**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 02 - in effect as of: 1 July 2004)**

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**Annexes**



**Appendix**



**Enclosure**

## SECTION A. General description of project activity

### A.1 Title of the project activity:

>>

Partial replacement of fossil fuel by biomass as an alternative fuel, for Pyro-Processing in cement plant of Shree Cements Limited at Beawar in Rajasthan in India.

Version 01

26 October 2005

### A.2. Description of the project activity:

>>

**Pre Project Activity**

Shree Cements plant at Beawar in Rajasthan has two cement production units. Unit-I produced 1041442 Metric Tons, whereas Unit-II produced 1441805 Metric Tons of clinker in the year 2004-2005. Pyro processing which is the main energy intensive process of cement manufacturing burns fossil fuel to generate heat. In this process, raw material gets converted into clinker which is then finally being crushed to cement.

**Project Scenario and Post Project activity**

The proposed project activity is, partial replacement of fossil fuel by millet husk, soyabean husk, cotton sepal, mustard husk, saw dust (hereafter referred to as biomass fuel) for Pyro-processing in cement plant. The introduction of biomass firing in cement plant conserves non-renewable fuel resources and aids in Green House Gas (GHG) emission reduction.

The project activity is being implemented in phases; phase-1 involves replacement of part of fossil fuel with 150 Tonnes per day (TPD) of biomass in the Calciner & Kiln of unit 2. It contributes around 15 % of total process heat requirement of unit 2 and rest of the heat contribution (85%) will come from fossil fuels. Phase 2 of project activity envisage replacement of fossil fuel by 100 TPD of biomass in the Calciner and Kiln of unit 1. This contributes around 14 % of total process heat requirement of unit 1 and rest of the heat contribution (86%) will come from fossil fuels. Biomass firing system in cement plant is made up of state-of –the-art equipments and the system is monitored and controlled by the highly modernized central control room. The technology to use biomass fuels in the Calciner & Kiln is indigenously developed by project proponent (Shree Cements Limited).

Shree Cements Limited (SCL) procures biomass from farmers & biomass dealers which are brought to the cement plant through trucks. The biomass supply chain from collecting, sorting, and processing & transportation of biomass is labour intensive. The internal study made by SCL reveals that one-ton of biomass collection, sorting & processing requires at least 5 people. The project activity contributes towards the social well being of the local community by providing employment opportunities, both direct as well as induced.

The biomass business generates additional revenue for the economically backward farmers, which helps in ameliorating the economic status of the farmers of the region. The project activity hence contributes to economic well-being of the community.

**A.3. Project participants:**

>>

| Name of Party involved ( 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) |
|---|---|---|
| Ministry of Environmental & Forest (MoEF), India | Shree Cements Limited (Private entity) | No |

**A.4. Technical description of the project activity:**

**A.4.1. Location of the project activity:**

>>

**A.4.1.1. Host Party(ies):**

>> Ministry of Environment and Forest, Government of India

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

>> Rajasthan

**A.4.1.3. City/Town/Community etc:**

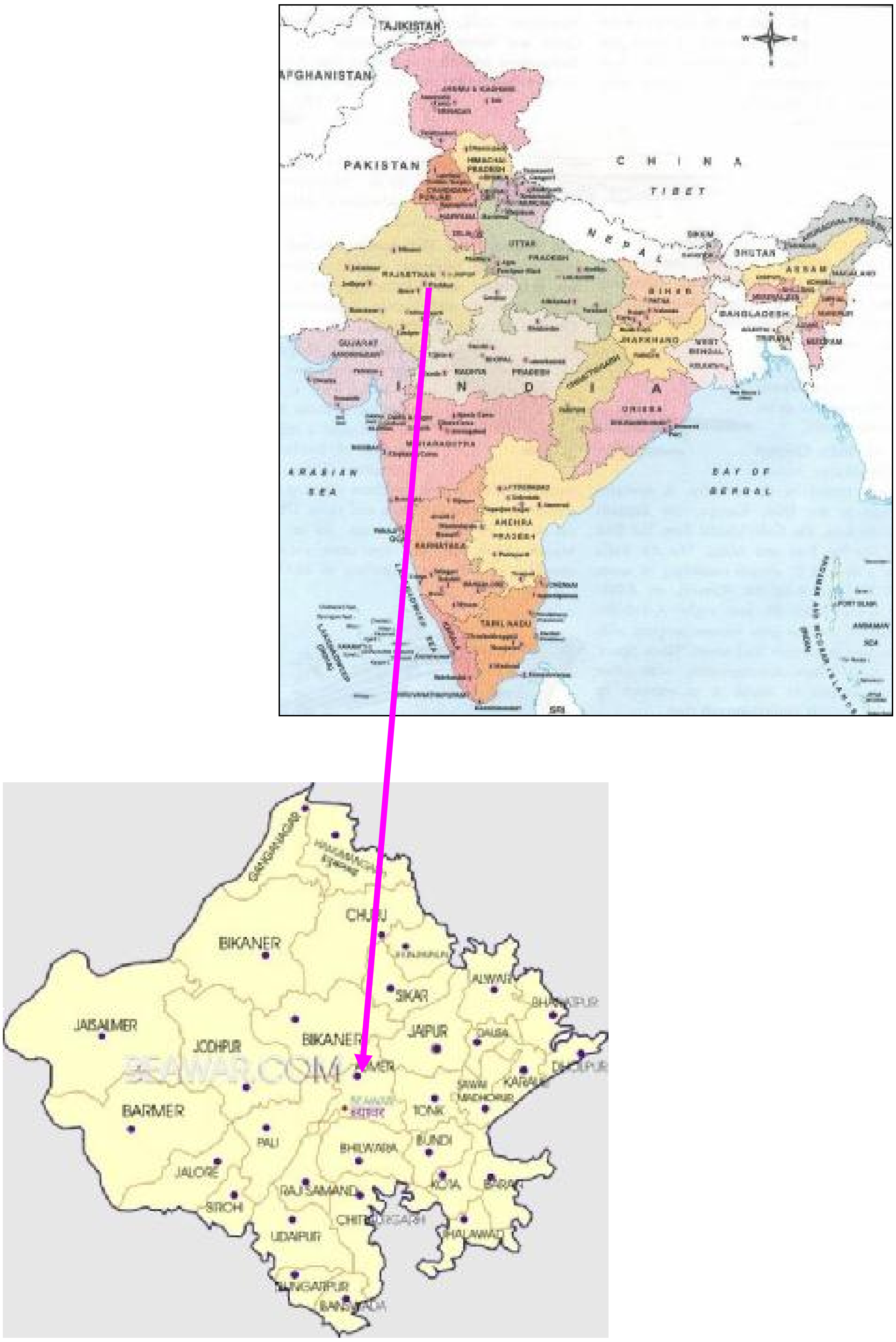
>> Beawar

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

>>

The project activity is located at cement manufacturing facility of Shree Cements Limited at Beawar, in Ajmer district in Rajasthan .The plant is located near Delhi – Ahmedabad highway and is 185 km from Jaipur – the state capital. The plant is well connected by railway line and the nearest port is Kandla.

Fig 1 : Location of activity site



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

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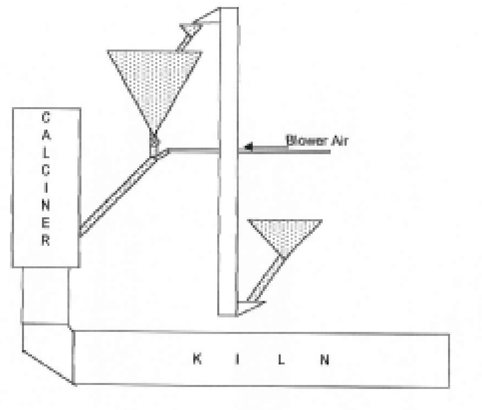
The project activity can be categorised under sectoral scope number 4 for Manufacturing Industries, as per the classification of sectoral scope for accreditation of designated operational entity. This sectoral scope is based on list of sectors and sources contained in annexure A of the Kyoto Protocol.

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

>>

The technology to be employed for burning biomass fuel is indigenously developed by SCL. Various experts from manufacturing technology providers like KHD, Germany were consulted for the project. SCL personnel have made many visits to countries like Switzerland to gain experience to use alternate fuels in Kiln. The biomass fuel received from various sources (farmers, biomass dealers) is fed to the dump hopper of 5T capacity. An agitator is placed below the hopper, which takes care of free flow of biomass to the weigh feeder.

The weigh feeder of 1 % accuracy level weighs and regulates the biomass fed to the belt conveyor. The troughed belt conveyor transports the biomass to the preheater building. The troughed belt conveyor is chosen to abate the impacts of abrasion property of biomass. The conveyor is fully covered to avoid dust emission and minimize environmental impacts. The pneumatically operated control valves (installed at the discharge end of the belt conveyor) ensure leak proof biomass feeding to the pyroclone. This feeding point is chosen by various practical experiments and expert consultations. The biomass feeding system is monitored and controlled by the state-of-the-art central control room. While designing the feeding system, care has been taken to ensure accurate and consistent dosing without jamming of kiln materials.




The various critical parameters like clinker quality, kiln operational stability and productivity , biomass Feeding rate, fuel mix, combustion properties in kilns, were studied and analyzed by numerous, periodic trails & experiments. A typical feeding diagram for biomass in calciner is shown in the above figure.

**A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:**

>>

The proposed CDM project activity, involves partial replacement of fossil fuel by carbon neutral biomass fuel. The heat generated as a result of burning fuel, will be used in kiln for conversion of raw material into final product known as clinkers.

Biomass burning as fuel would emit less quantity of GHGs in comparison if fossil fuel is used for producing equivalent amount of heat. The partial replacement of carbon intensive fossil fuel by biomass, results in lowering of GHG emissions from the project activity.

The above statement is supported by theory “Net emissions from the renewable energy sources are zero”. As per this theory the total amount of carbon di oxide released on burning of biomass is equivalent to amount of carbon di oxide which biomass takes from atmosphere during photosynthesis process, which is then stored in biomass as carbon. Therefore the net emission on burning biomass is zero.

The biomass to be used viz. millet husk, soyabean husk, cotton sepal, mustard husk, saw dust contains only negligible quantities of elements like Nitrogen, Sulphur etc, hence release of other GHG’s are considered as negligible. The biomass is proposed to be stored for only 10-12 days and hence there is no chance of methane formation and associated emission.

Government of India, through Ministry of Non Conventional Energy Sources promotes various non conventional energy projects in various industrial sectors. Despite of extended government support, use of alternative biomass fuel in cement manufacturing is not a common practice in India. The fuel receipt and consumption pattern[1] in cement industry in India is presented in Table 1

**Table 1: Fuel receipt and consumption pattern in cement manufacturing process in india**

| Year | Receipt (Mn.T) | | | | Consumption (Mn.T) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Coal | Lignite | Petcoke | Total | Coal | Lignite | Petcoke | CPP | Total |

[1] Cement Manufacturing Association (CMA) statistics.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2000-01 | 14.93 | 0.05 | 0.37 | 15.35 | 13.05 | 0.05 | 0.37 | 1.9 | 15.37 |
| 2001-02 | 15.33 | 0.08 | 0.88 | 16.29 | 12.82 | 0.08 | 0.88 | 2.03 | 15.81 |
| 2002-03 | 20.44 | 0 | 1.09 | 17.87 | 14.17 | 0 | 1.09 | 2.57 | 17.83 |
| 2003-04 | 17.55 | 0.11 | 1.41 | 19.07 | 14.20 | 0.11 | 1.41 | 3.22 | 18.94 |
| 2004-05 | 19.74 | 0.76 | 1.87 | 22.37 | 14.95 | 0.76 | 1.87 | 3.63 | 21.21 |

It is evident from above table that use of alternative fuel has not been practiced in cement manufacturing in India in past years. Hassles associated with collection and transportation of biomass, absence of price controlling or regulating body, technological constraints associated with use of biomass in High temperature Kiln are some of the impediments in considering biomass use as a fuel in cement manufacturing.

The project proponent has taken decision to go ahead with the project despite of various constraints. The financial benefits which will come from the project in terms of CER credits on registration of project as a CDM activity would contribute positively to the financial viability of the project. In absence of carbon revenues, the project activity will not take place and manufacturing plant shall continue using pet coke and coal combination emitting large quantity of GHGs.

### A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

>>

**Table 2: CER reduction**

| Year | CER reduction | |
|---|---|---|
| | Unit-I | Unit-II |
| 2006-07 | 43005 | 63301 |
| 2007-08 | 43005 | 63301 |
| 2008-09 | 43005 | 63301 |
| 2009-10 | 43005 | 63301 |
| 2010-11 | 43005 | 63301 |
| 2011-12 | 43005 | 63301 |
| 2012-13 | 43005 | 63301 |
| 2013-14 | 43005 | 63301 |
| 2014-15 | 43005 | 63301 |
| 2015-16 | 43005 | 63301 |

| | | |
|---|---|---|
| **Total estimated reductions (**tonnes $CO_2$ equ.**)** | **430050** | **633010** |
| **Total no of Crediting Years** | 10 years | 10 years |
| **Annual average over the crediting period of estimated reductions (**tonnes of $CO_2$ e**)** | **106306** | |

**A.4.5. Public funding of the project activity:**

No public funding has been involved in the project.

## SECTION B. Application of a baseline methodology

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

>>
Title: **"Emission reduction through partial substitution of fossil fuels with alternative fuel in cement manufacturing"**
Reference: ACM0003, www.unfccc.org
[Approved by UNFCCC EB, Based on NM0040 & NM0048]

### B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

>>
Approved Baseline methodology "Emission reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture" (Approved consolidated methodology ACM0003, which is based on NM0040 & NM0048, is available on UNFCCC website) is appropriate for SCL's proposed project activity. The proposed project activity of SCL matches all the applicability criteria of ACM0003.

Following are the justifications for choosing ACM0003 as appropriate methodology for the proposed project activity.
**Fossil fuel(s) used in cement manufacture are partially replaced by alternative fuels, including renewable biomass, where renewable biomass residues are in surplus and leakages in other uses of the renewable biomass will not occur**

SCL has been planning to use 150 TPD of biomass in Phase-1 of the project which will contribute to 15% of the total heat requirement of the project. This amount of biomass will be burnt in unit-II of cement manufacturing plant. The Phase-II of the project envisage usage of 100 TPD of biomass in unit-I, which will contribute to 14% of the total heat requirement in unit-I. As per the biomass availability study[2] in the region quantity of biomass available in the region (0-15 km) is more than 1.5 times the requirement. Below is the table which shows the biomass availability in the region.

**Table : Surplus Biomass availability for SCL's Plant at Beawar**

| Source | Surplus Biomass Availability (MT/annum) | | | |
|---|---|---|---|---|
| | **0-15 km** | **15–50 km** | **50-100 km** | **Total** |
| Surplus Biomass generation from non agricultural land | 1,30,434 | 2,05,556 | 3,41,561 | 6,77,551 |
| Surplus Biomass generation from agricultural land | 48,959 | 1,45,190 | 2,19,712 | 4,13,860 |
| Waste wood and Saw dust | 0 | 0 | 4,500 | 4,500 |
| Total | 1,78,393 | 3,50,746 | 5,65,773 | 10,95,911 |

**$CO_2$ 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)**

Emission reductions due to replacement of part of carbon intensive fossil fuel by biomass residue have only been taken into account for calculations. Any other emission reductions occurred either during decarbonisation or in Pyro processing are not considered for CER calculations, as suggested in adopted methodology. (please see the emission reduction calculation for details).

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

As per the approved methodology, all calculations for CER estimation have been performed using clinker production data for the year 2004-2005. There will be no impact of project activity on the production of

[2] Refer Biomass Assessment Study Report prepared by Mitcon Consultancy Services Ltd. August 2004

manufacturing unit. The clinker production details for both units of the manufacturing plant for the year 2004-2005[3] are as follows:

| | |
|---|---|
| **Unit-I** | **1041442 MT** |
| **Unit-II** | **1441805 MT** |

**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**

Shree Cements limited conducted biomass survey to study the biomass availability in the region. It is evident from the report that there is excess amount of biomass available in the region. There is no established use of biomass in the region and the quantity of biomass available is more than 1.5 times its usage.

### B.2. Description of how the methodology is applied in the context of the project activity:

>>

The approved methodology ACM0003 is based upon two cases, "Replacement of Fossil Fuel by Palm Kernel Shell Biomass residue in cement manufacturing" NM0040, prepared by Lafarge Asia, and "Indocement's sustainable cement production project"NM0048-rev, prepared by Indocement. The project activity of Shree Cements Limited, partial replacement of fossil fuel by Biomass residue fuel in Pyro processing fulfils all applicability conditions given in the applicability criteria of the methodology. Applicability criteria of ACM0003 have been discussed in details in the above section.

The physical project boundary covers all production processes related to clinker production. The specific production step associated with GHG emissions that will define the project boundary primarily includes pyro-processing. In terms of gases covered, within the project boundary only $CO_2$ emissions from the combustion of fuels are considered, because the cement manufacturing process involves high combustion temperatures and long residence times that would limit production of other GHG emissions

**Baseline scenario selection**

***1. Define alternative scenarios for the fuel mix***

Pyro Processing is the most energy intensive process of cement manufacturing. The common practice in India is to use fossil fuel like coal, petcoke, lignite etc. for burning in Kilns during pyro processing. Alternative fuel like tyres or industrial wastes has been used as an alternative fuel in cement manufacturing but its usage is limited. It is evident from statistics of cement manufacturing association that fossil fuel is

[3] Data provided by SCL.

the predominant fuel for cement manufacturing in India. The baseline scenario has been selected by considering various alternative scenarios and selecting the most plausible scenario which would have occurred in the absence of project activity by performing barrier analysis.

***Option 2: Select baseline scenario through barriers analysis***

**Alternative Scenariao-1: Continuation of current practice scenario**

Current practice in cement manufacturing is to use fossil fuel for burning in Kilns. Use of Biomass residue or any other alternative fuels like industrial waste, Municipal Solid Waste (MSW) etc. has not been practised. Various advantages associated with the use of conventional fossil fuel are enumerated below:

- Availability of large quantity of coal in India and regulatory price mechanism of coal which removes uncertainties associated with its prices, make coal as the most sought fuel for burning in India.
- Biomass residue market being an unorganized market poses disadvantages in collection and distribution and hence not a preferred choice.
- Lack of technological advancement in area of burning biomass fuel at a very high temperature, as in Kiln inhibits use of alternative fuel and vis a vis promote usage of fossil fuel.
- Use of alternative fuel is not mandatory as per the Indian regulations, hence manufacture prefer to choose an economically better fossil fuel.

**Alternative Scenario-2: Investment in energy efficiency improvement projects motivated by potential for energy cost savings.**

Shree Cements has a vision about fast depleting non renewable energy sources. It is implementing various energy efficiency projects, like flyash blending in cement manufacturing, as its commitment towards sustainable development. Since the company is already implementing various energy efficiency projects, any other alternative energy efficiency project is not likely to happen in absence of project activity.

**Alternative Scenario-3: Scenario in which traditional fuels are partially substituted with alternative fuels (i.e. the proposed CDM project activity).**

Use of alternative fuel is not a preferred choice because of various advantages associated with use of fossil fuels as enumerated in Alternative scenario -1 and barriers associated with use of alternative fuel.

**Additionality**

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

SCL has done trial run with Biomass alternative fuel and wishes to start using it from 1st April 2006.

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

Various alternatives have been discussed above to select the most plausible baseline scenario. Alternative-1 is the most economical scenario as it does not seek any investment. Alternative scenario-2 is not applicable as discussed above. Scenario-3 being uneconomical on account of anticipated production losses and barriers enumerated below, associated with use of alternative fuel, can not be considered as baseline scenario.

**Step 2. Investment analysis**

**Step 3. Barrier analysis**

Shree Cements Limited proceeds with the Step 3 i.e Barrier Analysis, to depict the additionality of the project activity.

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

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

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

There are several barriers associated with the use of alternative fuel in cement manufacturing industry. It is evident from the fact that till now there is no well established practice of using alternative fuel in kiln in India for burning as present in the European Union. The proposed project activity has to overcome various barriers which are presented in the following paragraphs.

- Technological Barrier

Unavailability of practising technology for using biomass in Kiln for cement manufacturing in India inhibits usage of alternative fuel. SCL will be one of the first cement manufacturing companies in India which will use biomass based residue for burning in the kiln. The fuel consumption pattern data of cement manufacturing association for the year 2004-2005 is presented below.

**Fuel consumption pattern in cement manufacturing process in india**

| Sl No | Fuel type | Consumption in kilns (Million Tones) | % |
|---|---|---|---|
| 1 | Coal | 14.95 | 85.04 |
| 2 | Pet coke | 1.87 | 10.64 |
| 3 | Lignite | 0.76 | 4.32 |
| | **Total** | **17.58** | **100** |

It is evident from the table that only fossil fuel has been used in cement manufacturing till recent years.

- Other Barriers

***Resource Barrier***: Shree Cement limited has an experience of using fossil fuel in Kiln and does not have trained people to handle biomass residue. Biomass being a highly volatile material requires modification in handling and storage requirements.

***Market Barrier:*** Unsustainable biomass supply, non existence of a fuel market with unreliable supply and price fluctuations acts as a barrier in using Biomass. Transportation difficulties associated with biomass poses barrier in setting up fuel transportation network.

***Investment Barrier:*** Storage capacity has to increase due to fluffy nature of the biomass which incurs an additional investment cost. An alternative arrangement of hopper, belt conveyor, rotary air lock, weighing device is required to transport biomass from ground level to precalciner. Installation of these units again requires an additional investment.

***Production Losses:*** SCL uses biomass on trial bases before implementation of the project activity. It is evident from the test report that on replacing a part of fossil fuel with biomass there is an overall reduction in the clinker production. The anticipated production loss acts as a barrier in taking decision to implement the project activity. Report of the test is available with SCL. Large construction activities in the state results in huge demand for cement. Due to production losses SCL may not be able to meet the cement demand of dealers on time. This may tarnish the reputation of SCL in the market, hence causing long term harm to the company. Despite of this threat, SCL took the decision of going ahead with the project activity showing its confidence in Clean Development Mechanism of UNFCC.

From the Step 1 and Step 3 it can be concluded that there are alternatives as given in section B.2. that do not have any impediments preventing their implementation. However the project activity faces barriers, which would prevent SCL from implementing the project activity as elaborated in the 'Barrier Analysis'.

**Step 4. Common practice analysis**

Use of alternative fuel in cement manufacturing is not a common practice in India. Data of cement manufacturing association presented in above paragraphs depicts that use of fossil fuels like coal and pet coke is predominant in India. The project activity is unique as it takes the risk of implementing the project despite of barriers explained above.

**Step 5. Impact of CDM Registration**

Registration of proposed project activity under CDM of UNFCC has increased its viability. Following are the major impacts of registration of project under CDM:

- Anticipation of production losses has made the project activity economically unviable. Inflow of carbon revenue as a result of registration may boost the financial attractiveness of the project.
- The project can become a role model for others in cement manufacturing, has it been able to achieve its financial bottom line because of registration and subsequent carbon revenues.
- Registration of project activity promotes the usage of renewable energy sources in manufacturing. Thereby causing net reduction in GHGs emissions.
- Registration of project activity will enhance the confidence of other project developers in Clean Development Mechanism of Framework.

**Baseline and project emissions calculations**

The calculations are discussed in the section E of CDM PDD.

**B.3. 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:**

>>

The above section discuss about the additionality of the project activity. It is established carbon intensive fossil fuel emanates large quantity of GHGs which gets reduced on replacement of fossil fuel by carbon neutral biomass. This reduction in emission would have been not occurred in the absence of the project activity.

**B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:**

>>

The project boundary includes all processes related to clinker production. The specific production step is Pyro processing which has been considered for defining project boundary. Due to high combustion temperature and long residence time only $CO_2$ from fuel burning is considered.

**B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:**

>>

Date: 21/11/2005

Entity: Shree Cements Limited and Associated consultants

## 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:

>>

The Project Activity starting date has been taken as 1st April 2006

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

>>

25 years

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

Project activity will use fixed crediting period of ten years.

#### C.2.1. Renewable crediting period

Not Applicable

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

>>

Not Applicable

##### C.2.1.2. Length of the first crediting period:

>>

Not Applicable

#### C.2.2. Fixed crediting period:

##### C.2.2.1. Starting date:

>>

01/04/2006

##### C.2.2.2. Length:

>>

10 years 0 months

## SECTION D. Application of a monitoring methodology and plan

### D.1. Name and reference of approved monitoring methodology applied to the project activity:

>>

Title: **"Monitoring Methodology for emission reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture"**
Reference: ACM0003, www.unfccc.org
[Approved by UNFCCC EB, Based on NM0040 & NM0048]

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

>>

Approved monitoring methodology "Emission reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture" is appropriate for proposed project activity as all the applicability conditions of this methodology are fulfilled.

Justification for using the said methodology has been given in the following paragraphs.

**Fossil fuel(s) used in cement manufacture are partially replaced by alternative fuels, including renewable biomass, where renewable biomass residues are in surplus and leakages in other uses of the renewable biomass will not occur**

Proposed project activity will partially replace the fossil fuel by alternative biomass fuels like millet husk, soyabean husk, cotton sepal, mustard husk, saw dust in the cement manufacturing. Biomass availability study has been conducted and it is found that the agriculture by-products are available in excess quantity in the near vicinity of project area. SCL has proposed to use 150 TPD of biomass for Phase-I and 100 TPD of biomass in Phase-II.

**$CO_2$ 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 only has been 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 methodology (Please see the emission reduction calculation for details).

**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 has no impact on the production capacity of the plant. Clinker production data for the year 2004-2005 has been taken for estimation of CERs.

| | |
|---|---|
| **Unit-I** | **1041442 MT** |
| **Unit-II** | **1441805 MT** |

**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**

Shree Cements limited conducted biomass survey to study the biomass availability in the region. It is evident from the report that there is excess amount of biomass available in the region. There is no established use of biomass in the region and the quantity of biomass available is more than 1.5 times its usage.

## D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

### D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

| ID number *(Please use numbers to ease cross-referencing to D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| **Monitoring of parameter related to clinker production** | | | | | | | | |
| D.2.1.a | Clinker Production | Plant | Tonnes | M, C | Recorded/ calculated & reported monthly | 100% | Electronic | |
| **Monitoring of emissions related to the use of alternative fuels in kilns during the crediting period (for each type of fuels)** | | | | | | | | |
| D.2.1.b | Quantity of Alternative fuel used | Plant | Tonne | M & C | Recorded continuously& reported monthly | 100% | Electronic | |
| D.2.1.c | Heat value of alternative fuel | Laboratory/ Plant | TJ/ton | M & C | Monthly | 100% | Electronic | |
| D.2.1.d | Alternative | Plant | C | Calculated & | Monthly | 100% | Electronic | |

| ID number *(Please use numbers to ease cross-referencing to D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| | fuel heat input | | | reported monthly | | | | |
| D.2.1.e | Moisture in alternative fuel | Laboratory/ Plant | % | Actual sample testing before kiln firing | Monthly | 100% | Electronic | |
| D.2.1.f | Emission factor | Fixed | $TCO_2$/TJ | IPCC Default value | Fixed | 100% | Electronic | |
| D.2.1.g | Share of heat input from alternative fuel | Plant | % | Calculated | Monthly | 100% | Electronic | |
| D.2.1.h | Moisture penalty | Plants | MJ/tonne /10% alt fuel share | Calculated | At start of crediting period | 100% | Electronic | |

**D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)**

>>

**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).

**2. Calculate alternative heat input as a share of total baseline fossil fuel heat input**

$$S_{AF} = \frac{HI_{AF}}{\sum Q_{FF} \times HV_{FF}} \quad \textbf{(2)}$$

Where:

$S_{AF}$ = alternative heat input share of total baseline fossil fuel heat input

$HI_{AF}$ = heat input from alternative fuels (TJ/yr)

$Q_{FF}$ = quantity of each fossil fuel used in baseline (tonnes/yr)

$HV_{FF}$ = lower heating value of the fossil fuel(s) used in baseline (TJ/tonne fuel).

**3. Application of project specific moisture "penalty"**

$$mp = \frac{(HC_{AF}(i) - HC_{FF})}{S_i} \times 10 \quad \textbf{(3)}$$

Where:

mp = moisture penalty (MJ/tonne/10% alternative fuel share of total heat input)

$HC_{AF}$(i) = specific heat consumption using *i* % alternative fuel (MJ/tonne clinker)

$HC_{FF}$ = specific heat consumption using fossil fuels only (MJ/tonne clinker)

Si = alternative fuel heat input share of total baseline heat input in the moisture penalty test

**The total moisture penalty is therefore calculated as follows:**

$$MP_{Total} = \frac{S_{AF}}{10\%} \times C \times mp \qquad \textbf{(4)}$$

Where:

$MP_{Total}$ = total moisture penalty (TJ/yr)

$S_{AF}$ = alternative fuel heat input share of total baseline heat input

C = total clinker production (tonnes/yr)

mp = moisture penalty (MJ/tonne-10% alternative fuel share of total heat input)

**4 Calculate GHG emissions from the use of alternative fuels in kilns:**

$$AF_{GHG} = \sum (Q_{AF} \times HV_{AF} \times EF_{AF}) \qquad \textbf{(5)}$$

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).

**D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project**

| boundary and how such data will be collected and archived : | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ID number *(Please use numbers to ease cross-referencing to table D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e), | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
| **Monitoring of parameter related to clinker production** | | | | | | | | |
| D.2.2.a | Clinker Production | Plant | Tonnes | M, C | Recorded/ calculated & reported monthly | 100% | Electronic | |
| **Monitoring of emissions related to the use of alternative fuels in kilns during the crediting period (for each type of fuels)** | | | | | | | | |
| D.2.2.b | Fossil fuel used | Plant | Tonne | M & C | Recorded continuously & reported monthly | 100% | Electronic | |
| D.2.2.c | Heat value of fossil fuel | Laboratory/ Plant | TJ/ton | M & C | Monthly | 100% | Electronic | |
| D.2.2.d | Emission factor | Fixed | $TCO_2$/TJ | IPCC Default value | Fixed | 100% | Electronic | |

| **D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)** |
|---|

>>

**1. Calculate the baseline GHG emissions from the fossil fuel(s) displaced by the alternative fuel(s)**

$$FF_{GHG} = [(Q_{AF} \times HV_{AF}) - MP_{TOTAL}] \times EF_{FF} \quad \textbf{(7)}$$

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 baseline value and would be the weighted average for the mix of fossil fuels if more than one fossil fuel is used.

| **D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).** |
|---|

Not applicable.

| **D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:** |
|---|

| ID number *(Please use numbers to ease cross-referencing to table D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e), | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |

**D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.):**

>>

**D.2.3. Treatment of leakage in the monitoring plan**

**D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity**

| ID number *(Please use numbers to ease cross-referencing to table D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| **Monitoring of emissions due to offsite transport of fuels** | | | | | | | | |
| D.2.3.a | Alternative fuels | Plant | Ton | Measured | Recorded continuously & reported monthly based on actual silo stock level change | 100% | Electronic | |
| D.2.3.b | Average truck capacity for alternative fuel | Plant | Ton/truck | Calculated | Monthly | 100% | Electronic | |
| D.2.3.c | Average distance for transportation of alternative fuels | Plant / transporters | Km/truck | Calculated | Monthly | 100% | Electronic | |

| ID number *(Please use numbers to ease cross-referencing to table D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| D.2.3.d | Emission factor | IPCC default value | $TCO_2$/TJ | Fixed | Fixed | 100% | Electronic | |
| D.2.3.e | Quantity of fossil fuel replaced by alternative fuels | Plant | Ton | Measured | Recorded continuously and reported monthly | 100% | Electronic | |
| D.2.3.f | Average truck capacity for fossil fuel | Plant | Ton/truck | Calculated | Monthly | 100% | Electronic | |
| D.2.3.g | Average distance for transportation of fossil fuels | Plant / transporters | Km/truck | Calculated | Monthly | 100% | Electronic | |
| **Monitoring of alternative fuel reserves that may be used by other users (Data to be completed for each type of fuel independently)** | | | | | | | | |
| D.2.3.g | Alternative fuels used by | Third party survey | Ton | Estimated | Yearly | 100% | Electronic | Track whether project activity reduces alternative fuel available to other users |

| ID number *(Please use numbers to ease cross-referencing to table D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| | other users | | | | | | | groups so that their GHG emissions will increase |
| D.2.3.h | Alternative fuel reserve available in the region | Third party survey | Ton | Estimated | Yearly | 100% | Electronic | Track whether project activity reduces alternative fuel available to other users groups so that their GHG emissions will increase |

**D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)**

>>

**1. Calculate CH4 emissions due to biomass that would be burned in the absence of the project.**

$$BB_{CH4} = Q_{AF\text{-}B} * BCF * CH_4F * CH4/C * GWP\_CH_4 \quad \textbf{(8)}$$

Where:

$BB_{CH4}$ = GHG emissions due to burning of biomass that is used as alternative fuel (tCO2e/yr)

$Q_{AF\text{-}B}$ = amount of biomass 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 fuel (tC/t biomass) estimated on basis of default values,

$CH_4F$ = fraction of the carbon released as CH4 in open air burning (expressed as a fraction),

$CH_4/C$ = mass conversion factor for carbon to methane (16 tCH4/12 tC), and

$GWP\_CH_4$ = global warming potential of methane (21).

**2. Calculate the CH4 emissions due to anaerobic decomposition of wastes in landfills.**

$$LW_{CH4} = Q_{AF\text{-}L} * DOC * DOC_F * MCF * F * C * (1\text{-}OX) * NFL * GWP\_CH_4 \quad \textbf{(9)}$$

Where:

$LW_{CH4}$ = baseline GHG emissions due to anaerobic decomposition of biomass wastes in landfills ($tCO_{2e}$/yr)

$Q_{AF\text{-}L}$ = amount of wastes (e.g. biomass) used as alternative fuel that would be landfilled in the absence of the project (t/yr)

DOC = degradable organic carbon content of the waste (%)

$DOC_F$ = portion of DOC that is converted to landfill gas (0.77 default value)

MCF = methane conversion factor for landfill (%)

F = fraction of $CH_4$ in landfill gas (0.5 default value)

C = carbon to methane conversion factor (16/12)

OX = oxidation factor (fraction default is 0)

NFL = non-flared portion of the landfill gas produced (%)

$GWP\_CH_4$ = global warming potential of methane (21).

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

The emissions from transportation should be calculated as follows:

$$LK_{trans} = LK_{AF} - LK_{FF} \quad \textbf{(10)}$$

$$LK_{AF} = (Q_{AF}/CT_{AF}) * DAF * EFCO2e/1000 \quad \textbf{(11)}$$

$$LK_{FF} = (Q_{FF}/CT_{FF}) * D_{FF} * EF_{CO2e}/1000 \quad \textbf{(12)}$$

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 = 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)

$Q_{FF}$ = quantity of fossil fuel (tonnes) that is reduced due to consumption of alternative fuels.

$CT_{FF}$ = 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:

$$EF_{CO2e} = EFT_{CO2} + (EF_{T\,CH4} * 21) + (EF_{T\,N2O} * 310) \quad \textbf{(13)}$$

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.

**D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)**

>>

**Emission reductions by the project activity**

Total emission reductions are given by the following formula

$$AF_{ER} = FF_{GHG} - AF_{GHG} - OT_{GHG} - LK_{trans} + OT\_GHG_{FF} + BB_{CH4} + LW_{CH4} - GHG_{PAFO} \quad \textbf{(15)}$$

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)
$OT_{GHG}$ = GHG emissions from on-site transport and drying of 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)
$OT\text{-}GHG_{FF}$ = emissions from reduction of on-site transport of fossil fuels ($tCO_{2e}$)
$BB_{CH4}$ = GHG emissions due to burning of biomass that is used as alternative fuel ($tCO_{2e}$/yr)
$LW_{CH4}$ = baseline GHG emissions due to anaerobic decomposition of biomass wastes in landfills ($tCO_{2e}$/yr)
$GHG_{PAFO}$ = GHG emissions that could be generated during the preparation of alternative fuels outside the project site ($tCO_2$/yr)

| **D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored** | | |
|---|---|---|
| Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)* | Uncertainty level of data (High/Medium/Low) | Explain QA/QC procedures* planned for these data, or why such procedures are not necessary. |
| D.3.1.a | Low | ISO 9001 |
| D.3.1.b | Low | ISO 9001 |
| D.3.1.c | Low | ISO 9001 |
| D.3.1.d | Low | ISO 9001 |

| | | |
|---|---|---|
| D.3.1.e | Low | ISO 9001 |
| D.3.1.f | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.1.g | Low | ISO 9001 |
| D.3.1.h | Low | ISO 9001 |
| D.3.1.i | Low | ISO 9001 |
| D.3.1.j | Low | ISO 9001 |
| D.3.1.k | Low | ISO 9001 |
| D.3.1.l | Low | ISO 9001 |
| D.3.1.m | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.2.a | Low | ISO 9001 |
| D.3.2.b | Low | ISO 9001 |
| D.3.2.c | Low | ISO 9001 |
| D.3.2.d | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.3.a | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.3.b | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.3.c | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.3.d | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.3.e | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.3.f | Medium | Fraction of biomass that would have been decayed/burnt &/or landfilled will be estimated |
| D.3.3.g | Low | Yes, ISO 9001 |
| D.3.3.h | Low | ISO 9001 |
| D.3.3.i | Low | ISO 9001 |
| D.3.3.j | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |
| D.3.3.k | Low | ISO 9001 |
| D.3.3.l | Low | ISO 9001 |
| D.3.3.m | Low | ISO 9001 |

| | | |
|---|---|---|
| D.3.3.n | Low | ISO 9001 |
| D.3.3.o | Low | ISO 9001 |
| D.3.3.p | Low | ISO 9001 |
| D.3.3.q | Low | ISO 9001 |
| D.3.3.r | Low | While IPCC fractions are reliable defaults, the project proponent should validate these default values |

* QA/QC procedures should cover scope, responsibility, sampling of data, frequency of measurements, assumptions (if any), calibration frequency of instruments used (and status of calibration), and calculation/estimation/testing methods.

**D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity**

>>

SCL follows the guidelines of ISO-9001 for operations and process management. There will be a separate monitoring cell which monitors the overall activity starting from the procurement of biomass, quantity to be used in the kiln etc. separate persons for monitoring will be employed.

**D.5 Name of person/entity determining the monitoring methodology:**

>>

Shree Cements Limited and Associated Consultants

## SECTION E. Estimation of GHG emissions by sources

### E.1. Estimate of GHG emissions by sources:

>>

Following are sample calculations. For details, please refer Enclosure-1

**1. Heat input from alternative fuels**

Biomass fuel will be consumed

| | |
|---|---|
| Unit-I | = 33000 tones |
| Unit-II | = 49500 tones |
| Heating value of biomass fuel | = 0.014 TJ/ton of fuel |

$$HI_{AF} = \sum Q_{AF} \times HV_{AF}$$

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).

**Heat Input from alternative fuel for Unit-I**

$$HI_{AF} = (33000 \times 0.01359)$$

**= 448.58 TJ/annum**

**Heat Input from alternative fuel for Unit-II**

$$HI_{AF} = (49500 \times 0.01359)$$

**= 672.87 TJ/annum**

**2. Calculate alternative heat input as a share of total baseline fossil fuel heat input**

| | |
|---|---|
| Petcoke consumed in baseline (Unit-I) | = 99122.06 ton |
| Imported Coal consumed in baseline (Unit-I) | = 342.95 ton |
| Low CV Fuel consumed in baseline (Unit-I) | = 18688 |
| Petcoke consumed in baseline (Unit-II) | = 125264 ton |
| Imported Coal consumed in baseline (Unit-II) | = 0 ton |
| Low CV Fuel consumed in baseline (Unit-II) | = 26023 ton |
| Calorific value of petcoke | = 0.034 TJ/ton |
| Calorific value of Imported coal | = 0.026 TJ/ton |

Calorific value of Low CV Fuel = 0.0134TJ/ton

$$S_{AF} = \frac{HI_{AF}}{\sum Q_{FF} \times HV_{FF}}$$

Where:

$S_{AF}$ = alternative heat input share of total baseline fossil fuel heat input

$HI_{AF}$ = heat input from alternative fuels (TJ/yr)

$Q_{FF}$ = quantity of each fossil fuel used in baseline (tonnes/yr)

$HV_{FF}$ = lower heating value of the fossil fuel(s) used in baseline (TJ/tonne fuel).

$$S_{AF} = \frac{462.00}{3639.3}$$ **for Unit-I**

**=0.127**

$$S_{AF} = \frac{693.00}{4621.1}$$ **for Unit-II**

**= 0.15**

**3. Application of project specific moisture "penalty"**

$$mp = \frac{(HC_{AF}(i) - HC_{FF})}{S_i} \times 10$$

Where:

mp = moisture penalty (MJ/tonne/10% alternative fuel share of total heat input)

$HC_{AF}(i)$ = specific heat consumption using *i* % alternative fuel (MJ/tonne clinker)

$HC_{FF}$ = specific heat consumption using fossil fuels only (MJ/tonne clinker)

Si = alternative fuel heat input share of total baseline heat input in the moisture penalty test

**The total moisture penalty is therefore calculated as follows:**

$$MP_{Total} = \frac{S_{AF}}{10\%} \times C \times mp$$

Where:

$MP_{Total}$ = total moisture penalty (TJ/yr)

$S_{AF}$ = alternative fuel heat input share of total baseline heat input

C = total clinker production (tonnes/yr)

mp = moisture penalty (MJ/tonne-10% alternative fuel share of total heat input)

$$MP_{Total} = \frac{(HC_{AF}(i) - HC_{FF})}{S_i} \times C \times \frac{S_{AF}}{}$$

**= 20.49 TJ/annum for Unit-I**

**= 42.50 TJ/annum for Unit-II**

**4 Calculate GHG emissions from the use of alternative fuels in kilns:**

Being a Carbon neutral fuel GHG emission on fuel burning is **zero**

**5. Calculate GHG emissions due to preparation of alternative fuels**

Not Applicable

| E.2. Estimated leakage: |
|---|

>>

Leakages from difference off site transportation of Biomass and replaced fuel is calculated as per the calculations given below (for values refer Enclosure-1) it is found that reductions in emissions are there as Pet coke replaced has to be brought from large distances. Emission reductions arising out of this difference are not considered for net CER calculations. Leakages due to anaerobic decomposition or open burning are not considered as it does not depict the actual scenario.

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

The emissions from transportation should be calculated as follows:

$LK_{trans} = LK_{AF} - LK_{FF}$

$LK_{AF} = (Q_{AF}/CT_{AF}) * DAF * EFCO2e/1000$

$LK_{FF} = (Q_{FF}/CT_{FF}) * D_{FF} * EF_{CO2e}/1000$

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 = 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)

$Q_{FF}$ = quantity of fossil fuel (tonnes) that is reduced due to consumption of alternative fuels.
$CT_{FF}$ = 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:

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

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.

**E.3. The sum of E.1 and E.2 representing the project activity emissions:**

>>
Project emissions = 0 CO2/annum

**E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:**

>>
**Calculate the baseline GHG emissions from the fossil fuel(s) displaced by the alternative fuel(s)**

$$FF_{GHG} = [(Q_{AF} \times HV_{AF}) - MP_{TOTAL}] \times EF_{FF}$$

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).

$$FF_{GHG} = [(448.58) - 20.49] \times 100.46$$

**For Unit-I**

**= 43005 tons $CO_2$/annum**

**For Unit-II**

$$FF_{GHG} = [(672.87) - 42.50] \times 100.43$$

= **63301 tons $CO_2$/annum**

**E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:**

>>
Emission Reduction = Baseline emissions – Project Emissions

**Unit-I** = 43005 – 0
**= 43005 ton $CO_2$/annum**
**Unit-II = 63301 – 0**
**= 63301 ton $CO_2$/annum**

The total emission reduction due to project activity would be **1063060** tons of $CO_2$ per annum.

**E.6. Table providing values obtained when applying formulae above:**

>>

**CO2 emission reduction table**

| **Year** | **CER reduction** |
|---|---|
| 2006-07 | 106306 |
| 2007-08 | 106306 |
| 2008-09 | 106306 |
| 2009-10 | 106306 |
| 2010-11 | 106306 |
| 2011-12 | 106306 |
| 2012-13 | 106306 |
| 2013-14 | 106306 |
| 2014-15 | 106306 |
| 2015-16 | 106306 |
| **Total estimated reductions** (tonnes $CO_2$ equ.) | **1063060** |
| Total no of Crediting Years | **10 years** |
| **Annual average over the crediting period of estimated reductions** (tonnes of $CO_2$ e) | **106306** |

## SECTION F. Environmental impacts

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

>>

The project activity under consideration does not require any Environmental clearance from host country as it does not fall under the project category which requires mandatory EIA study for clearance. However the positive and negative outcomes of the activity have been meticulously examined by the project proponent.

The proposed project activity contributes towards the sustainable development as it promotes the usage of renewable energy source in manufacturing of cement. Use of biomass as fuel will benefit local farmers positively as they will be able to sell their biomass to the manufacturing unit. Since there is no established usage of biomass in the locality no negative impact is associated with the procurement of biomass in the locality.

SCL being an ISO 14001, OHSAS 18001 certified organisation has a well established environmental management system in place. The project activity is a step forward by SCL which ensures its commitment towards sustainable development.

**F.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 has been envisaged due to implementation of the project activity. It does not fall under the project category, which requires mandatory EIA study for clearance.

## SECTION G. Stakeholders' comments

>>

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

>>

Stakeholders involved in the project activity are Farmers growing biomass, biomass dealers and local community which may get affected by the proposed project activity. SCL invited stakeholders through printed invitation letter for a meeting.

The proposed project activity being envisaged inside the premises of existing cement manufacturing unit, does not require any land procurement. It will not have any negative impact on the economy of locality. However, SCL has intimated about the activity to local people through gram panchayat and local municipality. A meeting has been organised to make local community and biomass traders aware about the project activity and economical benefits associated with its implementation.

SCL representatives briefed people about their proposed project and benefits associated with its implementation. It has been informed that reduction in emissions by using Biomass will improve the ambient air quality in the area. Opportunities arising out of biomass transaction will improve the financial condition of the farmers and biomass traders in the area. There is no negative impact due to the proposed project activity.

### G.2. Summary of the comments received:

>>

Gram Panchayat which represents local community appreciates SCL efforts to use Biomass in cement production which will reduce emissions from the kiln and eventually improves the ambient air quality.

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

>>

No negative remarks have been received on the project activity.

Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
| Organization: | Shree Cements Limited |
| Street/P.O.Box: | Bangur Nagar |
| Building: | |
| City: | Beawar |
| State/Region: | Rajasthan |
| Postfix/ZIP: | 305901 |
| Country: | India |
| Telephone: | 91 1462 228124 |
| FAX: | 91 1462 228117-9 |
| E-Mail: | bhargavr@shreecementltd.com |
| URL: | www.shreecementltd.com |
| Represented by: | |
| Title: | Additional General Manager (R&D) |
| Salutation: | Mr. |
| Last Name: | Bhargava |
| Middle Name: | |
| First Name: | R |
| Department: | Research and Development |
| Mobile: | +91-9829072895 |
| Direct FAX: | 91 1462 228124 |
| Direct tel: | 91 1462 228124 |
| Personal E-Mail: | bhargavar@shreecementltd.com |

Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

No Public funding is involved in the project activity.

**Annex 3**
**Baseline information**

Please refer to enclosure 1 for baseline information.

Annex 4

## MONITORING PLAN

**Description of the Monitoring Plan**

The Monitoring and Verification (M&V) procedures define a project-specific standard (baseline of historical emissions) against which the project's performance (i.e. GHG reductions) and conformance with all relevant criteria will be monitored and verified. It includes developing suitable data collection methods and data interpretation techniques for monitoring and verification of GHG emissions with specific focus on specific energy consumption parameters. It also allows scope for review, scrutinize and benchmark all this information against reports pertaining to M & V protocols.

The M&V protocol provides a range of data measurement, estimation and collection options/techniques in each case indicating preferred options consistent with good practices to allow project managers and operational staff, auditors, and verifiers to apply the most practical and cost-effective measurement approaches to the project. The aim is to enable this project have a clear, credible, and accurate set of monitoring, evaluation and verification procedures. The purpose of these procedures would be to direct and support continuous monitoring of project performance/key project indicators to determine project outcomes, greenhouse gas (GHG) emission reductions.

The project activity proposes to employ monitoring and control equipment in the kilns that will measure, report, monitor and control the quantity of alternative fuel used. Further the project activity would measure calorific values and carbon content in the fossil & biomass fuels.

The instrumentation and control system is the key factor for salubrious functioning of any monitoring and verification system of a CDM project activity. Taking these issues into considerations, SCL has proposed adequate and apt instruments like weighing feeders for the project activity, to control and monitor various operating parameters for safe, effective & efficient operations of the kiln system.

SCL has also proposed arrangements with in house laboratory for quality analysis of the fossil & biomass fuels used in kilns.

The proposed instrumentation system comprises of microprocessor-based instruments like weigh feeders, that adheres the required specifications and of best accuracy levels. The instruments will be calibrated and marked at regular intervals ensuring the accuracy of measurements always. The calibration frequency too is a part of the monitoring and verification parameters.

**Project boundary and GHG sources**

The Project boundary covers all processes involved in production of clinker. Specific consideration has been given to units involved in pyro processing particularly the kiln for estimation of GHG reduction.

**GHG emission sources of the project**

**Direct on-site emissions**

The project will use eco-friendly biomass as fuel. The GHG emissions (mainly $CO_2$) from the biomass combustion process are consumed by plant species during photosynthesis representing a cyclic process. Hence biomass is $CO_2$ neutral fuel and results in no net increase of $CO_2$ in the atmosphere.

The biomass contains negligible quantities of other elements like Nitrogen, Sulphur etc., Hence release of other GHGs are considered as negligible. The biomass is proposed to be stored for only 5-6 days in a well-designed storage area, hence no methane emissions are associated with the storage.

The project activity partially displaces the fossil fuels like pet coke, coal used in cement kilns by biomass. Hence, the direct on-site emission source of the project is combustion of pet coke, coal in the kiln, which would lead to $CO_2$ generation. In order to arrive at the actual CERs due to the project activity, the difference in the $CO_2$ generation from fossil fuel combustion in pre-project & post project scenario is calculated.

**Indirect on-site emissions**

The indirect on site GHG source is the consumption of energy and the emission of GHGs involved in the construction of the biomass conveying & handling equipments. Considering the life cycle assessment of the project activity and the emissions to be avoided in the life span of 20 years, emissions from the above-mentioned source is too small and hence neglected. Also the emission due to electrical energy consumed during biomass handling would be offset by the emission that would have occurred due to fossil fuel preparation.

No other indirect on-site emissions are anticipated from the project activity.

**Direct off site emissions**

The direct off-site emissions of the project activity arise from the biomass transport. The biomass will be transported from near by fields (0-15 km radius maximum) by means of trucks & tractors to the SCL's premises. However in the baseline scenario $CO_2$ emissions would occur during the transportation of pet coke, coal (reduced by the proposed project activity) from the refinery & mines to the same SCL's premises. Both these emissions are taken into account.

**Key Project parameters affecting emission reduction claims**
**Quantity and Quality of the biomass used in the kiln as fuel**

The biomass received from various farmers & dealers would be stored in the specially designed storage area. The stored biomass would be fed to the dump hopper and from the dump hopper, the biomass is transferred to the weigh feeders with the help of gravity. The weigh feeder of high accuracy level will measure the quantity of biomass fed to kiln and recorded.

The weighing system needs to be calibrated regularly to ensure the accuracy of the measurement. The data will be recorded for further verification. The amount of biomass purchased, will be based on invoices / receipts from fuel contractors.

The properties of the biomass from ultimate analysis, calorific value, ash composition etc. will be consistent in the region. However, it is proposed to monitor various quality parameters of alternative fuels, by taking samples at random and tested by reputed laboratory as per international practices and data or documents would be kept open for verifiers.

**Monitoring**

The CDM mechanism stands on the quantification of emission reduction and keeping the track of the emissions reduced. The project activity reduces the carbon dioxide whereas an apt monitoring system ensures this reduction is quantified and helps maintaining the required level. The monitoring system brings about the flaws (if any are identified) in the system and opens up always, opportunities for correction in the CER calculations.

**Monitoring Approach**

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and reporting

**Frequency of monitoring**

The emission reduction units from the project activity are determined by reduction of usage of fossil fuels for clinker burning. It becomes vital for the project activity to monitor the quantity of fossil / biomass fuels used in the kiln. SCL has kiln monitoring system, which will continuously measure, monitor and record many parameters like clinker produced, amount of pet coke, coal used etc. The quantity of biomass fuel fed to the kiln are measured individually and reported continuously. The over view of kiln monitoring system is shown below. The quality of the pet coke, coal is monitored daily.

**Reliability**

The measurement devices of the project activity are weigh feeders of microprocessor based (in case of biomass, petcoke, coal, clinker) with best accuracy, standards and procured from reputed manufacturers and calibrated. Since the reliability of the monitoring system is governed by the accuracy of the measurement system, the measuring instruments must be calibrated once a year for ensuring reliability of the system. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration.

The quality of fossil /biomass fuels is tested as per international & best practices at reputed labs. Moreover all the fuel purchase figures are audited by the statutory regulations laid by Government of India. These are also reflected in the audited annual balance sheet. The amount of emission reduction units is proportional to the net fossil fuel replaced in the project. Thus, the clinker production and fuel consumed are the key variable for the project. These figures are audited by the statutory regulations laid by Government of India. These are also reflected in the audited annual balance sheet.

**Registration and reporting**

Daily, weekly and monthly reports will be prepared after starting the project activity.

Appendix i

## Abbreviation

| | |
|---|---|
| CDM | Clean development mechanism |
| CER | Certified emission reduction |
| CMA | Cement manufacturers association |
| $CO_2$ | Carbon dioxide |
| CPP | Captive Power Plant |
| Distt | District |
| EIA | Environment impact assessment |
| Equ | Equivalent |
| Gcal | Giga calories ($10^9$ calories) |
| GHG | Greenhouse gas |
| IPCC | Inter governmental panel on climate change |
| IRR | Internal Rate of Return |
| Km | Kilometer |
| KWh | Kilo watt hour |
| MNES | Ministry of Non-conventional Energy Source |
| MoEF | Ministry of Environment & Forest |
| MTPA | Million tonne per annum |
| PDD | Project design document |
| p.a. | Per annum |
| INR | Indian rupees |
| Sp | Specific |
| UNFCCC | United Nations Framework Convention on Climate Change |
| SCL | Shree Cement Limited |

Appendix ii

**References**

| Sl. No. | Particulars of the references |
|---|---|
| 1 | Kyoto Protocol to the United Nations Framework Convention on Climate Change |
| 2 | Website of United Nations Framework Convention on Climate Change (UNFCCC), http://unfccc.int |
| 3 | UNFCCC document: 'GUIDELINES FOR COMPLETING CDM-PDD, CDM-NMB and CDM-NMM'-Version 04 |
| 4 | UNFCCC document: CLEAN DEVELOPMENT MECHANISM, PROJECT DESIGN DOCUMENT FORM (CDM-PDD), VERSION 02 - IN EFFECT AS OF: 1 JULY 2004) |
| 5 | Cement Statistics 2005, Cement Manufacturers Association (CMA) |
| 6 | Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual |
| 7 | www.ceaindia.nic |

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