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

CONTENTS

Annexes

Enclosures

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

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

ENERGY EFFICIENCY MEASURES IN A PORTLAND SLAG CEMENT PLANT

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

Birla Corporation Limited (BCL) is the flagship company of the M.P. Birla Group. Durgapur unit of Birla Corporation Limited (BCL) is one of the major cement production units in the state of West Bengal, India. BCL's Durgapur facility, Durgapur Cement Works (DCW), mainly produces Portland Slag Cement (PSC).

The manufacturing process is energy intensive with high electrical energy consumption. With growing concern for cleaner production, the company had focused on energy efficient technologies. The corporation considered the global climate change and sustainable development issues seriously in the late nineties and being a responsible corporate citizen, Birla Corporation committed to cleaner and greener production. The project activity resulting in energy efficiency in PSC manufacturing is part of the same endeavour.

Purpose:

The basic objective of the project is to reduce energy consumption per tonne of cement production through implementation of energy efficient technologies at DCW. The company performed an internal energy audit study and identified the possible areas where there was scope for improvement. The main thrust areas were identified as flow control devices and use of more efficient grinding technologies.

Salient Features of the Project:

The project activity involves upgradation of existing cement grinding technology. Project proponent has implemented various technologically advanced measures in the cement mills at DCW under its programme for energy efficiency improvement. The efficiency improvement programme under the project activity consists of: -

- Installation of classifying liners and high lift liners
- Installation of auto loop control.
- Optimisation in grinding media loading.
- Installation of flow control diaphragms.

Project's contribution to sustainable development

The energy efficiency improvement initiative is one of the major steps taken up by the company in keeping with its commitment as a responsible corporate citizen contributing towards sustainable development. This is reflected in the energy management policy of the company.

The measures taken have reduced specific energy consumption for cement production. This in turn have reduced the demand for equivalent generation of electrical energy in the grid mix and reduced a corresponding amount of Greenhouse Gas (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. The coal thus saved can cater to a future demand. Reduction in generation from thermal sources helps in related pollution abatement also.

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. The energy efficiency measures which result in a reduction in electricity demand on the state grid has its indirect social benefits through reducing the demand-supply gap and conservation of equivalent amount of non-renewable resources which otherwise would have been consumed to generate the same amount of electrical energy.

The energy efficiency measures directly reduce the power consumption by the facility and thereby reduce demand on the grid supply. The reduction in power generation corresponds to the reduced fossil fuel combustion, which implies reduced GHG emission, reduced emission in transportation & mining of fuel and reduced pollution load.

A.3. Project participants:

Durgapur Cement Works, Prop: Birla Corporation Limited

Contact person: Mr. V.S. Panwar, Asst. Vice President, Projects

(Details in Annex I)

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 considered as project participant (Yes/ No)
Ministry of Environment and Forests, Government of India	Birla Corporation Limited; Unit: Durgapur Cement Works	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.:

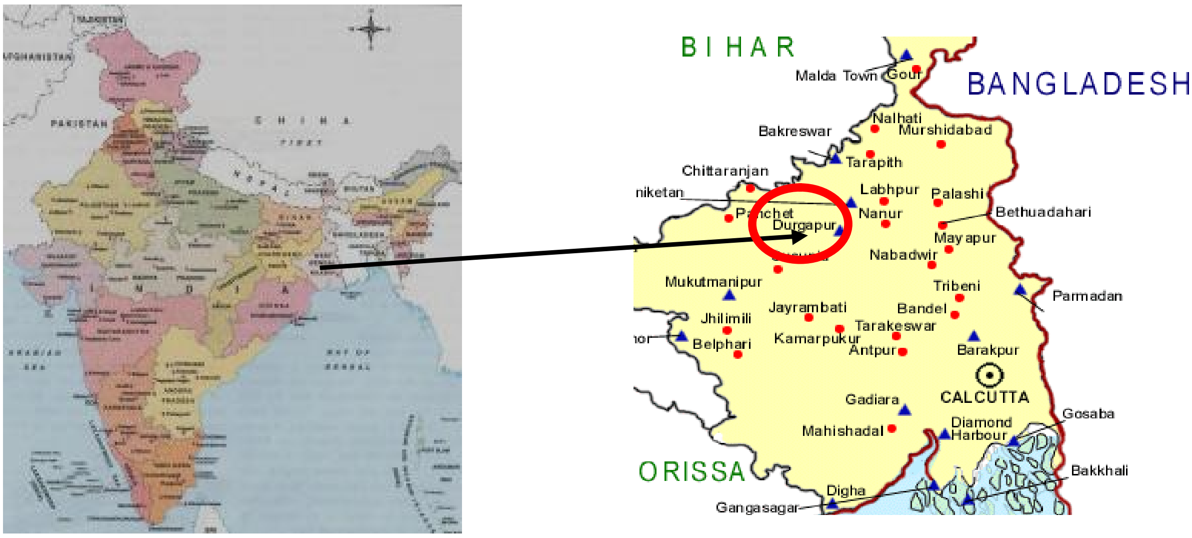
West Bengal

A.4.1.3. City/Town/Community etc:

Durgapur

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

The project is implemented at the Durgapur Cement Works of Birla Corporation Limited. DCW is located in the city of Durgapur around 200 Km to the north of Kolkata, West Bengal, India. The nearest railway station is Durgapur. The plant is located on the Grand Trunk Road, thus well connected by road and rail. This is the nearest major cement plant to cater to the demand of West Bengal and the North-eastern states.



Maps not to scale

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

The project activity involving energy efficiency measures at a single industrial facility, DCW, falls under Type II of small scale CDM project activity as defined by the United Nations Framework Convention on Climate Change (UNFCCC).

Main category -**Type II [Energy Efficiency Improvement Projects]**

Sub Category - **D [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 15 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 15 GWh /annum, project falls under **small-scale** Category II.D.

Project Activity with technology details

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

- Installation of classifying liners and high lift liners
- Installation of auto loop control.
- Optimisation in grinding media loading.
- Installation of flow control diaphragm.

Efficiency measures have enabled the system to reduce its consumption of electricity in the order of 6 kWh / tonne of cement produced.

The Technology:

The project includes the Energy Efficiency and process improvement measures adopted in the form of technology up-gradation and instrumentation in the Cement Milling section during the period February 2000 to March 2003.

The following measures are included under the project activity

➢ **Installation of High Lift liners and Classifying liners**

a) **High Lift Liners in the first chamber of mill**: The most frequent phenomenon of concern in all cement mill chambers is wearing of the mill liners leading to grooves formation. The increased abrasion of the working mill surface reduces mill efficiency and product quality. The grooves thus formed affect normal operation of the grinding media/balls and disturbs their free fall motion. This consumes more energy in normal cases. DCW with their engineering and technical capabilities installed suitably designed high lift boltless liners with its hard surface made of high iron chrome which allows less abrasion of the lining and let the grinding media/ grinding balls to fall freely and maintain a correct trajectory motion. The modified liners also provide required lift to the grinding balls for effective grinding and increase the crushing/ grinding efficiency with resultant energy savings.

b) Installation of Classifying Liner in the 2nd chamber of mill: In grinding mills at DCW, grinding balls (corresponding to feed charge) of 50mm, 40mm, 30mm, 25mm and 20mm diameters are being used. Different sizes of balls are used for effective attrition action with ideal orientation of the balls with appropriate grading. To maintain this orientation classifying liners play a vital role. Installed classifying liner pushes the bigger size balls backward, resulting in classification of grinding balls in a descending order grade along the grinding path. The proper size adjustment of the grinding media increases fineness across the grinding path resulting in increase of grinding efficiency of cement mill and leads to further energy consumption reduction in grinding.

- **Installation of auto loop control**: - The system works through automated controller (TUC-2) Controllers of weigh feeder and ensures optimal feeding and mill filling at all times, resulting in efficient production and energy saving. On installation of auto loop controls feeding system, feeding of the raw material (clinker, slag and gypsum) has been optimised for minimum power consumption at all times (overloading or underloading). Also, this controls the degree of grinding (final particle size) and avoids excess grinding. This aspect saves excess energy consumption and higher output of the mill.

- **Optimisation in grinding media loading**: DCW on utilizing the high chrome grinding media has found that these balls do not de-shape on continuous wear and tear during grinding operation. This change provides with better grinding efficiency to a considerable extent and resulted in energy efficiency of the motors running the mills.

- **Installation of Flow Control Diaphragms (FCD)**: It is always desirable to transfer only the desired sized and quantity of grounded material from 1st to the 2nd compartment of the cement mill to save the extra milling work required to achieve the given fineness. For efficient grinding, material should be broken down in the first compartment itself in such a way that they are small enough to be efficiently downsized by the small grinding media of the 2nd compartment of the mill. When ground material is passed from 1st chamber of the grinding mill to the 2nd chamber, it is desired that only fixed size and optimum quantity of the grounded material should be transferred. To control the flow of the materials effectively in chamber, the project activity has installed a diaphragm like structure that acts as a regulator to control the flow of the grounded materials and allows the grounded material to pass only when desired level of grinding has been achieved. The material in the diaphragm passes through a grate with slots of designed width that let crushed material through, yet hold back any particles that have not been sufficiently broken down. After installation of flow control diaphragm the efficiency of the grinding mills has increased with effective distribution of the material thus further reducing the specific energy consumption.

Implementation Schedule of the Project Activity

Cement Mill (CM) # ⇒ / Time ⇓	CM1	CM2	CM3	CM4	Common
Feb, 00	Autoloop Control [feed control]				
Jul, 00				High lift liners	
Oct, 01		Auto loop Control			
Jan, 02			i] High lift liners		Optimisation in grinding media loading – through 2002
			ii] Flow Control Diaphragm		
			iii] Classifying liner		

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 West Bengal State Electricity Board (WBSEB) 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 **30116 t of CO_2 equivalent during the 10 years crediting period.** (Refer to Enclosure IV for detailed calculations)

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

Sl. No.	Operating Years	CO_2 Emission Reductions (tonnes of CO_2)
1.	2000-2001	939.41
2.	2001-2002	1655.48
3.	2002-2003	3117.62
4.	2003-2004	3486.32
5.	2004-2005	3486.32
6.	2005-2006	3486.32
7.	2006-2007	3486.32
8.	2007-2008	3486.32
9.	2008-2009	3486.32
10.	2009-2010	3486.32
Total		30116

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 components. 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; and
- 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 DCW's case, it clearly does not fall under the debundled category and qualifies as a small scale CDM project. The different components of the energy efficiency project activity of DCW are not actually parts of a bigger project activity. These components belong to the same category (energy efficiency) but all these are individual and independent projects taken in different units of the same manufacturing facility of DCW. 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:

Title: ENERGY EFFICIENCY IMPROVEMENT PROJECTS – Energy Efficiency Measures for Industrial Facilities – Category II.D

Reference: Appendix B 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 05: 25 February 2005).

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). Baseline Methodology specified for Category II.D project activities in this Appendix has been followed for DCW's project activity.

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.

Baseline methodology for projects under Category II.D of approved small scale methodology has been considered in this project activity.

The project activity includes several components like installation of classifying liners and high lift liners, installation of auto loop control, optimisation in grinding media loading and installation of flow control diaphragms to improve the energy efficiency of cement production process thereby reducing electrical energy consumption on the demand side. The reduction is within the upper cap for a small scale CDM project activity under Category II.D (ie. up to the equivalent of 15 GWh per year). Annual average reduction in electrical energy consumption per annum is of the order of 3.089 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.

Since the project will be reducing electrical energy consumption on demand side of the state grid, the methodology of estimation of baseline emission factor as described in paragraph 7 under Category I.D is applicable for the project activity.

A complete analysis of West Bengal's state grid has been carried out along with the study of various related issues like technology scenario, policy matters, economic conditions, etc. for preparation of baseline scenario and calculation of baseline emission factor of the grid.

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 greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

The project activity is an energy efficiency improvement measure resulting in the reduction of electricity consumption patterns of the grinding mills at DCW thereby reducing the CO_2 emission. DCW decided to take up the project execution, in phases as a step towards climate change initiative after Kyoto Protocol came into existence. The project activity was initiated to reduce the specific energy consumption and thereby the carbon dioxide emissions by sources and would otherwise not have been implemented due to the existence of the operational barrier(s) discussed below.

Additionality test based on barriers to the project activity

Barrier due to prevailing practice

Till the time of project conception, only two cement plants were there in the state of West Bengal. Out of these, DCW is the older one (1975) with similar technology and scale The prevailing practice in the plant operation had been stabilised over two decades and the same practice followed for achieving production target. DCW had taken initiative to break the jinx of three decades of stabilised and practiced operation with personnel of particular skill set and achieved energy savings in cement grinding.

Technological Barrier[1]:

The activity involves risk of failure as the plants are originally designed in 1975 and the technology chosen for up-gradation are of late ninety's. For efficiency of mill the mill internal changing depends on a number of factors like:

- The optimum revolutions, resulting from mill diameter
- Amount, Type and Size of grinding media
- Correct size of grinding compartments
- Grindability of mill feed
- The L/D ratio
- The mill system
- The kind of mill lining

[1] Cement data book, Dipl.-Ing Walter H. Duda, Vol.1, International Process Engineering in Cement Industry, 3rd Edition, Bauverlag GmbH; ISBN, 3-7625-2137-9

In the project activity almost all the parameters barring the L/D ratio and feed quality has been changed. The technology up-gradation in an old mill with a two decade back L/D ratio always carries risk of failure of such retrofit measures. The technology adopted is new to the project proponent too; however, they have gone ahead with the implementation risking the net production and market share. The initiative adopted was a proactive step towards greenhouse gas reductions.

The major operational risks faced by the project proponent are discussed below:

Risk of retention time in first chamber (Flow Control Diaphragm)

The first chamber of cement mills has to crussh the material to approximately 5% residue on 2 mm. Otherwise this would become a bottleneck in the sense there is a possibility of choking or back spillage during such conditions.

The primary function of the intermediate diaphragm if not suited with the specific L/D ratio and appropriate length of first chamber, the separation of charges might hamper and non specified sized particles might move to the downstream chamber thus affecting product strength and quality. Also the retention time of the material if altered in the 1st chamber, the subsequent conditioning in the 2nd chamber would be affected. This could also generate hard impact conditions leading to higher wear of internals. The installation of Flow Control Diaphragm also runs the risk of interfering with the maintenance of maximum area for air passage for the normal ventilation conditions.

Risk Associated with liner modifications:

In cement grinding mill, throughput rate must remain unaffected in any of the lifter settings. The same can be expressed as:

Q (Lifter output/mill through put)

= **S** (Effective c/s area) x **h** (Effective material height in the lifter) = **<u>should be constant</u>**.

In the new lifter modification in 1^{st} and 2^{nd} chamber of the mill, the retrofit project always poses a threat to the change in the parameter which in turn depends on material quality, ball size, and relative hardness and most significant of them is the angle of repose. The dynamic angle of repose for maximum efficiency at 76% of the critical speed should be 35^0 20’. The change in lifter settings poses threat in change of angle of repose and therefore affecting efficiency and quality. Even with the same physical dimension, the lifter modification can produce different result based on other operational parameters.

Risk Associated with auto loop control and grinding media loading:

Optimum retention time of the material in the 1st chamber leads to optimum crushing efficiency. Any change in the level control or change in the grinding media affects the retention time thereby risking the optimal efficiency set point. The change in media loading is also associated with risk of resultant lack of material in the subsequent chambers.

Other possible risks associated with change of mill internals

- Disproportionate heat transfer from the peripheral ring to the mill shell to resulting in deferential deformation.
- Inadequate and inefficient ventilation system through the mill - thus calling for problems like coating, over grinding of fines, and bad de-dusting inside the mill.
- Increase in the wear normally associated with high-speed dusty air.

Investment Barrier:

The technology adopted being new to the project proponent, the investment made involved higher risks in comparison with capacity expansion plans to meet the demand and avail the benefit of economy of scale. However, they have gone ahead with the implementation risking the net production and market share.

It is important to note that the company has taken the decision in spite of its poor financial performance during the past 5-6 years when it was making losses. The company invested over Rupees 20 Million on the project activity despite its poor economic health.

In order to encompass the investment barrier issue more comprehensively, the simple fact is enough to indicate that similar projects in terms of technology, fuel, size, site and process have not been commercially implemented, with/without carbon finance, in the region in the past (before start of project activity at DCW).

Additionality test for Regulatory/Legal requirements:

There is no legal binding on DCW 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 greenhouse gas emissions. The CDM project activity is additional and will help to reduce 30116 t 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:

As per the Appendix B of simplified M&P for small-scale CDM project activities "the project boundary is the physical, geographical site of the industrial facility, processes or equipment that are affected by the project activity."

In DCW's project activity, the project boundary covers the cement mill grinding system from the point where the raw materials enter the cement milling section and upto the point where the finished product (PSC) exits the milling section.

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

The detailed computations of the energy baseline (Step-I) and emission baseline (Step –II) are based on the approved simplified baseline methodologies specified in Appendix B for project category II.D. For baseline analysis, data/information was collected from the West Bengal State Electricity Board 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 the project activity.

Step – I: Determination of Energy Baseline

Step – II(a): Choice of the grid - The current delivery system is studied for selection of a realistic grid representing the baseline scenario corresponding to the project activity

Step – II(b): Determination of carbon intensity of the chosen grid – West Bengal's Power Generation: Present generation mix, sector wise installed capacities, IPCC emission co-efficient are used to arrive at the net carbon intensity/baseline emission factor 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

Power savings by project activity: The project activity will save 3.089 million units per annum on an average. Therefore, a conventional energy equivalent of 30.89 million kWh for a period of 10 years would be conserved by the project activity, which would otherwise be consumed by the plant. Without project activity, the same energy load would have been taken up by grid-connected power plants and emission of CO_2 would have occurred due to fossil fuel combustion in the thermal power plants connected to the grid.

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" for the projects installed based on the guidance provided in paragraph 6 of Category II.D of Appendix B.

The "power that would be consumed" by the plant in absence of the project activity is recorded from the past specific energy consumption pattern which is subjected to statutory audit process. We may therefore conclude that in the absence of project activity, DCW plant would draw power (corresponding to the pre-project scenario) from WBSEB grid, and the system boundary would include the grid's generation mix. In other words, the project activity would displace an equivalent amount of electricity the plant would have drawn from the grid.

The grid's generation mix comprises of power generated through sources such as coal and gas based thermal power plants and hydro power stations. The total generation from all these coal and gas based thermal power plants and hydro power stations are considered for the purpose of grid analysis.

STEP – II Determination of Carbon Intensity of the Chosen Grid

STEP–II (a): Choice of the Grid

The Current Delivery System in India and West Bengal were studied for selection of a realistic grid representing the factual scenario associated with the project activity. Relevant information/data are provided herein.

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 Eastern Regional Grid consists of Bihar, Jharkhand, Orissa, West Bengal, Damodar Valley Corporation (DVC) and Sikkim state sector grids. These regional grids have independent Load Dispatch Centres (LDCs) that manage the flow of power in their jurisdiction. Power generated by state owned generation units and private owned generation units would be consumed totally by respective states. However there is a deviation in the case of West Bengal Grid. The deviation has been dealt with in the following section. 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 the West Bengal State.

GRID SELECTION

The total installed capacity of the power generating stations in the National Grid, Eastern Regional Grid and the West Bengal State Grid are provided given below.

Table B-1: Current Power Sector Scenario

Monitored Capacity (MW)	
National Grid	107877
Eastern Region Grid	16755.97
West Bengal State Grid	4784.38
Source: CEA General Review 2002-2003, Table No. 2.3	

The project activity would be saving on an average 0.4MW of power and the reduced power is 0.00037% of national grid capacity, 0.0024% of the regional grid capacity and .0083% of state grid capacity. It is too small to have a significant impact on the national grid or regional grid in terms of marginally effecting changes in the generation and dispatch system (operating margin) or delay future power projects that may be commissioned during the crediting period (build margin) in the national or eastern regional grid. Therefore, the principal effect of the project activity would be on the lowest level of the grid i.e. the carbon intensity of the West Bengal state grid.

Over and above the small size of the project activity, it was noted that the project activity is connected to the grid operated by the West Bengal State Electricity Board (WBSEB) and would be reducing the power load from the power plants comprising the WBSEB. We may therefore conclude that WBSEB Grid is the most representative system boundary for the project activity. Further the DCW plant is connected to the WBSEB grid.

We would therefore determine the carbon intensity of the grid mix which is governed by WBSEB in Step II to arrive at the baseline emission factor for baseline emission calculations for the project activity's crediting period.

The WBSEB has the primary responsibility for the supply of electricity that may be required within the state and for transmission and distribution of the same in most efficient manner.

The transmission and distribution system in West Bengal has access to electricity generated from:

- West Bengal's share from generating stations set up by the Central Government ["Central Sector Plants"]

The central government (Government of India) owns power generation plants managed by Government of India Enterprises like National Thermal Power Corporation Ltd (NTPC), National Hydroelectric Power Corporation Ltd (NHPC), Damodar Valley Corporation (DVC) and Power Grid Corporation of India (PGCIL) Chukka. Power generated by the central sector is being fed to the grid, which is accessible to all states in the region. The power generated by central sector generation plants is shared by all states forming part of the grid in fixed proportion as mentioned above. As per the Availability Based Tariff (ABT) Notification the central sector power generating units would operate at a plant load factor of 80% and West Bengal state has to make payments for its total share in the central sector. Therefore West Bengal would have to draw its allocated share from the central sector generating stations. India, nuclear power generation is allowed only by Central Sector Organisations. However West Bengal has no share in the nuclear power generating stations. Therefore the power mix may be thermal, hydro and wind.

- West Bengal's State owned generation

The state sector in West Bengal comprises of three entities namely West Bengal State Electricity Board (WBSEB), West Bengal Power Development Corporation Limited (WBPDCL) and Durgapur Projects Limited (DPL). WBSEB currently has a total generating capacity of 253.5 MW (details provided in the Table B-4 given below) and is primarily into transmission and distribution. WBPDCL is in the business of electric power generation and supply and has a total generating capacity of 2690 MW.

DPL operates a power plant with a capacity of 395 MW and is engaged in all the three functional areas of a power utility – the generation, transmission and distribution. The company is generating power from its six power units and distributing power at 11KV in its licensed area at Durgapur and the surplus power is transmitted to WBSEB Grid.

- West Bengal's Private owned generation

In addition to the State Sector, the other entities operating in West Bengal as Private Companies are CESC Limited (with a generating capacity of 1065 MW) and Dishergarh Power Supply Company Limited (with a generating capacity of 40 MW).

CESC Limited is the oldest private utility in India and started its operations in 1987. It generates and distributes electricity in and around Kolkata. It has five thermal power generating stations and a vast transmission and distribution network of network of 13,882 circuit km spread over 567 sq. km. in Kolkata and the adjoining districts. The present generation capacity is 1065 MW and the system's maximum demand was 1238 MW as on March 31st March, 2001.

Dishergarh Power Supply Company Limited is supplying power to Asansol-Raniganj industrial belt of West Bengal and is a part of the grid mix.

However both these private owned generation units from CESC and Dishergarh Power Supply Company Limited are not entirely dispatched into the WBSEB transmission systems. They have separate jurisdiction of operation and therefore do not contribute to the grid mix of the WBSEB. Therefore these two private companies have not been considered for estimation of the baseline carbon intensity of the grid mix of WBSEB. There has been a small amount of purchase from Dishergarh Power Supply Company Limited which has been considered in the grid mix.

STEP–II (B): Determination of carbon intensity of the chosen grid

The carbon intensity or baseline emission factor of the WBSEB is calculated as a Combined Margin.

As per the provisions of paragraph 5 of Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21], the emission coefficient (measured in kg CO_2equ/kWh) for the electricity displaced would be calculated in accordance with provisions of paragraphs 6 and 7 for category I.D projects.

The provisions of paragraph 7 of Appendix B require the emission coefficient (measured in kg CO_2equ/kWh) to be calculated in a transparent and conservative manner as:

(a)The average of the “approximate operating margin” and the “build margin” (or combined margin)

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

The Built Margin has been re-defined as the weighted average emissions (in kgCO_2equ/kWh) of recent capacity additions to the system, which capacity additions defined as the greater (in MWh) of most recent[2] 20 per cent[3] of existing plants or the 5 most recent plants as in Annex 2 (Amendment to Appendix B of the simplified modalities and procedures for small-scale CDM project activities) of Executive Board.

Complete analysis of the system boundary’s electricity generation has been carried out for the calculation of the emission coefficient as per point 7 (a) and (b) given above and for baseline emission calculations.

COMBINED MARGIN

The baseline methodology suggests that the project activity will have an effect on both the operating margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the state grid mix) and the build margin (i.e. weighted average emissions of recent capacity additions) of the selected WBSEB grid and the net baseline emission factor would therefore incorporate an average of both these elements.

[2] Generation data available for the most recent year.
[3] If 20% falls on part capacity of a plant, that plant is included in the calculation.

OPERATING MARGIN

The baseline factor as per the Operating Margin takes into consideration the present power generation mix excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation1 of the selected grid and the actual emission factors of the thermal power plants.

Present power generation mix

The consumers of the West Bengal state get a mix of power from the different sources. The figures of installed power capacity, share of the state in the central pool, and actual plant availability decides the content of power. The real mix of power in a particular year is however based on actual units generated from various sources of power. DCW is connected to the West Bengal State Electricity Board (WBSEB) which gets its major portion of power from WBSEB, WBPDCL and DPL along with the central sector generation plants. The actual generation data of the WBSEB for the year 2000-2001, 2001 – 2002 and 2002 – 2003 are available in the form of documents which includes own generation and purchase from central sector power plants is given below in Table B-2, B-3, B-4 and B-5.

Table: B-2 – Power Generation Mix of WBSEB grid consisting of Own Generating stations[4] and purchase from other State owned and Private Generating Stations (2000-2001)			
Sr. No.	**Energy Source**		**Purchase/ Own Generation in MkWh (2000-2001)**
I.	**West Bengal State Sector**		
1.	Thermal (Coal Based)		
	WPDCL	Kola ghat	6711.28
		Bakereswar	
	WBSEB	Bandel	2128.549
		Santhandih	1053.552
	DPL		131.33
A	**Thermal Coal Based Total:**		**10024.711**
2.	Thermal (Gas Based)		
	WBSEB	Kasbha GTPS	3.707
		Haldia GTPS	2.573
		Siliguri GTPS	0.000
B.	**Thermal Gas Based Total:**		**6.280**
1.	Hydro		
	WBSEB	Jaldhaka	92.951
		Rammam	233.088
		Teesta Canal Falls	118.945
C.	**Hydro Total**		**444.984**
II.	**West Bengal Private Sector**		
1.	DPSCL(coal)		148.14
D.	**Private Sector Total**		**148.14**
E.	**State Sector Total**		**10624.115**

[4] Both Bandel ans Santhaldih Thermal Power stations have been handed over to WBPDCL by WBSEB w.e.f 1st July, 2001(refer pg. 11, WBSEB Annual Report 2001-2002)

<table>
<tr><td colspan="4">Table: B-3 – Power Generation Mix of WBSEB grid from the Central Generating Stations[5] (2000-2001)</td></tr>
<tr><th>Sr. No.</th><th colspan="2">Energy Source</th><th>Purchase in MkWh (2000-2001)</th></tr>
<tr><td>I.</td><td colspan="2">West Bengal's Share in Central Sector Schemes</td><td></td></tr>
<tr><td>A</td><td colspan="2">Thermal Coal Based</td><td></td></tr>
<tr><td>1.</td><td colspan="2">NTPC Thermal (Coal Based)</td><td></td></tr>
<tr><td></td><td rowspan="3">NTPC</td><td>Farakka T.P.S (1600 MW)</td><td rowspan="3">2106.38</td></tr>
<tr><td></td><td>Kahalgaon T.P.S (840 MW)</td></tr>
<tr><td></td><td>Talcher T.P.S (1000 MW)</td></tr>
<tr><td></td><td colspan="2">NTPC share of Thermal Coal Based Total:</td><td>2106.38</td></tr>
<tr><td>2.</td><td colspan="2">DVC Thermal (Coal Based)[6]</td><td>667.536</td></tr>
<tr><td>a.</td><td colspan="2">DVC Thermal (Coal Based) Total</td><td>667.536</td></tr>
<tr><td></td><td colspan="2">Total Thermal Coal Based</td><td>2773.916</td></tr>
<tr><td>B</td><td colspan="2">Thermal Gas Based</td><td></td></tr>
<tr><td>1.</td><td colspan="2">DVC Thermal (Gas Based)[6]</td><td>1.528</td></tr>
<tr><td></td><td rowspan="2">NEEPCO[7]</td><td>Assam GBPP</td><td rowspan="2">122.56</td></tr>
<tr><td></td><td>Agartala GBPP</td></tr>
<tr><td></td><td colspan="2">Total Thermal Gas Based</td><td>124.088</td></tr>
<tr><td>C</td><td colspan="2">Hydro Based</td><td></td></tr>
<tr><td>4.</td><td colspan="2">PGCIL Hydro</td><td></td></tr>
<tr><td></td><td>PGCIL / PTC</td><td>Chukha H.P.S.</td><td>520</td></tr>
<tr><td></td><td></td><td>Kurichhu H.P.S.</td><td>0</td></tr>
<tr><td>5.</td><td>NHPC</td><td>Rangit H.P.S.</td><td>113.24</td></tr>
<tr><td>6.</td><td rowspan="2">NEEPCO</td><td>Kopili H.P.S</td><td rowspan="2">66.19</td></tr>
<tr><td></td><td>Doyang H.P.S</td></tr>
<tr><td>7.</td><td colspan="2">DVC Hydro[6]</td><td>23.745</td></tr>
<tr><td></td><td colspan="2">Total Hydro</td><td>723.175</td></tr>
<tr><td>D.</td><td colspan="2">Central Sector Total</td><td>3621.179</td></tr>
</table>

[5] Enclosure-IV

[6] Note: The total DVC generation contributed to the WBSEB grid mix was available in the WBSEB annual reports for the year 2000-2001, 2001-2002 and 2002-2003. The DVC Coal, Gas and Hydel generations are calculated based on the total generation mix of DVC for the year 2000-2001, 2001-2002 and 2002-2003

[7] The total NEEPCO generation contributed to the WBSEB grid mix was available in the WBSEB annual reports for the year 2000-2001, 2001-2002 and 2002-2003.The NEEPCO Gas and Hydel generations are calculated based on the total generation mix of NEEPCO from the annual reports for the year 2000-2001, 2001-2002 and 2002-2003

Table: B-4 – Power Generation Mix of WBSEB grid from the Own Generating Stations, purchase from other State and Private Generating Stations (2001-2002 and 2002-2003)				
Sr. No.	**Energy Source**		**Own Generation/ Purchase in MkWh (2001-2002)**	**Own Generation/Purchase in MkWh (2002-2003)**
I.	**West Bengal State Sector**			
1.	Thermal (Coal Based)			
	BPDCL	Kola ghat	10334.67	12411.80
		Bakereswar		
		Bandel		
		Santhandih		
	DPL		350.08	344.38
A	**Thermal Coal Based Total:**		**10684.75**	**12756.18**
2.	Thermal (Gas Based)			
	WBSEB	Kasbha GTPS	0.629	0.163
		Haldia GTPS	0.00	0.024
		Siliguri GTPS	0.00	0.000
B.	**Thermal Gas Based Total**		**0.629**	**0.187**
1.	Hydro			
	WBSEB	Jaldhaka	137.273	124.09
		Rammam	239.275	221.348
		Teesta Canal Falls	169.37	163.979
C.	**Hydro Total**		**545.918**	**509.417**
II.	**West Bengal Private Sector**			
2.	DPSCL (coal)		153.69	151.95
D.	**Private Sector Total**		**153.69**	**151.95**
E.	**State Sector Total**		**11384.987**	**13417.734**

Table: B-5 – Power Generation Mix of WBSEB grid from the Central Generating Stations (2001-2002 and 2003)				
Sr. No.	**Energy Source**		**Purchase in MkWh (2001-2002)**	**Purchase in MkWh (2002-2003)**
I.	**West Bengal's Share in Central Sector Schemes**			
	Thermal Coal Based			
1.	NTPC Thermal (Coal Based)			
	NTPC	Farakka T.P.S (1600 MW)	1875.82	516.75
		Kahalgaon T.P.S (840 MW)		
		Talcher T.P.S (1000 MW)		
a.	**NTPC Thermal Coal Based Total:**		**1875.82**	**516.75**
2.	DVC Thermal (Coal Based)[8]		653.603	589.809
b.	**DVC Thermal (Coal Based) Total**		**653.603**	**589.809**
A.	**Total Thermal Coal Based**		**2529.423**	**1106.559**
	Thermal Gas Based			
3.	DVC Thermal (Gas Based)[8]		1.538	0.568
	*NEEPCO	Assam GBPP	148.86	173.157
		Agartala GBPP		
B.	**Total Thermal (Gas Based)**		**150.398**	**173.725**
C	**Hydro Based**			
4.	PGCIL Hydro			
	PGCIL / PTC	Chukha H.P.S.	525.89	486.59
		Kurichhu H.P.S.	29.04	99.81
5.	NHPC	Rangit H.P.S.	139.48	127.47
6.	*NEEPCO	Kopili H.P.S	70.136	45.838
		Doyang H.P.S		
		Ranganadi H.P.S		
7.	DVC Hydro[8]		25.019	20.053
	Total Hydro		**789.565**	**780.238**
D.	**Central Sector Total**		**3469.39**	**2060.522**

[8] Note: The total DVC generation contributed to the WBSEB grid mix was available in the WBSEB annual reports for the year 2000-2001, 2001-2002 and 2002-2003. The DVC Coal, Gas and Hydel generations are calculated based on the total generation capacity mix of DVC for the year 2000-2001, 2001-2002 and 2002-2003

Emission factors

The emission factors used are given in Table B-5 and are based on a study from the OECD [OECD, 2000] and on the IPCC-guideline (IPCC, 1995). The emission factors vary widely depending on the type of fuel used.

Table B-6 Emission factors (OECD, 2000/ IPCC, 1996)

Source	Emission Factor(tCO_2/TJ)
Nuclear	0
Biomass	0
Hydro	0
Solar	0
Wind	0
Natural Gas	56.10
Coal	96.10

Standard emission factors given in IPCC for coal & gas (Thermal generation) are applied over the expected generation mix and net emission factors are determined for each year.

Efficiency

The most important parameter in estimating the emissions is the thermal efficiency of the power plant. The net energy consumption norms were based on best efficiency for each of the technologies considered. As per the CEA Performance Report, the estimated weighted average operating Station Heat Rate at All India basis are 2763 kcal/kWh, 2755 kcal/kWh and 2745 kcal/kWh and average thermal efficiency of 31.13%, 31.22% and 31.33% for the year 2000-2001, 2001-2002 and 2002-2003 respectively. As per the same report the estimated weighted average operating Station Heat Rate for the Eastern Region are 3306.02 kcal/kWh, 3712.04 kcal/kWh and 3302.87 kcal/kWh and average thermal efficiency of 26.01%, 23.17% and 26.04% for the year 2000-2001, 2001-2002 and 2002-2003 respectively. The percentage of carbon that is not burnt is very low and, hence, complete combustion was assumed. On a conservative basis average efficiency for base line calculations for operating margin and built margin is considered as per the average thermal efficiency estimated based on the operating Station Heat Rate at All India basis.

Average efficiency of gas based thermal plants in West Bengal as against the standard norms works out to be around 40%[9].

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[9]Source-www.worldbank.org/html/fpd/energy/subenergy/energyissues20.pdf

Operating Margin Emission Factor

The operating margin emission factor calculated from the above data for West Bengal is 1.07926 $kgCO_2/kWh$. Detail calculations have been shown in Enclosure-IV.

BUILD MARGIN

The baseline factor as per the Build Margin takes into consideration the delay effect on the future projects. As per the proposed baseline methodology, the baseline factor for "build margin" is the weighted average emissions (in kg CO_2equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or the 5 most recent plants.

In case of WBSEB grid, the total power generation of the most recent 20% of existing plants is 3197 million units which is greater than the total power generation of 5 most recent plants built for the WBSEB grid. Therefore for our build margin calculation we would take into consideration the 6 most recent plants which accounts for 20% of the existing plants built in West Bengal as given below in Table B-6.

<table>
<tr><th colspan="5">Table: B-6– 20% of the most recent plants built in West Bengal</th></tr>
<tr><th>Sl. No.</th><th>Year of Commissioning / Year of Purchase</th><th>Plant</th><th>MW</th><th>Own Generation/Purchase for 2002-03 (MU)</th></tr>
<tr><td>1</td><td>2001</td><td>Bakreswar U-2</td><td>210</td><td rowspan="3">2492.153</td></tr>
<tr><td>2</td><td>2001</td><td>Bakreswar U-3</td><td>210</td></tr>
<tr><td>3</td><td>2000</td><td>Bakreswar U-1</td><td>210</td></tr>
<tr><td>4</td><td>2000</td><td>NEEPCO (gas)</td><td>375</td><td>173.157</td></tr>
<tr><td>5</td><td>2000</td><td>NEEPCO (hydro)</td><td>730</td><td>45.838</td></tr>
<tr><td>6</td><td>1999</td><td>PGCIL Chukha (Hydro)</td><td>336</td><td>486.59</td></tr>
<tr><td colspan="4">Total</td><td>3197.738</td></tr>
<tr><td colspan="4">20% of Gross Generation-15478.256 MU</td><td>3095.6512</td></tr>
<tr><td colspan="4">Coal based</td><td>2492.153</td></tr>
<tr><td colspan="4">Gas Based</td><td>173.157</td></tr>
<tr><td colspan="4">Hydro based</td><td>532.428</td></tr>
<tr><td colspan="4">% of generation by coal out of total</td><td>77.93487146</td></tr>
<tr><td colspan="4">% of generation by gas out of total</td><td>5.414983967</td></tr>
<tr><td colspan="4">% of generation by hydro out of total</td><td>16.65014457</td></tr>
</table>

Build Margin Emission Factor calculated from the above data is 0.87058 $kgCO_2/kWh$.

Combined Margin Emission factor

= Avg. of Operating Margin Emission Factor and Build Margin Emission Factor

= (1.07926 + 0.87058)/2 = 0.97492 $kgCO_2/kWh$

Baseline Emissions

The main GHG emissions in this system boundary arise from burning of fossil fuels for electricity generation.

In addition to the emissions arising from fossil-fired power generation, additional CO_2 emissions occur during the transport of coal from coalmines (or ports). In the eastern region coalfields are not far from the coal-fired power stations. Because of a lack of data on average transport distance for coal to power stations in West Bengal we have not included fuel transport emissions in the system boundary in the baseline scenario. This also provides a conservative estimate of the emission reductions.

The baseline emissions are arrived at based on the above mentioned baseline emission factor calculated as Combined Margin and the power consumption saved in the project boundary by the project activity.

Based on the Combined Margin Method detailed above, (see Section E for calculations) the project activity will reduce 30116 tonnes of CO_2 in 10 year of credit period. Since, the project activity is not a baseline scenario, without project activity there will be emission as per the carbon intensity of the grid (0.97 $kgCO_2/kWh$). Therefore the project activity implementation reduces the energy requirement of the devices in the project boundary and its associated emission reductions.

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:

February 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:

April 2003

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 paragraph 6 under Category II.D project category of 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) Documenting the specifications of the equipment replaced;

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

(c) 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:

The project includes DCW's grinding mills where installation of efficient instruments and technological up-gradation have resulted in substantial saving of specific energy consumption. Hence, emission reduction quantity totally depends on the units of energy in kWh saved at the grid by the project facility from grinding mill section.

Description of Monitoring Plan

DCW made a voluntary commitment for reducing greenhouse gas emissions. A proper Monitoring & Verification (M&V) Plan has been developed for proper monitoring and verification of actual GHG emission reductions at the plant from the project activity.

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, scrutiny and benchmarking of all these 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 and resultant 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 grinding mill
- 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 reductions in tonnes of CO_2 equivalent.

The project has employed the state of the art monitoring and control equipment that measure; record, report, monitor and control mentioned key parameters. The instrumentation systems for monitoring of the project mostly comprise 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 some energy efficiency improvement measures resulting in savings of electrical power consumption.

The project monitoring includes:

- Monitoring the performance of newly adopted measures,
- Metering the specific 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 document for choice of monitoring methodology - *Appendix B of the simplified M&P for small-scale CDM project activities* also suggests the same for similar projects under Category II.D in the paragraphs *6 (a), (b) and (c).*

The quantity of emission reduction unit claimed by the project will be the total electrical energy saved by the plant. Therefore it is justified to check the total consumption of power by the whole plant of DCW and comparing the specific units consumed with pre-project stage historical data of electricity consumption within the said project boundary.

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.

WBSEB grid has been identified as emission baseline systems and project activity would affect this system. The current generation mix of WBSEB is being influenced by project activity; hence for baseline emission calculation data will be collected from WBSEB. WBSEB publishes yearly reports regarding the performance of all power generation units (which include private sector generation units and WBSEB's own generation units). Hence, authentic data related to the measurements, recording, monitoring and control of the generation mix of the WBSEB network is ensured. The statutory financial audit for the respective plants ensures the accuracy and reliability of captive generation data.

The WBSEB report contains all information regarding type of generation like hydro, thermal, nuclear, renewable *etc*., installed capacity, de-rated capacity, performance of generating unit, actual generation, capacity additions during the year, *etc*. which can be used for verification of generation mix and emission factors for baseline calculation for a particular year.

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 of the project activity 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 WBSEB grid as direct off -site reduction.

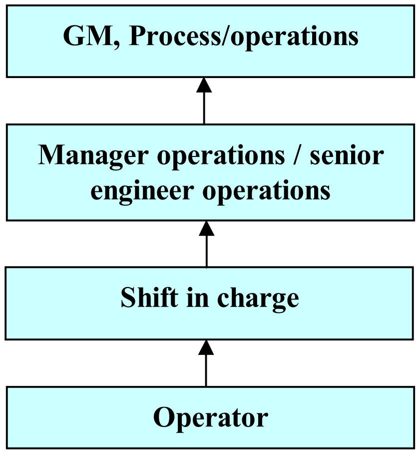
D.3 Data to be monitored:

ID number	Data type	Data variable	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)	For how long is archived data to be kept?	Comment
D.3.1.	Energy in grinding mill	Electrical energy consumption	kWh	m	Daily	100%	Electronic/paper	2 years after completion of crediting period	This data is required for the calculation of specific electrical energy consumption.
D.3.2	Material	Production	Tonne/day	m	Daily	90%	Paper	2 years after completion of crediting period	This data is required for the calculation of specific electrical energy consumption.

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.

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:



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

Plant professionals and Consultants of Durapur 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 West Bengal State Grid and the net effect of the project activity would primarily be on this grid. Therefore the grid scenario is analysed and 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 as per the guidelines provided in paragraph 7 under Category I.D in Appendix B of the simplified M&P for small-scale CDM project activities.

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 below:

Calculation of Baseline Emission Factor of the grid mix

Operating Margin

Formulae:

A. Baseline Power generation

$P_{gr} = P_{tot} - P_{lrc}$ where,

Sl. No.	Symbolic Representation	Illustration
1.	P_{tot}	Power generation by all sources of grid mix.
2.	P_{gr}	Power generation by all sources without low running cost plants
3.	P_{lrc}	Power generation by low running cost projects

B. Sectorwise baseline Power generation

$P_{n\%} = \frac{P_n}{P_{gr}} x100$ where,

Sl. No.	Symbolic Representation	Illustration
1.	$P_{n\%}$	Share (in %) of power generation by each fuel used (coal and gas in present scenario), out of total power generation excluding, power from low running cost plants.
2.	P_n	Power generation by fuel used. (in Million kWh units)
3.	P_{gr}	Power generation by all sources, without low running cost plants.

C. Calculation of Operating Margin emission factor

$OM_{gr} = \sum \frac{3.6 \otimes P_{n\%} \otimes E_n}{Eff_n}$ where,

Sl. No.	Symbolic Representation	Illustration
1.	OM_{gr}	OM Emission factor of baseline (tCO_2/GWh)
2.	E_n	Emission factor (actual) for each fuel type considered (e.g. coal, gas).
3.	$P_{n\%}$	Share (in %) of power generation by each fuel used (coal and gas in present scenario), out of total power generation excluding, power from low running cost plants.
4.	Eff_n	Efficiency for each fuel type.

Build Margin

Formulae:

A. Power generation from each project type of the cohort of plants identified

$$P_{n\%} = \frac{P_n}{P_{gr}} x100 \quad \text{where,}$$

Sl. No.	Symbolic Representation	Illustration
1.	$P_{n\%}$	Share (in %) of power generation by each project type / fuel used (n = types e.g. coal, natural gas, diesel, hydro) out of total power generation from recent capacity additions
2.	P_n	Power generation by project types/fuel used (n = types e.g. coal, natural gas, diesel, hydro) from recent capacity additions to the system, which capacity additions defined as the greater (in MWh) of most recent[10] 20 per cent[11] of existing plants or the 5 most recent plants
3.	P_{gr}	Total power generation from recent capacity additions to the system, which capacity additions defined as the greater (in MWh) of most recent 20 per cent of existing plants or the 5 most recent plants

[10] Generation data available for the most recent year.

[11] If 20% falls on part capacity of a plant, that plant is included in the calculation.

B. Calculation of Built Margin emission factor for each source of baseline generation mix

$$BM_{gr} = \sum \frac{3.6 \otimes P_{n\%} \otimes E_n}{Eff_n}$$ where,

Sl. No.	Symbolic Representation	Illustration
1.	BM_{gr}	Build Margin for base year.(t CO_2/GWh) – (weighted average of emissions from recent capacity additions to the system, which capacity additions defined as the greater (in MWh) of most recent 20 per cent of existing plants or the 5 most recent plants)
2.	E_n	Emission factor (actual) for each fuel type considered (e.g. coal, gas).
3.	$P_{n\%}$	Share (in %) of power generation by each fuel used (coal and gas in present scenario), out of power generation from recent capacity additions to the system, which capacity additions defined as the greater (in MWh) of most recent 20 per cent of existing plants or the 5 most recent plants
4.	Eff_n	Efficiency for each fuel type.

Calculation of Combined Margin emission factor

$$CM_{NET} = \frac{(OM_{gr} + BM_{gr})}{2}$$ where

Sl. No.	Symbolic Representation	Illustration
1.	CM_{NET}	Combine Margin Factor
2.	OM_{gr}	OM Emission factor of baseline (tCO_2/GWh)
3.	BM_{gr}	Build Margin for base year.(tCO_2/GWh) - weighted average of emissions from recent capacity additions to the system, which capacity additions defined as the greater (in MWh) of most recent 20 per cent of existing plants or the 5 most recent plants

Estimation of energy units conserved by the project activity

- The phase wise implementation of technical up-gradation and instrumentation during the period 2000-2003 are considered under the project.
- Data sheet for cement production provides information on Mill motor kWh, Auxiliary kWh, respective kWh/t, mill running hours, cement production [total], rate of production in tph (tonne per hour) [4 mills together], raw material consumed.
- kWh/t of cement production is considered the key indicator keeping the property and quality of cement unchanged.
- Weighted average of the same with total production as weights have been calculated for the following periods

  - ✓ April 99-Feb00
  - ✓ Mar00-Jul00
  - ✓ Aug00-Oct01
  - ✓ Nov01-Jan02
  - ✓ Feb02-Mar03

These are periods between 2 successive implementations/installations.

- Reduction in kWh/t is from 53.25 [Apr 99-Feb00] to 47.05 [Jan03-Mar03] = 6.1968 kWh/t (Enclosure III)
- Average monthly production during the consecutive period (of implementation) is considered.
- Weighted average specific energy consumption value is calculated (kWh/t)

For estimation of kWh savings from each of the components under the project activity the following algorithm has been followed

Activity	Cumulative production	Weighted average Sp. Energy Consumption during the period	kWh Savings during the consecutive period	Remarks
Before project implementation	B	C	0	
Activity 1	B1	C1	K1 = (C-C1)x (B1-B)	Otherwise (B1-B) would be produced at rate C
Activity 2	B2	C2	K2 = (C-C2)x (B2-B1)	Otherwise (B2-B1) would be produced at a specific energy consumption of C
Activity 3	B3	C3	K3 = (C-C3)x (B3-B2)	Otherwise (B3-B2) would be produced at a specific energy consumption of C

Net Energy Savings = K1+K2+K3

Generalising for the entire crediting period, the net energy saving is given as:

($C - C_n$) x production of cement during the period between (n-1)th and nth energy efficiency measure where 'n' denotes the number of energy efficiency measures adopted.

Net kWh Savings:

Net kWh savings during the 10 years crediting period = 30889385kWh

The details are provided in the excel spreadsheet. (Enclosure III)

With Emission Factor of 0.97 the net CO_2 savings during the Crediting period:

Net CO_2 savings during the 10 years crediting period (t CO_2 equ) 30116

Average Annual CO_2 savings during the 10 years crediting period (t CO_2 equ) 3011.6

The baseline CO_2 emission is calculated as given below:

Baseline Emission Calculations				
Step 1	**:**	Units substituting the grid	=	(Units conserved by the Project activity)
Step 2	**:**	CO_2 Baseline Emissions	=	Units substituting the grid x CM_{NET}

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, estimated following the above described algorithms.

Table E.1: Table showing CO_2 emission reductions due to project activity

Sl. No.	Operating Years	Baseline Emission Factor (tonnes of CO_2 / TJ)	Baseline Emissions (tonnes of CO_2)	Project Emission (tonnes of CO_2)	CO_2 Emission Reductions (tonnes of CO_2)
1.	2000-2001	0.97	939.41	Nil	939.41
2.	2001-2002	0.97	1655.48	Nil	1655.48
3.	2002-2003	0.97	3117.62	Nil	3117.62
4.	2003-2004	0.97	3486.32	Nil	3486.32
5.	2004-2005	0.97	3486.32	Nil	3486.32
6.	2005-2006	0.97	3486.32	Nil	3486.32
7.	2006-2007	0.97	3486.32	Nil	3486.32
8.	2007-2008	0.97	3486.32	Nil	3486.32
9.	2008-2009	0.97	3486.32	Nil	3486.32
10.	2009-2010	0.97	3486.32	Nil	3486.32
Total			**30116**		**30116**

SECTION F.: Environmental impacts:

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

The Ministry of Environment and Forests (MoEF), Government of India has, under the Environmental (Protection) Act 1986, promulgated a notification on 27 January 1994 (amended on 04/05/1994, 10/04/1997, 27/1/2000 and 13/12/2000) making environmental clearance mandatory for expansion or modernisation of any activity or for setting up new projects listed in Schedule I of the notification. EIA clearance is required for 29 categories of industries from the central government which can be broadly categorised under sectors of industries, mining, thermal power plants, river valley, ports, harbours and airports, communication, atomic energy, transport (rail, road, highway), tourism (including hotels, beach resorts). For some projects, EIA is not needed, which includes **Energy Efficiency Measures** in existing industrial set-up[12].

There are no negative environmental impacts from the adoption of technologically upgraded energy efficiency measures 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 emission 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) Greenhouse Gas Abatement
2) Primary Resource Conservation and facilitating sustainable development
3) Pollution abatement in Thermal power plant and its upward linkages.

[12] Reference: http://www.envfor.nic.in

SECTION G. Stakeholders' comments:

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

Identification of Stakeholders

The various stakeholders identified for the project activity are as under

- West Bengal State Electricity Board (WBSEB)
- West Bengal Pollution Control Board (WBPCB)
- Industrial associates
- Consultants
- Equipment suppliers
- Community at large

Stakeholders list includes various government and non-government parties, which are involved directly or indirectly in the project activity at various stages.

G.2. Summary of the comments received:

Stakeholders Involvement

The project activity will not cause any adverse social impacts on the local population. It will have benefits for the society at large by conserving energy and non-renewable fuel resources and thus taking one more step ahead towards sustainable development goals of the organization.

The unit operates with all necessary statutory clearances from the WBPCB and other government bodies.

Projects consultants are to be involved in the project activity to take care of the various pre contract and post contract issues / activities like preparation of Detailed Project Report (DPR), preparation of basic and detailed engineering documents, preparation of tender documents, selection of vendors / suppliers, supervision of project operation, implementation, successful commissioning and trial run.

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

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Annex 2 : Information Regarding Public Funding

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