use of the proposed technologies or raw materials for the manufacturing of bricks unless widespread non compliance (i.e. less than 50% of brick production activities in the country comply) of the local regulation evidenced.	Natural gas will be used in the project activity after the fuel switch. Neither the use of previously used fuel (coal) nor the use of new fuel (Natural Gas) is against regulations.

B.3. Project boundary

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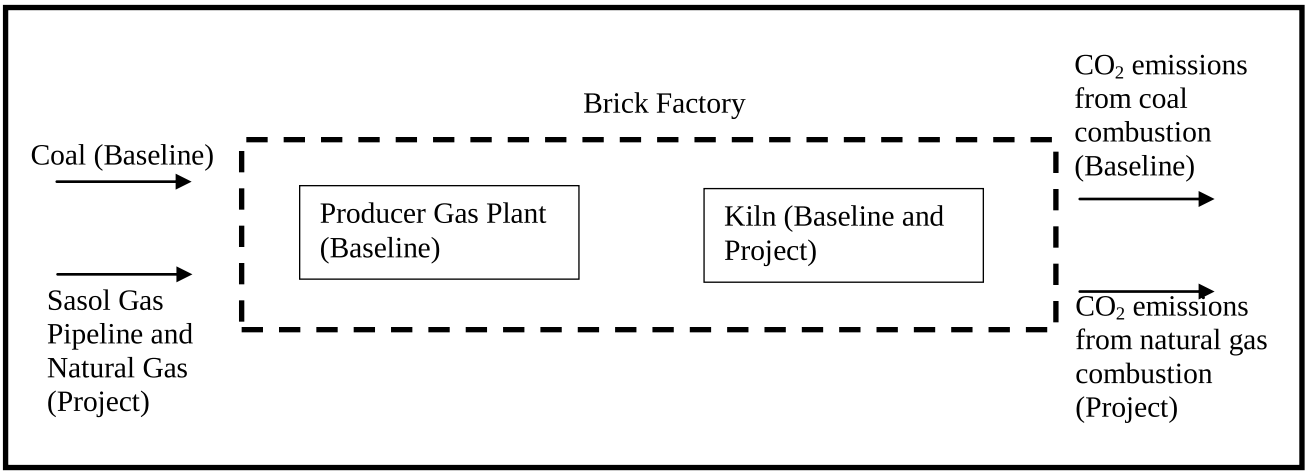
As per paragraph 13 of the methodology, *"The project boundary is the physical, geographical site where the brick production takes place during both the baseline and crediting periods. It also includes all installations, processes or equipment affected by the switching.*"

The project boundary consists of:

1. The tunnel kiln;
2. The Sasol owned natural gas pipeline;
3. The coal used prior to the switch;
4. The natural gas used post the fuel switch;
5. The decommissioned producer gas plant.



In order to be conservative, the reduction in emissions from no longer needing to transport the coal will not be included in the project boundary.

B.4. Establishment and description of baseline scenario

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As per paragraph 14 of the methodology AMS-III.Z Version 4.0, *"The baseline emissions are the fossil fuel consumption related emissions (fossil fuel consumed multiplied by an emissions factor) associated with the system(s), which were or would have otherwise been used, in the brick production facility(ies) in the absence of the project activity:*

a) *For projects that involve replacing, modifying or retrofitting systems in existing facilities, the average of the immediately prior three-year historical fossil fuel consumption data, for the existing facility, shall be used to determine an average annual baseline fossil fuel consumption value. Similarly, prior three-year historical baseline brick production rate in units of weight or volume. For calculating the emission factor, reliable local or national data shall be used. IPCC default values shall be used only when country or project specific data are not available or demonstrably difficult to obtain;"*

Since the project activity involves the modification of an existing system, the baseline emissions are determined using three-year historical fossil fuel consumption data for the existing facility (option (a) as per paragraph 14 of the methodology AMS-III.Z Version 4.0). The coal consumption (and calorific values of the coal) for the three years prior to the fuel switch (2005 – 2007) is presented in the table below. These figures were obtained from invoices and coal analysis reports.

Coal consumption (tonnes)			
	2005	**2006**	**2007**
Jan	2,650.47	2,351.95	2,533.53
Feb	2,440.29	2,151.15	2,280.07
Mar	2,571.5	2,466.66	2,532.00
Apr	2,215.41	2,439.82	2,630.12
May	2,470.31	2,093.44	2,634.00
Jun	2,389.41	2,333.44	2,597.71
Jul	2,481.04	2,500.66	2,818.38
Aug	2,520.88	2,201.46	2,801.47
Sep	1,278.59	2,201.46	2,793.44
Oct	2,480.54	2,360.40	2,688.58
Nov	2,370.09	2,514.62	2,600.31
Dec	2,398.87	2,493.26	2,687.00

Coal Calorific Value (MJ/kg)			
Month	**2005**	**2006**	**2007**
Jan	28.369	27.432	27.054
Feb	26.730	26.111	26.039
Mar	28.612	27.471	26.039
Apr	26.634	27.936	27.286
May	25.916	25.969	27.286
Jun	26.398	27.251	26.673
Jul	28.286	27.175	27.614
Aug	28.213	28.107	27.289
Sep	26.766	27.807	27.289
Oct	26.727	27.160	27.289
Nov	27.230	27.600	27.289
Dec	26.777	27.600	27.289

B.5. Demonstration of additionality

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As per the ‘Guidelines on the demonstration of additionality of small-scale project activities (version 09.0)’, the project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the recognised barriers.

The most appropriate barrier is the investment barrier, which according to the guidelines should prove that a financially more viable alternative to the project activity would have led to higher emissions.

The investment barrier is demonstrated and assessed using the latest version of "Tool for the demonstration and assessment of additionality" (Version 07.0.0).

Since small scale projects are not required to use the "Tool for the demonstration and assessment of additionality", only steps 1 and 2 of the tool will be applied to demonstrate the investment barrier.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations
Step 2: Investment analysis

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

The following alternative scenarios for generating the energy needed in the brick-firing kiln (which are consistent with current laws and regulations) have been identified:

a. The replacement of coal with natural gas (proposed project activity) without being registered as a CDM project activity.
b. The replacement of coal with Heavy Furnace Oil (HFO).
c. The use of coal to produce the energy needed for brick-firing (continuation of current activity).
d. The use of Eskom electricity to produce the energy needed for brick firing.
e. The replacement of coal with diesel
f. The replacement of coal with renewable biomass

Paragraph 22 of the "Tool for demonstration of assessment and additionality version 07" states: "F*or the purpose of identifying relevant alternative scenarios, the project participant should include the technologies or practices that provide outputs (e.g. cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas as the proposed CDM project activity and that have been implemented previously or are currently being introduced in the relevant country/region.*"

Options (d) and (e) cannot be considered realistic and credible alternatives to the project activity as no brick making kilns in South Africa operate on the energy produced from electricity/diesel.

Option (f) cannot be considered a realistic and credible alternative to the project activity as there is not sufficient biomass fuel available in the region. This was confirmed in a letter from an independent renewable energy company.

Step 2: Investment analysis

The tool requires the project proponent to determine whether the proposed project activity is not:

a) The most economically or financially attractive; or
b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

To conduct the investment analysis, the following sub-steps have been followed:

Sub-step 2a: Determine appropriate analysis method

In the "Tool for the demonstration and assessment of additionality" (Version 07.0.0), three options are available for investment analysis: the simple cost analysis (Option I), the investment comparison analysis (Option II) and the benchmark analysis (Option III).

Option II, the investment comparison analysis was decided to be the most appropriate analysis method. This is because the revenue before and after the project will remain the same. There is no additional revenue as a result of project implementation, and therefore it is not possible to perform a benchmark analysis. The nature of the project is such that it does not have an impact on the revenue generated by the business.

This is in accordance with version 05 of the "Guidelines on the assessment of investment analysis" which states: "*If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used…The purpose of an investment analysis in the context of the CDM is to determine whether the project is less financially attractive than at least one alternative in which the project participants could have invested.*"

Sub-step 2b: Option II. Apply investment comparison analysis

The most financially viable supply of energy to the brick making facility is the option that will give the least cost of energy supply over a given period of time. This is calculated as a Net Present Value (NPV).

Sub-step 2c: Calculation and comparison of financial indicators

The NPV value of each scenario is calculated as it is found to be the most suitable way to compare the different project alternatives.

The NPV values for all scenarios presented in Step 1 are presented below:

Alternative scenario	NPV	Comments
a. The replacement of coal with natural gas (proposed project activity) without being registered as a CDM project activity	-140,178,941	
b. The replacement of coal with Heavy Furnace Oil	-315,190,782	
c. The use of coal to produce the energy needed for brick-firing (continuation of current activity)	-94,191,027	Lowest cost option (without the CDM)
d. The proposed project activity undertaken as a CDM project activity	-84,805,720	

The following input data was used in the investment analysis:

Input Data	**Source**
Monetary value used is ZAR	-
The South African inflation rate in 2007 was between 3%-6%. As such, an average value of 4.5% is applied.	Supporting document: (73) SA inflation rate 2007 from the National Assembly 14 March 2007
A prime lending rate of 12.5% is applied	See supporting document (77)
Capital cost: ZAR30 million for the extension of the Sasol Gas Pipeline, and ZAR11,370,178 of fuel switch related costs	Capital costs can be found in supporting document 'Addendum to Gas Supply Agreement with SASOL, (26-09-2006)" The supporting docs for the ZAR 11,370,178 are "Conversion to Natural Gas Project Cost" and "Cost code 32BS.1650 for conversion"
Prices and costs as at February/March 2007 were used in the investment analysis calculations	-
Fuel Prices in 2007 a. Coal: ZAR 322.60/ton	a. Cost of coal (26-03-2007), as obtained from internal order database.

Coal: ZAR 12.46/GJ b. Natural Gas: ZAR 32.48/GJ Natural Gas: ZAR 26/GJ c. HFO fuel: ZAR 89.90/GJ	Based on calorific value Coal obtained from 'Coal Analysis Report, 2004-2007' b. Sasol Natural Gas invoices (February-November 2008) Sasol Gas contract (26 September 2006) c. HFO price (R/l) was obtained from document Supply of Sasol Fuel Oil 150 (HFO 150). Average density and Lower Heating Value of HFO from the Engineering Toolbox: http://www.engineeringtoolbox.com/fuels-higher-calorific-values-d_169.html
Material Prices Duff: ZAR35.00/ton Tar: ZAR390/ton	Duff: Duff Supply Invoices November 2006, and January-March 2007. Tar sales, March 2007
Regular maintenance on gasifiers ZAR441,666	In-house maintenance cost
CER price €13.00	Refer to the 'State and Trends of the Carbon Market 2007', published by the World Bank. The document states that '*CER assets traded considerably higher (in 2007) in secondary markets (in a range of US$14.30-19.50 or €11-15)*'. The midpoint/average of this is €13.
Cost of Demolition of gasifiers: ZAR 0.	The demolition of the gasifiers was not included in the initial capital cost of the project. At the start of the project activity, the gasifiers were kept on site in case Corobrik needed to switch back to coal if the fuel switch was not feasible. As such, the cost to demolish the gasifiers and the revenue from the scrap steel has been excluded from the investment analysis. These costs and revenues were not considered at the time of the investment decision.

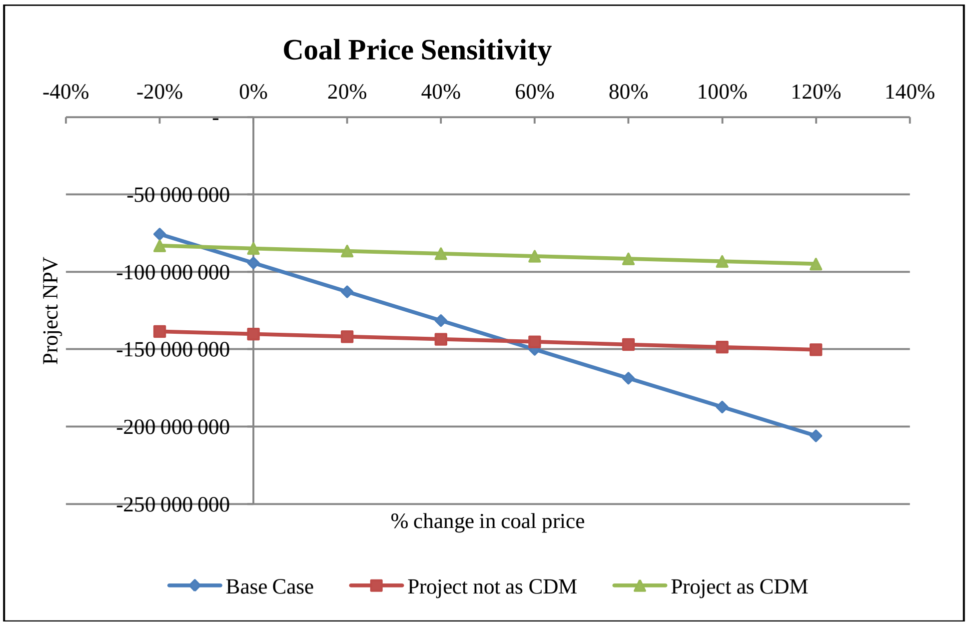
The NPV for the proposed project scenario where natural gas is used to produce the energy needed for brick-firing, is lower (more negative) than that of baseline scenario. As such, the most economic option would be to continue using coal to produce energy needed for brick-firing.

Sub-step 2d: Sensitivity Analysis

In accordance with the '*Guidelines on the assessment of investment analysis (version 05)*', the following sensitivity analyses have been performed on aspects affecting project cost:

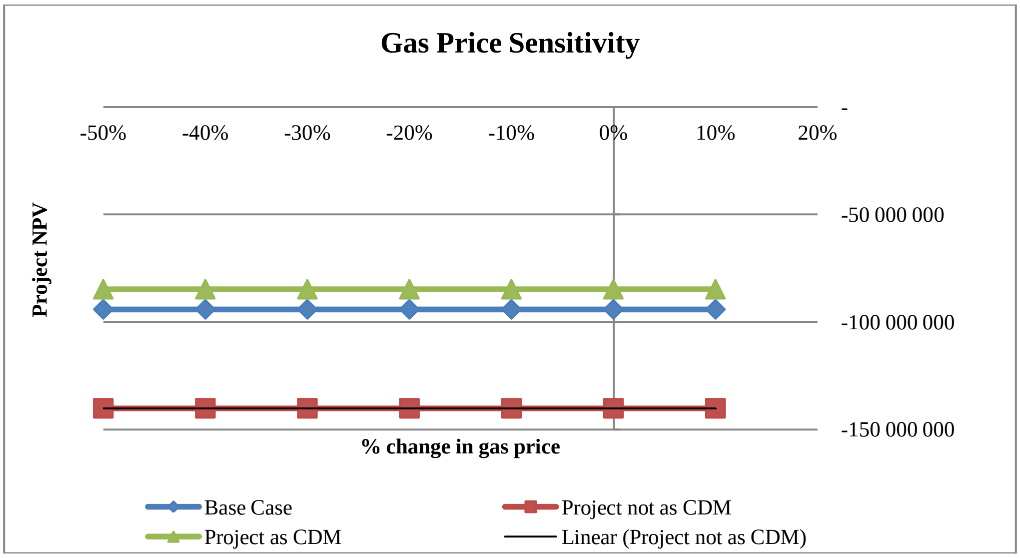
- Coal price
- Natural gas price
- Heavy fuel oil price
- Investment cost

Sensitivity Analysis 1:
By how much must the coal price rise to make coal more expensive than natural gas?



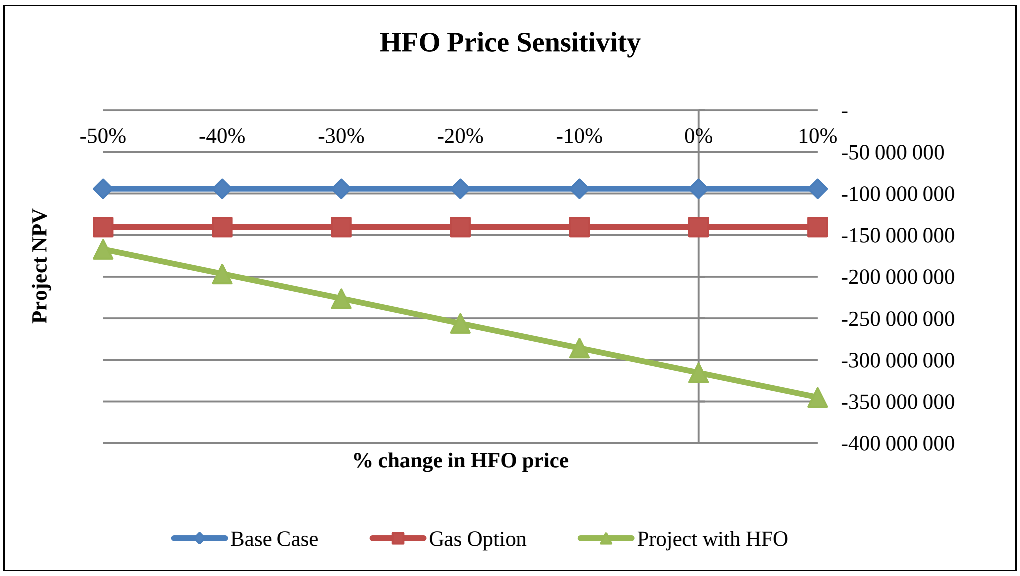
From the above graph it can be seen that a rise of 54% in coal price would make the coal more expensive than natural gas. The probability of such an increase is extremely low given the availability of coal in South Africa.

Sensitivity Analysis 2:
By how much must the natural gas price decrease to make coal more expensive than natural gas?



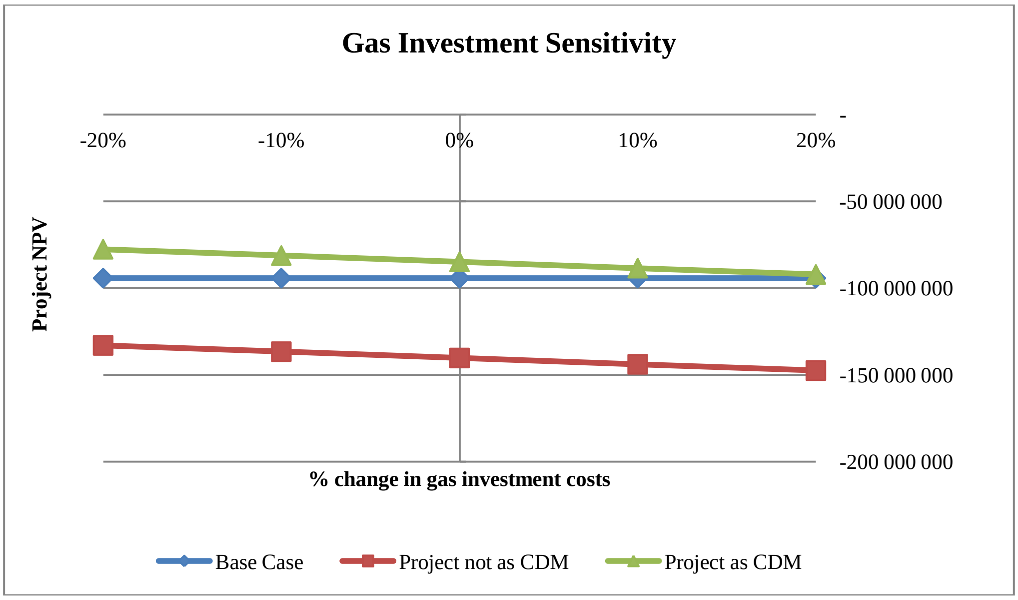
From the graph it can be seen that a decrease of 50% in natural gas price still doesn't make natural gas cheaper than coal.

Sensitivity Analysis 3:
By how much must the Heavy Fuel Oil price decrease to make natural gas more expensive than Heavy Fuel Oil?



If heavy fuel oil prices decreases with by more than 50%, a fuel switch to heavy fuel oil will be more profitable than a natural gas fuel switch. This decrease in heavy fuel oil costs is however very unlikely as the heavy fuel oil price is related to crude oil prices, which are not expected to come down by more 50%.

Sensitivity Analysis 4:
By how much must the project (gas switch) investment costs decrease to make the project more profitable than the base case?



As shown in the graph above, a 20% investment cost reduction doesn't make the project NPV come close to the base case NPV. It is unlikely that the investment costs are reduced with more than 20% at any point in time.

Outcome of Step 2

The above presented sensitivity analyses show that the proposed project activity is not the most economically attractive option and is not financially feasible without the revenue from the sales of the CERs. The most financially viable option is to keep using coal for brick-firing which would result in higher emissions.

CDM Consideration

Date	Progress
22 Apr 2005	Carbon buyer visits Corobrik Driefontein to review and discuss the potential of the Driefontein fuel switch project being developed as a CDM project
7 Nov 2005	Telephone conference between Statkraft (Stef Peters), Corobrik (Dirk Meyer) and Nu Planet (Anton-Louis Olivier) further discussing the Corobrik Driefontein fuel switch project as a CDM project
8 Nov 2005	Plan of study for environmental scoping for extension of the pipeline
Dec 2005	Statkraft and Corobrik sign the amended ERPA for Corobrik Lawley which includes additional CERs, expectedly from the Corobrik Driefontein project.
3 Jul 2006	Completion of the environmental management plan for the extension of the pipeline
26 Sept 2006	Signing of the Sasol gas supply contract by Mr. Trevou, MD of Corobrik
8 Dec 2006	Proposal to revamp the kiln to operate on natural gas
17 Jan 2007	Preparation of the document for the meeting of the board members. The document refers to the CDM and potential revenue of the project.
Jan 2007	Construction Licence for the extension of the pipeline was received
13 Feb 2007	Record of Decision for the EIA for the pipeline extension was received
28 Mar 2007	Board meeting with discussion of the Driefontein project
4 Jun 2007	Email from Statkraft about the development of the PDD for the Driefontein Project: ERPA discussion
01 Jun 2007	Invoice being raised by Sasol for R25 million for the Sasol pipeline to be constructed for Corobrik. A contract with Sasol was signed, which would become legally binding once all conditions precedent were met. Of the two conditions precedent (a positive environmental record of decision and all required licenses for the gas pipe), only the environmental record of decision was obtained when both parties agreed to continue with the project. This resulted in an invoice being raised on the 1st of June 2007 and the payment being raised on the 30th of June. The operation license for the Sasol pipeline was obtained 12-11-2010.
11 June 2007	**Construction of the pipeline started. This date is seen as the first real action on the project and is therefore chosen as the starting date, due to the fact that** excavation and root clearing of vegetation was started on this date to make way for the pipeline.
30 Jun 2007	A first payment of R25 million for the Sasol Pipeline is made by Corobrik (Pty) Ltd.
25 Sep 2007	Email sent to Nu Planet, CDM developer, to develop the Driefontein fuel switch as a CDM project
23 Oct 2007	First draft of the Driefontein PDD by NuPlanet
Dec 2007	Implementation of the Driefontein fuel switch (Sasol gas invoices as reference); the February 2008 invoice shows that first consumption must have occurred in January 2008.
23 Jan 2008	Corobrik meeting to discuss progress of the Driefontein PDD

Date	Progress
15 Sep 2008	Corobrik contacts Promethium Carbon to work on Driefontein project
9 Oct 2008	Promethium proposal accepted and work on the PDD begins. Site visit by Promethium to Driefontein Factory
20 Feb 2009	Stakeholder consultation for the CDM project commences
Feb 2009	Draft PDD completed by Promethium
20 Mar 2009	Requested quote for validation of Driefontein Fuel Switch Project from SGS
14 Apr 2009	Requested quote for validation of Driefontein Fuel Switch Project from Tuev Nord and ERM
9 Apr 2009	Quote received from SGS
8 May 2009	Quote received from ERM
9 May 2009	Quote received from Tuev Nord
19 Aug 2009	Tuev Nord quote is accepted by Corobrik, but unfortunately it had expired. Hence, an updated quote was requested from Tuev Nord.
Aug - Nov 2009	Follow up on proposal from Tuev Nord
20 Nov 2009	Updated quote received from Tuev Nord
1 Feb 2010	PDD uploaded for global stakeholder consultation by Tuv Nord
18 June 2012	Validation concluded by Tuv Nord
29 June 2012	PDD submitted to EB
17 May 2013	PDD rejected by EB
13 August 2013	Promethium Carbon revises PDD on new methodology
1 November 2013	Carbon Check contracted to perform validation
19 November 2013	PDD uploaded for global stakeholder consultation on UNFCCC website

It is important to note that the implementation of the project could only take place in December of any given year in order to coincide with the holidays of the construction industry. Less bricks are required during the holidays for the construction industry.

B.6. Emission reductions

B.6.1. Explanation of methodological choices
>>

Baseline Emissions

$$BE_y = EF_{BL} \times P_{PJ,y} \qquad (1)$$

Where:

BE_y The annual baseline emissions from fossil fuels displaced by the project activity in tCO_2e in year y (of the crediting period)

EF_{BL} The annual production specific emission factor for year y, in tCO_2/kg or m^3

$P_{PJ,y}$ The annual net production of the facility in year y in kg or m^3

$$EF_{BL} = \sum_{j,i} \left(FC_{BL,i,j} \times NCV_j \times EF_{CO2,j} \right) / P_{Hy} \qquad (2)$$

Where:

$FC_{,BL}$ Average annual baseline fossil fuel consumption value for fuel type j combusted in the process I, using volume or weights units

NCV_j Average net calorific value of fuel type j combusted, TJ per unit volume or mass unit

$EF_{CO2,j}$ CO_2 emission factor of fuel type j combusted in the process i in tCO_2/TJ

P_{Hy} Average annual historical baseline brick production rate in accordance with paragraph 14(a), in units of weight or volume, kg or m^3

Leakage Emissions

As per paragraph 19 of AMS-III.Z *'In the case of project activities involving a change in the production process or a change in the type or quantity of raw and/or additive materials as compared to the baseline, the incremental emissions associated with the production / consumption and transport of those raw and/or additive materials consumed as compared to baseline, shall be calculated as leakage.'*

No changes in type or quantity of raw and / or additive material use occurred; therefore no leakage is expected.

Project Emissions

$$PE_y = PE_{elec,y} + PE_{fossilfuel,y} + PE_{transporty} + PE_{cultivation,y} + PE_{CH4,y} \quad (3)$$

PE_y Project emissions in year y (tCO_2)
$PE_{elec,y}$ Project emissions due to electricity consumption in year y (tCO_2)
$PE_{fossilfuel,y}$ Project emissions due to fossil fuel consumption in year y (tCO_2)
$PE_{transport,y}$ *Project emissions from transportation of the renewable biomass from the places of their origin to the manufacturing facility site in year y (tCO_2)*
$PE_{cultivation,y}$ *Project emissions from renewable biomass cultivation in year y (tCO_2)*
$PE_{CH4,y}$ *Project emissions due to the production of charcoal in kilns not equipped with a methane recovery and destruction facility in year y (tCO_2e)*

Calculation of $PE_{elec,y}$

The emissions include electricity consumption (including auxiliary use), calculated as per the tool '*Tool to calculate baseline, project and / or leakage emissions from electricity consumption*'.

Within the fuel switch project boundary itself no electricity is consumed and therefore these emissions are not included in the Project Emissions.

Calculation of $PE_{fossilfuel,y}$

The emissions include fossil fuel consumption associated with the operation of the manufacturing process, calculated as per the '*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*' (version 02):

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y} \quad (4)$$

$PE_{FC,j,y}$ Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr)
$FC_{i,j,y}$ Is the quantity of fuel type *i* combusted in the process *j* during the year *y* (mass or volume units/year)
$COEF_{i,y}$ Is the CO_2 emission coefficient for fuel type *i* in year *y* (tCO_2/mass or volume unit)
i Are the fuel types combusted in process *j* during the year *y*

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \quad (5)$$

$COEF_{i,y}$	Is the CO_2 emission coefficient for fuel type *i* in year *y* (tCO_2/mass or volume unit)
$NCV_{i,y}$	Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	Is the weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)
i	Are the fuel types combusted in process *j* during the year *y*

<u>Emission Reductions</u>

$$ER_y = BE_y - PE_y \quad (6)$$

Where:

ER_y	Emission reductions in year y (tCO_2e/yr)
BE_y	Baseline emissions in year y (tCO_2e/yr)
PE_y	Project emissions in year y (tCO_2/yr)
LE_y	Leakage emissions in year y (tCO_2/yr)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$FC_{BL,i,coal}$
Unit	Tonnes/month
Description	Average annual baseline fossil fuel consumption value for fuel type j (coal) combusted in the process i, using volume or weights units
Source of data	Corobrik Coal Records (Supporting document 27 and 27b)
Value(s) applied	see table below
Choice of data or Measurement methods and procedures	Not applicable.
Purpose of data	Used to calculate baseline emissions.
Additional comment	-

Coal Consumption (tonnes)			
	2005	**2006**	**2007**
Jan	2650.47	2351.95	2533.53
Feb	2440.29	2151.15	2280.07
Mar	2571.5	2466.66	2532.00
Apr	2215.41	2439.82	2630.12
May	2470.31	2093.44	2634.00
Jun	2389.41	2333.44	2597.71
Jul	2481.04	2500.66	2818.38
Aug	2520.88	2201.46	2801.47
Sep	1278.59	2201.46	2793.44
Oct	2480.54	2360.40	2688.58
Nov	2370.09	2514.62	2600.31
Dec	2398.87	2493.26	2687.00

Data / Parameter	$EF_{CO2,coal}$
Unit	tCO_2/TJ
Description	CO_2 emission factor of fuel type j (coal) combusted in the process i in tCO2/TJ
Source of data	2006 IPCC Guidelines
Value(s) applied	94.6
Choice of data or Measurement methods and procedures	Since project-specific or national data is not available, the emission factor is sourced from the 2006 IPCC Guidelines.
Purpose of data	Used to calculate baseline emissions.
Additional comment	-

Data / Parameter	NCV_{coal}
Unit	TJ/tonne
Description	Average net calorific value of fuel type j (coal) combusted, TJ per unit volume or mass unit
Source of data	From coal analysis records (Supporting document 21 Central Laboratory Coal Analysis)
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	The net calorific value of coal is measured by the Corobrik Central Laboratory on a quarterly basis.
Purpose of data	Used to calculate baseline emissions.
Additional comment	-

NCV coal (TJ/t)			
	2005	**2006**	**2007**
Jan	0.028	0.027	0.027
Feb	0.027	0.026	0.026
Mar	0.029	0.027	0.026
Apr	0.027	0.028	0.027
May	0.026	0.026	0.027
Jun	0.026	0.027	0.027
Jul	0.028	0.027	0.028
Aug	0.028	0.028	0.027
Sep	0.027	0.028	0.027
Oct	0.027	0.027	0.027
Nov	0.027	0.028	0.027
Dec	0.027	0.028	0.027

Data / Parameter	P_{Hy}
Unit	tonne
Description	Average annual historical baseline brick production rate
Source of data	Plant records
Value(s) applied	137,618
Choice of data or Measurement methods and procedures	The tonnes of bricks produced in the baseline are calculated by multiplying the quantity of bricks by the average mass of the brick.
Purpose of data	Used to calculate baseline emissions.
Additional comment	-

Data / Parameter	$EF_{CO2,natural\ gas}$
Unit	tCO_2/TJ
Description	Is the weighted average CO_2 emission factor of natural gas in year y
Source of data	2006 IPCC Guidelines
Value(s) applied	64.2
Choice of data or Measurement methods and procedures	Default emission factor provided by the IPCC.
Purpose of data	Used to calculate project emissions.
Additional comment	-

Data / Parameter	EF_{BL}
Unit	tCO_2/tonne brick
Description	Annual production specific emission factor
Source of data	Historical records
Value(s) applied	0.548
Choice of data or Measurement methods and procedures	EF_{BL} is calculated ex-ante from the: • Average annual baseline coal consumption • Average net calorific value of coal • CO_2 emission factor of coal • Average annual historical brick production rate
Purpose of data	Used to calculate baseline emissions.
Additional comment	-

B.6.3. Ex-ante calculation of emission reductions

>>

Baseline Emissions

Equation 1

$$BE_y = EF_{BL} \times P_{PJ,y}$$

Year	BE_y	EF_{BL}	$P_{PJ,Y}$
	tCO_2e	tCO_2/tonne bricks	tonnes brick
2015	63 115	0.54802	115 170
2016	63 115	0.54802	115 170
2017	63 115	0.54802	115 170
2018	63 115	0.54802	115 170
2019	63 115	0.54802	115 170
2020	63 115	0.54802	115 170
2021	63 115	0.54802	115 170

Equation 2

$$EF_{BL} = \sum_{j,i} \left(FC_{BL,i,j} \times NCV_j \times EF_{CO2,j} \right) / P_{Hy}$$

Year	EF_{BL}	FC_{BL}	NCV_{coal}	$EF_{CO2,coal}$	P_{Hy}
	tCO_2/tonne brick	kg	TJ/kg	tCO_2/TJ	tonne brick
2015	0.54802	29 324 110	0.00002719	94.6	137 618
2016	0.54802	29 324 110	0.00002719	94.6	137 618
2017	0.54802	29 324 110	0.00002719	94.6	137 618
2018	0.54802	29 324 110	0.00002719	94.6	137 618
2019	0.54802	29 324 110	0.00002719	94.6	137 618
2020	0.54802	29 324 110	0.00002719	94.6	137 618
2021	0.54802	29 324 110	0.00002719	94.6	137 618

Project Emissions

Equation 3

$$PE_y = PE_{elec,y} + PE_{fossifuel,y} + PE_{transporty} PE_{cultivation,y} + PE_{CH4,y}$$

Year	PE_y	$PE_{elec,y}$	$PE_{fossilfuel,y}$	$PE_{transport,y}$	$PE_{cultivation,y}$	$PE_{CH4,y}$
	tCO_2	tCO_2	tCO_2	tCO_2	tCO_2	tCO_2
2015	25 170	-	25 170	-	-	-
2016	25 170	-	25 170	-	-	-
2017	25 170	-	25 170	-	-	-
2018	25 170	-	25 170	-	-	-
2019	25 170	-	25 170	-	-	-
2020	25 170	-	25 170	-	-	-
2021	25 170	-	25 170	-	-	-

Tool to calculate project or leakage CO2 emissions from fossil fuel combustion

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Year	$PE_{FC,j,y}$	$FC_{i,j,y}$	$COEF_{i,y}$
	tCO_2	Nm^3	tCO_2/m^3
2015	25 170	10 715 039	0.0023
2016	25 170	10 715 039	0.0023
2017	25 170	10 715 039	0.0023
2018	25 170	10 715 039	0.0023
2019	25 170	10 715 039	0.0023
2020	25 170	10 715 039	0.0023
2021	25 170	10 715 039	0.0023

Tool to calculate project or leakage CO2 emissions from fossil fuel combustion

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Year	$COEF_{i,y}$	$NCV_{i,y}$	$EF_{CO2,i,y}$
	tCO_2/m^3	GJ/m^3	tCO_2/GJ
2015	0.0023	0.0366	0.0642
2016	0.0023	0.0366	0.0642
2017	0.0023	0.0366	0.0642
2018	0.0023	0.0366	0.0642
2019	0.0023	0.0366	0.0642
2020	0.0023	0.0366	0.0642
2021	0.0023	0.0366	0.0642

Emission Reductions

Equation 4

$$ER_y = BE_y - PE_y$$

Year	ER_y	BE_y	PE_y	LE_y
	tCO_2e	tCO_2e	tCO_2e	tCO_2e
2015	37 944	63 115	25 170	-
2016	37 944	63 115	25 170	-
2017	37 944	63 115	25 170	-
2018	37 944	63 115	25 170	-
2019	37 944	63 115	25 170	-
2020	37 944	63 115	25 170	-
2021	37 944	63 115	25 170	-

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2e)	Project Emissions (tCO_2e)	Leakage (tCO e)	Emission Reductions (tCO_2e)
2015	63 115	25 170	0	37 944
2016	63 115	25 170	0	37 944
2017	63 115	25 170	0	37 944
2018	63 115	25 170	0	37 944
2019	63 115	25 170	0	37 944
2020	63 115	25 170	0	37 944
2021	63 115	25 170	0	37 944

Total:	**441 803**	**176 193**	**0**	**265 610**
Total number of crediting years	Seven years (renewable twice)			
Annual average over the crediting period	63 115	25 170	0	37 944

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$P_{PJ,y}$
Unit	Tonnes of bricks produced per year
Description	The annual brick production of the Corobrik Driefontein Factory in year *y*
Source of data	Quantity of bricks and brick weight
Value(s) applied	115,170
Measurement methods and procedures	Amount of bricks produced are monitored daily. The average brick weight is based on brick weight tests conducted monthly.
Monitoring frequency	Annual
QA/QC procedures	Cross check with financial records from the factory
Purpose of data	Baseline emission calculations
Additional comment	-

Data / Parameter	$FC_{natural\ gas,y}$
Unit	Nm^3/yr
Description	Amount of fossil fuel (natural gas) consumed for captive energy generation in the project activity in year y
Source of data	The natural gas consumption is recorded on the Sasol invoices.
Value(s) applied	10,715,039
Measurement methods and procedures	The Sasol natural gas meter is compensated for temperature and pressure.
Monitoring frequency	Monthly
QA/QC procedures	The Sasol gas invoices will be checked against the Corobrik Driefontein gas meter readings. Should there be a material discrepancy in the trend of the data from the invoices and the Corobrik meter (taking into consideration that the Corobrik meter is not compensated for temperature and pressure), the source of the variation will be identified. The quality assurance is provided in the certificate of calibration conducted by SANAS (Calibration Laboratory). The document is provided as a supporting document: (56) Gas temperature and pressure correcter – calibration certificates.
Purpose of data	To calculate project emissions.
Additional comment	-

Data / Parameter	$NCV_{natural\ gas,y}$
Unit	GJ/Nm^3
Description	Net calorific value for the fossil fuel (natural gas) used in the project case
Source of data	Sasol invoices supply the monthly gross calorific value (GCV) for natural gas used. This is converted to net calorific value (NCV) by multiplying the GCV value by the factor 0.9031.
Value(s) applied	0.03666
Measurement methods and procedures	Average value calculated for the year. The Sasol invoices for natural gas contain the gross calorific value of the gas. The calorific value is typically in GJ/Nm^3 and can be converted into TJ/Nm^3 by dividing by 1000.
Monitoring frequency	Monthly
QA/QC procedures	Check that there are no significant changes in the calorific value every month.
Purpose of data	To be used in equation 5 to calculate project emissions related to fossil fuel use
Additional comment	The Sasol invoices contain the GCV of the natural gas. In future NCV might appear directly on the invoice; however until that is the case, the reported GCV will be converted to NCV by multiplying the GCV value by the factor 0.9031, as per Sasol gas specification.

Data / Parameter	$Test_{unit}$
Unit	N/A
Description	Test to validate that the project bricks meet the performance requirements and specifications
Source of data	Laboratory
Value(s) applied	N/A
Measurement methods and procedures	Brick samples will be sent to a SABS accredited laboratory for sampling
Monitoring frequency	Every 6 months
QA/QC procedures	The quality assurance for the brick samples were tested by SANAS (Testing Laboratory) and accredited under the SANS 227-2007 methodology. The document is provided as a supporting document: (63) SANAS external brick performance testing.
Purpose of data	In accordance with paragraph 28c in the methodology AMS-III.Z, “Tests to validate that the project bricks meet the performance requirements and specifications at six-month intervals.”
Additional comment	-

Data / Parameter	Material Consumption $_{clay}$
Unit	tonnes
Description	Clay consumed for brick production (principal raw material)
Source of data	Quarry records will be kept to confirm the monthly consumption of clay.
Value(s) applied	Not applicable. This parameter is used for cross-checking purposes, and not for calculating emission reductions.
Measurement methods and procedures	Measured by mass.
Monitoring frequency	Monthly
QA/QC procedures	N/A
Purpose of data	These records are kept for quality assurance purposes .
Additional comment	-

Data / Parameter	Material Consumption $_{ash}$
Unit	tonnes
Description	Ash consumed for brick production (principal additive material)
Source of data	Stockpile records will be kept to confirm the monthly consumption of ash.
Value(s) applied	Not applicable.
Measurement methods and procedures	Measured by mass.
Monitoring frequency	Monthly
QA/QC procedures	N/A
Purpose of data	These records are kept for quality assurance purposes.
Additional comment	The ash that is mixed into the bricks is a by-product of the coal that was burned in the baseline scenario (as part of the gasification process). The ash has been stockpiled on site and has a lifetime of 30 years.

B.7.2. Sampling plan
>>
Not applicable

B.7.3. Other elements of monitoring plan
>>
The purpose of this Monitoring Plan (MP) is to provide a procedure by which Corobrik Driefontein can conduct the monitoring of the proposed project activity. The MP is in accordance with all relevant rules and regulations of the CDM.

Driefontein will follow the MP in order to measure and track the project activity and prepare for the periodic verification process required to confirm the amount of CERs received. The management and operation of the project is the responsibility of Driefontein.

1 Overall project management

The Driefontein Plant has a clear and well defined management structure. The management structure has been developed over the years that the plant has been in operation and is based on Corobrik's extensive experience in running brick plants. Corobrik Driefontein plant has been ISO certified. Overall responsibility at the plant lies with the Factory Manager who also has final responsibility for the CDM project at the Driefontein plant. The Assistant Factory Manager who reports directly to the Factory Manager is directly responsible for all aspects related to this monitoring plan.

2 Data to be monitored

The data that needs to be monitored in the project activity is as follows:

- Annual brick production
- Amount of natural gas consumed for brick firing in the kiln
- Net calorific value of natural gas
- Test to validate that the project bricks meet the performance requirements and specifications
- Principal raw and additive material consumption

3 Data collection and storage

The natural gas consumption and the calorific value of the gas will be obtained from a monthly invoice received from Sasol, the gas supplier. These invoices will be stored on-site for a minimum period of two years after the end of the crediting period. Brick production is monitored daily and consolidated monthly. Brick weight is tested monthly, from which yearly average brick weights will be calculated. Brick quality will be tested twice per year in a SABS accredited laboratory. The principal raw material consumption (clay) and principal additive material (ash) is measured monthly. Clay quarry records and ash stockpile records will be kept on-site for a minimum period of two years after the end of the crediting period.

4 Installation, maintenance and calibration of monitoring equipment

The only relevant monitoring equipment for this project relates to the consumption of natural gas. Two natural gas consumption measuring stations have been installed on site. The monitoring equipment at the Sasol meter station is owned, operated, calibrated and maintained by Sasol, the natural gas provider.

5 Monitoring procedures

The day to day record keeping of the natural gas consumption by the kiln is the responsibility of the Assistant Factory Manager. An invoice for the natural gas consumption of the factory is received on a monthly basis from Sasol. The gas consumption presented in this monthly invoice is used in the annual emission reduction calculations.

The Assistant Factory Manager is also responsible for the records relating to principal raw and additive consumption in the brick making process, the tests to validate that the bricks meet performance requirements and specifications, and the consolidated brick production records.

All records will be retained for two years after the end of the crediting period.

6 QA/QC procedure

The data from the Sasol invoices (from the primary Sasol meter) will be checked against the Corobrik meter readings for quality control purposes. Minor differences are to be expected due to the fact that the Corobrik meter is not adjusted for temperature and pressure whereas the Sasol meter is.

The quantity of bricks produced in the factory will be cross-checked with the Corobrik Driefontein's financial records on a monthly basis.

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity
>>

11/06/2007 is the project start date as on this day the first real action took place, namely the start of the construction of the pipeline. The first real action refers to the excavation and root clearing of vegetation to make way for the pipeline, which took place on 11/06/2007.

C.1.2. Expected operational lifetime of project activity

>>

The life of the plant depends on the clay reserves. It is estimated that the clay reserves will last at least another 100 years. Maintenance is carried out every four years on the kiln. Therefore, the life of the brick factory is expected to exceed the crediting period.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

Renewable crediting period

This is the first crediting period.

C.2.2. Start date of crediting period

>>

01/01/2015 (or date of project registration, whichever occurs later)

C.2.3. Length of crediting period

>>

7 years (renewable twice)

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

The project has and will continue to have positive environmental impacts; which create a cleaner working environment. The project has received accreditation from the West Rand District Municipality (supporting document number 66) which is valid for a period of five years of operation from the date of signature by the Air Quality Officer, after which Corobrik must apply for a renewal of the license. The date of the license is 24 November 2012, and is thus still valid.

The project involved the extension of the natural gas pipeline to the project site. For this extension, an Environmental Impact Assessment (EIA) was conducted in accordance with section 21, 22 and 26 of the Environmental Conservation Act (Act No.73 of 1989). The EIA report for this pipeline extension is available.

The use of natural gas plant will continue to comply with the legal requirements acts and has many positive environmental impacts:

- The emission of particulates from coal combustion has been eliminated.
- The emission of SO_2 from the coal combustion is eliminated.
- The gasifiers used to combust the coal and generate the producer gas have been decommissioned and will be disassembled and sold as scrap metal.
- The environmental impact of coal mining is reduced.
- The environmental impacts and emissions associated with coal transport are avoided.

Overall, the working environment has become cleaner.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

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Stakeholders were identified as active community groups and individuals in the area where the project would be implemented. The public consultation process around the gas pipeline was done in accordance with the requirements of the National Environmental Management Act (NEMA). In addition the general public in the area was informed via articles and advertisements in the local regional newspaper.

The fuel switch project involved the extension of the Sasol Gas pipeline to connect Driefontein to the natural gas-network. For this extension, an Environmental Impact Assessment (EIA) was conducted. The EIA includes Public Participation which included:

- An advertisement about the project proposal was published in the Krugersdorp North local newspaper (10 March 2006) as well as a local newspaper in Carletonville (24 February – 2 March 2006). A database had been developed where comments of interested and affected parties were recorded.
- Site notices about the gas pipeline extension were posted.
- Meetings were conducted with the relevant councillors ward committees (14 June 2006 at Kloof Mine, Libanon; 5 April 2006 with Merafong City Municipality Councillors Wars Committee; 12 April 2006 with Westonaria City Municipal Councillors Ward Committee). The minutes of the meetings were recorded.

Corobrik also placed advertisements in English and Afrikaans for the fuel switch project in the local newspaper the Carletonville Herald (20 February 2009).

E.2. Summary of comments received

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Table 3 summarises the comments received at the Public Participation.

Table 1: Comments Received

NAME	ISSUE / CONCERN
1. Nokukhanya Maluleke, Goldfields (also on behalf of the Far West Rand Dolomitic Water Association). Represent 26 properties affected by the gas pipeline.	• When will construction start? • Will the gas pipeline be buried underground? • With reference to the environmental impacts that were identified, what are "muti" plants? • If any liability arises during construction, how will it be handled?
2. D Kotze, Intersite (Spoornet)	• He wanted to confirm that the pipeline would not affect the railway line.
3. M Vicente Sr, owner of Elandsfontein Properties	• How wide will the servitude be? • Will I be compensated for damage and land use? • Will cars be able to travel over the pipeline once it has been buried? • We have no objection against the gas pipeline.
4. M Vicente Jr	• No objection.
5. Andre Jacobs, Randfontein	• We welcome the gas pipeline crossing the open veld opposite our houses.
6. Kenny Stuart, landowner	• Wants to use gas for his roadside tuck shop.

7. Quinton Stuart, landowner	• Will I have to take down my tuck shop?

No comments regarding the actual onsite fuel switching process were received.

E.3. Report on consideration of comments received

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Table 2: Summary of responses to comments received

NAME	ISSUE / CONCERN	RESPONSE
1. Nokukhanya Maluleke, Goldfields (also on behalf of the Far West Rand Dolomitic Water Association). Represent 26 properties affected by the gas pipeline.	• When will construction start?	• *As soon as environmental authorization has been received and after the 30-day appeal period has lapsed.*
	• Will the gas pipeline be buried underground	• *Yes*
	• With reference to the environmental impacts that were identified, what are "muti" plants?	• *Plants occurring in the natural environment and used for medicinal purposes.*
	• If any liability arises during construction, how will it be handled?	• *Sasol Gas will enter into a servitude agreement with the landowner, which will include compensation for possible damages. It will be done in consultation with the landowner and lessee.*
2. D Kotze, Intersite (Spoornet)	• He wanted to confirm that the pipeline would not affect the railway line.	• *Confirmed, no affect.*
3. M Vicente Sr, owner of Elandsfontein Properties	• How wide will the servitude be?	• *Construction (temporary): 23 meters; final servitude over the pipeline: 6 meters.*
	• Will I be compensated for damage and land use?	• *Yes, Sasol will make an appointment with you.*
	• Will cars be able to travel over the pipeline once it has been buried?	• *Yes*
	• We have no objection against the gas pipeline.	
4. M Vicente Jr	• No objection.	
5. Andre Jacobs, Randfontein	• We welcome the gas pipeline crossing the open veldt opposite our houses. Please take away the slight hill behind which thieves are hiding.	• *Earth moving will be limited to the installation of the gas pipeline.*
6. Kenny Stuart, landowner	• Wants to use gas for his roadside tuck shop.	• *The matter will be investigated.*
7. Quinton Stuart,	• Will I have to take down my tuck	• *No, the gas pipeline will*

landowner	shop?	*deviate around the shop.*

SECTION F. Approval and authorization
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The host country Letter of Approval (received 06/01/2012) for carrying out the project activity is available at the time of validation and has been provided along with the PDD.

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Appendix 1: Contact information of project participants

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Middle name	
First name	Daniele
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2: Affirmation regarding public funding

No public funding was used in either the development or implementation of this project.

Appendix 3: Applicability of selected methodology

Referring to Section B.2 of PDD, based on the applicability criteria the methodology has been found to be applicable to the proposed project activity.

Appendix 4: Further background information on ex ante calculation of emission reductions

Not Applicable

Appendix 5: Further background information on monitoring plan

Not Applicable

Appendix 6: Summary of post registration changes

Not Applicable

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02	EB 20, Annex 14 08 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		