CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:

ENERGY EFFICIENCY MEASURES AT CEMENT PRODUCTION PLANT IN CENTRAL INDIA

Date:29/03/2007, Version 06

A.2. Description of the small-scale project activity:

Satna unit of Birla Corporation Limited (BCL) is one of the major cement production units in the state of Madhya Pradesh, India. The BCL – Satna facility houses Satna Cement Works (SCW) and Birla Vikas Cement Works (BVCW) at the same premise. BCL- Satna mainly produces Ordinary Portland Cement (OPC) and Portland Pozzolona Cement (PPC).

Purpose:

BCL – Satna unit produces OPC grade and PPC grade cement. The process is energy intensive and consumes both thermal and electrical energy. With the growing concern of cleaner production, the company had focused on energy efficient technologies. The basic objective of the project is to reduce energy consumption per tonne of cement production through implementation of energy efficient technologies at SCW and BVCW.

The company performed an internal energy audit study and identified the possible areas where improvement can be done. The main thrust areas were identified as flow control and use of more efficient electrical drives.

Salient Features of the Project:

Project participant has implemented various technologically advanced instruments at BCL-Satna under its programme for energy efficiency improvement initiative. The efficiency improvement programme mainly consists of: -

- Installation of Variable Frequency Drives
- Replacement of existing equipments with more efficient equipments
- Optimisation in operation of equipments and controls
- Modification of processes to attain higher efficiency

Project's contribution to sustainable development

The measures taken reduce specific energy consumption for cement production. This in turn will reduce the equivalent generation of electrical energy in the grid mix and corresponding amount of GHG

emission. Moreover, these efforts save the use of coal in a proportionate manner, which is a primary resource for power generation and metallurgical applications that can cater to a future demand. Reduction in generation from thermal sources helps in related pollution abatement. Some of the other sustainability issues addressed by the project are:

Social Well Being: As an enlightened corporate citizen, Birla Corporation Limited is keenly aware of its social responsibilities too, and besides providing education and health care facilities for its employees, their families and the community at large, the Group is involved in a number of philanthropic activities. It also runs schools at Satna.

Environmental Well Being: The energy efficiency measures directly reduce the power consumption by the facility and thereby reduce demand at the power generation end (which is enhanced by the T&D loss).

A.3. Project participants:

Name of party involved (host party)	Private and/or public entity (ies) project participants (as applicable	Kindly indicate if the Party involved wishes to be considred as project participant (Yes/ No)
Ministry of Environment and Forests, Government of India	Birla Corporation Limited; Unit: Satna	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

India

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

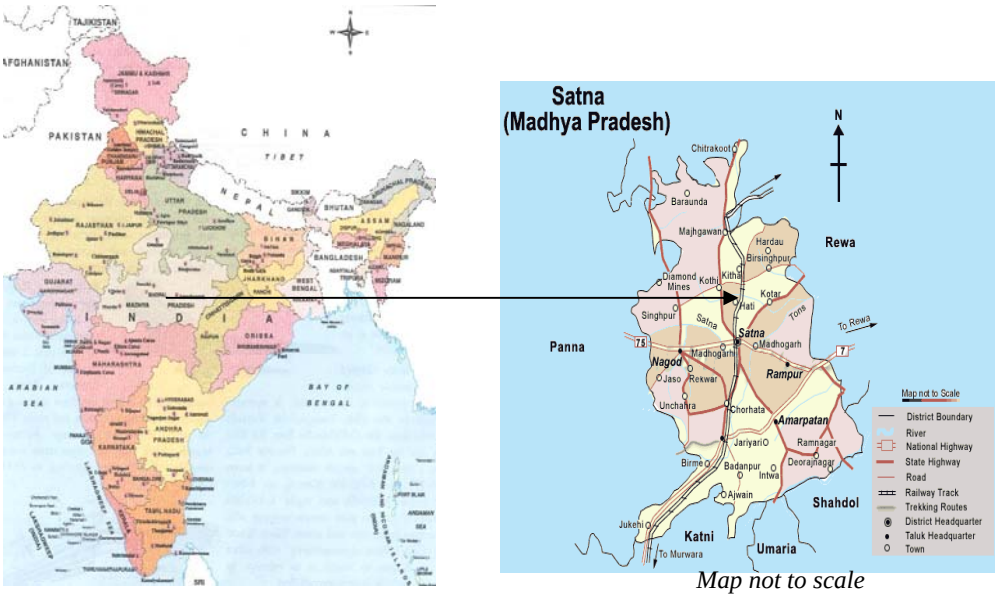
Madhya Pradesh

A.4.1.3. City/Town/Community etc:

Satna

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):

The project is located in Satna, Madhya Pradesh, India. The Latitude and longitude of Satna is **24.34 N& 80.55 E**; Postal address: P.O. Birla Vikas, Satna-485005, Madhya Pradesh.



Map not to scale

A.4.2. Type and category(ies) and technology of the small-scale project activity:

The project falls under the UNFCCC small scale CDM project activity under Type II with project activity involving energy efficiency measures reducing energy consumption on the demand side.

Category-AMS IID [Energy efficiency and fuel switching measures for industrial facilities]

As per Appendix B of the UNFCCC-defined simplified modalities and procedures for small-scale CDM project activities, the aggregate energy savings from the project activity primarily aimed at energy efficiency measures, may not exceed the equivalent of 60 Giga-watt hour (GWh) per year, for the project to qualify as a small-scale CDM project under Category II.D.

The project consists of industrial energy efficiency improvement measures through technological up gradation and instrumentation. It reduces energy consumption on the demand side. As the net energy consumption reduction is less than 60 GWhe /annum, project falls under **small-scale** Category II.D.

Project Activity with technology details

The project includes the Energy Efficiency and process improvement measures adopted in the form of technology up-gradation and instrumentation in the plants.

The following measures are included under the project -

(2000-01):

- Replacement of existing equipments with more efficient equipments
  - Installation of high efficiency fan for Primary Air fan along with inverter drive panel for speed control of the fan:

  The less efficient primary air fan was replaced with a high efficiency fan along with an inverter drive for speed control, resulting in energy saving of 96252 kWh (0.11 kWh/T clinker).
- Replacement of existing equipments with more efficient equipments
  - Replacement of V4, V5A and Primary Air (PA) fan with high efficiency fans along with VVVF AC drives for speed control:

  The less efficient fans for V4, V5A and PA fan were replaced with energy efficient fans. VVVF AC drives were installed for speed *control of* these fans. Provision of inverter was made only for K-12 fan. These activities resulted in energy savings of 542850 kWh (0.65 kWh/t clinker).
- Installation of Variable Frequency Drives
  - Replacement of V5B, V6 and K-20 fans with high efficiency fans along with VVVF AC drives for speed control of these fans:
  - The less efficient fans for V5B, V6 and K20 were replaced with energy efficient fans. VVVF AC drives were installed for speed control of these fans. These activities resulted in energy savings of 1147740 kWh (1.34 kWh/t clinker).
- Modification of processes to attain higher efficiency
  - Installation of SPRS (Slip Power Recovery System) for PC fan speed control (70% to 100%):

  Earlier, a liquid rotor regulator was being used for the speed reduction of PC fan and damper control resulting in high energy consumption. A SPRS was installed for 70% to 100% speed control, which had resulted in energy savings of 533610 kWh (0.62 kWh/t Clinker).
- Replacement of existing equipments with more efficient equipments
  - Replacement of PH fan with a high efficiency fan:

  The less efficient PH fan was replaced with a high efficiency pre-heater fan, which resulted in the energy savings of 604890 kWh (0.70 kWh/t clinker).

(2001– 02):

- Modification of processes to attain higher efficiency

- Modification of LKS Classifier of VRM with LV technology Classifier:

The existing VRM 36.41 classifier technology was modified and up-graded with LV-Technology classifier. The basic idea behind LV technology was to improve aerodynamics inside the mill by directing the ground material up to the full length of modified classifier by increasing the velocity from bottom to the top by suitably modifying the cross sectional area from the bottom of the mill to the top of the classifier, thereby reducing the pressure drop and turbulence within the mill body. This has resulted in increase of mill output and reduction in specific power consumption. This activity resulted in the energy saving of 1.62 kWh/T clinker.

o Modification of processes to attain higher efficiency

- Installation of vortex finder vanes on top stage cyclones for reduction in differential pressure:

The conventional immersion tube of pre-heater (PH) stage-I twin cyclone was replaced with state of the art "vortex finder vanes". Vortex finder vane reduces pressure drop across the cyclone by 30% and thereby reduces the fan power consumption. The activity had resulted in the power savings of 414624 kWh (0.5 kWh/t clinker).

- Installation of Vortex Finder Vanes for stage-1 cyclones of PC & PH strings for reduction in differential pressure:

The conventional immersion tube of PH & PC strings stage-I twin cyclone was replaced with state of the art "Vortex Finder Vanes". Vortex finder vane, latest technology in cyclone immersion tube, reduces the pressure drop across the cyclone by 30% and thereby saves the fan power consumption. The activity resulted in energy savings of 555660 kWh (0.62 kWh/t clinker).

o Replacement of existing equipments with more efficient equipments

- Replacement of separator in coal mill circuit with an efficient grit separator:

Before the project activity, the pressure drop across the original coal mill separator was 200-250 mmWG. This had been reduced to approximately 120 mmWG after installation of modified grit separator. The earlier motor of 300 Kw/1500 rpm was replaced with 200 Kw/1000 rpm motor to address the change in reduced inlet draft of BDC fan and had resulted in saving in fan power. The activity resulted in energy savings of 237600kWh
(0.26 kWh/t clinker).

- Replacement of raw mill vent fan and WIL circulating fan with high efficiency fans connected with VVVF AC drive inverters:

The less efficient raw mill vent fan and WIL circulating fans were replaced with high efficiency fans with VVVF AC drive inverters. The activity resulted in 558870 kWh (0.36 kWh\ t clinker) of energy savings.

(2002-03):

- Modification of processes to attain higher efficiency

  - Installation of 3-Fan System with LP Cyclones for VRM:

The pyro-processing and raw grinding system was originally designed for 2475 TPD clinker production. In 2-fan system, a part of PH flue gases from PH fan had to pass through the VRM and part of the gases was taken to coal mill. During raw mill 'OFF' condition, the gases were taken directly to ESP inlet through a by-pass circuit of VRM. The ESP fan served dual purpose as Mill fan and ESP fan both. At production level of 2475 TPD, the system was operating without any difficulty. With higher production rate and during coal mill 'OFF' condition, the kiln production was required to be reduced as raw mill was unable to take additional volume of PH flue gases.

To overcome this limitation, a 3-Fan system was installed, which had a separate mill fan to take care of VRM operation. This had facilitated in bypassing of excess PH flue gases under increased production through VRM by-pass circuit. VRM exit gases and excess PH flue gases were mixed at ESP inlet and handled by the ESP fan.

The above measure helped the project proponent to reduce energy consumption by avoiding false air entry and this has resulted in power saving in the ESP fan. This activity resulted in energy savings of 2.3 kWh/T Clinker.

- Modification of processes to attain higher efficiency

  - Increase of PH exit gas down comer duct diameter from 2.8 Mtr. to 3.5 Mtr:

The diameter of existing down comer duct (from stage-1 to PH fan) was increased from 2.8 Mtr. to 3.50 Mtr. This has resulted in pressure drop reduction by about 25mmWG and thereby saving in PH fan power by 35-40 KWh/hr. This measure has effected energy savings of 311840 KWh (0.32 kWh/T clinker).

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

The project activity includes a host of energy efficiency measures in the form of modification in the present grinding system through technology up-gradation. All these improved technology measures had helped in reducing the direct demand of electricity and indirect demand of fossil fuel (coal) in view of the fact that in absence of these measures an equivalent amount of electricity would have been drawn from the Madhya Pradesh State Electricity Board (MPSEB, part of western regional grid) grid dominated by supply from thermal power plants fed by coal.

The energy efficiency measures would reduce the indirect coal combustion for the same production quantity. The reduction in specific electricity consumption for cement production reduces equivalent amount of carbon dioxide emissions into the atmosphere. The estimated emission reductions from the project activity would be around **68636 t of CO_2 equivalent during the 10 years crediting period.** (Refer to Enclosure III for detailed calculations)

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

Years	Estimation of annual emission reductions in tonnes of CO_2 e
2000-2001	1094
2001-2002	5231
2002-2003	7507
2003-2004	7748
2004-2005	7843
2005-2006	7843
2006-2007	7843
2007-2008	7843
2008-2009	7843
2009-2010	7843
Total estimated reductions (tonnes of CO_2 e)	**68636**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	6864

A.4.4. Public funding of the small-scale project activity:

No public funding from parties included in Annex – I of Kyoto Protocol is available so far to the project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

According to **Appendix C of Simplified Modalities & Procedures for small scale CDM project activities**, ***'Debundling'*** is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities.

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small- scale activity at the closest point.

In BCL-Satna's case, it clearly does not fall under the debundled category and qualifies as a small scale CDM project. It is the single such project of the promoters. The conditions in para 2 of Appendix C confirm that the small-scale project activity is not a debundled component of a larger project activity.

SECTION B. Application of a baseline methodology:

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

***Reference**: UNFCCC website*[1], *http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_FCPCJVQYJG7WVBPQB75TO25HGTJONS* of the simplified modalities and procedures for small-scale CDM project activities - Indicative Simplified Baseline And Monitoring Methodologies For Selected Small-Scale CDM Project Activity Categories; Version 08: 23 December 2006

This appendix has been developed in accordance with the simplified modalities and procedures for small-scale CDM project activities (contained in Annex II to decision 21/CP.8, see document FCCC/CP/2002/7/Add.3) & subsequent & Decision -/CMP.2 Further guidance relating to the clean development mechanism[2]
Baseline Methodology specified for ASM II.D project activities in this Appendix has been followed for BCL's project at Satna.

B.2 Project category applicable to the small-scale project activity:

Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website, provides guidelines for preparation of Project Design Document (PDD) including baseline calculations. The project activity conforms to "AMS II.D" in Appendix B. The project activity includes measures to improve the energy efficiency of cement production processes that reduces electrical energy consumption on the demand side. The reduction is within the upper cap of the small scale CDM project activity under AMS II.D (i.e., up to the equivalent of 60 giga-watt-hours per year). Annual average electrical energy reduction per annum is to be of the order of 7.71 GWh. Thus the baseline methodology prescribed by the UNFCCC in Appendix B to Simplified M&P for small scale CDM projects activities belonging to Category II.D, is justifiably applicable for the project activity.

[1] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html
[2] http://unfccc.int/files/meetings/cop_12/application/pdf/cmp_8.pdf

A complete analysis of Western Regional electricity grid has been carried out by Central Electricity Authority (CEA) for preparation of baseline scenario and calculation of baseline emission factor of the grid. [3]

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 small-scale CDM project activity:

As per the decision 17/CP.7 paragraph 43, a CDM project activity is additional if anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity includes energy efficiency improvement measures with net CO_2 emission reductions due to reduced specific electricity consumption patterns in the cement plant.

BCL-Satna decided to take up the project execution, in phases as a step towards climate change activity after Kyoto Protocol came into existence. The project activity was initiated to reduce the carbon dioxide emissions by sources and would otherwise not have been implemented due to the existence of the operational barrier(s) discussed below. The continued investment in phases has been influenced by the Clean Development Mechanism (CDM) related development at the United Nations Framework Convention on Climate Change.

Additionality test based on barriers to the project activity

Barriers to the project activity

The BCL-Satna unit was one of the first cement industries of its type in the same social, economic and regional class in the cluster, to identify the areas where the improvement in cement grinding could be adopted and electrical energy consumption and its associated emissions could be reduced. The measures adopted were a proactive step towards GHG emission reductions. The barriers to the project activity would be dealt in following two steps. In first steps, the general barriers are discussed and in step two, how BCL-SATNA has overcome these barriers to avail CDM benefits.

[3] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Step I: General barrier to Energy Efficiency projects in India[4]:

Status of Energy Efficiency in India

As per Bureau of Energy Efficiency (BEE), under Ministry of Power Govt. of India (the nodal body responsible for energy efficiency improvement in India and empowered for implementation of Energy Conservation Act 2001), there are several barriers present in Indian energy and industry sector that needs to be removed. India's energy intensity per unit of GDP is higher by 3.7 times of Japan, 1.4 times of Asia and 1.5 times of USA, indicating not only a very high energy wastage but also potential of substantial energy saving.

Industrial sector in India is a major energy user, accounting for about 48% of the commercial energy consumption. Energy saving potential is up to 30% through retrofitting in this sector. Some of the estimates made by different study reports for energy conservation in energy intensive industries are given in table below.

Table- : Scope for Energy Conservation in Energy – Intensive Industries

Data	Aluminum	Textile	Chlor Alkali	Petro chemicals	Fertilizer	Sugar	Paper	Cement
Energy Consumption (million Gcal)	30.1	52.5	20.0	5.8	112	100	26	67
Energy cost as a % of manufacturing Cost	40	13	30-35	7	60	12	25	40
Scope of energy conservation (%)	15-20	20-25	15	15	10	20	20	10

Barriers to Energy Efficiency

Considerable untapped potential exists for curbing waste of energy estimated to be of the order nearly 30 per cent of the total consumption of commercial energy. BEE observes that in spite of many efforts and benefits of energy efficiency several technical financial market and policy barriers have constrained the implementation of energy efficiency projects.

(a) Lack of Awareness: The main barrier to energy conservation is the lack of awareness of industry managers of the potential gains from improved efficiency. Industries as well as the Government and

[4] www.bee-india.org (Bureau of Energy Efficiency, Government of India)
[4] UNDP, GEF , Project Document, PIMS No. 1515, Project Number: IND/03/G31
[4] Environmentally sound energy efficient strategies: a case study of the power sector in India Prof. Jyoti Parikh, Dr. J.P Painuly and Dr. Kankar Bhattacharya
[4] http://www.ises.org/sepconew/Pages/EE_Policy_in_Germany/1.html
[4] http://www.gefweb.org/Outreach/outreach-PUblications/Project_factsheet/India-ener-5-cc-wb-eng.pdf

customers, are yet to take into consideration factors such as tax credits, depreciation benefits, electricity price escalation, and life cycle savings of the investment.

(b) Lack of Widespread Education and Training: Shortage of widespread educational opportunities in energy management and conservation and appropriate facilities; lack of trainers and auditors.

(c) Economic and Market Distortions: Irrational response to conservation measures because of inappropriate pricing and other market distortions, or socio-economic factors.

(d) Lack of Standardization and Labeling of Equipment / devices: Slow rate of progress in achieving higher standards of energy consumption in equipment and appliances.

(e) Lack of financing: The lack of credit and the inability to obtain financing for projects are strong deterrents to investments in energy efficiency in India.

(f) Lack of Effective Co-ordination: In India, the lack of effective national-level coordination and promotion of energy conservation activities have been a major constraint to achieving energy efficiency.

In spite of having a large potential for the net energy efficiency improvement has not happened owing to the above mentioned barriers. The market potential for investments in energy efficiency measures is very large and presently only captured by about 20% in India[5].

Step II: Barriers for BCL-Satna

BCL-Satna, has been producing cements in the Satna cluster of Madhya Pradesh, India over last four decades. The company was subjected to the above said barriers. In absence of any dedicated energy managers, or specific energy management plans the company was not been able to take up major energy efficiency improvement initiatives. The organization had taken up only very small energy efficiency initiatives in the late nineties as a part of process efficiency improvements. However, the concept of Clean Development Mechanism in the late nineties has acted as an additional motivator for taking up additional risks with energy efficiency projects that influenced BCL in deciding on implementation of energy efficiency projects.

Few of the major initiatives undertaken by the corporation have been published in technical journals and conferences relating to cement technology. This includes the three fan modification system that is published in International Cement Review in the year 2002. Few of other achievements are also presented in seminars/conferences indicating the uniqueness of the initiatives in the local cement

[5] http://www.energymanagertraining.com/new_kaupp.php

industries. BCL-Satna, being the oldest plant in the region/cluster, has been able to reduce the specific consumption level due to its initiatives above common practices followed. The initiatives taken by them indirectly reflect the additional efforts put in behind the project activity. The project proponent had taken risks in investing in the projects that were not practiced in general in the cluster and were not sure about the success of the retrofit measures.

Technological Barrier:

The activity involves high risk of failure as the plants are originally designed in eighty's and the technology chosen for up-gradation are of late ninety's. The basic design of cement plants, the quality of raw material, clinker and the mill characteristics have changed over the years. The technologies adopted under the project activity and the investment made involved higher risks in comparison with capacity expansion plans to meet the demand and avail the benefit of economy of scale. The retrofit measures always have performance risks as the projected benefits in most cases are assumed rather than accurately computed. For VFD projects, the reduction in electrical supply frequency (below 50 Hz) is associated with lower RPM of drive motor resulting into lower pressure head development and associated flow. As the cement plat's equipment are basically air based transport of granular/micro granules of cement, raw meal, and air delivery for cooler fans/coal mill, the change in flow affects on the dynamics of the thermal system and material transport. The retrofit measures in other aspects like change in physical configuration like that of riser duct or pre heater cyclones were experimental basis and they effect the entire draft system was predicted. These depend on the actual dust load on the system and change in the profile can cause hindrance in the fluid flow system. However, the project proponent had gone ahead with the implementation, risking the net production and market share.

The above said barriers cover the reasons why the energy efficiency in Indian Industries has not geared up. They are very difficult to categorically segregate as for which particular barrier (technological/common practice etc.) the efficiency improvement has not happened. Energy efficiency initiatives traditionally has been a less priority than production processes for the management as benefit from such small energy efficiency initiatives practically does not make any impact on company balance sheets**. CDM has contributed or motivated higher management to give priority towards energy efficiency considering the green image and global face/image that carries with. The CDM benefit is one of the drivers, but the satisfaction of contributing towards global partner of climate change has deeply motivated the BCL management for going ahead with energy efficiency projects.**

Additionality test for Regulatory/Legal requirements

There was no legal binding on BCL-Satna to take up the project activity.

From the above analysis of barriers for the project activity we can conclude that the project activity is not a baseline scenario and without the project activity the pre-project phase would have continued with no reduction in the electrical energy consumption and its associated GHG emission reductions. The CDM project activity is additional and will help to reduce 68636 tonnes of CO_2 in 10 years of crediting period, calculated as per the approved baseline and monitoring methodologies of the Simplified Modalities and Procedures for Small Scale CDM Project Activities [details provided in section E].

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

The project boundary covers the cement and clinker production units. The boundary starts from raw material input to final product (cement) despatch. It also includes all form of energy inputs.

B.5. Details of the baseline and its development:

The detailed computations of the energy baseline (Step-I) and emission baseline (Step –2) are based on the approved simplified baseline methodologies specified in appendix B for project category Type II D. For baseline analysis, data/information was collected from the Western Regional Grid and was used as under for total emission baseline.

The baseline study is a two Step study conducted to determine the Baseline emissions over the crediting period in absence of project activity.

Step – I: Determination of Energy Baseline

Step – II (a): Choice of the grid - The current delivery system isstudied for selection of a realistic grid representing the factual scenario associated with the project activity

Step – II (b): Determination of carbon intensity of the chosen grid – The baseline emissions and the emission reductions from project activity are estimated based on the carbon intensity of the chosen grid and the quantum of reduced electricity consumption due to implementation of the project activity.

STEP – I: Determination of the Energy Baseline (before implementation of project activity)

POWER SAVINGS BY PROJECT ACTIVITY

The project activity will save around 7.71 million units(kWh) per annum on an average.

Therefore, a conventional energy equivalent of 77.1 million kWh for a period of 10 years would be conserved by the project activity; an equivalent amount of electricity for the plant would have otherwise been drawn from the grid and captive power plant. Without the project activity, the same energy load would have been taken up by power plants and emission of CO_2 would have been occurred due to coal combustion (proportional to the share of thermal power in generation mix).

ENERGY BASELINE

The annual energy baseline values (annual energy consumption in absence of project activity) for the crediting years are calculated by monitoring the "power that would be consumed" and "operating hours" of the devices installed based on the guidance provided in ASM II-D of Appendix B.
The "power that would be consumed" by the device in absence of the project activity is recorded from the experimental energy consumption commensurable with nameplate data and the "operating hours" of device are recorded using run time metering.

The proposed project activity will save electricity generation through energy efficiency measures. The emission reduction resulting from the proposed project activity will depend on the emission factor of the grid mix. Therefore it is required to select the appropriate grid where an equivalent amount of electricity will be displaced by the electricity generated from the proposed project activity.

Choice of the Grid

The Current Delivery System in India and Western Regional Grid has been studied by the project proponent for selection of a realistic grid representing the factual scenario associated with the proposed project activity.

Current Delivery System

Indian power grid system (or the National Grid) is divided into five regional grids namely Northern, North Eastern, Eastern, Southern and Western Region Grids. The Western Regional Grid consists of Gujarat, Madhya Pradesh, Maharashtra, Goa and Chattisgarh state sector grids and Union Territories of Daman and Diu and Dadra and Nagar Haveli. These regional grids have independent Load Dispatch Centres (WRLDC in case of Western Regional Grid) that manage the flow of power in their jurisdiction. Generally power generated by state owned generation units and private owned generation units would be

consumed totally by respective states. The power generated by central sector generation plants will be shared by all states forming part of the grid in fixed proportion. This central share amount has been allocated for Madhya Pradesh also. Presently, Madhya Pradesh State Electricity Department is the authority which transmits power through state grid network in Madhya Pradesh. However Madhya Pradesh Electricity Regulatory Commission has also been set up. The State is dependent on the self power generation and power allocated from the Central generating stations located in the Western and Southern regions and wheeled through the neighbouring state grids.

Grid Selection

Primarily Madhya Pradesh state grid gets power from self generation and as per its share in the central sector power projects located in various states of Western Regional Grid with a certain portion of import from Southern Regional Grid. The project proponents will therefore required to determine the carbon intensity of the grid that they are sharing, i.e. western regional grid. In practice, thus, the power inflow on these MP electricity grid lines will be reduced by an equivalent amount from the proposed project activity. The said lines are normally connected with Western Regional Grid. Thus the proposed project activity will reduce an equivalent amount of power import from the Western Regional Grid and hence the project proponents will require to use the carbon intensity of the Western Regional Grid as the baseline emission factor for baseline emission calculations over the proposed project activity's crediting period.

The details of emission factor determination is provided in Enclosure 4.

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SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

02/02/2000

C.1.2. Expected operational lifetime of the small-scale project activity:

15 years

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

C.2.1. Renewable crediting period:

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

28/7/2000

C.2.2.2. Length:

10 years

SECTION D. Application of a monitoring methodology and plan:

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

As per Appendix B of the simplified M&P for small-scale CDM project activities for Industrial energy efficiency projects,

In the case of retrofit measures, monitoring shall consist of:

(a) Metering the energy use of the industrial facility, processes or the equipment affected by the project activity;

(b) Calculating the energy savings using the metered energy obtained from sub-paragraph '(b)'

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

Installation of energy efficient equipments and technological up gradation at BCL-Satna units has resulted in substantial amount of reduction in specific energy consumption and thereby resulted reduction in GHG emissions. Hence, emission reduction quantity totally depends on the units of energy (kWh) saved at the grid by the Project activity.

Description of Monitoring Plan

BCL-Satna made a voluntary commitment for reducing green house gas emissions. A proper Monitoring & Verification (M&V) Plan has been developed by BCL-Satna for proper monitoring and verification of actual emission reduction.

The Monitoring and Verification (M&V) procedures define a project-specific standard 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 technical / efficiency / performance 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 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’s revenue is based on the units (kWh) saved in comparison to the units (kWh) consumed before the implementation of the project, measured by power meters at plant. The monitoring and verification system would mainly comprise of these meters as far as power import and savings of energy is concerned.

The other project specific parameter and performance indicators are: -

- Specific electrical energy consumption by the plant
- Operating hours of the particular equipment under project activity.

Monitoring and verification of raw material characteristics (physical characteristics)/ quality is also required to be monitored as it could influence change in efficiency of the equipments and hence the quantum of emission reduction in form of CO_2.

The project employs state of the art monitoring and control equipments that measure; record, report, monitor and control the key parameters. The monitoring system implemented comprises of microprocessor-based instruments of reputed make with desired level of accuracy. All instruments are calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time.

Justification of choice of methodology

Project activity includes installation of modern energy efficient equipments, replacing the higher energy consuming equipments.

The monitoring activity includes:

- Monitoring of new installed equipments,
- Metering the electrical energy consumption by the specified equipments and
- Calculating the difference in specific electrical energy consumption after and before project implementation, which is equivalent to total energy saved at the grid.

According to UNFCCC released document (appendix B) of the simplified M&P for small-scale CDM project activities, the quantity of emission reduction unit claimed by the project would be the total electrical energy saved by the plant. Therefore it is justified to check the total consumption of power by BCL –Satna and to compare the specific energy consumed in the pre-project stage from historical data.

Project Parameters affecting Emission Reduction: -

The parameters that affect project emission are as follows:

a) Quality of material input that the equipment handle

b) Quality of energy input to the equipment

c) Operating parameter and product quality.

For baseline emission calculation, data will be taken from CEA publication for grid emission factor of western regional grid and would be used for calculation of each year's emission reduction

GHG Sources

There is no direct onsite emission from the project activity. Also there had been no additional construction work involved for project specific requirement, hence no indirect onsite emission. The indirect off-site GHG source is the emission of GHG's that are involved in the process of transportation

for procurement of equipments. However, considering the life cycle assessment of the total power saved and the emissions to be avoided in the life span of 15 years; emissions from the above-mentioned source are too small and hence neglected. Project positively reduces GHGs at the thermal power unit connected to the MPSEB grid as direct off -site reduction.

D.3 Data to be monitored:

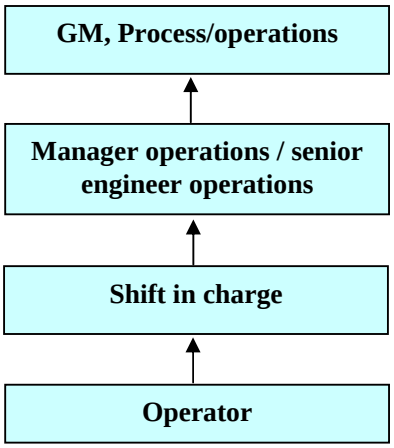
(The table below specifies the minimum information to be provided for monitored data. Please complete the table for the monitoring methodology chosen for the proposed project activity from the simplified monitoring methodologies for the applicable small-scale CDM project activity category contained in appendix B of the simplified M&P for small-scale CDM project activities.Please note that for some project categories it may be necessary to monitor the implementation of the project activity and/or activity levels for the calculation of emission reductions achieved.Please add rows or columns to the table below, as needed)

ID number	Data type	Data variable	Data unit	Measured (M) /Calculated (C)/estimated (E)	Recording frequency	How is data archived? (electronic/paper)	For how long is data archived to be kept?	Comment
D.3.1	Production	Clinker production	Tons	M	monthly	Paper/electronic	2 years after completion of crediting period	
D.3.2	Energy consumption	Average electrical energy for individual activity	kWh/Hr	C	monthly	Paper & Electronic	2 years after completion of crediting period	To be calculated from collected data.
D3.3	Time	Operating hours of the equipment	Hour	M	Monthly	Electronically online system/ daily log sheet	2 years after completion of crediting period	
D.3.4	Power	Power consumption by equipment	kW	M	Instantaneous, once in each month	Electronically online system/ daily log sheet	2 years after completion of crediting period	Collected based on random sampling and annual energy audit by plant personnel
D3.5	Emission factor	Combined margin Grid Emission factor	$kgCO_2/kWh$	Published document of CEA	Annual	Paper	2 years after completion of crediting period	

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

Regular calibration of energy meter has been undertaken by third party. The amount of material ground is measured. Same can be verified from silo measurement which is subjected to financial audit also. The company is ISO certified and the energy consumption figures are reflected in statutory audit report and also furnished with Cement Manufacturing association, India

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:



The operator ensures the operation od projects under project activity, Shift in charge logs the data which is verified by senior engineers. Senior engineer also prepares the emission reduction estimates which is verified by Manager operations. GM process overseas the entire process and communicates with Validator/verifier/UNFCCC

D.6. Name of person/entity determining the monitoring methodology:

Plant professionals and Consultants of Satna Cement Works

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

No specific formula has been provided in Appendix B of the simplified M&P for small-scale CDM project activities for the said project category.

E.1.2 Description of formulae when not provided in appendix B:

The project activity draws power from the Madhya Pradesh State Grid and the net effect of the project activity is reflected wholly on it. Therefore the grid scenario is analysed and calculation of anthropogenic emissions by fossil fuels during power generation is noted. The net baseline factor based on the combined margin approach is calculated considering all the plant contributing to the grid and the build margin of the most recent power plants are taken into consideration in a most conservative manner.

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

The project activity does not result in any GHG emissions within or beyond the project boundary.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

There is no leakage from the project activity. However the performance of the system may degrade over time and the efficiency may drop down which has to be taken into due account at the time of verification. This would be reflected in the specific kWh consumption across project boundary.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

None.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

Formulae used for estimation of the anthropogenic emissions by sources of greenhouse gases of the baseline are provided:

Calculation of CERs

- The phase wise implementation of tech. Up-gradation and instrumentation during the period of 2000 – 2001, 2001 – 2002 and 2000-2003 are considered under the project.
- Data sheet for equipment performance provides information on motor kWh, Auxiliary kWh, respective kWh / t, mill running hours, cement production [Total] and raw material consumed
- kWh /unit of output is considered the key indicator keeping the property and quality of cement unchanged.

For CO_2 Reduction for nth year: Following algorithm is followed

Activity	Production	Sp. Energy Consumption reduction during the period	KWh Savings during the period	Emission Reduction
Before project implementation	B	C = 0	K = B x C	
Activity 1	B	C1	K1 = B x C1	
Activity 2	B	C2	K2 = B x C2	
Activity 3	B	C3	K3 = B x C3	$E_n = K_n * EF_n$

EF_n = Emission factor for the nth year
K_n = Net energy savings in the n th year
=(K1 +K2 + K3)
E_n = Emission reduction in the n th year.

The net emission reduction during crediting period $E = \sum_{n=1,10} E_n$

Determination of project energy savings:

Unit – SCW

Project Detail	Saving KWH /T Clinker	Total Savings
High efficiency Fan for Primary Air Fan along with invertor drive panel for speed control of the fan	0.110	
Modification of LKS Classifier of VRM with LV_technology Classifier	1.620	
Installation of Vortex Finder Vanes on top stage Cyclones for reduction in differential pressure	0.500	
2000-01	**2.230**	**207807**
Installation of 3-Fan System with LP Cyclones for VRM	2.300	
High efficiency Fans for Coal mill Circulating Fan alongwith inverters	0.130	
2001-02	**2.430**	**2441269**
Increase of PH exit gas downcomer duct dia. from 2.8 Mtr. to 3.5 Mtr	0.320	
2002-03	**0.320**	**4520638**
2003-04		**4749531**

Determination of project energy savings:

Unit - BVCW

S.No.	Project Detail	Saving KWH /T Clinker	Total Savings (kWh)
1	High efficiency Fans for V4, V5A and Primary Air Fan along with VVVF AC drives for speed control of these fans and provision of invertor only for K-12 Fan	0.650	
2	High efficiency Fans for V5B, V6 and K-20 Fans along with VVVF AC drives for speed control of these fans	1.340	
3	Installation of SPRS (Slip power recovery system) for PC Fan speed control (70% to 100%)	0.620	
4	Replacement of Pre-Heater Fan with a high efficiency Fan	0.700	
	2000-01	**3.310**	**1038619**
5	Installation of Vortex Finder Vanes for stage-1 Cyclones of PC & PH Strings for reduction in differential pressure	0.620	
7	Installation of an efficient modified Grit Separator in place of old separator in Coal mill circuit	0.260	
8	High efficiency Fans for Raw Mill Vent Fan and WIL Circulating Fan alongwith VVVF AC drive inverters	0.360	
	2001-02	**1.240**	**3414271**
	2002-03	**4.55**	**4017241**
	2003-04		**4017241**

Yearwise Energy Savings Summary at BCL-Satna

Year	SCW (kWh)	BVCW(kWh)	Total(kWh)
2000-01	207807	1038619	1246425
2001-02	2441269	3414271	5855539
2002-03	4520638	4017241	8537878
2004-05	4749531	4017241	8766771
2005-06	4749531	4017241	8766771
2006-07	4749531	4017241	8766771
2007-08	4749531	4017241	8766771
2008-09	4749531	4017241	8766771
2009-10	4749531	4017241	8766771
2010-11	4749531	4017241	8766771
Total Energy Savings (kWh estimation)			**77007240**

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Following formula is used to determine Emission reduction

CO_2 Emission Reduction Calculations		
Baseline Emissions	-	Project Emissions

E.2 Table providing values obtained when applying formulae above:

Following tables indicate the baseline emission factors and emission reductions of each year, for Combined Margin.

Table E.2 – CO_2 emission reductions due to project activity

Year	Estimation of project activity emission reductions (tonnes of CO_2	Estimation of baseline emission reductions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	CO_2 Emission Reductions (tones of CO_2)
2000-2001	Nil	1094	Nil	1094
2001-2002	Nil	5231	Nil	5231
2002-2003	Nil	7507	Nil	7507
2003-2004	Nil	7748	Nil	7748
2004-2005	Nil	7843	Nil	7843
2005-2006	Nil	7843	Nil	7843
2006-2007	Nil	7843	Nil	7843
2007-2008	Nil	7843	Nil	7843
2008-2009	Nil	7843	Nil	7843
2009-2010	Nil	7843	Nil	7843
Total		**68636**		**68636**

SECTION F. Environmental impacts:

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

There are no negative environmental impacts from the installation of technologically upgraded energy efficiency equipment and instrumentation work. The technologies are easily transportable and installation does not require any major construction equipment. Only emissions that take place during the whole project execution are the transportation of the implemented machineries and instruments. However considering the life cycle of the project and the beneficial aspects such emissions is negligible.

Summary on Environmental Impact

The project does not have any major environmental impacts nor is the execution of an Environmental Impact Assessment required. However the beneficial aspects of the project are as follows:

The project activity results in

1) Green House Gas Abatement

2) Primary Resource Conservation and facilitating sustainable development

3) Pollution abatement in thermal power plant and its upward linkages.

SECTION G. Stakeholders' comments:

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

The main stakeholders of the project activity are the management representatives who were actively a part of decision-making. The other stakeholders are the employees of the organization who work in the plant and the family members who live in the plant campus. Although such in-house energy efficiency measures adopted by a plant does not demand an elaborate stakeholder consultation process the project proponent has involved its employees at all levels in order to ensure proper understanding of the effects of such initiatives being adopted. The benefits from such activity have also been transparently shared with the supply chain and shareholders.

G.2. Summary of the comments received:

The energy efficiency project does not have any negative impact. The projects also improved the working environment and resulted in better control of operation with reduced hazards. The emission from the captive power plant has also been reduced and local environment has been improved.

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

The relevant comments and important clauses mentioned in the project documents / clearances like Feasibility Report, local clearances *etc.* were considered while preparing the CDM Project Design Document.

As per UNFCCC requirement the PDD will be published at the validator's web site for public comments.

Annex 1 : Contact Information For Participants In The Project Activity

(Please repeat table as needed)

Organization:	Birla Corporation Ltd, Unit- Satna Cement Works
Street/P.O.Box:	9/1 R. N. Mukherjee Road
Building:	Birla Building
City:	Kolkata
State/Region:	West Bengal
Postcode/ZIP:	Pin – 700 001
Country:	India
Telephone:	+91 – (033) 2213 1680 / 1688 / 1689
FAX:	+91 – (033) 2248 3239
E-Mail:	tcs@birlacorp.com
URL:	www.birlacorporation.com/cementframe.html
Represented by:	
Title:	Asst. Vice President - Projects
Salutation:	Mr.
Last Name:	Panwar
Middle Name:	S
First Name:	V
Department:	Projects – Birla Corporation Ltd
Mobile:	
Direct FAX:	+91 – (033) 2248 3239
Direct tel:	+91 – (033) 2213 1680 / 1688 / 1689
Personal E-Mail:	vspanwar@birlacorp.com

Annex 2 : Information Regarding Public Funding

Till now funding from any Annex I party is not available.

Enclosures

Enclosure I : Abbreviations

%	Percentage
A	Ampere
ABT	Availability Based Tariff
BCL	Birla Corporation Limited
BM	Build Margin
BVCW	Birla Vikas Cement Works
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Certified Emission Reduction
CM	Combined Margin
CO_2	Carbon di Oxide
CO_2 equ/kWh	Carbon di Oxide Equivalent per Kilo Watt Hour
ERU	Emission Reduction Unit
ESP	Electro Static Precipitator
GHG	Green House Gases
Hz	Hertz
IPCC	Intergovernmental Panel on Climate Change
KV	Kilo Volt
KW	Kilo Watt
kw	Kilo Watt
kWh	Kilo Watt Hour
KWH / T	Kilo Watt Hour per Tonne
LDC	Load Dispatch Centre
M & P	Modalities and Procedures
M & V	Monitoring and Verification
MoEF	Ministry of Environment and Forest
MP	Madhya Pradesh
MPSEB	Madhya Pradesh State Electricity Board
MSEB	Maharastra State Electricity Board
MW	Mega Watt
NHPC	National Hydroelectric Power Corporation
NTPC	National Thermal Power Corporation
OECD	Organization for Economic Co-operation and Development

OM	Operating Margin
PGCIL	Power Grid Corporation of India
RSEB	Rajasthan State Electricity Board
SCW	Satna Cement Works
T & D	Transmission and Distribution
tCO_2/TJ	Tonnes of Carbon di Oxide per Trillion Joule
TPS	Thermal Power Station
UPSEB	Uttar Pradesh State Electricity Board
WRED	Western Regional Electricity Grid

Enclosure II: List of 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 Decision 17/CP.7: Modalities and procedures for a clean development mechanism as defined in article 12 of the Kyoto Protocol.
4.	UNFCCC, Clean Development Mechanism Simplified Project Design Document For Small Scale Project Activities (SSC-PDD) *[Version 01: 21 January, 2003]*
5.	UNFCCC document: Appendix B (contained in Annex-II to decision 21/CP8, see document FCCC/CP/2002/7/Add.3) Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories [Version 05: 25 February 2005]
6.	http://www.energymanagertraining.com/kaupp/Article25.pdf
7.	http://www.bee-india.com
8.	http://cea.nic.in/

Enclosure III: Baseline Information

Enclosure IV: CER estimation and grid emission factor