ºCLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

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Title: CEMEX Costa Rica: Use of biomass residues in Colorado cement plant.
Version 01
Date: 01/05/2007

A.2. Description of the project activity:

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The project activity consists in the partial substitution of fossil fuels with alternative fuels (Rice Husk, saw dust, and others biomass residues) in cement manufacturing.

The most energy and CO2-intensive part of cement production is the burning of clinker. In this pyro-process a substantial quantity of heat is required to achieve the necessary chemical reactions in the raw meal. In Costa Rica the main fuels used in the clinker kilns are fossil fuels like coal and pet coke. The project activity aims to take the most of the alternative fuels in cement manufacturing.

The purpose of the project activity at CEMEX Costa Rica plant is to reduce emissions of anthropogenic CO2 in the cement production by the partial substitution of fossil fuels by biomass-based alternative fuels like agricultural by-products (Rice Husk), saw dust and other biomass residues, all being CO2 neutral fuels. The partial replacement of fossil fuels used in the clinker kiln by alternative fuels will result in significant reductions of CO2 emissions from combustion of fossil fuels.

In recent times the Colorado de Abangares plant has done some industrial-scale trials of biomass fuels. These trials have proven the feasibility of using a substantial share of biomass as kiln fuel, but they have also clearly shown that there are significant barriers that have to be overcome before biomass fuels can be considered a commercial practice.

During 2004 – 2006 periods, Colorado cement plant did several trials at industrial scale with significant shares of biomass and found out that an economically sustainable use of biomass levels requires:

1. A complete new system for reception, storage, and feeding of biomass fuels.
2. Significant additional efforts and new developments in areas such as maintenance or process and quality control.

Even with the above two requirements are fulfilled there is still a substantial risk that the day-to-day use of significant amounts of biomass fuels will lead to additional and costly operational problems.

<u>Environmental and social benefits other than GHG emission reductions</u>

In addition to lower GHG emissions, other environmental and social benefits would include:

- Decrease in the use of fossil fuels as energy sources and consequently reduction of the national dependence on imported fuels.

- Local economy is benefited due to the employment creation during the construction phase. Furthermore the project activity also generates employment for the handling and transport of the increase of alternative fuels in the manufacturing plant. Biomass suppliers will gain a culture of protecting the environment. This means they will improve their products handling, storage and transportation systems.
- Thermal consumption from fossil fuels is reduced as the result of a better resource utilisation. This possibly will encourage to other companies to initiate and explore this agricultural supply chain between different industries that leads to sustainable development.
- As the fossil fuel input is partially replaced, upstream environmental impacts related to petroleum extraction, refining, cracking are reduced.
- Additional income for the local biomass suppliers.
- The Project will significantly reduce the negative impacts of unsustainable practices in the area of agricultural waste management (most of the wastes that the plant is going to burn are currently been burned or dumped in rivers).
- The project will be an illustrative example of sustainable development that can help develop more environmental conscience in both the plant's workforce and the local community

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*) (as applicable)**	**Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Govt. of Costa Rica	CEMEX Costa Rica, S.A.	No

Table 1. Project participants

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>
Costa Rica

A.4.1.2. Region/State/Province etc.:

>>
Department of Guanacaste.

A.4.1.3. City/Town/Community etc:

>>
Colorado de Abangares.

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The project will take place in CEMEX Costa Rica's cement plant, which is located in the city of Colorado de Abangares, a municipality of the Department of Guanacaste. The plant is 140 km North West of the capital city of San Jose. The municipality of Colorado de Abangares is a community of some 4,000 people. The most important economic activities are agriculture, cattle, fisheries, mining (including cement production), and tourism. Its geography is characterized by plain lands that descend towards the Pacific. In Guanacaste the dry tropical climate predominates.

A.4.2. Category(ies) of project activity:

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The project is a cement sector project activity and may principally be categorized in the scope 4: Manufacturing Industries.

A.4.3. Technology to be employed by the project activity:

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The cement plant undertaking the CDM project activity has a clinker production capacity of 2.000 ton clinker/day

Storage and handling System for Alternative Fuels.

In order to implement the project activity a complete system for receiving, storing, and feeding alternative fuels needs to be built.

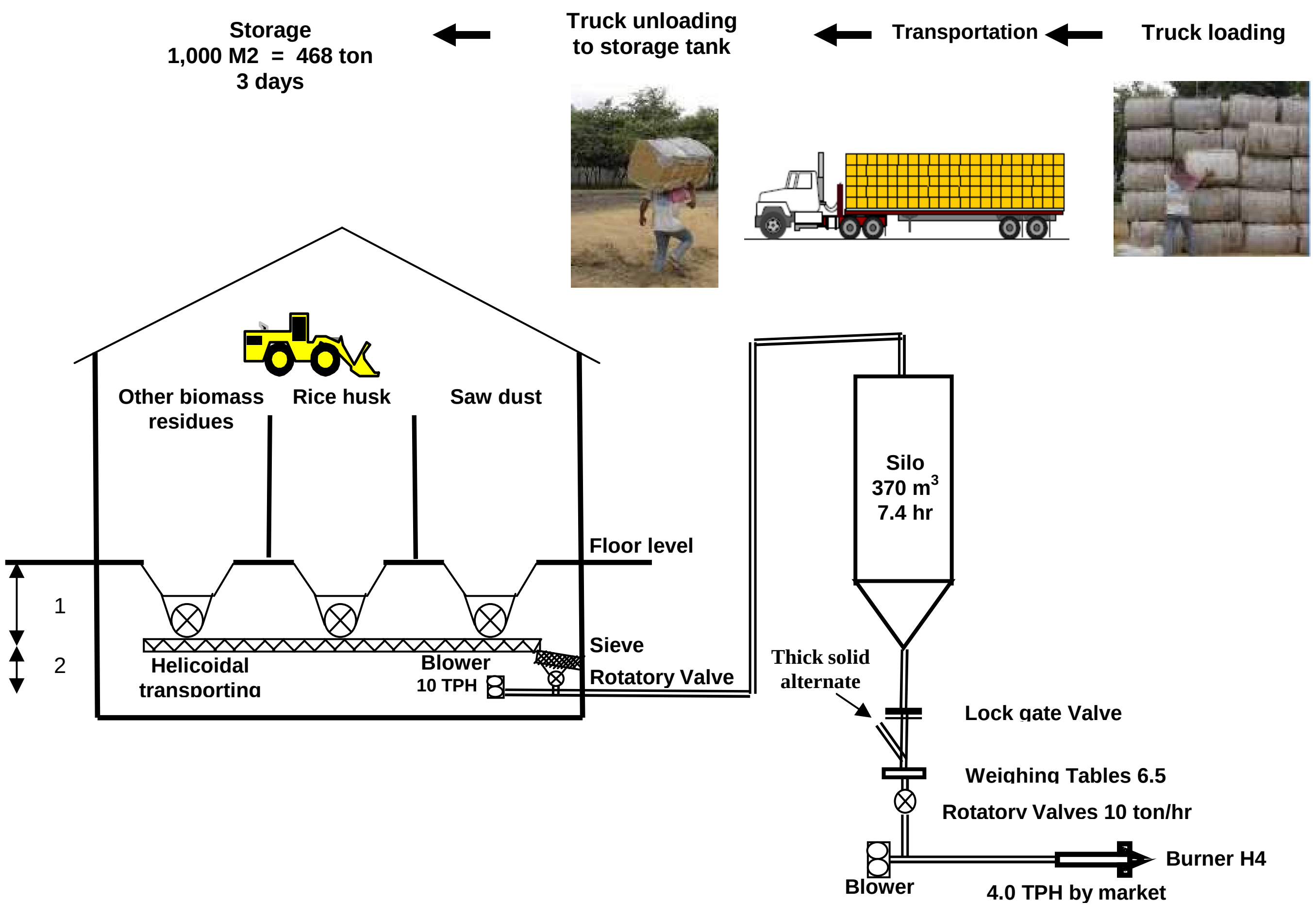
The storage system has three different functions:

- Protect fuels from the rain.
- Avoid leakages.
- Keep a constant stock supply of rice husks and saw dust.

To meet these functions the proposed system includes:

- A transport system fed by a pay loader in the warehouse. This transport system, formed by an helicoidal transporting, will deliver the biomass into
- A sieve, that will filter the particles. From the sieve the fuel will enter into
- A pipe connected to a blower, that will transport the biomass into a silo that will have enough capacity for 7.4 operational hours. The silo serves as a buffer to ensure continuity of supply.
- Each silo will have one pipe that will discharge the mix into one weighing table using a lock gate.
- From the weighing table a rotatory valve will supply the biomass to
- A blower, this feeding system will deliver the biomass into the burner.

As well a small grinder (not represented in the following scheme) will be implemented in the warehouse. This way an appropriate particles size will be obtained for the saw dust in order to avoid the jamming in the kiln feeders. This grinding process is needed as a consequence of the Nationals sawmills saw dust supply, usually containing big size wood particles that normally cause jamming. *See diagram above.*



A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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A fixed crediting period formula starting on January 1, 2008, has been selected, with an overall CO_2 emission reduction expected of 434.374 tCO_2 for the cement plant.

Year	Annual estimation of emission reductions in tonnes of CO2 e
2008	43.437
2009	43.437
2010	43.437
2011	43.437
2012	43.437
2013	43.437
2014	43.437
2015	43.437
2016	43.437

2017	43.437
Total estimated reductions (tonnes of CO2 e)	434.374
Total number of crediting years	10 Years
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)	43.437

Table 2. Emission reductions

A.4.5. Public funding of the project activity:

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No public funding is used for this project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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For the project activity, the approved baseline methodology used is ACM0003 Version 04, consolidated baseline methodology for "*emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture*".

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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The Colorado de Abangares project activity fulfils all the applicability conditions of the consolidated baseline methodology for "*emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture*":

- Fossil fuel(s) used in cement manufacture are partially replaced by the following *alternative fuels*:

  (b) Biomass residues where they are available in surplus and would in the absence of the project activity be dumped or left to decay or burned in an uncontrolled manner without utilizing them for energy purposes;

The fossil fuel consumed in the clinker kiln is partially replaced by biomass residues (rice husk, saw dust and other biomass residues).

- In case of project activities using biomass residues, any preparation of the biomass, occurring before use in the project activity, does neither require significant energy quantities (e.g. etherification of waste oils), except from transportation and/or drying of the biomass, nor does it cause significant GHG emissions (such as, for example, methane emissions from anaerobic treatment or char coal production).

The alternative fuels used in the project activity do not require significant energy quantities in the preparation phase.

- CO_2 emissions reduction relates to CO_2 emissions generated from fuel burning requirements only and is unrelated to the CO_2 emissions from decarbonisation of raw materials (i.e. $CaCO_3$ and $MgCO_3$ bearing minerals);

For the estimation of CO_2 emissions reduction, the reduced emission due to fuel burning requirements is taken into account. The reduction in CO_2 emissions of clinkerisation process due to use of alternative fuels is not taken into account based on guidelines of the methodology.

- The methodology is applicable only for installed capacity (expressed in tonnes clinker/year) that exists by the time of validation of the project activity;

The project activity is not increasing the production. The emission reduction calculations are based on the average clinker production capacity, 2.000 ton clinker/day

- The amount of alternative fuels available for the project is at least 1.5 times the amount required to meet the consumption of all users consuming the same alternative fuels, i.e. the project and other alternative fuel users.

The alternative fuels are available in abundance in the project activity region. The project proponent has proposed to use the following fuel types as alternative fuels included in the project activity:

- Agriculture fuels: The project proponent has proposed to use Rice Husk as agricultural fuel. Unused Rice Husk is available in abundance in Costa Rica (41.000 tonnes/year, more than two times of the plant's requirement).

- Saw dust: The project proponent has proposed to use saw dust as residual biomass. Saw dust is available in abundance (112.000 ton/year,, more than five times of the plant's requirement) in Costa Rica. The availability of this agricultural fuel meets the proposed methodology requirement.

- Other biomass residues: The project proponent has proposed to use other biomass residues such as coffee husk, fish fat, fatty acids from oil industry, corn residues, etc. generated by agricultural and industrial activities. The availability of these biomass residues is 2.420 tons per year (more than 2 times the amount required to meet the cement plant consumption).

This baseline methodology shall be used in conjunction with the approved monitoring methodology ACM0003 ("Monitoring methodology for emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture")

B.3. Description of the sources and gases included in the project boundary

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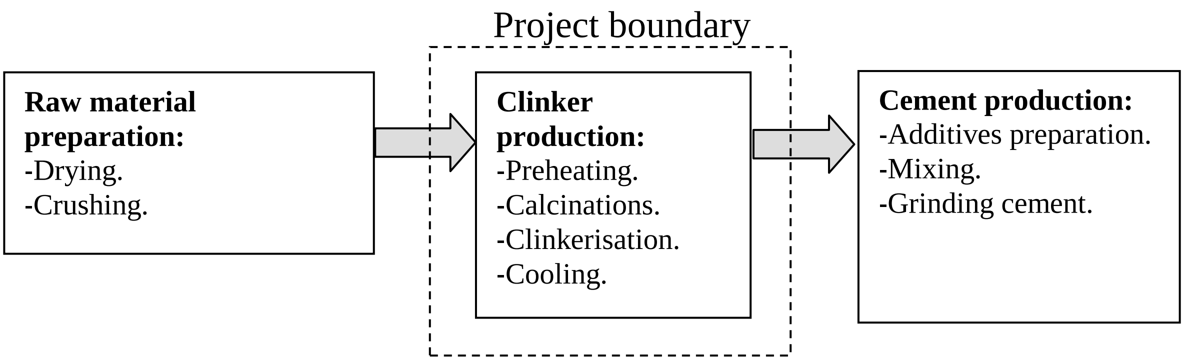
The following diagram shows the project boundary:



	Source	Gas	Included?	Justification / Explanation
Baseline Emission	Clinker kiln in baseline scenario	CO_2	Yes	Clinker production is based on baseline fuel mix.
		CH_4	No	Negligible.
		N2O	No	Negligible.
Project Activity Emissions	Clinker kiln in project activity plant	CO_2	Yes	Clinker production is based on project fuel mix.
		CH_4	No	Negligible.
		N2O	No	Negligible.
	On-site transportation and drying of alternative fuels	CO_2	No	Negligible.
		CH_4	No	Negligible.
		N2O	No	Negligible.
Leakage	Burning leakage methane emissions	CO_2	No	NA
		CH_4	Yes	Methane emissions due to biomass residues that would be burned in the absence of the project
		N2O	No	NA
	Decomposition leakage methane emissions	CO_2	No	NA
		CH_4	No	NA
		N2O	No	NA
	Off-site transport and drying leakage emissions	CO_2	Yes	Off-site transportation fuels are mainly fossil fuels.
		CH_4	No	Due to incomplete combustion.
		N2O	No	Due to the combustion process.

Table 3. Sources and gases included in the project boundary

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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Project activity

The project activity is emission reduction in cement production through partial substitution of fossil fuels with alternative fuels.

Approach
The baseline approach is based on paragraph 48 of the CDM modalities and procedures "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investments."

Baseline scenario selection

Define alternative scenario for the fuel mix

Baseline scenario 1: Continuation of current practice scenario

CEMEX Costa Rica initiated in the Colorado cement plant a trial period burning biomass for the cement manufacturing process. This process began as a non sustainable trial period, due to the lack of a proper fuel feeding and storage system, but it was made to verify process variability and system requirement for a biomass project implementation. The Colorado de Abangares cement plant fuel mix before the trial period, considered as the baseline scenario, is the following one:

Pet coke	75,0%
Coal	17,9%
Bunker	7,1%

Table 4: Fuel mix in Colorado de Abangares cement plant, Ag. 2003 – July 2004.

Residual fuel oils are not considered alternative fuels in the context of this project; in all relevant aspects they are like bunker fuel (no need for infrastructure; homogeneous, uncomplicated fuel, similar emission factor).

In the absence of the project activity the Colorado de Abangares cement plant will consume the same fuel mix as in baseline scenario 1. Therefore the fuel mix projection for this scenario during the crediting period remains as is shown in Table 4.

Baseline scenario 2: Scenario in which traditional fuels are partially substituted with alternative fuels (i.e. the proposed CDM project activity).

The project activity scenario is characterized by a substantial use of biomass fuels, reaching roughly 20% of substitution.

The estimated fuel mix during the crediting period is given below:

Fuel Oil	2,1%
Coke	71,9%
Coal	0,0%
Rice Husk	11,8%
Saw dust	7,3%
Other biomass residues	0,7%
Residual fuel oil	6,2%

Table 5: Fuel mix during the crediting period (2008 – 2017).

Option 2: Select baseline scenario through barriers analysis

Alternative scenario	**Investment barriers**	**Technological barriers**	**Barrier due to prevailing practice**	**Other barriers**
Scenario 1	No initial capital investment	There are no technological barriers.	This scenario is the common practice.	None. Continuation of current practice.
Scenario 2	Significant investment is required to implement the project activity.	• Additional procedures to maintain clinker quality. • Potential impact on kiln capacity. • Additional Production losses due to increased maintenance times and kiln shut-down during infrastructure construction.	This scenario is not the common practice. No similar practices in place in Costa Rica.	Supply barriers due to a non-settled supply network for alternative fuels in Costa Rica.

Table 6: Barrier analysis

Based on above barrier analysis the scenario 1 is the most likely scenario in the absence of project activity. Scenario 1 i.e. continuation of current practices is selected as the baseline scenario. The parameters and data source for the baseline scenario estimation are given in the table below:

Parameter	***Data Source***
Clinker production Manufacturing plant	Colorado de Abangares cement plant
Fossil fuel consumption Manufacturing plant	Colorado de Abangares cement plant
Fossil fuel mix in baseline scenario 1	Calculated
Fossil fuel mix in baseline scenario 2	Calculated

Table 7: Parameters required for baseline scenario

The emission factor from baseline Scenario 1 will be taken as baseline for the calculation of emission reduction.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

Analysis of the additionality of the project

To demonstrate the additionality of the project, the Tool for demonstration and assessment of additionality approved has been used, following all steps defined. These steps will demonstrate that the project activity is not the baseline scenario.

Step 0. Preliminary screening based on the starting date of the project activity

The crediting period of the project activity will start after the registration of the project activity, so step 0 does not apply to the project activity

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

Sub-step 1a. Define alternatives to the project activity

All realistic scenarios have been developed in baseline scenario selection. The alternatives are:

1. Baseline scenario 1: Continuation of current practice scenario
2. Baseline scenario 2: Scenario in which traditional fuels are partially substituted with alternative fuels (i.e. the proposed CDM project activity).

Sub-step 1b. Enforcement of applicable laws and regulations

The regulatory framework which may be applicable to this project activity is the environmental regulations on air emissions and the project is meeting all the compliances of environment in this regards.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

The project activity generates incomes other than CDM related income, so a straight forward cost analysis cannot be applied. Instead, the benchmark analysis (Option III) will be used.

Sub-step 2b. Option III. Apply benchmark analysis

For the benchmark analysis the opportunity cost of capital for CEMEX Costa Rica S.A. is considered as benchmark i.e. 10.1% (WACC). The financial analysis – internal rate of return (IRR) is conducted for the alternative fuel project. ´

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

The summary of IRR is given below.

Parameters	Value
Investment	1,68 MUSD
Pet coke	99,5 USD/ton
Rice Husk	18,5 USD/ton
Saw Dust	18,5 USD/ton
Other biomass residues	8 USD/ton
IRR without CERs	Not positive
IRR with CERs (15 USD/tCO2)	40,27%

Table X: IRR analysis for the proposed CDM project activity

The Weighted average cost of capital (WACC) (financial benchmark) for CEMEX Costa Rica is 10.1% which is calculated based on Return on Debt and Return on Equity. This shows that any project should yield returns more than 10.1% to consider it for implementation.

The IRR calculations shows that the IRR of the project is below the financial benchmark i.e. WACC (10.1%) that can be achieved without CDM revenues. It improves IRR to 40,27% with CDM revenues thanks to CERs income, which is more than WACC.

Sub-step 2d. Sensitivity Analysis

Sensitivity analysis is conducted based on the fuel price variations in the alternative fuels. The fuel prices in the IRR calculations are taken as base (100%) and the variation in the IRR with increasing and decreasing fuel prices are calculated and explained in the following table:

Table X (a): Sensitivity Analysis for change in and Rice Husks prices

Price fluctuation % of Base price	Price of fuel (USD/ton)	IRR without CDM revenues	IRR with CDM revenues
85%	15,7	4,49%	43,07%
90%	16,6	2,52%	42,14%
95%	17,5	0,36%	41,21%
100%	18,5	Not positive	40,27%
105%	19,4	Not positive	39,31%
110%	20,3	Not positive	38,35%
115%	21,2	Not positive	37,37%

Table X (a): Sensitivity Analysis for change in Saw dust prices

Price fluctuation % of Base price	Price of fuel (USD/ton)	IRR without CDM revenues	IRR with CDM revenues
85%	15,7	4,60%	43,13%
90%	16,6	2,60%	42,18%
95%	17,5	0,40%	41,23%
100%	18,5	Not positive	40,27%
105%	19,4	Not positive	39,29%
110%	20,3	Not positive	38,31%
115%	21,2	Not positive	37,31%

Therefore in spite of sensitivity analysis on the basis of realistic deviations in assumptions, the IRR of project activity remains less attractive than financial benchmark without CERs sales.

<u>Step 3. Barrier analysis</u>

The project proponent is required to determine whether the project activity faces barriers that:

(a) Prevent the implementation of this type of project activity; and
(b) Do not prevent the implementation of at least one of the alternatives through the following sub-steps

All the barriers that prevail for the project activity are detailed in Sub-step 3b.

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity.

Technological Barrier:

The implementation of the project will require the introduction of new technologies to transport, handle and inject substantial amounts of biomass fuels into the kiln, which will require not only new equipment, but also extensive training of the workforce. These fuels will require changes in the traditional operation and the maintenance of the kiln in order to maintain clinker quality.

The main technological barriers identified in the project activity scenario are:

1. Due to the rice husks the input of silica into the burner, and consequently into the kiln, is increased. As a consequence of this the chemistry in the process is affected and quality of the clinker could as well be affected.
2. Proper feeding of fuel: A homogeneous energy flow is crucial for persistently high clinker quality. The flowing of alternative fuel is not as smooth as fossil fuel. In addition, biomass fuel has more affinity to moisture which increases the risk of clogging.
3. There will be changes in the raw meal composition to meet the relevant quality standard. Al_2O_3 and Fe_2O_3 quantities will be increased in order to meet CEMEX quality standard.
4. Process disturbance: due to different type of alternative fuels and the changes in the alternative fuels mix composition used in the clinker production, the disturbance in process is most likely to happen.
5. Kiln inlet jamming: The alternative fuel have less calorific value and low density compared to conventional fossil fuels; so the volume will increase for the same heat input. This significantly increases the risk of jamming at the kiln inlet.
6. The type of refractories might need to be changed in order to ensure a long life.
7. Clinker production capacity can be reduced due to higher air demand. Therefore the use of blowers for the burner feeding is limited, in order to avoid the efficiency loss that follows the increase of air in the process.

Training will be a key factor in the successful introduction of other types of fuels. Kiln operators and management have to understand what will be the changes that these alternative fuels consumption will bring in the operation, maintenance and quality assurance of the process. They have to develop new ways to operate in order to minimize problems.

It has to be emphasized that even with proper training, process control, new equipment etc. the use of such large amounts of biomass fuels is very likely to cause additional problems that will lead to higher maintenance cost and increases downtime of the system.

Investment Barrier:

The project activity will have a high cost associated to the equipment required for the use of alternative fuels in cement manufacturing. CEMEX Costa Rica S.A. will invest in the infrastructure of project activity implementation in order to ensure proper and effective utilization of alternative fuels. In addition, to overcome the technical issues, a significant cost for maintenance, training and additional quality control measures will be incurred.

As was shown in Step 2 of the additionality test, the operative cost reductions related to the use of alternative fuels do not justify the investment.

Prevailing practice Barrier:

In Costa Rica there are only two Clinker kilns: one is property of CEMEX Costa Rica and it is placed in Colorado de Abangares. The second one is of Holcim Costa Rica S.A. No one in the cement industry tried before to implement in the host country this kind of fossil fuel switching project. Therefore the project activity is the “first of its kind” in the host country.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the project activity).

None of the barriers would prevent the implementation of scenario 1 (current practice). Several barriers have been identified that prevent the development of the proposed project activity (detailed in Sub-step 3a):

- Technological barrier.
- Investment barrier.
- Prevailing practice barrier.

<u>Step 4. Common practice analysis</u>

Sub-step 4a. Analyze other activities similar to the proposed project activity.

There are no other activities similar to the project activity in Costa Rica.

Sub-step 4b. Discuss any similar options that are occurring.

Use of biomass fuel in cement manufacturing is not common practice in Costa Rica.

<u>Step 5. Impact of CDM registration.</u>

The following are the impacts of CDM registration:

- Provide additional coverage to the risk due to failure of the project activity as loss of production (due to increased maintenance).
- Diversification of cash flow, further reducing the financial risk due to the different nature of these revenues (e.g. CER-related income is independent from fuel prices).

B.6. Emission reductions:

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B.6.1. Explanation of methodological choices:

The following equations will be applied for the emission reductions:

1. Project emissions:

Step 1. Calculate project heat input from alternative fuels

Heat input from alternative fuels with significant moisture content is calculated first to allow for the calculation of a project-specific moisture "penalty" for alternative fuel heat input requirements.

$$HI_{AF} = \sum Q_{AF} \times HV_{AF} \quad \textbf{(1)}$$

where:

HI_{AF} = heat input from alternative fuels (TJ/yr)
Q_{AF} = quantity of each alternative fuel (tonnes/yr)
HV_{AF} = lower heating value of the alternative fuel(s) used (TJ/tonne fuel).

Step 2. Estimate project specific moisture "penalty"

This project specific penalty should be determined as follows:

$$MP_y = C_{Pr,y} x (HC_{AF} - HC_{FF}) \quad \textbf{(2)}$$

where:

MP_y = moisture penalty (TJ/yr) for year y
$C_{Pr,y}$ = is the clinker production for year y
$HC_{AF,y}$ = is the specific fuel consumption on project case (TJ/tClinker) in year y
HC_{FF} = is the specific fuel consumption in the baseline when only fossil fuel is used, in TJ/tClinker.

$$HC_{AF} = \frac{\left(\sum Q_{FF,Pr} \times HV_{FF}\right) + HI_{AF}}{\left(C_{Pr}\right)} \quad \textbf{(3)}$$

where:

$Q_{FF,pr}$ = is the quantity of fossil fuel used in the project case;
HV_{FF} = is the lower heating value of the fossil fuel used (TJ/tonne);
HI_{AF} = is heat input from alternative fuels (TJ/yr) in project case;
C_{Pr} = is the production of clinker in the project case; and

$$HC_{FF} = \frac{\left(\sum Q_{FF,Ba} \times HV_{FF}\right)}{C_{Bl}} \quad \textbf{(4)}$$

where:

$Q_{FF,Ba}$ = is the quantity of fossil fuel used in the baseline case;
HV_{FF} = is the lower heating value of the fossil fuel used (TJ/tonne) used in the baseline (it would be the same as project case if the fossil fuel used in the project case is same as that in the baseline)
C_{Bl} = is clinker production in the base case corresponding to the $Q_{FF,Ba}$

Step 3 Calculate GHG emissions from the use of alternative fuels in kilns:

$$AF_{GHG} = \Sigma(Q_{AF} * HV_{AF} * EF_{AF}) \quad \textbf{(5)}$$

where:

AF_{GHG} = GHG emissions from alternative fuels (tCO_{2e}/yr)
Q_{AF} = monitored alternative fuels input in clinker production (tonnes/yr).
HV_{AF} = heating value(s) of the alternative fuel(s) used (TJ/tonne fuel).
EF_{AF} = emission factor(s) of alternative fuel(s) used (tCO_{2e}/TJ).

2. Baseline emissions:

Step 4 Calculate the baseline GHG emissions from the fossil fuel(s) displaced by the alternative fuel(s)

$$FF_{GHG} = [(Q_{AF} * HV_{AF}) - MP_{total}] * EF_{FF} \quad \textbf{(6)}$$

where:

FF_{GHG} = GHG emissions from fossil fuels displaced by the alternatives ($tCO_{2/yr}$)
$Q_{AF} * HV_{AF}$ = total actual heat provided by all alternative fuels (TJ/yr)
MP_{total} = total moisture penalty (TJ/yr)
EF_{FF} = emissions factor(s) for fossil fuel(s) displaced (tCO_2/TJ).

EF_{FF} is the estimated baseline value and would be the lowest of the following CO_2 emission factors :

- the weighted average annual CO_2 emission factor for the fossil fuel(s) consumed and monitored ex ante during the year before the validation,
- the weighted average annual CO_2 emission factor for the fossil fuel(s) consumed and monitored during the corresponding verification period (e.g. the period during which the emission reductions to be certified have been achieved),

- the weighted average annual CO_2 emission factor for the fossil fuel(s) that would have been consumed according to the baseline scenario determined in section 1 and 2 of the "Additionality and baseline scenario selection" section above.

3. Leakage emissions:

Step 1. Calculate CH_4 emissions due to biomass residues that would be burned in the absence of the project

$$BB_{CH4} = Q_{AF-B} * BCF * CH_4F * CH_4/C * GWP\_CH_4 \quad \textbf{(7)}$$

where:

BB_{CH4}	= GHG emissions due to burning of biomass residue that is used as alternative fuel (tCO_{2e}/yr)
Q_{AF-B}	= amount of biomass residue used as alternative fuel that would have been burned in the open field in the absence of the project (t/yr)
BCF	= carbon fraction of the biomass residue (tC/t biomass) estimated on basis of default values,
CH_4F	= fraction of the carbon released as CH_4 in open air burning (expressed as a fraction),
CH_4/C	= mass conversion factor for carbon to methane (16 tCH_4/12 tC), and
GWP_CH_4	= global warming potential of methane (21).

Step 3. Calculate emissions from off-site transport of alternative and fossil fuels

The emissions from transportation should be calculated as follows:

$$LK_{trans} = LK_{AF} - LK_{FF} \quad \textbf{(8)}$$

$$LK_{AF} = (Q_{AF}/CT_{AF}) * D_{AF} * EF_{CO2e}/1000 \quad \textbf{(9)}$$

$$LK_{FF} = (RQ_{FF}/CT_{FF}) * D_{FF} * EF_{CO2e}/1000 \quad \textbf{(10)}$$

where:

LK_{trans}	= leakage from transport of alternative fuel less leakage due to reduced transport of fossil fuels (tCO_2/yr)
LK_{AF}	= leakage resulting from transport of alternative fuel (tCO_2/yr)
LK_{FF}	= leakage due to reduced transport of fossil fuels (tCO_2/yr)
Q_{AF}	= quantity of alternative fuels (tonnes)
CT_{AF}	= average truck or ship capacity (tonnes/truck or ship)
D_{AF}	= average round-trip distance between the alternative fuels supply sites and the cement plant sites (km/truck or ship)
RQ_{FF}	= quantity of fossil fuel (tonnes) that is reduced due to consumption of alternative fuels estimated as:
CT_{FF}	= average truck or ship capacity (tonnes/truck or ship)
D_{FF}	= average round-trip distance between the fossil fuels supply sites and the cement plant sites (km/truck or ship)
EF_{CO2e}	= emission factor from fuel use due to transportation (kg CO_{2e}/km) estimated as:

$EF_{CO2e} = EF_{T\ CO2} + (EF_{T\ CH4} * 21)+(EF_{T\ N2O} * 310)$ **(11)**

where:

$EF_{T\ CO2}$ = emission factor of CO_2 in transport (kg CO_2/km)
$EF_{T\ CH4}$ = emission factor of CH_4 in transport (kg CH_4/km)
$EF_{T\ N2O}$ = emission factor of N_2O in transport (kg N_2O/km)

21 and 310 are the Global Warming Potential (GWP) of CH_4 and N_2O respectively

4. Emission Reductions

Total emission reductions are given by the following formula:

$AF_{ER} = FF_{GHG} – AF_{GHG} – LK_{trans} + BB_{CH4}$ **(12)**

where:

FF_{GHG} = GHG emissions from fossil fuels displaced by the alternatives ($tCO_{2/yr}$)
AF_{GHG} = GHG emissions from alternative fuels (tCO_{2e}/yr)
LK_{trans} = leakage from transport of alternative fuel less leakage due to reduced transport of fossil fuels (tCO_2/yr)
BB_{CH4} = GHG emissions due to burning of biomass residue that is used as alternative fuel (tCO_{2e}/yr)

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	**EF_{AF}**
Data unit:	tCO_2/TJ
Description:	Emission factor of alternative fuel
Source of data used:	IPCC
Value applied:	Rice Hisk: 0 Saw Dust: 0 Other biomass residues: 0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data archived: entire crediting period. IPCC default value.
Any comment:	Biomass residues are considered as CO2 – neutral.

Data / Parameter:	**EF_{FF}**
Data unit:	tCO_2/TJ
Description:	Emission factor of fossil fuel
Source of data used:	IPCC
Value applied:	Pet coke: 100,83 tCO2/TJ Fuel oil: 77,37 tCO2/TJ

	Residual fuel oil: 73,33 tCO2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data archived: entire crediting period. IPCC default value.
Any comment:	For each fossil fuel consumed: (i) in year prior to the validation (ii) during the crediting period (iii) in the baseline scenario

Data / Parameter:	**$EF_{T\ CO2}$**
Data unit:	gCO_2/km
Description:	Emission factor
Source of data used:	ACM0003 ver 04, reference notes
Value applied:	1108
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data archived: entire crediting period. Value is as per UNFCCC guidance.
Any comment:	

Data / Parameter:	**$EF_{T\ CH4}$**
Data unit:	gCH_4/km
Description:	Emission factor
Source of data used:	ACM0003 ver 04, reference notes
Value applied:	0,06
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data archived: entire crediting period. Value is as per UNFCCC guidance.
Any comment:	

Data / Parameter:	**$EF_{T\ N2O}$**
Data unit:	gN_2O/km
Description:	Emission factor
Source of data used:	ACM0003 ver 04, reference notes
Value applied:	0,031
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data archived: entire crediting period. Value is as per UNFCCC guidance.
Any comment:	

Data / Parameter:	**$Q_{AF-D/B}$**
Data unit:	Tonnes
Description:	Biomass residues which would have been burnt in the absence of the project activity.
Source of data used:	Estimated and 100% biomass residues have been considered on conservative basis.
Value applied:	See Annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data Archived: 2 years after the end of the crediting period.
Any comment:	Conservative assumption.

Data / Parameter:	**BCF**
Data unit:	tC/ ton of biomass
Description:	Carbon fraction of the biomass residue
Source of data used:	IPCC default value
Value applied:	Rice Husk: 0,39 Saw Dust: 0,39
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data Archived: 2 years after the end of the crediting period.
Any comment:	

Data / Parameter:	**CH_4F**
Data unit:	%
Description:	Carbon released as CH4 in open air burning
Source of data used:	IPCC default value
Value applied:	0,5%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data Archived: 2 years after the end of the crediting period.
Any comment:	

Data / Parameter:	**Alternative fuels availability**
Data unit:	Tonnes
Description:	Alternative fuels availability
Source of data used:	Biomass availability report.
Value applied:	Not used in emission reductions calculations.

Justification of the choice of data or description of measurement methods and procedures actually applied :	Data Archived: 2 years after the end of the crediting period.
Any comment:	This report will be updated yearly

B.6.3 Ex-ante calculation of emission reductions:

>>

Please, see Annex 3 (Baseline Information).

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Total emission reduction during the crediting period: 472.042 tCO_2 (See Annex 3)

Estimation of emission reductions:

Year	**Estimation of project activity emissions (tonnes of CO_2 e)**	**Estimation of baseline emissions (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of overall emission reductions (tonnes of CO_2 e)**
2008	0	41.322	2.115	43.437
2009	0	41.322	2.115	43.437
2010	0	41.322	2.115	43.437
2011	0	41.322	2.115	43.437
2012	0	41.322	2.115	43.437
2013	0	41.322	2.115	43.437
2014	0	41.322	2.115	43.437
2015	0	41.322	2.115	43.437
2016	0	41.322	2.115	43.437
2017	0	41.322	2.115	43.437
Total (tonnes of CO2 e)	**0**	413.224	21.150	434.374

Table 10. Ex-ante estimation emission reductions.

The registration of the project will take place before its commissioning, so there will be no emission reductions prior to its registration.

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	C_{Pr}
Data unit:	Tonnes
Description:	Clinker production
Source of data to be used:	Plant records (GrafOper)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	649.000 ton/year
Description of measurement methods and procedures to be applied:	Instrument used: Weighing feeders. Data Archived: 2 years after the end of the crediting period.
QA/QC procedures to be applied:	Instrument should be calibrated according to manufacturer's guidelines.
Any comment:	

Data / Parameter:	Q_{AF}
Data unit:	Tonnes
Description:	Fuel Type
Source of data to be used:	Plant records.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Rice Husk: 19.850 ton/year Saw dust: 19.450 ton/year See Annex 3.
Description of measurement methods and procedures to be applied:	Instrument used: Scale. Data Archived: 2 years after the end of the crediting period.
QA/QC procedures to be applied:	Instrument should be calibrated according to manufacturer's guidelines.
Any comment:	

Data / Parameter:	HV_{AF}
Data unit:	TJ/Tonne
Description:	Fuel heating value
Source of data to be used:	Plant records.
Value of data applied	

for the purpose of calculating expected emission reductions in section B.5	**Fuel Type** / **Kcal/kg** / **TJ/tonne** Rice Husk / 3200 / 0.013376 Saw Dust / 2000 / 0.00836 Other Biomass residues / 4.000 / 0,0167
Description of measurement methods and procedures to be applied:	Instrument used: Calorimeter. Data Archived: 2 years after the end of the crediting period.
QA/QC procedures to be applied:	Instrument should be calibrated according to manufacturer's guidelines.
Any comment:	

Data / Parameter:	$\mathbf{Q_{FF}}$
Data unit:	Ton
Description:	Fuel type
Source of data to be used:	Plant records.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Pet coke: 47.001 ton/year Fue Oil: 1.208 ton/year Residual fuel oil: 8.309 ton/year See Annex 3.
Description of measurement methods and procedures to be applied:	Instrument used: Scale. Data Archived: 2 years after the end of the crediting period.
QA/QC procedures to be applied:	Instrument should be calibrated according to manufacturer's guidelines.
Any comment:	

Data / Parameter:	$\mathbf{HV_{FF}}$
Data unit:	TJ/Tonne
Description:	Heating value.
Source of data to be used:	Plant records.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	**Fuel Type** / **Kcal/kg** / **TJ/tonne** Fuel Oil / 9.320 / 0,0390 Coke / 8.200 / 0,0343 Residual fuel oil / 4000 / 0.0167
Description of measurement methods and procedures to be applied:	Instrument used: Calorimeter. Data Archived: 2 years after the end of the crediting period.
QA/QC procedures to be applied:	Instrument should be calibrated according to manufacturer's guidelines.
Any comment:	

Data / Parameter:	**C_{BI}**
Data unit:	Ton
Description:	Clinker production
Source of data to be used:	Plant records.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	592.237 ton/ year
Description of measurement methods and procedures to be applied:	Instrument used: Weighing feeders. Data Archived: 2 years after the end of the crediting period.
QA/QC procedures to be applied:	Instrument should be calibrated according to manufacturer's guidelines.
Any comment:	

Data / Parameter:	**CT_{AF}**
Data unit:	Tonnes/truck
Description:	Average truck capacity for transport alternative fuels.
Source of data to be used:	Plant records, Biomass supplier.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	11,67 ton/truck
Description of measurement methods and procedures to be applied:	Calculated Data Archived: 2 years after the end of the crediting period.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**D_{AF}**
Data unit:	Km/truck
Description:	Average distance for transport alternative fuel
Source of data to be used:	Plant records, Biomass supplier.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	117 Km/truck
Description of measurement methods and procedures to be	Calculated. Data Archived: 2 years after the end of the crediting period.

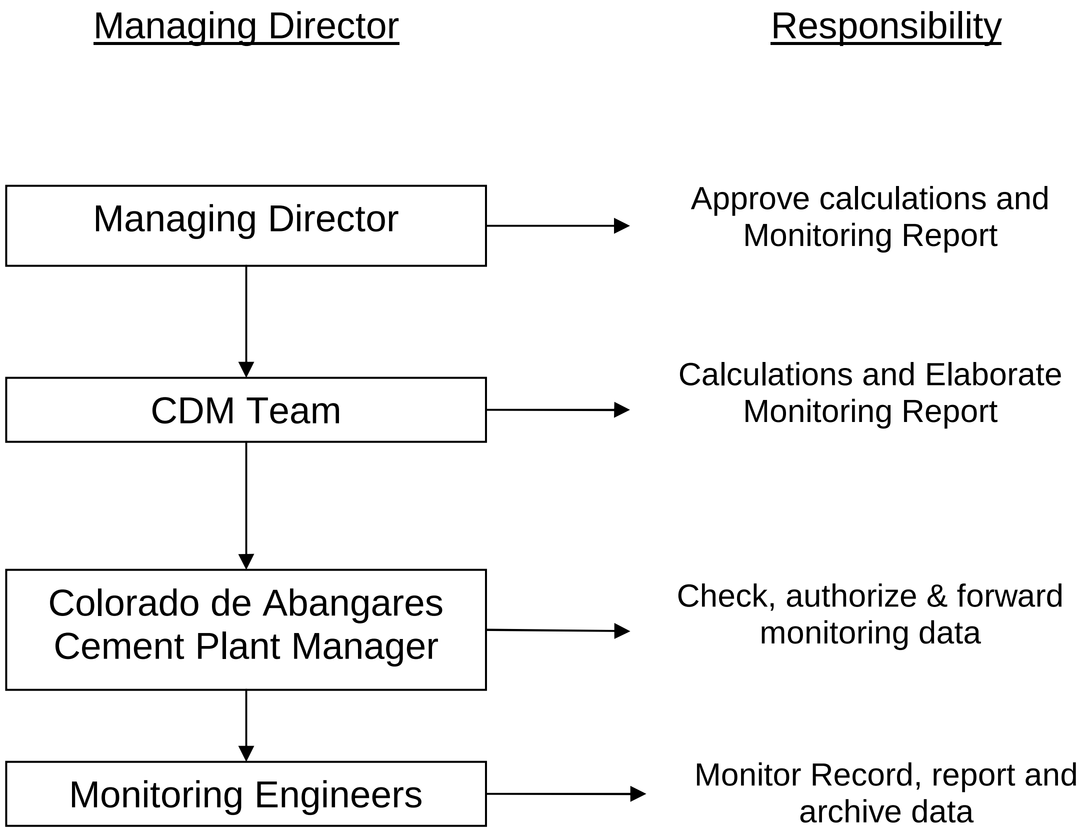
applied:	
QA/QC procedures to be applied:	
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The project meets the applicability criteria under the monitoring methodology, ACM0003 Version 04 **"Emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture"**

This figure describes the operational and management structure that will monitor emissions reductions generated by the project activity.



Emission Monitoring and Calculation Procedure	
Data Source and collection	Data are taken from plant records.
	Most data are available and recorded according to the actual data management system (GrafOper and SICA).
	Frequency of data is based on actual data management system.
	Data are monitored by monitoring engineers in Colorado cement plant. All data are reviewed by Operation Department.
Data compilation	All data from the plant is centralised.
	Data is transmitted to CDM Team
Emission calculation and Monitoring Report	Emission calculations are conducted on yearly basis from data which is collected daily, monthly or annually,

	depending on the nature of the data.
	All data is calculated by CDM Team, using a excel spreadsheet. Monitoring Report will be elaborated by CDM Team.
Emission data review and approval	Calculation and Monitoring Report is reviewed and approved by CDM project manager.
Record keeping	All data will be recorded electronically. Monitoring engineers are responsible for record keeping.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>
Date of completion: May 2007

Name of entity determining the baseline: CO_2 Global Solutions International S.A. See contact information in Annex 1.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
Commercial operation of the new biomass facilities at Colorado de Abangares cement plant will begin 01/01/2008.

C.1.2. Expected operational lifetime of the project activity:

>>
The project activity is expected to have a minimum operational lifetime of 20 years from starting date; this is, until the end of 2027.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
N/A

C.2.1.2. Length of the first crediting period:

>>
N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/01/2008

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
The project activity under consideration does not require any Environmental Authorization from the host country as it does not fall under the project category which requires mandatory EIA study for clearance. However the impact of the activity on the environment has been meticulously examined by the project proponent.

- the combustion of alternative fuels will not lead to noticeable increase of emissions of airborne controlled substances such as dust or sulphur dioxide
- the project is not expected to result in additional emissions to water
- increased emissions due to transport of alternative fuels are small and are at least partly offset by emission reductions in the upstream processes of the replaced fossil fuels
- the project will reduce substantially the amount of biomass residues that are currently disposed of in an unsustainable way

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
No negative impact of the project activity has been identified.

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>
The 16 November CEMEX Costa Rica invited different PYMES (Small and Medium Companies of the zone) and neighbors from the Colorado and Sanbuenaventura communities (nearest the plant), to visit its facilities in Colorado Plant to show them a project that has a very important contribution environmentally and CEMEX Costa Rica is planning to develop it.

The stakeholders consultation took place in one of the reunion rooms of Colorado Plant. The consultation consisted in the explanation to the guests of what the project consist and a presentation was showed for explaining what activities is CEMEX Costa Rica currently doing and what are the plans to develop the project.

After the presentation, the doubts were cleared and CEMEX proceeded to give to each participant a questionnaire (see annex) in which it was asked their opinion about the project, their preoccupations and if they agreed or not in which CEMEX develop this project.

At the end of the presentation the guest signed an Assistance registry. Also photos were taken from the presentation as evidence for the project approval.

The groups invited to the consultation were associations that have been favored by the agreements of CEMEX Costa Rica and the schools of the community. These organizations and schools are the following:

- Asociación de Mujeres de Colorado (ASOMUC) - PYME
- Asociación de Mujeres de Sanbuenaventura (ASOMUS) - PYME
- Oscar Gómez (Dios de Pacto Church) – Communal leader
- Aventuras Turísticas de Colorado - PYME
- Viviana Gómez (San Buenaventura School)
- Gerardo Carrillo (Peñas Blancas School)
- Shirley Romano (Colorado School)
- Enock Riso - Justo Tenorio (Asociación de Desarrollo Integral de Colorado)
- Nicolas Orias - Dayla Galagarza (Asociación de Desarrollo Integral de San Buenaventura)

The following authorities and association were interviewed:

- FONAFIFO : FONDO NACIONAL DE FINANCIAMIENTO FORESTAL.
- Local authorities.
- Designated National Authority in Costa Rica (OCICC).
- Health Ministry.
- CONARROZ: the main rice producer.

E.2. Summary of the comments received:

>>
No objections have been received.

E.3. Report on how due account was taken of any comments received:

>>
NA

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

PRIMARY PROJECT SPONSOR

Organization:	CEMEX COSTA RICA, S.A.
Street/P.O.Box:	
Building:	
City:	Colorado de Abangares
State/Region:	Department of Guanacaste
Postfix/ZIP:	
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URL:	www.cemex.co.cr
Represented by:	
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CONSULTANT

Organization:	CO_2 Global Solutions International S.A. (Consultant)
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Represented by:	Alfonso Lanseros Valdés
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Direct FAX:	00 34 91 781 41 49
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Personal E-Mail:	alv@co2-solutions.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

N/A

Annex 3

BASELINE INFORMATION

Baseline scenario: Ag. 2003 – July 2004.

Baseline Scenario (Ag. 2003 - July 2004)

	Ton	%
Fuel Oil	3.706	7,1%
Coke	44.288	75,0%
Coal	19.451	17,9%
Clinker production	tClinker	592.237

Fuel data:

	Heat value	Heat value	Carbon content	Emission factor
	kcal/kg	TJ/ton	tC/TJ	tCO2/TJ
Fuel Oil	9.320	0,0390	21,1	77,37
Coke	8.200	0,0343	27,5	100,83
Coal	4.450	0,0186	26,2	96,07
Rice Husk	3.200	0,0134	0,00	0,00
Saw dust	2.000	0,0084	0,00	0,00
Other biomass residues	4.000	0,0167	0,00	0,00
Residual fuel oil	4.000	0,0167	20,00	73,33

Fuel consumption and clinker production in project scenario:

Project scenario		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Fuel Oil	Ton	1.208	1.208	1.208	1.208	1.208	1.208	1.208	1.208	1.208	1.208
Coke	Ton	47.001	47.001	47.001	47.001	47.001	47.001	47.001	47.001	47.001	47.001
Coal	Ton	0	0	0	0	0	0	0	0	0	0
Rice Husk	Ton	19.850	19.850	19.850	19.850	19.850	19.850	19.850	19.850	19.850	19.850
Saw dust	Ton	19.450	19.450	19.450	19.450	19.450	19.450	19.450	19.450	19.450	19.450
Other biomass residues	Ton	938	938	938	938	938	938	938	938	938	938
Residual fuel oil	Ton	8.309	8.309	8.309	8.309	8.309	8.309	8.309	8.309	8.309	8.309
CPr Total Clinker production	tClinker	649.000	649.000	649.000	649.000	649.000	649.000	649.000	649.000	649.000	649.000

Heat input from project alternative fuels in project scenario:

Heat Input from alternative fuels Project		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
HIaf input in project scenario	TJ/year	444	444	444	444	444	444	444	444	444	444

Moisture penalty

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
MPy moisture penalty											
HCbl specific fuel consumption in project scenario	TJ/tClinker	0,00345	0,00345	0,00345	0,00345	0,00345	0,00345	0,00345	0,00345	0,00345	0,00345
HCpr specific fuel consumption in baseline	TJ/tClinker	0,00342	0,00342	0,00342	0,00342	0,00342	0,00342	0,00342	0,00342	0,00342	0,00342
MPy moisture penalty	TJ/año	23	23	23	23	23	23	23	23	23	23

Alternative fuel emissions

N/A

Baseline emissions:

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Baseline emissions											
EFff expost emission factor	tCO2e/TJ	98,09	98,09	98,09	98,09	98,09	98,09	98,09	98,09	98,09	98,09
EFff exante emission factor	tCO2e/TJ	98,31	98,31	98,31	98,31	98,31	98,31	98,31	98,31	98,31	98,31
FFghg GHG baseline emissions from fossil fuels	tCO2e	41.322	41.322	41.322	41.322	41.322	41.322	41.322	41.322	41.322	41.322

Calculation of CH4 emissions due to biomass residues that would be burned in absence of the project.

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Biomass residues burnt in absence of the project activity											
Rice husk burnt in the open field	ton/year	19.850	19.850	19.850	19.850	19.850	19.850	19.850	19.850	19.850	19.850
Saw dust burnt in the open field	ton/year	19.450	19.450	19.450	19.450	19.450	19.450	19.450	19.450	19.450	19.450
BCF carbon fraction of Rice Husk	tC/tbiomass	0,41	0,41	0,41	0,41	0,41	0,41	0,41	0,41	0,41	0,41
BCF carbon fraction of Saw dust	tC/tbiomass	0,47	0,47	0,47	0,47	0,47	0,47	0,47	0,47	0,47	0,47
CH4F	%	0,5%	0,5%	0,5%	0,5%	0,5%	0,5%	0,5%	0,5%	0,5%	0,5%
CH4/C mass conversion factor		1,33	1,33	1,33	1,33	1,33	1,33	1,33	1,33	1,33	1,33
GWP CH4 global warming potential of methane	tCO2e/tCH4	21	21	21	21	21	21	21	21	21	21
BB CH4	tCO2e/year	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437

Calculation emissions from off-site transport of alternative and fossil fuels

		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Emissions from off-site transport											
Q_AF	ton/year	40.238	40.238	40.238	40.238	40.238	40.238	40.238	40.238	40.238	40.238
CT_AF average truck capacity AF	ton/veh.	16	16	16	16	16	16	16	16	16	16
D_AF average round-trip distance AF	km/trip	117	117	117	117	117	117	117	117	117	117
RQff quantity of fossil fuel reduced	ton/año	0	0	0	0	0	0	0	0	0	0
CT_FF average truck capacity AF	ton/veh.	0	0	0	0	0	0	0	0	0	0
D_FF average round-trip distance AF	km/trip	0	0	0	0	0	0	0	0	0	0
EFCO2 transport	kgCO2e/km	1,1079	1,1079	1,1079	1,1079	1,1079	1,1079	1,1079	1,1079	1,1079	1,1079
LK_trans	tCO2e/year	322	322	322	322	322	322	322	322	322	322

Emission reductions

Emission reductions		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
FFghg BL	tCO2e/año	41.322	41.322	41.322	41.322	41.322	41.322	41.322	41.322	41.322	41.322
AFghg	tCO2e/año	0	0	0	0	0	0	0	0	0	0
LK-trans	tCO2e/año	322	322	322	322	322	322	322	322	322	322
BB CH4 emissions	tCO2e/año	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437	2.437
Leakege	tCO2e/año	2.115	2.115	2.115	2.115	2.115	2.115	2.115	2.115	2.115	2.115
AFER emission reductions	tCO2e/año	43.437	43.437	43.437	43.437	43.437	43.437	43.437	43.437	43.437	43.437

Annex 4

MONITORING INFORMATION

Please refer to Section B.7.