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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

"Waste Heat Recovery and Utilization for Power Generation at Maple Leaf Cement Factory Limited, Iskanderabad, Pakistan"
Version: 01
Date: 07/07/2009

A.2. Description of the project activity:

Maple Leaf Cement Factory Limited (hereafter referred to as MLCFL) is the third largest cement producer in Pakistan. It was setup in 1956 as a joint collaboration between the West Pakistan Industrial Development Cooperation and Government of Canada. In 1992, Kohinoor Group acquired the ownership and management of MLCFL under the privatization policy of the Government of Pakistan. Presently, Kohinoor Group is the holding company for MLCFL.

MLCFL is strategically located at Iskanderabad, near the city of Daudkhel, an area which is rich in raw materials required for the production of cement. MLCFL has an ISO 9000/9001/9004/19011: 2000 certification and manufactures high quality cement products (Ordinary Portland Cement, White Cement, Sulphate Resistant Cement, Low Alkali Cement and Oil Well Cement).

The cement plant is divided into two phases. Phase I of the plant has five kilns with a combined clinker production capacity of 1600 tonnes per day (TPD). Phase II of the plant has two kilns; kiln 1 of 4000 TPD and kiln 2 of 6700 TPD. All the kilns are fossil fuel based and utilize coal, HFO, natural gas and diesel as fuel.

Phase I and phase II of the plant have individual grid connections, 10 MW and 40 MW, respectively. The cement plant also has a fossil fuel (HFO and natural gas) based captive power plant which has 4 Niigata engines (4 x 5.96 MW) and one Wartsila engine (16.4 MW).

The waste heat is available from the clinker production process and the exhaust of the Wartsila engine. In the baseline scenario, most of the waste heat from clinker production process is vented to the atmosphere with only a small portion recovered to heat the incoming raw materials. All the waste heat from the Wartsila engine is vented to the atmosphere without any utilization for energy generation.

The project activity is implemented at Phase II of the plant and involves the installation of a Waste Heat Recovery (WHR) system to generate electricity.

Waste heat will be recovered by installing six Heat Recovery Steam Generators (HRSGs) having total capacity of 70.4 TPH and electricity will be generated by installing a steam turbine of 16.5 MW. The electricity generated by the component of heat coming from the exhaust of Wartsila engine will be ignored and emission reduction would be claimed only for the electricity generated by utilizing waste heat coming from the clinker production process.

The electricity generated by the project will partially displace the grid electricity import of phase II of the plant. Since the grid electricity in Pakistan is primarily fossil fuel based, the project activity would result in partial displacement of the electricity which would otherwise be generated by power plants connected

to the grid. Thus, the project will reduce GHG emissions by 47,807 tCO_2 per year and will lead to sustainable development.

In the absence of the project the current situation will continue i.e. waste heat will be vented to the atmosphere with only a small portion from clinker production process recovered to heat the incoming raw materials and the fossil fuel based grid will be used as source of electricity.

The project activity will result in transfer of efficient and modern technology from China and Japan to the region and will encourage others to adopt similar technologies leading to further conservation of energy, fuel and environment.

The project activity will result in:

Environmental Development

- significant reduction in the emissions of Greenhouse Gases
- improvement of the local environment by reduction in temperature of the vented hot air
- reduction in local air pollutants which will benefit the local community due to reduced costs for health care and climate change adaptation.

Social Development

- creation of new permanent jobs during construction and operation phase of the project activity
- alleviation of poverty by providing labour employment opportunities to the local community during construction phase

Economic Development

- cost effective way of generating electricity since no additional fuel is used
- diffusion of the new technology in the industrial sector. This would provide ample opportunity to local engineers and engineering companies to study this technology and develop similar indigenous technologies which would reduce future technology imports
- trigger new economic activities within the same sector of economy

Technology Development

- introducing modern technology in the country
- improve technical knowledge of local population through technology transfer of the system by the supplier
- setting up an example of sustainable development to be followed by other cement factories

A.3. Project participants:

The table A.3.1 illustrates the participants involved in the project activity. Contact information is provided in Annex 1

Table A.3.1: Project Participants

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Islamic Republic of Pakistan (host)	Maple Leaf Cement Factory Limited (private entity)	No
Islamic Republic of Pakistan (host)	Carbon Services Private Ltd. (private entity)	No
Switzerland	First Climate (Switzerland) AG (private entity)	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Islamic Republic of Pakistan

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

Punjab Province

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

Iskanderabad (close to Daud Khel city), District Mianwali

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

The map below shows the exact location of the project activity.

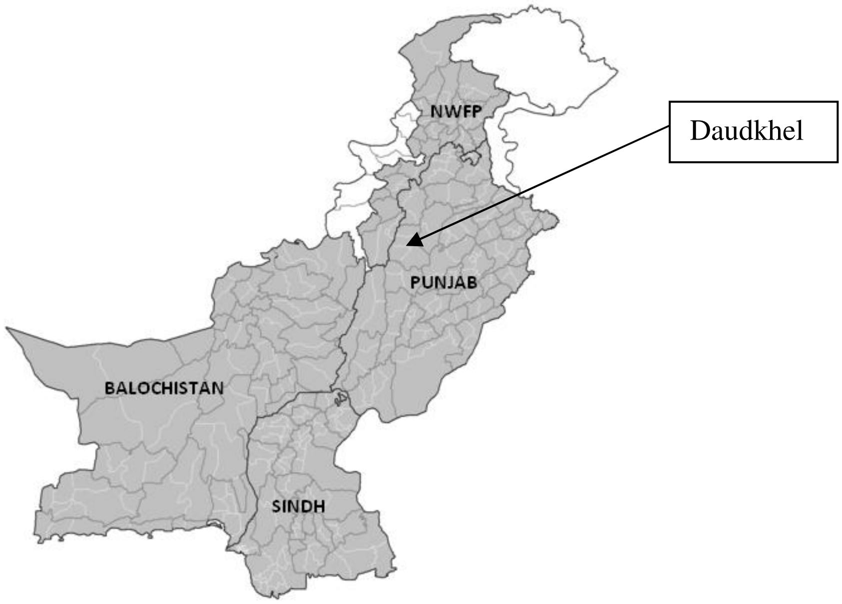

Fig A.4.1.4.1: Map of Pakistan [1]

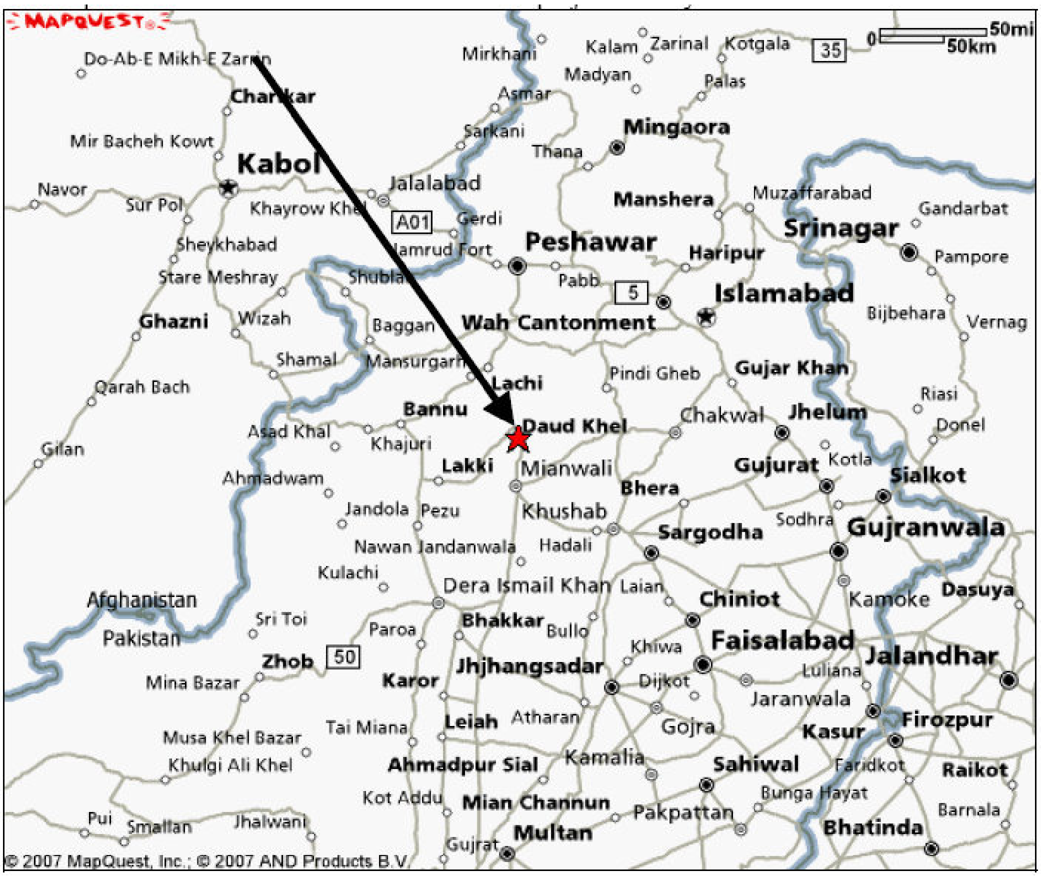

Fig A.4.1.4.1: Location of the Project Site [2]

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[1] **Source: http://www.wikipedia.org**
[2] **Source: http://www.mapquest.com**

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

As per the sectoral scope of the project activities mentioned in the list of sectoral scopes, 25 Feb 2009 for accreditation of DOEs, the project activity falls under

- Sectoral Scope 1 – Energy industries (renewable / non-renewable sources); and
- Sectoral Scope 4 – Manufacturing industries

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

Maple Leaf Cement Factory is divided into two phases. Phase I of the plant has 5 kilns with a combined clinker production capacity of 1600 TPD and phase II of the plant has two kilns; kiln 1 of 4000 TPD and kiln 2 of 6700 TPD. Kiln 1 was upgraded from 3300 TPD during July 2005 while kiln 2 was commissioned in February 2007. All the kilns are fossil-fuel based utilizing coal, HFO, natural gas and diesel as fuel.

Currently the electricity is supplied by two sources to the cement plant; grid and captive power plant. Phase I of the plant has a grid connection of 10 MW and phase II of the plant has a grid connection of 40 MW. The captive power plant is fossil fuel (HFO and Diesel) based which has 4 Niigata Engines of 5.96 MW each (23.84 MW) and a Wartsila 18V50 engine of 16.4 MW. The captive power plant provides electricity to both phases of the cement plant.

The waste heat is available from two sources. The major portion of waste heat (approximately 89%) is available from the clinker production process i.e. from the pre-heater (PH) and cooler (AQC) ends of kilns. Currently, a small portion of waste heat from the clinker production process is recovered in order to heat up the incoming raw materials and the major portion of this waste heat is vented to atmosphere.

The 2nd source of waste heat is the exhaust of Wartsila engine. This waste heat comprises only 11% of total waste heat to be utilized by the project activity. Currently, all the waste heat from this source is vented to atmosphere without any recovery.

The project activity involves installation of WHR system to generate electricity at Phase II of the plant. The electricity generated by the project activity will partially displace the grid electricity of phase II of the plant.

The waste heat available from the two kilns at phase II (kiln 1 of 4000 TPD, kiln 2 of 6700 TPD) and the exhaust of the Wartsila engine will be recovered by installing a total of six Heat Recovery Steam Generators (HRSGs). Two HRSGs, 15.4 tph and 8.5 tph would be installed on PH and cooler AQC end of Kiln 1, respectively; likewise, three HRSGs, two 11.5 tph each and one 15.6 tph would be installed on PH and AQC end of Kiln 2, respectively.. A sixth HRSG of 7.9 tph will be installed on the exhaust of Wartsila Engine. Table A.4.3.1 below shows the technical details of HRSGs.

The electricity generated by the component of heat coming from Wartsila engine will be ignored for calculating emission reductions as the methodology only allows the recovery of waste heat which falls within the energy balance boundary of the clinker making process and which is reflected in the specific fuel consumption of the clinker line per unit output of clinker. As the waste heat from the exhaust of Wartsila engine falls outside the energy balance boundary of the clinker making process, the electricity generated by this component of waste heat will not be included in the calculation of electricity that is displaced by the project activity.

Tables A.4.3.1: Technical characteristics of HRSGs

<table>
<tr><th>Equipment</th><th>Location</th><th>Waste Heat Generation (Nm^3/Hr)</th><th>Capacity (TPH)</th><th>Steam Pressure (MPa)</th><th>Steam Temperature (ºC)</th></tr>
<tr><td>HRSG 1</td><td>Pre-heater end of kiln 1 (4000 TPD)</td><td>214,000</td><td>15.4</td><td>1.63</td><td>312</td></tr>
<tr><td>HRSG 2</td><td>Cooler end of kiln 1 (4000 TPD)</td><td>103,333</td><td>8.5</td><td>1.63</td><td>355</td></tr>
<tr><td>HRSG 3</td><td>Pre-heater end of kiln 2 (6700 TPD)</td><td rowspan="2">195,500</td><td>11.5</td><td>1.63</td><td>301</td></tr>
<tr><td>HRSG 4</td><td>Pre-heater end of kiln 2 (6700 TPD)</td><td>11.5</td><td>1.63</td><td>301</td></tr>
<tr><td>HRSG 5</td><td>Cooler end of kiln 2 (6700 TPD)</td><td>173,000</td><td>15.6</td><td>1.63</td><td>366</td></tr>
<tr><td>HRSG 6</td><td>Exhaust of Wartsila Engine</td><td>80,912</td><td>7.9</td><td>1.68</td><td>370</td></tr>
</table>

The superheated steam generated by the HRSGs will be utilized to generate electricity by installing a 16.5 MW steam turbine. Table A.4.3.2 shows the technical specifications of the steam turbine.

Table A.4.3.2: Technical characteristics of steam turbine

Quantity	1
Rated output	16,500 kW
Nominal output	13,900 kW
Revolution	3000 rpm
Inlet steam pressure	1.53 MPa
Inlet steam temperature	325 ºC

The electricity generated by the project activity will be consumed within the cement works and will partially displace the grid electricity of Phase II of the plant. The project reduces the GHG emissions by replacing fossil fuel based electricity generated by power plants connected to the grid.

In the absence of the project activity the existing situation will continue i.e. the waste heat will be vented to the atmosphere with only a small portion recovered from the clinker making process to heat the incoming raw material and the electricity from the grid will be used at the plant. Net electricity generated by the project activity (based on the waste heat utilization only from the clinker production process) will be 99,000 MWh/yr and this will result in, approximately, 47,807 t CO_2 reductions per year by displacing the fossil fuel based electricity generated by power plants connected to the grid.

The project activity will result in transfer of efficient and modern technology from China and Japan to the region. The import of new equipments (steam turbo-generator, HRSG, and allied equipments) not merely means technology transfer but skill transfer as well. This kind of innovative and energy efficient technology would serve to demonstrate the operational efficiency of such systems and encourage others to adopt similar technologies leading to further conservation of energy, fuel and environment.

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

For the fixed crediting period of 10 years (from 01/12/2009 to 30/11/2019) the annual & total estimation of emission reductions is:

Table A.4.4.1: Estimated emission reductions

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2009 (December)	3,894
2010	47,807
2011	47,807
2012	47,807
2013	47,807
2014	47,807
2015	47,807
2016	47,807
2017	47,807
2018	47,807
2019 (January to November)	43,913
Total estimated reductions (tonnes of CO_2e)	**478,070**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**47,807**

A.4.5. Public funding of the project activity:

No public funding is involved in this project activity.

SECTION B. Application of a baseline and monitoring methodology

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

Approved Baseline Methodology AM0024

Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants
AM0024 / Version 02.1 Valid from 02 Nov 2007 onwards

http://cdm.unfccc.int/UserManagement/FileStorage/EDS6TS9TXOQP14XNXJZKKZVDTIBRH9

Referred Tools

- Tool for the demonstration and assessment of additionality (Version 05.2)
- Tool to calculate the emission factor of an electricity system (Version 01.1)

Approved Monitoring Methodology AM0024

Monitoring methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants
AM0024 / Version 02.1

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

AM0024 comprises “project activities that use waste heat gas generated in clinker making process (i.e. in the cement kilns) to produce electricity.” This project activity involves the installation of a waste heat recovery system to use the waste heat gas generation in the clinker making process of MLCFL. As the objective is to produce electricity, AM0024 / Version 02.1 is generally applicable, given that the further conditions, as outlined in the table below, are applicable.

Table B.2.1: Applicability of the methodology AM0024 / Version 02.1

Condition	Project Activity/Baseline Scenario	Applicability
The electricity produced is used within the cement works where the proposed project activity is located and excess electricity is supplied to the grid; it is assumed that there is no electricity export to the grid in the baseline scenario (in case of existing captive power plant);	The electricity produced by the project activity will be used within the cement works where the proposed activity is located. Since there is no excess electricity generated, so electricity export to the grid in the project as well as baseline situation is zero.	Methodology is applicable to project activity.

Electricity generated under the project activity displaces either grid electricity or from an identified specific generation source. Identified specific generation source could be either an existing captive power generation source or new generation source;	Electricity generated under the project activity displaces the fossil fuel based electricity imported from the grid.	Methodology is applicable to project activity.
The grid or identified specific generation source option is clearly identifiable;	The project activity will directly displace the grid electricity and the grid is clearly identifiable.	Methodology is applicable to project activity.
Waste heat is only to be used in the project activity; In the baseline scenario, the recycling of waste heat is possible only within the boundary of the clinker making process (e.g. clinker production lines in baseline scenario could include some heat recovery systems to capture a portion of the waste heat from the cooler end of the clinker kiln and use this to heat up the incoming raw materials and fuel - so called Type 1 Waste Heat Utilization as described in explanatory note below).	Waste heat is used in the project activity only. In the baseline scenario, waste heat from the kiln is used for pre-heating raw materials within the cement works (Type 1 Waste Heat Utilization). The second waste heat source is the exhaust of the Wartsila engine which is vented to the atmosphere without utilization energy.	Methodology is applicable to project activity.
The current use of waste heat or the identified alternative business as usual use of waste heat is not located outside of the clinker making process (so called Type 2 Waste heat utilization);	The current use of waste heat from the kiln is for pre-heating raw materials and thus located inside of the clinker making process.	Methodology is applicable to project activity.
The project activity does not affect process emissions from cement plants.	The project activity does not involve any changes in the cement production process and therefore does not affect process emissions from cement plants.	Methodology is applicable to project activity.

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

Description of the sources and gases included in the project boundary according to Table 1 of AM0024 / Version 02.1 is provided in Table B.3.1 below.

Table B.3.1: Overview of emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.

Project Activity	On-site fossil fuel consumption due to the project activity	CO_2	Included	May be an important emission source.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

The project boundary is illustrated in the figure below:

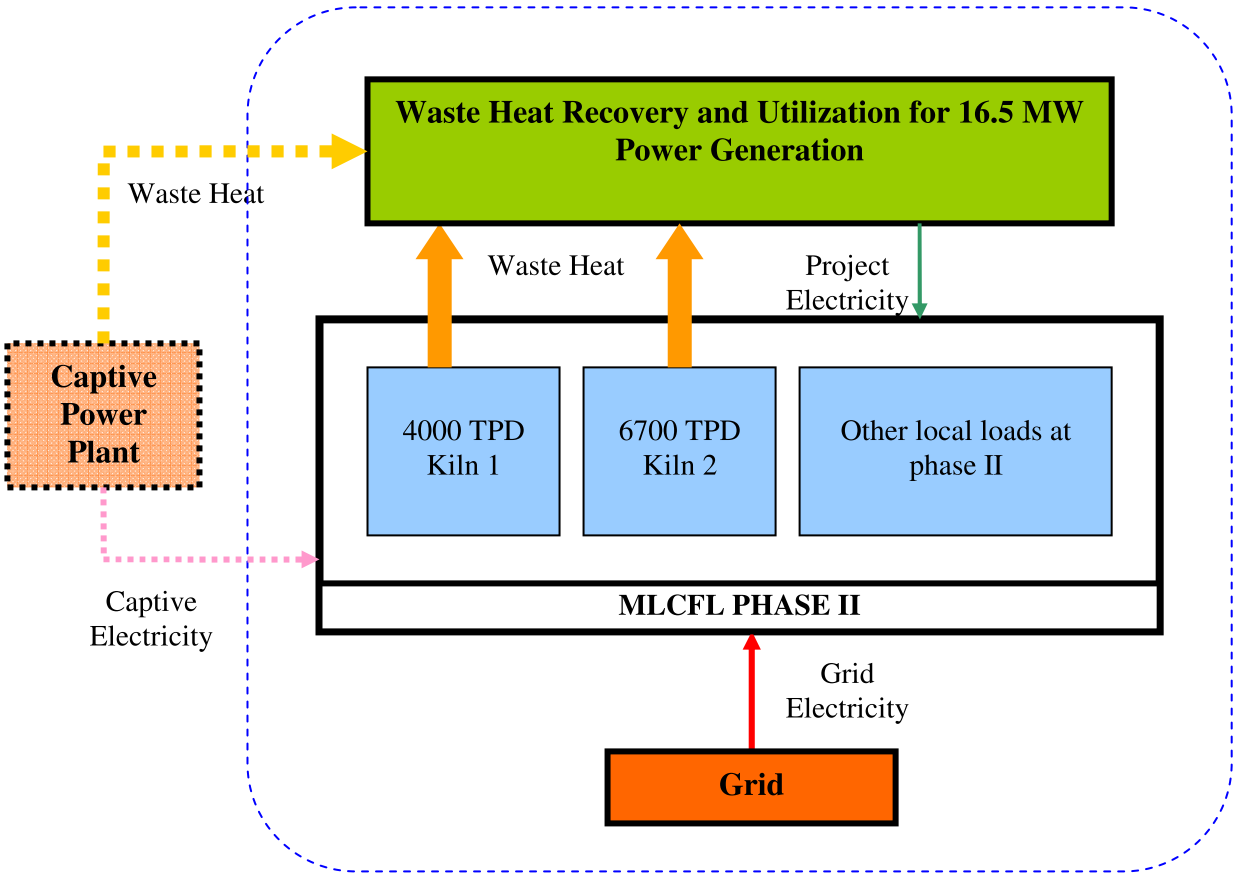

Fig B.3.1: Project boundary

Although waste heat from captive power plant is included in the project boundary, the electricity generated by this component of heat will be ignored and emission reduction would be claimed only for the electricity generated by utilizing waste heat coming from the clinker production process.

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

According to AM0024 the baseline scenario for the project must be identified through the following steps:

- Step 1: Determination of technically feasible alternatives to the project activity
- Step 2: Compliance with regulatory requirements
- Step 3: Undertake economic analysis of all options that meets the regulatory requirements

Step1: Determination of technically feasible alternatives to the project activity:

1.A Current business in the local context

Current business of waste heat at Phase II of MLCFL is venting it into the atmosphere. Only a small portion of waste heat is circulated and used for preheating the incoming raw materials and fuel. Similar practice is observed in other cement manufacturing plants of Pakistan. There is no industrial or commercial facility in the close vicinity of MLCFL to which waste heat could be transferred; therefore potential of waste heat utilization in an activity other than the project activity is eliminated.

There is no demand of waste heat within the project boundary, that's why it had been vented to the atmosphere except small portion was used for preheating raw materials and fuel. In the project situation, all the waste heat will be captured by HRSGs for steam generation. Steam will be fed to turbo-generator to generate electricity for cement works. Hot exhaust of the HRSGs will still be used for preheating the incoming raw materials and fuel. Hence it's clear that use of waste heat in the project situation will be within the energy balance boundary of clinker making process (Type 1 waste heat utilization).

1.B Source of electric energy supply for cement plants in the local context

As stated through the Platts Data Base (2007), in Pakistani cement sector, the primary source of electricity is fossil fuel based generator sets at captive power plant. Grid imports exist in cement factories and some plants have grid connection as backup. Hence, cement companies in Pakistan generate the required electricity in their captive power plants and use grid electricity as peak demand supply source or as a backup option.

The electricity demand of the MLCFL is met by combination of captive power generation and grid electricity imports. The calculation of the baseline scenario taking into account the continuation of the current situation is based on the historical data of MLCFL.

Three years historical data (for calendar years 2004 - 2006) is available and is given below in Table B.4.1 to Table B.4.3. Kiln 1 had a capacity of 3300 TPD and was upgraded to 4000 TPD in July 2005. This upgrade had significant impact on the performance characteristics of the kiln. The data of some months immediately after this upgrade cannot be considered as representative data. Also due to commissioning of kiln 2 in February 07, the production data for year 2007 cannot be considered as representative data; hence, the data of one complete year (January to December 2006) according to AM0024 / Version 02.1 is selected for determination of baseline calculation for the continuation of the current situation scenario.

Number of operational days of cement plant depends upon market demand of cement in the local and international market which is variable. In the project situation, MLCFL plans to run the cement manufacturing plant for 330 days which is quite realistic and achievable production plan.

Table B.4.1 Clinker Production Data (Tonnes/year)

Kiln	Historical Year			Baseline	Project Year	
	2004	2005	2006		Year 1	Year 2
Phase II Kilns:						
Kiln 1	1,022,736	1,056,978	1,192,527	1,320,000	1,320,000	1,320,000
Kiln 2	0	0	0	2,211,000	2,211,000	2,211,000
Phase I kilns	213,450	289,089	227,287	227,287	227,287	227,287

Electricity consumption data is given below in Table B.4.2

Table B.4.2 Electricity Consumption Data (MWh/year)

Load	Historical Year			Baseline	Project Year	
	2004	2005	2006		Year 1	Year 2
Kiln 1	33,259.634	33,828.332	35,588.195	39,392.330	39,392.330	39,392.330
Other loads at kiln 1	76,642.721	84,471.613	88,490.270	97,949.276	97,949.276	97,949.276
Kiln 2	0	0	0	63,014.500	63,014.500	63,014.500
Other loads at kiln 2	0	0	0	156,683.463	156,683.463	156,683.463
Phase I kilns	4,828.925	5,466.785	5,253.411	5,253.411	5,253.411	5,253.411
Total Electricity Consumption	136,051	148,737	163,031	395,991	395,991	395,991

Data of electricity supply sources is given below in Table B.4.3

Table B.4.3 Electricity Supply Data (MWh/year)

Source	Historical Year			Baseline	Project Year	
	2004	2005	2006		Year 1	Year 2
WHR Project	0	0	0	0	110,088.000	110,088.00
Captive	114,935.212	118,949.099	92,364.842	224,347.825	224,347.825	224,347.825
Grid	21,115.800	29,787.600	70,666.200	171,643.321	61,555.321	61,555.321
Total Electricity Supply	136,051	148,737	163,031	395,991	395,991	395,991

According to AM0024 / Version 02.1, the following broad categories should be analysed to identify baseline electricity options.

(i) Supply from grid;
(ii) Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source, if one exists; and
(iii) Construction of a captive power plant with different fuel options if electricity demand is increasing

(i) Supply from grid

Primary source of electricity in the cement factories in Pakistan is captive power plant, and many cement factories have grid connection as back up or to meet the peak demand. MLCFL has grid connection to meet the peak demand but MLCFL cannot meets its all power demand by completely (no captive generation) switching to grid. This is because national grid in Pakistan is unreliable and is not able to consistently meet the national demand. Regular and unscheduled outages because of load shedding are observed which may result in huge loss of production material. Electricity generated by the proposed

CDM project activity will provide uniform and reliable services. For gap in national demand and generation demand, please observe http://www.ppib.gov.pk/SupplyDemand.htm

It is evident that grid electricity imports don't provide outputs or services comparable with the proposed CDM project activity hence getting all the supply from grid isn't a feasible alternative. However, meeting the partial (peak) demand from the grid is a technically feasible and is the current practice at MLCFL.

(ii) Supply from existing capacity or in case of increase of energy demand expansion of captive power generation source

The capacity of existing captive power plant is sufficient to meet the projected power demand of the cement plant; therefore expansion of captive power generation source is not required. Supply from the captive power plant (primarily) and peak demand from the grid is the scenario which is historically practised by the project proponent, and this scenario will continue in future in the absence of proposed CDM project activity.

(iii) Construction of a captive power plant with different fuel options if electricity demand is increasing

Electricity demand in the project years is higher than the historical year (January to December 2006) because of commissioning of new kiln (6700 TPD) at the factory. However, existing captive power plant and grid is quite capable to meet the projected demand in the absence of the proposed CDM project activity. Hence, construction of a captive power plant with different fuel options if electricity demand is increasing is not a feasible alternative to the project activity.

It's clear from the context that the project proponent has only one technically feasible alternative to the proposed CDM project activity, namely the supply from the existing captive power plant and the grid (continuation of current practice).

Step 2: Compliance with regulatory requirements

The identified solely technically feasible alternative is continuation of current practice by supply from the existing capacity and the grid. The aforementioned scenario is completely in compliance with all the legal requirements and meets the current NEQS (National Environmental Quality Standards). Moreover, there are no legal, national, or sectoral policies in place which either prohibit the project proponent from the continuation of current practice in the project years or force the project proponent to undertake the proposed CDM project activity.

Hence the identified technically feasible alternative is fully in compliance with the regulatory requirements.

Step 3: Undertake economic analysis of all options that meets the regulatory requirements

Since there is only one alternative to the project activity, which is the continuation of the current situation, no further analysis is required. It can be concluded that the continuation of the current situation is the baseline scenario.

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

The demonstration of additionality is realised through application of the latest version of the "Tool for the demonstration and assessment of additionality (Version 05.2)".

CDM consideration before starting date of the project activity

The starting date of the project activity is the date of L/C on the 14th of February 2008. CDM was considered before the start date of the project activity and formed an integral part of the investment decision taken on 26th of September 2007 to implement the project[3]. Discussions with CDM consultants started in January 2007 and during the whole implementation phase before validation, MLCFL was assisted by CDM consultants.

Please find below the project timeline Table B.5.1.

Table B.5.1 Project Timeline

Milestone	Date	Source
CDM Awareness	January, 2007	E-mail from Mr. Omar Malik, Director Carbon Services, to Mr. Sayeed Tariq Saigol, CEO MLCFL
Investment Decision	September 26, 2007	Extract from Minutes of the Board of Directors Meeting
Proposal from Factor Consulting[4]/Carbon Services	December 5, 2007	E-mail from Director Mr. Omar Malik to MLCFL CEO Mr. Sayeed Tariq Saigol
Starting Date	February 14, 2008	Date of L/C
LOI for civil works	September 23, 2008	Letter from MLCFL to DDFC (Pvt) Limited
Project Commissioning	December 1, 2009	Tentative

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

1a: Define alternatives to the project activity

As determined in the section B.4, the realistic and credible alternatives for the project activity are:

a) Business-as-usual (current situation or baseline) – No waste heat recovery and electricity supply by Grid and Captive Power Generation from HFO and Natural Gas.
b) Project Activity without CDM-Registration (Grid electricity replacement).

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[3] Proofs for CDM awareness and consideration will be provided to DOE during validation.

[4] Factor Consulting merged in April 2008 with 3C Company to First Climate.

1b: Consistency with mandatory laws and regulations

As set out in section B.4 these alternatives are in compliance with applicable laws and regulations.

Step 2: Investment Analysis

Sub-step 2a: Determine appropriate analysis method

For the investment analysis Option III (Benchmark Analysis) of the 'Tool for the demonstration and assessment of additionality' is chosen.

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

As benchmark applicable for MLCFL, the Citibank of Pakistan confirmed the use of the benchmark for long term loans with tenors greater than one year of either 3 or 6 month KIBOR, available on the website of the State Bank of Pakistan (www.sbp.org.pk). The credit spread over KIBOR for corporate borrowers vary widely and depend on various factors which make it difficult to give a specific quote. Nevertheless, Citibank estimates a credit spread between 200 and 350 basis points above 3 or 6 month KIBOR as appropriate for a 7 year term loan with 2 years principal grace period with a loan amount over PKR 100 million.

As MLCFL is a well known company in Pakistan with a good financial reputation, the present analysis considered a credit spread of 350 basis points and 3 month KIBOR rate is considered. With an average 3 month KIBOR rate for August 2007 of 9.82 %, the benchmark is evaluated at 13.32 %.

This calculated benchmark will be compared to the IRR of the project savings compared to the current situation. In the Investment Analysis, only the direct costs of the project (investment, operation & maintenance and electricity costs) are taken into account.

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III)

The most suitable financial indicator for the investment analysis of the project and its alternatives is the Internal Rate of Return (IRR) of the savings in electricity costs of the clinker production process resulting by the project activity. The calculation of the savings between the baseline and the project activity permits to compare the resulting IRR with the benchmark and the situation including the CER revenues. The analysis is drawn over a period of 20 years which corresponds to the technical lifetime. As the analysis period corresponds to the technical lifetime and depreciation period of the investment, the fair value of the project assets is zero at the end of the analysis period.

To calculate the IRR of the electricity cost savings resulting out of the project investment, the following information is needed:

- Amount of electricity generated by different sources:

As explained in section B.4, Kiln 1 was upgraded in June 2005 what led to a significant change in the performance characteristics of the kiln, the historical data before that moment and some month after the

implementation is highly different. For that reason, only data from January to December 2006 is considered for the Investment Analysis.

Table B.5.2 shows the comparison between the electricity produced in the baseline and the project situation.

Table B.5.2 Baseline versus Project Values

		Baseline	Project
Electricity generation by Steam Turbine	MWh/yr	-	110'088
Electricity import from the grid	MWh/yr	171'643	61'555
Electricity generation by the captive power plant	MWh/yr	224'348	224'348

As shown in Table B.5.2, the projected annual electricity generation from waste heat is 110,088 MWh determined on the net output of the steam turbine in the project activity of 13.9 MW and 330 working days per year. The generated electricity from the waste heat will replace partially the grid electricity and not change the captive power generation of MLCFL. Grid electricity import will be 61,555 MWh and captive power generation will stay at 224,348 MWh.

- Electricity prices:

The electricity prices to compare the expenditures for electricity generation are equal for the baseline and project scenario. As data considered is of the year 2006, also unit cost values are assumed the prices paid by MLCFL in 2006. The considered grid electricity price is 3,968 PKR per MWh. For the Captive Power Production HFO price is at 21,782 PKR per ton, Diesel price is at 30.79 PKR per litre and Natural Gas price is at 1,080 PKR per Hm^3. The results of the electricity cost calculation are shown in table B.5.3.

Table B.5.3. Electricity Prices and Total Electricity Cost

	Baseline			Project Activity		
Yearly Electricity Costs	Cost	Cost per MWh	%	Cost	Cost per MWh	%
Costs of Steam Turbine (PKR)	0	0	0%	0	0	0%
Cost of Grid Electricity (PKR)	681'147'141	3968.39	38%	244'275'343	3968.39	15%
Cost of Captive Power Electricity HFO (PKR)	806'328'676	5522.15	45%	806'328'676	5522.15	61%
Cost of Captive Power Electricity Diesel (PKR)	18'442'115	82.20	1%	18'442'115	82.20	1%
Cost of Captive Power Electricity NG (PKR)	300'686'154	3838.68	17%	300'686'154	3838.68	23%
Total Cost of Electricity	**1'806'604'086**			**1'369'732'288**		

As only the grid electricity amount is changing in the project activity, only the cost of this value is affected in the electricity price comparison. The costs per MWh stay the same in the baseline and the project situation and only the quantity change of the grid electricity affects the total electricity cost of the project.

- Project investment and costs:

In the baseline scenario, no additional investment is necessary and only electricity production and purchase costs are considered for the investment comparison. In the project scenario, a significant

investment is necessary and recurring maintenance costs are to be covered. Table B.5.4 shows the needed investment and costs.

Table B.5.4 Project investment and Costs

Project Investment Cost	PKR 2'016'210'843
Yearly Operation and Maintenance Cost	PKR 104'400'000

Total investment cost is the sum of equipment cost, civil and electrical works, the technical advisory fee, freight, duties & taxes, and other local costs. Yearly operation and maintenance cost is composed of maintenance costs of the waste heat recovery & power generation equipment, and the operating costs (salaries, wages, repair, insurance, etc).

- Other Assumptions for IRR calculation

Depreciation period is 20 years, which corresponds to the technical lifetime of the installations. Yearly depreciation and financial expenditures are not taken into account in the financial analysis. The net income is taxed at 35% and is considered in the analysis.

To calculate the IRR for the different scenarios, some supplementary assumptions have to be taken. Concerning the change rate between the US dollar and the Euro to the Pakistani Rupee, the average change rate of August 2007 is considered. The yearly increase rate of the different fuel prices are calculated on the basis of the Annual Energy Outlook 2007, presented by the Energy Information Administration and the Pakistani Energy Yearbook 2006. The high correlation of the US fuel prices and the Pakistani fuel prices between 2000 and 2006 permit to extrapolate the Annual Energy Outlook for the Pakistani reality. Considering the average increase of the change rate, the expected Pakistani fuel price increase for the future can then be calculated. Table B.5.5 shows the change rate, the yearly estimated increase rate of the different fuels as well as the expected increase in operation and maintenance costs.

Table B.5.5 Other Assumptions

Project Decision Moment	Sep 07	
Project Start Date	Feb 08	
Exchange rate US $ --> PKR	60.56	PKR
Exchange rate € --> PKR	82.47	PKR
Technical lifetime of the plant	20	years
Depreciation period	20	years
Taxes paid on Net Income	35%	
Price Increase Grid Electricity	0.62%	per year
Price Increase HFO	1.92%	per year
Price Increase Diesel	0.93%	per year
Price Increase NG	0.20%	per year
Price Increase O&M costs	5.00%	per year

The resulting IRR of the project saving potential by introducing the project activity is 11.14 %. As the benchmark is determined at 13.32 % (see sub-step 2b above), the project activity would not be implemented. Considering the CER revenues of 55,049,181 PKR per year, the IRR would come up to 13.91 % and so gets an economically attractive investment option for MLCFL.

Table B.5.6 IRR Results

Project Saving IRR without CER	**11.14%**
Project Saving IRR with CER	**13.91%**
Benchmark (sub-step 2b)	**13.32%**

Sub-step 2d: Sensitivity analysis (only applicable to Options II and III)

To show the robustness of the results, a sensitivity analysis is carried out for the variation of the decisive variables of the project activity. These are the initial project investment as well as the HFO cost. The results of the sensitivity analysis are shown in Table B.5.5.

Table B.5.5 Sensitivity Analysis

Project Investment	-10%	Base Case	10%
Net Saving Cash Flow w/o CER	13.01%	11.14%	9.57%
Benchmark	13.32%	13.32%	13.32%
Break Even Point	-11.50%		

Grid Price	-10%	Base Case	10%
Net Saving Cash Flow w/o CER	9.11%	11.14%	13.05%
Benchmark	13.32%	13.32%	13.32%
Break Even Point	11.45%		

The sensitivity analysis shows that the results are robust. As well for the Project Investment Cost and the grid price, the variation of +/- 10% is not sufficient to make the project economically attractive. For the project investment, the limit of financial viability is situated at a total investment cost decrease of 11.50 %. This is in the present project highly unlikely. In the same order an initial grid price of more than 11.45 % would turn the project attractive.

Step 4: Common practice analysis

In Pakistan, there are a total of 29 cement factories[5]. Most of them tend to produce the required electricity in their captive power plants and use grid electricity as a backup option only or as source of additional electricity supply to meet the peak demand[6]. Currently, in all the cement factories, the waste heat from the clinker production process is only used for pre-heating the raw materials and the major portion is vented to the atmosphere. The waste heat recovery and utilization system for power generation is, currently, not in operation in any cement factory of the country. However, the system is being implemented in following cement factories:

1. Askari Cement
2. Bestway Cement
3. Cherat Cement
4. D.G. Cement
5. Fecto Cement
6. Lucky Cement Karachi Plant
7. Lucky Cement Pezu Plant

[5] http://www.apcma.com/pages/data_productioncapacity.html

[6] Platt's Database 2007

According to the Project Proponent's knowledge, all of these factories have implemented waste heat recovery project after considering the benefits of CDM. No WHR project has been implemented without prior considering of the revenues generated by carbon credits. Hence it can be concluded that the recovery and utilization of waste heat from the clinker production process for power generation is not a common practice in Pakistan cement industry.

B.6. Emission reductions

B.6.1. Explanation of methodological choices:

Approved baseline methodology AM0024 / Version 02.1 "Baseline methodology for greenhouse gas reductions through waste heat recovery and utilization for power generation at cement plants" is used to determine emission reductions.

In context of the baseline methodology AM0024 / Version 02.1, following procedure and equations are used to calculate project emissions, baseline emissions, and net emission reductions.

Net Emission Reductions

The project activity reduces CO_2 emissions from the grid by using waste heat to produce electricity. The emission reduction, ER_y, during a given year y is given by:

$$ER_y = EB_y - PE_y$$ **Equation (1) of methodology**

Where:

EB_y are the baseline emissions in year y, expressed in tCO_2

PE_y are the project emissions due to possible fuel consumption changes in the cement kilns, of the cement works where the proposed project is located, as a result of the project activity in year y, expressed in tCO_2

Project Emissions

Project emission (PE_y) is the difference in CO_2 emissions from use of fossil fuel in the clinker making process in cement manufacturing unit, where the project is being implemented, before and after the project implementation.

$$PE_y = \sum_i \Delta EI_i * [O_{clinker,i}] * COEF_{fuel,i}$$ **Equation (6) of methodology**

Where:

i is the index of each clinker production line in the cement plant where the project activity is being implemented;

ΔEI_i is the *ex-ante* design estimate of the change in the specific energy consumption of each clinker kiln in TJ / ton Clinker, due to project implementation.

$O_{clinker, y}$ is the clinker output of the cement works in a given year y.

$COEF_{fuel,y}$ is the carbon coefficient (tCO_2 / TJ of input fuel) of the fuel used in cement works in year y to raise the necessary heat for clinker production. IPCC values of $COEF_{fuel}$ are used to calculate the project emissions.

$$EI_B = \frac{F_B}{O_{clinker,B}}$$ **Equation (3) of methodology**

Where:

EI_B is the pre-project energy consumption per unit output of clinker in TJ/ton of clinker produced (i.e. measured before the Project activity goes into operation).

F_B is the average annual energy consumption, expressed in TJ, of clinker making process prior to the start of operation of the project activity. One full year of data is used.

$O_{clinker, B}$ is the average annual output, expressed in tonnes, of clinker prior to the start of operation of the project activity. One full year of data is used.

$$EI_{P,y} = \frac{F_{P,y}}{O_{clinker,y}}$$ **Equation (4) of methodology**

Where:

$EI_{p,y}$ is the *ex-post* energy consumption per unit output of clinker for given year y, in TJ/ton of clinker produced.

$F_{P, y}$ is monitored annual energy consumption in a year y, expressed in TJ, of clinker making process;

$O_{clinker, y}$ is monitored annual output, expressed in a year y, in tonnes of clinker.

Baseline Emissions

The baseline emissions are those from electricity generation source(s) that:

(a) would have supplied the cement works and
(b) would have been generated by the operation of grid-connected power plants in absence of the proposed CDM project activity. The baseline emissions during a given year y are calculated as:

$$EB_y = EG_{CP,y} * EF_{Elec,y} + EG_{Grid,y} * EF_{Grid,y}$$ **Equation (7) of methodology**

Where:

$EG_{CP,y}$ is the portion of project electricity generated by waste heat recovered from the kilns and then supplied to the cement plant, expressed in MWh;

$EF_{Elec,y}$ is the emission factor of the baseline electricity supply source, expressed as tCO_2 / MWh. In this case baseline scenario electricity is supplied from the grid

$EG_{Grid,y}$ is the electricity supplied from the project activity to the grid, expressed in MWh;

$EF_{Grid.y}$ is the emission factor of the electricity grid, expressed as tCO_2 / MWh.

Determination of baseline grid emission factor (*EF* $_{Grid, CM, BL}$)

Baseline grid emission factor (0.48290 tCO2 / MWh) has been calculated *ex ante* as combined margin which uses a combination of operating margin (OM) and build margin (BM) factors. The grid emission factor is calculated once at the start of the crediting period and will remain fixed during the crediting period (refer to Annex 3 for details of the procedure adopted to calculate the baseline grid emission factor).

Emissions Because of Leakage

Emissions because of leakage are negligible and therefore ignored as per guidance provided in the baseline methodology AM0024 / Version 02.1

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

Data / Parameter:	**$COEF_{HFO}$**
Data unit:	tCO_2/TJ (metric tonnes of Carbon Dioxide per Tera joule)
Description:	Emission Coefficient of HFO
Source of data used:	The Carbon emission factor is taken as per "Table 2.3 Default Emission Factors for Stationary Combustion in Manufacturing Industries and Construction" Chapter 2: Stationary Combustion, 2006 IPCC Guidelines for National Greenhouse Gas Inventories and is available in kg CO_2 / TJ.
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per baseline methodology AM0024 / Version 02.1, if local value is not available then IPCC default value can be used.
Any comment:	

Data / Parameter:	**$COEF_{diesel}$**
Data unit:	tCO_2/TJ (metric tonnes of Carbon Dioxide per Tera joule)
Description:	Emission Coefficient of diesel
Source of data used:	The Carbon emission factor is taken as per "Table 2.3 Default Emission Factors for Stationary Combustion in Manufacturing Industries and Construction" Chapter 2: Stationary Combustion, 2006 IPCC Guidelines for National Greenhouse Gas Inventories and is available in kg CO_2 / TJ.
Value applied:	74.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per baseline methodology AM0024 / Version 02.1, if local value is not available then IPCC default value can be used.
Any comment:	

Data / Parameter:	$COEF_{coal}$
Data unit:	tCO_2/TJ (metric tonnes of Carbon Dioxide per Tera joule)
Description:	Emission Coefficient of coal
Source of data used:	The Carbon emission factor is taken as per "Table 2.3 Default Emission Factors for Stationary Combustion in Manufacturing Industries and Construction" Chapter 2: Stationary Combustion, 2006 IPCC Guidelines for National Greenhouse Gas Inventories and is available in kg CO_2 / TJ.
Value applied:	96.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per baseline methodology AM0024 / Version 02.1, if local value is not available then IPCC default value can be used.
Any comment:	

Data / Parameter:	$COEF_{NG}$
Data unit:	tCO_2/TJ (metric tonnes of Carbon Dioxide per Tera joule)
Description:	Emission Coefficient of natural gas
Source of data used:	The Carbon emission factor is taken as per "Table 2.3 Default Emission Factors for Stationary Combustion in Manufacturing Industries and Construction" Chapter 2: Stationary Combustion, 2006 IPCC Guidelines for National Greenhouse Gas Inventories and is available in kg CO_2 / TJ.
Value applied:	56.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per baseline methodology AM0024 / Version 02.1, if local value is not available then IPCC default value can be used.
Any comment:	

Data / Parameter:	$HFO_{kiln1,b}$
Data unit:	t/yr (metric tonnes per year)
Description:	HFO consumption of 4000 TPD kiln for a given year in baseline situation
Source of data used:	Calculated using historical specific fuel consumption of kiln 1
Value applied:	2,744
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by multiplying $O_{clinker1,b}$ and specific HFO consumption at kiln 1 for year 2006. Specific consumption of HFO at kiln 1 during year 2006 is 0.0021 tonnes HFO/ton clinker.
Any comment:	

Data / Parameter:	$HFO_{kiln2,b}$
Data unit:	t/yr (metric tonnes per year)
Description:	HFO consumption of 6700 TPD kiln for a given year in baseline situation
Source of data used:	Calculated using design value of specific fuel consumption of kiln 2

Value applied:	600
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by multiplying $O_{clinker2,b}$ and design value of specific energy consumption at kiln 2.
Any comment:	

Data / Parameter:	**$Coal_{kiln1,b}$**
Data unit:	t/yr (metric tonnes per year)
Description:	Coal consumption of 4000 TPD kiln for a given year in baseline situation
Source of data used:	Calculated using historical specific fuel consumption of kiln 1
Value applied:	155,866
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by multiplying $O_{clinker1,b}$ and specific coal consumption at kiln 1 for year 2006.. Specific consumption of HFO at kiln 1 during year 2006 is 0.1307 tonnes coal/ton clinker.
Any comment:	

Data / Parameter:	**$Coal_{kiln2,b}$**
Data unit:	t/yr (metric tonnes per year)
Description:	Coal consumption of 6700 TPD kiln for a given year in baseline situation
Source of data used:	Calculated using design value of specific fuel consumption of kiln 2
Value applied:	274,508
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by multiplying $O_{clinker2,b}$ and design value of specific energy consumption at kiln 2.
Any comment:	

Data / Parameter:	**$NG_{kiln1,b}$**
Data unit:	Nm^3/yr (Normal cubic meter per year)
Description:	Natural gas consumption of 4000 TPD kiln for a given year in baseline situation
Source of data used:	Calculated using historical specific fuel consumption of kiln 1
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by multiplying $O_{clinker1,b}$ and specific natural gas consumption at kiln 1 for year 2006. Natural gas was not consumed at the kiln during this period, so its value is zero.
Any comment:	

Data / Parameter:	$O_{clinker1,b}$
Data unit:	t/yr (metric tonnes per year)
Description:	Total clinker production of 4000 TPD kiln for a given year in baseline situation
Source of data used:	Calculated by capacity and running days of kiln 1
Value applied:	1,320,000.00
Justification of the choice of data or description of measurement methods and procedures actually applied :	The capacity of kiln 1 is 4000 TPD and it is in operation for 330 days. So the total clinker production is calculated as 4000*330.
Any comment:	

Data / Parameter:	$O_{clinker2,b}$
Data unit:	t/yr (metric tonnes per year)
Description:	Total clinker production of 6700 TPD kiln for a given year in baseline situation
Source of data used:	Calculated by capacity and running days of kiln 2
Value applied:	2,221,000
Justification of the choice of data or description of measurement methods and procedures actually applied :	The capacity of kiln 2 is 6700 TPD and it is in operation for 330 days. So the total clinker production is calculated as 6700*330.
Any comment:	

Data / Parameter:	NCV_{HFO}
Data unit:	TJ/t (Tera joule per metric tonne)
Description:	Net Calorific Value of HFO
Source of data used:	Laboratory analysis
Value applied:	0.0412
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of GCV of HFO 18,634 BTU/lb was taken from laboratory test of HFO sample. The NCV value of 17,702 is 95 % of the GCV value as mentioned in IPCC 2006 guidelines. For emission reduction calculations this value was converted into TJ/ton using the following formula: NCV in TJ/ton = NCV in BTU/lb *0.001055056/(0.0004535924*10^6) The value of NCV calculated by above formula is 0.0412 TJ/ton
Any comment:	

Data / Parameter:	NCV_{Diesel}
Data unit:	MJ/l (Mega joule per litre)
Description:	Net Calorific Value of diesel
Source of data used:	IPCC Guidelines 2006
Value applied:	36.55
Justification of the choice of data or description of	IPCC default value of 43 TJ/Gg is used. For the analysis the value was converted into MJ/ltr using the following formula:

measurement methods and procedures actually applied :	NCV in MJ/ Ltr = NCV in TJ/Gg * density of diesel in kg/Ltr The density of diesel is taken from IPCC 2006 guidelines i.e. 0.85 kg/Ltr The value of NCV calculated by above formula is 36.55 MJ/ton
Any comment:	

Data / Parameter:	**NCV_{Coal}**
Data unit:	TJ/t (Tera joule per metric tonne)
Description:	Net Calorific Value of coal
Source of data used:	Laboratory analysis
Value applied:	0.024
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of GCV of coal i.e. 10,793 BTU/lb was taken from laboratory test of coal sample. The NCV value of 10,253 is 95 % of the GCV value as mentioned in IPCC 2006 guidelines. For emission reduction calculations this value was converted into TJ/ton using the following formula: NCV in TJ/ton = NCV in BTU/lb *0.001055056/(0.0004535924*10^6) The value of NCV calculated by above formula is 0.024 TJ/ton
Any comment:	

Data / Parameter:	**$NCV_{Natural\ Gas}$**
Data unit:	MJ/Nm^3 (Mega joule per normal cubic meter)
Description:	Net Calorific Value of natural gas
Source of data used:	Laboratory analysis
Value applied:	36.44
Justification of the choice of data or description of measurement methods and procedures actually applied :	The NCV value of 978 BTU/ft^3 has been taken from the laboratory test of natural gas sample. For emission reduction calculations, the value was converted to MJ/Nm^3 by using following formula: NCV in MJ/Nm^3 = NCV in BTU/ft^3 *0.001055056 / 0.02831685 The NCV in MJ/Nm^3 was calculated to be 36.44
Any comment:	

Data / Parameter:	**$E_{kiln1,b}$**
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity consumed by 4000 TPD kiln
Source of data used:	Calculated by using historical specific electricity consumption by kiln 1
Value applied:	39,392
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value has been calculated by using historical specific electricity consumption by kiln 1 per ton of clinker.
Any comment:	

Data / Parameter:	$E_{kiln2,b}$
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity consumed by 6700 TPD kiln
Source of data used:	Kiln 2 Specifications
Value applied:	63,014
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value has been calculated by using design value of specific electricity consumption by kiln 2 per ton of clinker.
Any comment:	

Data / Parameter:	E_{Loads}
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity consumed by other local loads at phase II
Source of data used:	Calculated by adding local loads of kilns at phase II
Value applied	254,633
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated by adding local loads of kilns 1 and kiln 2 at phase II
Any comment:	

Data / Parameter:	P_{Grid}
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity imported from grid for a given year in baseline situation
Source of data used:	Electricity generation log sheets
Value applied:	171,463
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been taken from electricity generation log sheets of Year 2006, QMS procedures are followed in measurement and reporting this value.
Any comment:	

Data / Parameter:	EF_{Grid}
Data unit:	tCO_2/MWh (metric tonnes of Carbon Dioxide per Mega watt hour)
Description:	Emission factor of the grid
Source of data used:	Pakistan Energy Year Book 2007
Value applied:	0.483
Justification of the choice of data or description of measurement methods and procedures	Calculated as per “Tool to calculate the emission factor for an electricity system / Version 01.1”

actually applied :	
Any comment:	The detailed calculation of grid emission factor is provided in Annex 3.

B.6.3. Ex-ante calculation of emission reductions:

Ex-ante calculation of emission reductions is based on approved baseline methodology AM0024 / Version 02.1. The equations involved in *ex-ante* calculations are enumerated in section B.6.1.

For details of parameters and notations, please refer to Annex 3: Details of Emission Reductions Calculations.

Baseline Emissions Calculation

Equation (7) of the approved baseline methodology AM0024 / Version 02.1

$$EB_y = EG_{CP,y} * EF_{Elec,y} + EG_{Grid,y} * EF_{Grid}$$
$$= 99{,}000 * 0.483 + 0 * 0.483$$
$$= 47{,}807 \quad t\ CO_2 / yr$$

Eelectricity generated by waste heat recovered from the kilns and then supplied to the cement plant i.e. $EG_{CP,\ y}$ is calculated as:

$$EG_{CP,\ y} = 12.5 * 330 * 24$$
$$= 99{,}000\ MWh / yr$$

The net capacity of the steam turbine is 13.9 MW. However, the share of the electricity generated by component of heat coming from the wartsila engine is calculated to be 1.4 MW and it has not been included in the calculation of electricity supplied by the project activity to the cement plant. In this way the emission reductions are estimated only for the electricity that is generated by utilizing the waste heat from the clinker production process. In project situation the enthalpy of steam generated by the two sources (kiln & genset) will be monitored to calculate the actual share of electricity generated by each component. As mentioned earlier the emission reductions will only be claimed for the amount of electricity that will be generated by the recovery of waste heat from the clinker production process.

Project Emissions Calculation

Equation (3) of the approved baseline methodology AM0024 / Version 02.1

For kiln 1 (4000 TPD)

$$EI_{1B} = F_{1B} / O_{clinker,1B}$$
$$= 4{,}229 / 1{,}320{,}000$$
$$= 0.0032 \quad TJ / ton$$

Similarly for kiln 2 (6700 TPD)

$$EI_{2B} = F_{2B} / O_{clinker.2B}$$
$$= 6{,}571 / 2{,}211{,}000$$
$$= 0.0030 \quad TJ / ton$$

Now using Equation (4) of the approved baseline methodology AM0024 / Version 02.1

For kiln 1 (4000 TPD)

$$EI_{1P} = F_{2P} / O_{clinker,1P} = 4{,}229 / 1{,}320{,}000 = 0.0032 \quad TJ / ton$$

Similarly for kiln 2 (6700 TPD)

$$EI_{2P} = F_{2P} / O_{clinker.2P} = 6{,}571 / 2{,}211{,}000 = 0.0030 \quad TJ / ton$$

Equation (6) of the approved baseline methodology AM0024 / Version 02.1

$$PE_y = PE_{y,kiln1} + PE_{y,kiln2} = 0 + 0 = 0 \quad t\ CO_2 / yr$$

Emission Reductions Calculation

Equation (1) of the approved baseline methodology AM0024 / Version 02.1

$$ER_y = EB_y – PE_y = 47{,}807 – 0 = 47{,}807 \quad t\ CO_2 / yr$$

Determination of baseline grid emission factor (*EF* $_{Grid, CM, BL}$):

Baseline grid emission factor (0.48290 tCO2 / MWh) has been calculated *ex ante* as combined margin which uses a combination of operating margin (OM) and build margin (BM) factors. The grid emission factor is calculated once at the start of the crediting period and will remain fixed during the crediting period (refer to Annex 3 for details of the procedure adopted to calculate the baseline grid emission factor).

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

Table B.6.4.1 Summary of estimated emission reductions

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2009 (December)	**0**	3,894	**0**	3,894
2010	**0**	47,807	**0**	47,807
2011	**0**	47,807	**0**	47,807
2012	**0**	47,807	**0**	47,807
2013	**0**	47,807	**0**	47,807
2014	**0**	47,807	**0**	47,807
2015	**0**	47,807	**0**	47,807

2016	**0**	47,807	**0**	47,807
2017	**0**	47,807	**0**	47,807
2018	**0**	47,807	**0**	47,807
2019 (January to November)	**0**	43,913	**0**	43,913
Total (tonnes of CO_2 e)	**0**	**478,070**	**0**	**478,070**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**NCV_{HFO}**
Data unit:	TJ/t (Tera joule per metric tonne)
Description:	Net calorific value of HFO
Source of data to be used:	Laboratory analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0412
Description of measurement methods and procedures to be applied:	Monitoring method: external data Data type: measured Archiving procedure: Paper and Electronic Recording Frequency: monthly
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	The value of GCV of HFO 18,634 BTU/lb was taken from laboratory test of HFO sample. The NCV value of 17,702 is 95 % of the GCV value as mentioned in IPCC 2006 guidelines. For emission reduction calculations this value was converted into TJ/ton using the following formula: NCV in TJ/ton = NCV in BTU/lb *0.001055056/(0.0004535924*10^6) The value of NCV calculated by above formula is 0.0412 TJ/ton

Data / Parameter:	**NCV_{coal}**
Data unit:	TJ/t (Tera joule per metric tonne)
Description:	Net calorific value of coal
Source of data to be used:	Laboratory analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.024

Description of measurement methods and procedures to be applied:	Monitoring method: external data Data type: measured Archiving procedure: Paper and Electronic Recording Frequency: monthly
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	The value of GCV of coal i.e. 10,793 BTU/lb was taken from laboratory test of coal sample. The NCV value of 10,253 is 95 % of the GCV value as mentioned in IPCC 2006 guidelines. For emission reduction calculations this value was converted into TJ/ton using the following formula: NCV in TJ/ton = NCV in BTU/lb *0.001055056/(0.0004535924*10^6) The value of NCV calculated by above formula is 0.024 TJ/ton

Data / Parameter:	**NCV_{diesel}**
Data unit:	MJ/l (Mega joule per litre)
Description:	Net calorific value of diesel
Source of data to be used:	IPCC Guidelines 2006
Value of data applied for the purpose of calculating expected emission reductions in section B.5	36.55
Description of measurement methods and procedures to be applied:	Monitoring method: external data Data type: measured Archiving procedure: Paper and Electronic Recording Frequency: monthly
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	IPCC default value of 43 TJ/Gg is used. For the analysis the value was converted into MJ/ltr using the following formula: NCV in MJ/ Ltr = NCV in TJ/Gg * density of diesel in kg/Ltr The density of diesel is taken from IPCC 2006 guidelines i.e. 0.85 kg/Ltr The value of NCV calculated by above formula is 36.55 MJ/ton

Data / Parameter:	**$NCV_{Natural\ Gas}$**
Data unit:	MJ/Nm^3 (Mega joule per normal cubic meter)
Description:	Net calorific value of natural gas
Source of data to be used:	Laboratory analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	36.44

Description of measurement methods and procedures to be applied:	Monitoring method: external data Data type: measured Archiving procedure: Paper and Electronic Recording Frequency: yearly
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	The NCV of 978 BTU/ft^3 has been taken from the laboratory test of natural gas sample. For emission reduction calculations, the value was converted to MJ/Nm^3 by using following formula: NCV in MJ/Nm^3 = NCV in BTU/ft^3 *0.001055056 / 0.02831685 The NCV in MJ/Nm^3 was calculated to be 36.44

Data / Parameter:	$HFO_{kiln\ 1}$
Data unit:	t/yr (metric tonnes per year)
Description:	Amount of HFO consumed at 4000 TPD kiln per year
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	360
Description of measurement methods and procedures to be applied:	Monitoring method: flow measurement Data type: measured Monitoring instrument: flow meter Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Paper and Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	$Coal_{kiln\ 1}$
Data unit:	t/yr (metric tonnes per year)
Description:	Amount of coal consumed at 4000 TPD kiln per year
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	31,704
Description of measurement methods	Monitoring method: weight measurement Data type: measured

and procedures to be applied:	Monitoring instrument: Pfister's rotary pumps Frequency of calibration: after every two years Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Paper and Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**Natural Gas $_{kiln\ 1}$**
Data unit:	Nm^3/yr (Normal cubic meter per year)
Description:	Amount of natural gas consumed at 4000 TPD kiln per year
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	SNGPL flow meters are used for measurement. SNGPL will be responsible to calibrate the flow meters. QMS procedures will be followed in measurement and reporting. Data will be archived electronically and on paper.
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**HFO $_{kiln\ 2}$**
Data unit:	t/yr (metric tonnes per year)
Description:	Amount of HFO consumed at 6700 TPD kiln per year
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	600
Description of measurement methods and procedures to be applied:	Monitoring method: flow measurement Data type: measured Monitoring instrument: flow meter Frequency of calibration: after every two years Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Paper and Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to	Any direct measurements will be cross-checked with an annual energy balance

be applied:	that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**Coal** $_{kiln\ 2}$
Data unit:	t/yr (metric tonnes per year)
Description:	Amount of coal consumed at 6700 TPD kiln per year
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	279,946
Description of measurement methods and procedures to be applied:	Monitoring method: weight measurement Data type: measured Monitoring instrument: Pfister's rotary pumps Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Paper and Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**Natural Gas** $_{kiln\ 2}$
Data unit:	Nm^3/yr (Normal cubic meter per year)
Description:	Amount of natural gas consumed at 6700 TPD kiln per year
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	SNGPL flow meters are used for measurement. SNGPL will be responsible to calibrate the flow meters. QMS procedures will be followed in measurement and reporting. Data will be archived electronically and on paper.
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**E** $_{kiln\ 1}$
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity consumed by 4000 TPD kiln
Source of data to be used:	Production plan of MLCFL

Value of data applied for the purpose of calculating expected emission reductions in section B.5	11,280
Description of measurement methods and procedures to be applied:	Monitoring method: electricity consumption measurement Data type: measured Monitoring instrument: Energy meter Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**$E_{kiln\ 2}$**
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity consumed by 6700 TPD kiln
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	74,000
Description of measurement methods and procedures to be applied:	Monitoring method: electricity consumption measurement Data type: measured Monitoring instrument: Energy meter Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**E_{Loads}**
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity consumed by other local loads for cement works at phase II
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected	254,633

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Monitoring method: electricity consumption measurement Data type: calculated Monitoring instrument: Energy meter Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**$O_{clinker,1}$**
Data unit:	t/yr (metric tonnes per year)
Description:	Amount of clinker produced at 4000 TPD kiln
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	313,333
Description of measurement methods and procedures to be applied:	Monitoring Method: Raw material weight measurement Data type: measured Monitoring instrument: Pfister's dosimates and dosax for weighing raw materials Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic and Paper Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**$O_{clinker,2}$**
Data unit:	t/yr (metric tonnes per year)
Description:	Amount of clinker produced at 6700 TPD kiln
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2,065.833
Description of	Monitoring Method: Raw material weight measurement

measurement methods and procedures to be applied:	Data type: measured Monitoring instrument: Pfister's dosimates and dosax for weighing raw materials Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic and Paper Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

<table>
<tr><td>Data / Parameter:</td><td>St_{HRSG}</td></tr>
<tr><td>Data unit:</td><td>Nm^3/yr (Normal cubic meter per year)</td></tr>
<tr><td>Description:</td><td>Amount of steam generated by each HRSG</td></tr>
<tr><td>Source of data to be used:</td><td>Production plan of MLCFL</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td><table>
<tr><td>HRSG 1</td><td>214,000</td></tr>
<tr><td>HRSG 2</td><td>103,333</td></tr>
<tr><td>HRSG 3</td><td rowspan="2">195,500</td></tr>
<tr><td>HRSG 4</td></tr>
<tr><td>HRSG 5</td><td>173,000</td></tr>
<tr><td>HRSG 6</td><td>80,912</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Monitoring method: flow measurement
Data type: measured
Monitoring instrument: flow meter
Frequency of measurement: continuous
Frequency of recording: daily
Archiving procedure: Paper and Electronic
Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>T_{Steam}</td></tr>
<tr><td>Data unit:</td><td>°C (Degree Celsius)</td></tr>
<tr><td>Description:</td><td>Temperature of steam generated by each HRSG</td></tr>
<tr><td>Source of data to be used:</td><td>Equipment Specification</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td><table>
<tr><td>HRSG 1</td><td>312 ºC</td></tr>
<tr><td>HRSG 2</td><td>355 ºC</td></tr>
<tr><td>HRSG 3</td><td rowspan="2">301 ºC</td></tr>
<tr><td>HRSG 4</td></tr>
<tr><td>HRSG 5</td><td>366 ºC</td></tr>
<tr><td>HRSG 6</td><td>370 ºC</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods</td><td>Monitoring Method: temperature measurement
Data type: measured</td></tr>
</table>

and procedures to be applied:	Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic and Paper Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**Pr_{Steam}**
Data unit:	MPa (Mega Pascal)
Description:	Pressure of steam generated by each HRSG
Source of data to be used:	Equipment Specification
Value of data applied for the purpose of calculating expected emission reductions in section B.5	HRSG 1: 1.63 MPa HRSG 2: 1.63 MPa HRSG 3, HRSG 4: 1.63 MPa HRSG 5: 1.63 MPa HRSG 6: 1.68 MPa
Description of measurement methods and procedures to be applied:	Data type: measured Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic and Paper Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	**$P_{Captive}$**
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Amount of electricity generated by captive power plant
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	224,348
Description of measurement methods and procedures to be applied:	Monitoring Method: Electricity generation measurement Data type: calculated Monitoring instrument: energy meter for total electricity Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic and Paper

	Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	P_{ST}
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity generated by waste heat recovery based steam turbo-generator
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	99,000
Description of measurement methods and procedures to be applied:	Monitoring Method: Electricity generation measurement Data type: measured Monitoring instrument: Energy meter Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to be applied:	Any direct measurements will be cross-checked with an annual energy balance that is based on purchased quantities and stock exchanges.
Any comment:	

Data / Parameter:	P_{Grid}
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity imported from the gird
Source of data to be used:	Production plan of MLCFL
Value of data applied for the purpose of calculating expected emission reductions in section B.5	61,555
Description of measurement methods and procedures to be applied:	Monitoring Method: Electricity import measurement Data type: measured Monitoring instrument: Energy meter installed by FESCO Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic Responsibility: See "Table B.7.2.2: Designation of personnel involved in monitoring plan" below
QA/QC procedures to	Any direct measurements will be cross-checked with an annual energy balance

be applied:	that is based on purchased quantities and stock exchanges.
Any comment:	

B.7.2. Description of the monitoring plan:

Data will be collected daily by Plant Operators at captive power plant and they will also prepare daily log sheets of electricity generation by project and captive power plant and electricity import from the grid, electricity consumption. Initially the data will be verified by Shift Engineers. At final stage, Plant Manager will verify the data.

Similarly Plants Operators at production plant will collect data and prepare daily production log sheet which includes daily clinker production, cement production, and fuel consumption at kilns. Initially the data will be verified by Shift Engineers and Manager Production. At final stage, Head of the Production Department will verify data.

All the data is annually audited by ISO representative. In case of erratic data, corrections and trend from the historical data will be sought.

Table B.7.2.1 describes the devices used at MLCFL to measure different parameters:

Table B.7.2.1: Data Measuring Devices

Item	Parameter	Recording Frequency	Description of equipment used	Calibration Mode		Calibration Frequency
				Internal Calibration	External Calibration	
Kiln 1 (4,000 TPD)	Annual clinker production	Daily	Raw material weight is used to calculate Clinker production. Pfister's dosimates and dosax used for weighing raw mat.	Instrumentation Deptt		Annually
	HFO consumption	Daily	Flow meter (Endresson+Hauser)	Inst. Deptt		2- Yearly
	Coal consumption	Daily	Pfister's rotary pumps are used to feed and measure coal.	Inst. Deptt.		Annually
	Natural gas consumption	Daily	SNGPL flow meters		SNGPL	
Kiln 2 (6,700 TPD)	Annual clinker production	Daily	Raw material weight is used to calculate Clinker production. Pfister's dosimates and dosax used for weighing raw mat.	Inst. Deptt		Annually
	HFO consumption	Daily	Flow meter (Endresson+Hauser)	Inst. Deptt		2- Yearly
	Coal consumption	Daily	Pfister's rotary pumps are used to feed and measure coal.	Inst. Deptt.		Annually
Electricity Consumption	Electricity consumed by Kilns 1 & 2	Daily	Alpha Energy Meters Landis+GYR Dialog AEG Energy Meter Type B114W-1/6*5R Siprotec 7SJ6225	Electrical Deptt		Annually

	Electricity consumed by other local loads	Daily	Alpha Energy Meters Landis+GYR Dialog AEG Energy Meter Type B114W-1/6*5R Siprotec 7SJ6225	Electrical Deptt		Annually
Captive Power Generation	Electricity generated by captive power plant	Daily	Total electricity is measured with the help of following Meters. M8G-K30VR Mitsubishi for Nigata VASA VAMP 260 Power Monitoring Unit for Wartsilla		3rd party	3 Yearly
Project Electricity	Electricity generated by steam turbo-generator	Daily	Energy Meter will be installed at WHR Plant		3rd party	3 Yearly
Grid	Electricity imported from the grid	Daily	Shanghai Meter		FESCO	
Steam Generation by HRSGs	Steam generated by each HRSG	Daily	Flow Meter	Inst. Deptt		Annually
	Steam Temperature at each HRSG	Daily	Thermometer	Inst. Deptt		Annually
	Steam Pressure at each HRSG	Daily	Pressure Gauge	Inst. Deptt.		Annually

The following table shows the designation of the personnel involved in the monitoring plan.

Table B.7.2.2: Designation of Personnel Involved in Monitoring Plan

Parameter	Hourly Data Collection	Daily Data Log Preparation	Initial Data Verification	Final Data Verification	Data Auditing	
					Designation	Frequency
Fuel Consumption at kilns	Plant Operator	Plant Operator / Shift Engineer	Manager Production	HOD Production	ISO Representative	Annually
Electricity Generation & Consumption	Plant Operator	Plant Operator	Shift Engineer	Plant Manager	ISO Representative	Annually
Clinker Production	Plant Operator	Plant Operator / Shift Engineer	Manager Production	HOD Production	ISO Representative	Annually

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

Date of Completion (DD/MM/YYYY): 03/02/2009

Table B.8.1: Name of Responsible Entities

First Climate (Switzerland) AG Stauffacherstrasse 45 CH-8004 Zurich Switzerland URL: www.firstclimate.com Contact person: Mr. Nikolaus Wohlgemuth Email: nikolaus.wolhlgemuth@firstclimate.com	Carbon Services (Private) Limited 19 Davis Road, 2nd Floor, Al Maalik, Lahore Pakistan URL: www.carbon.com.pk Contact person: Mr. Omar Malik Email: omar.malik@carbon.com.pk

Both, First Climate (Switzerland) AG and Carbon Services (Private) Limited, are project participants.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

14/02/2008, which is the date of L/C

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

20 years

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

C.2.1. Renewable crediting period:

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/12/2009 or the date of registration by the CDM EB, whichever is later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

According to the host country regulations, the project activity had to receive an Environmental Approval by the Environment Protection Department of the local government, upon submission of an Initial Environmental Examination (IEE) Report by MLCFL.

The IEE points out that the project will be beneficial to the environment as utilization of waste heat and thus lower consumption of fossil fuels are made possible by the new technology. No negative environmental impacts are to be considered, as the technology to be adopted is mature and safe, once appropriate operation and maintenance procedure are in place.

All environmental analysis conducted by MLCFL prior to engage into the project are consistent in demonstrating that the project activity is expected to remain fully compliant with NEQS (National Environmental Quality Standards). In fact, it is expected that pollutant emissions (both of local concern and global concern, such as CO_2) will reduce from the current levels.

IEE Report and the accompanying approval request letter were submitted on August 22nd, 2008. Approval letter was issued on October 10th, 2008. A copy is shown in Annex 6. The approval letter does not raise any particular issue with regard to the environmental impact of the project.

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

Neither the project participants nor the host Party have any concern about negative environmental impacts associated with the project activity, given that project activity aims at reducing the local and global environmental impacts of the industrial site where the project activity is to be implemented.

SECTION E. Stakeholders' comments

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

Stakeholders were informed about the project activity through specific advertising published by the project owner both in English and in the local language. Advertisement is shown in Annex 5.

The Stakeholder consultation meeting was held on 8th November, 2008 at Maple Leaf Cement Factory and was open to anybody willing to participate (private citizens, representatives of associations, interest groups, unions, public authorities, NGOs, etc.).

The meeting was introduced by the representative of the project owner who explained in details the project activity and stimulated the debate and the expression of comments. Pictures of the Meeting are shown in Annex 5.

E.2. Summary of the comments received:

Comments from the stakeholders were collected in written form during and after the meeting. These are summarized in the table below.

Table E.2.1: Translated Summary of the Comments

Sr. No.	Stakeholder's Name	Designation/ Profession	Qualification	Address	Comments/Views about the Project
1	Khan Daad			E-8/3 Iskanderabad	I am glad that maple leaf is installing a new plant. It will provide employment opportunities to people and every one will benefit from it
2	Malik Saifullah	Contractor		Khairabad Daud Khel Iskanderabad	Maple Leaf has taken good step as installing waste heat project. It will help us to provide good opportunity of job for local peoples, and keep environment clean
3	Naseem	Shopkeeper		Iskanderabad	I am glad that maple leaf is working on a new project. It will provide employment opportunities and will reduce environmental pollution. We will fully contribute and help in installing this project as it is for the benefit of everyone.
4	Shahid	Business	F.A	Iskanderabad	This project is best for this area and is very useful for local people of the area. It will provide employment opportunities to the people. It will also reduce environmental pollution from the area
5	Muhammad Naseem	Business	F.A	Iskanderabad Colony District Mianwali	We are very glad that this kind of project is being installed in our area
6	Qasier Abbas		D.Com	Housing Colony Iskandarabad, District Mianwali	It is very fortunate for our area that maple leaf is working for this project. It is very useful for the environment of the area, people of the area and the country.
7	Muhammad Sahfiq	Job	F.A	Housing Colony Iskandarabad Mianwali	We are very glad that this backward area has been given priority. We shall be very thankful if we continue to get such opportunities.
8	Javed	Contractor		Khairabad	I am very glad that power plant is being installed here. It is very useful project for people.

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

All the comments received at the stakeholders meeting were expressing a positive opinion of the project. The personnel at MLCFL explained in detail the technical, environmental and social consequences of utilization of waste heat recovery for power generation. The stakeholders were satisfied, and were supportive to the project. In conclusion, no concerns were expressed by the stakeholders, which eventually expressed appreciation for initiative of MLCFL.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Maple Leaf Cement factory
Street/P.O.Box:	42 - Lawrence Road
Building:	
City:	Lahore
State/Region:	Punjab
Postcode/ZIP:	54000
Country:	Pakistan
Telephone:	+92-42-6278904 / 6278905
FAX:	+92-42-6363184
E-Mail:	sm.imran@kmlg.com
URL:	http://www.kmlg.com/
Represented by:	
Title:	Chief Executive Officer
Salutation:	Mr.
Last name:	Saigol
Middle name:	Tariq
First name:	Sayeed
Department:	
Mobile:	+92-300-8473800
Direct FAX:	+92-42-6368721
Direct tel:	+92-42-6304183 / 6304184
Personal e-mail:	sayeed.saigol@kmlg.com

Organization:	Carbon Services Private Limited
Street/P.O.Box:	19 Davis Road
Building:	2nd Floor, Al Maalik,
City:	Lahore
State/Region:	Punjab
Postfix/ZIP:	
Country:	Pakistan
Telephone:	+92-42-6313235 / 6313236
FAX:	+92-42-6312959
E-Mail:	
URL:	www.carbon.com.pk
Represented by:	Mr. Omar Malik
Title:	Director
Salutation:	Mr.
Last Name:	Malik
Middle Name:	
First Name:	Omar
Department:	
Mobile:	+92-300-8463743
Direct FAX:	+92-42-6312959
Direct tel:	+92-42-6313235 / 6313236
Personal E-Mail:	omar.malik@carbon.com.pk

Organization:	First Climate (Switzerland) AG
Street/P.O.Box:	Stauffacherstr.45
Building:	
City:	Zurich
State/Region:	Zurich
Postcode/ZIP:	8004
Country:	Switzerland
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FAX:	+41 44-298 2899
E-Mail:	info@firstclimate.com
URL:	www.firstclimate.com
Represented by:	
Title:	Regional Manager, Pakistan
Salutation:	Mr
Last name:	Wohlgemuth
Middle name:	
First name:	Nikolaus
Department:	
Mobile:	+41 79 887 90 13
Direct FAX:	+41 44 2982899
Direct tel:	+44 44 2982866
Personal e-mail:	nikolaus.wohlgemuth@firstclimate.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been sought for this project activity.

Annex 3

BASELINE INFORMATION

Fuel Characteristics

Fuel Characteristics			
GCV of HFO	BTU/lb	18,634	Confirmed
NCV of HFO	BTU/lb	17,702	IPCC guidelines
NCV of NG	BTU/ft3	978	Confirmed
NCV of diesel	TJ/Gg	43	IPCC
Density of diesel	kg/Ltr	0.85	IPCC
GCV of coal	BTU/lb	10,793	Confirmed
NCV of coal	BTU/lb	10,253	IPCC guidelines
NCV of HFO	TJ/ton	0.04	Conversion
NCV of NG	MJ/Nm3	36.44	Conversion
NCV of diesel	MJ/Ltr	36.55	Conversion
NCV of coal	TJ/ton	0.024	Conversion

Emission Coefficient of HFO	tCO2/TJ	77.4	IPCC default
Emission Coefficient of NG	tCO2/TJ	56.1	IPCC default
Emission Coefficient of diesel	tCO2/TJ	74.1	IPCC default
Emission Coefficient of coal	tCO2/TJ	96.1	IPCC default

Selected Historical Data

Selected Historical Data

Clinker Production

Month	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	TOTAL
Kiln 1 (4000 TPD)													
Clinker Production (Tons)	114,830	86,300	89,200	95,129	109,787	117,800	103,862	68,890	108,339	100,860	118,600	78,930	1,192,527
HFO Consumption (Tons)	10	0	98	282	1,119	73	60	603	112	47	0	75	2,479
Coal Consumption (Tons)	15,044	11,226	11,391	11,960	12,693	16,142	14,209	8,518	14,516	13,719	15,892	10,556	155,866
Natural Gas Consumption (Hm3)	0	0	0	0	0	0	0	0	0	0	0	0	0
Diesel Consumption (Ltrs)	1,000	0	2,700	4,000	7,500	1,500	1,550	6,000	2,500	1,500		4,750	33,000
Phase I Kilns													
Clinker Production (Tons)	2,632	8,360	25,365	35,110	22,330	26,850	29,450	27,330	26,630	10,555	10,255	2,420	227,287

Specific consumption of HFO	tons/ton	0.0021
Specific consumption of coal	tons/ton	0.1307
Specific consumption of natural gas	Hm3/ton	0.0000
Specific consumption of diesel	Ltrs/ton	0.0277
Specific electricity consumption of kiln 1	kWh/ton	29.84

Electricity Consumption & Generation

Month	Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	Nov-06	Dec-06	TOTAL
Electricity Consumption													
Phase II													
Kiln 1 [4000 TPD] (kWh)	3,491,378	2,637,935	2,573,614	2,825,242	3,224,840	3,459,000	3,217,279	1,356,373	3,300,948	3,168,559	3,725,634	2,607,393	35,588,195
Other local loads of kiln 1 (kWh)	7,537,294	6,788,743	7,319,843	7,184,865	7,681,694	7,877,909	7,721,001	6,469,666	7,637,227	7,118,372	8,363,130	6,790,526	88,490,270
Total consumed at Phase II (kWh)	11,028,672	9,426,678	9,893,457	10,010,107	10,906,534	11,336,909	10,938,280	7,826,039	10,938,175	10,286,931	12,088,764	9,397,919	124,078,465
Others													
Total consumption by Kilns at Phase I (kW	156,461	203,290	500,097	887,484	383,893	265,854	792,443	565,700	560,093	294,467	514,864	128,765	5,253,411
Other local loads at MLCF (kWh)	1,646,639	2,944,832	3,918,193	2,448,566	3,044,739	2,869,734	3,576,044	4,243,830	3,872,301	920,477	1,427,691	2,786,120	33,699,166
Total consumption at MLCF (kWh)	12,831,772	12,574,800	14,311,747	13,346,157	14,335,166	14,472,497	15,306,767	12,635,569	15,370,569	11,501,875	14,031,319	12,312,804	163,031,042
Electricity Supply Sources													
Electricity Imported from Grid (kWh)	2,141,400	3,379,680	4,632,000	3,613,920	3,864,960	3,716,160	4,752,960	6,154,560	10,428,960	7,581,120	8,859,360	11,541,120	70,666,200
Cost of Grid Electricity (PKR)	9,156,372	13,815,557	17,606,808	14,643,135	15,189,552	14,835,635	18,012,259	25,456,488	39,969,911	31,882,440	35,378,911	44,483,768	280,430,836
Electricity Generated by Captive Power Pl	10,690,372	5,800,217	5,899,747	5,618,477	5,968,017	6,256,337	6,453,807	4,018,226	2,986,102	2,375,489	3,620,371	428,684	60,115,846
Electricity Generated by Captive Power Pl	0	3,394,903	3,780,000	4,113,760	4,502,189	4,500,000	4,100,000	2,462,783	1,955,507	1,545,266	1,551,588	343,000	32,248,996
Total Generated by Captive Power Plant (	10,690,372	9,195,120	9,679,747	9,732,237	10,470,206	10,756,337	10,553,807	6,481,009	4,941,609	3,920,755	5,171,959	771,684	92,364,842
Total Electricity Available (kWh)	12,831,772	12,574,800	14,311,747	13,346,157	14,335,166	14,472,497	15,306,767	12,635,569	15,370,569	11,501,875	14,031,319	12,312,804	163,031,042

Grid electricity share	%	43.35%
Captive electricity share	%	56.65%
Consumption by kiln 1	%	28.68%
Consumption by other loads at kiln 1	%	71.32%

Details of Emission Reductions Calculations

Comparison of Baseline & Project Situation

Capacity of kiln 1	TPD	4,000
Capacity of kiln 2	TPD	6,700
Designed energy consumption of kiln 2	kJ/kg	2,972
Designed electricity consumption of kiln 2	kWh/ton	28.5
ST Net output with waste heat from captive	MW	13.9
ST Net output without waste heat from captive	MW	12.5
Operational days of Phase II	days/yr	330

Electricity Generation Comparison

		Baseline	Project
Electricity consumption by kiln 1	MWh/yr	39,392	39,392
Local loads at kiln 1	MWh/yr	97,949	97,949
Total electricity consumption by kiln 1	MWh/yr	137,342	137,342
Electricity consumption by kiln 2	MWh/yr	63,014	63,014
Local loads at kiln 2	MWh/yr	156,683	156,683
Total electricity consumption by kiln 2	MWh/yr	219,697	219,697
Electricity consumption by Phase I kilns	MWh/yr	5,253	5,253
Other local loads at MLCF	MWh/yr	33,699.166	33,699
Total consumption at MLCF	MWh/yr	395,991	395,991
Electricity generation by ST	MWh/yr	-	110,088
Electricity import from grid	MWh/yr	171,643.321	61,555.321
Electricity generation by captive	MWh/yr	224,347.825	224,347.825
Total electricity generation	MWh/yr	395,991	395,991

Clinker Production Comparison

		Baseline		Project	
		Kiln 1	Kiln 2	Kiln 1	Kiln 2
Clinker production	tons/yr	1,320,000	2,211,000	1,320,000	2,211,000
HFO consumption	tons/yr	2,744	600	2,744	600
Coal consumption	tons/yr	172,527	274,502	172,527	274,502
Natural gas consumption	Hm3/yr	-	-	-	-
Diesel consumption	Ltrs/yr	36,527	-	36,527	-

		Baseline	Project
Clinker production by Phase I kilns	tons/yr	227,287	227,287

Emissions Reduction Calculation

Project emissions	**tCO2/yr**	**0**
Baseline emissions	**tCO2/yr**	**47,807**

Emissions reduction	**tCO2/yr**	**47,807**

Calculation of Project Emissions

		Baseline		Project	
		Kiln 1	Kiln 2	Kiln 1	Kiln 2
Total clinker production	tons/yr	1,320,000	2,211,000	1,320,000	2,211,000
Total energy consumption	TJ/yr	4,229	6,571	4,229	6,571
Energy per ton clinker	TJ/ton	0.0032	0.0030	0.0032	0.0030

		Kiln 1	Kiln 2
Difference in specific energy consumption	TJ/ton	0	0
Project emissions	tCO2/yr	0	0
Total Project Emissions	**tCO2/yr**	**0**	

Calculation of Baseline Emissions

Total project electricity generation ignoring waste heat from genset	MWh/yr	99,000
Grid emission factor	tCO2/MWh	0.483
Baseline Emissions	**tCO2/yr**	**47,807**

Determination of grid emission factor

Electricity baseline emission factor ($EF_{Grid,\ CM,\ BL}$) is calculated *ex-ante* as a combined margin consisting of a combination of operating margin (OM) and build margin (BM) factors according to the following steps:

The emission coefficient (measured in kg CO_2e/kWh) can be calculated, either as combined margin (CM) consisting of the combination of operating margin (OM) and build margin (BM) OR as weighted average emissions (in kg CO_2e/kWh) of the current generation mix. As the **combined margin** shall be chosen, the procedures as per ‘Tool to calculate the emission factor for an electricity system’ apply.

For identifying the combined margin, the “Tool to calculate the emission factor for an electricity system” (Annex 12 of EB35, Ver. 1.1) suggests the following steps:

STEP 1: Identify the relevant electric power system
STEP 2: Select an operating margin (OM) method
STEP 3: Calculate the operating margin emission factor according to the selected method
STEP 4: Identify the cohort of power units to be included in the build margin
STEP 5: Calculate the build margin emission factor
STEP 6: Calculate the combined margin emission factor

Step 1 – Identify the relevant electric power system

Pakistani DNA has not published any delineation of the project electricity system and a connected electricity system. Moreover, the criteria provided in the “Tool to calculate the emission factor for an electricity system” under Step 1 do not result in a clear grid boundary as

1) a spot market for electricity does not exist in Pakistan
2) there is no official data available with regard to the operation of the transmission line between different electricity systems.

In such cases, the "Tool to calculate the emission factor for an electricity system" (Version 01.1) suggests "to use a regional grid definition in the case of large countries with layered dispatch systems (e.g. provincial/regional/national)" to distinguish a connected electricity system. In Pakistan, the electricity supply business is a sort of monopoly of two companies. For Karachi city and adjoining areas of Sindh and Balochistan, it is under Karachi Electric Supply Corporation (KESC). For rest of the Pakistan it falls under Water and Power Development Authority (WAPDA). In 1998, as part of the government's privatization policy, the National Transmission & Despatch Company (NTDC)[7] "was organized to take over all the properties, rights and assets obligations and liabilities of 220 KV and 500KV Grid Stations and Transmission Lines/Network Transmission Lines/Network owned by Pakistan Water and Power Development Authority (WAPDA). Both NTDC and KESC operate their own transmission networks but they are also physically interconnected to each other at two points[8] and trade electricity in significant amounts[9] in a sort that they both together constitute the national grid system, which becomes the project electricity system also.

The project activity is connected to the grid of Faisalabad Electric Supply Company Limited (FESCO), which is one of nine newly created distribution companies[10] and connected to NTDC, which is part of the national grid system.

Step 2 – Select an operating margin (OM) method

The "Tool to calculate the emission factor for an electricity system" (Version 01.1) offers four options for the calculation of the Operating Margin emission factor(s) ($EF_{Grid,OM,y}$):

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

Any of the four methods can be used in principle. Information to carry out a detailed dispatch data analysis is not publicly available; therefore the dispatch data analysis OM is not preferred for the proposed project and the **Simple Operating Margin**-Approach is chosen.

The Simple Operating Margin-Approach to calculating the Grid Emission Factor requires that the share of low-cost/must-run resources constitutes less than 50% of the total net electricity generation of the national grid. In Pakistan, the share of low-cost/must-run resources usually constitutes less than 50% of the total net electricity generation of the national grid.

According to the "Tool to calculate the emission factor for an electricity system" (Version 01.1), for simple OM, the emission factor can be calculated using either of the two following data vintages:

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[7] cf. www.ntdc.com.pk

[8] One is the Jamshoro - BinQasim link in East of Karachi and other is HUBCO-KESC link in West of Karachi.

[9] Actually 32% of total electricity supply in KESC in the year 2006/7 was purchased from NTDC. Cf. PEPCO/National Transmission & Despatch Co. (NTDC)/Planning Power Department (NTDC) 2008: Electricity Marketing Data (Power Systems Statistics), 32nd issue, Updated up to 30th June 2007. p. 90

[10] http://www.nepra.org.pk/lic_distribution.htm

- *Ex ante* option: A 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- *Ex post* option: The year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring. The data required to calculate the emission factor for year y is usually only available later than six months after the end of year y.

Project proponents employ **"*ex-ante* vintage"** for its operating margin calculation.

Step 3 - Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power/units. The "Tool to calculate the emission factor for an electricity system" (Version 01.1) offers three options for the calculation of the Simple OM.

1) Based on data on fuel consumption and net electricity generation of each power plant/unit (Option A), or

2) Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or

3) Based on data on net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option C)

Option A should be preferred and must be used if fuel consumption data is available for each power plant/unit. As the fuel consumption data for each power plant/unit is not available in Pakistan, Option A is not reasonable. Option C should only be used if the necessary data for Option A and Option B is not available. As station-wise fuel consumption or efficiency data (Option B) is indeed not available for all power units, **Option C** is chosen.

For Option C, the Simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system:

$$EF_{Grid,OM,BL} = \frac{\sum_i FC_{i,yBL} * NCV_{i,BL} * EF_{CO2,i,BL}}{EG_{BL}}$$ [Eq.5 of Methodological Tool :v 1]

Where:

$EF_{Grid,\ OM,\ BL}$ is the simple operating margin CO_2 emission factor in the baseline period (tCO_2/MWh)

$FC_{i,BL}$ is the amount of fossil fuel type i consumed in the project electricity system the baseline period (mass or volume unit)

$NCV_{i,BL}$ is the net calorific value (energy content) of fossil fuel type i in the baseline period (GJ / mass or volume unit)

$EF_{CO2,i,BL}$	is the CO_2 emission factor of fossil fuel type i the baseline period (tCO_2/GJ)
EG_{BL}	is the net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in the baseline period (MWh)
i	are all fossil fuel types combusted in power sources in the project electricity system in the baseline period
BL	are the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option), following the guidance on data vintage in step 2

On the basis of the data available, the operating margin emission factor (three-year generation-weighted average) is:

$EF_{Grid, OM, BL}$ = 0.72382 tCO_2/MWh

Step 4. Identify the cohort of power units to be included in the build margin

The sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20 per cent of the system generation (in MWh) and that have been built most recently.

Option (b) was chosen to calculate the Build Margin emission factor as it comprises the larger annual generation, as required per "Tool to calculate the emission factor for an electricity system" (Version 01.1)."
In terms of vintage of data, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, *ex-post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex-ante*, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

In accordance with the *ex-ante* calculation of the operating margin (see Step 2), **Option 1** is chosen.

Step 5 - Calculate the build margin emission factor

The **build margin** emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year for which power generation data is available, calculated as follows:

$$EF_{Grid,BM,y} = \frac{\sum_m EG_{m,y} * EF_{EL,m,y}}{\sum_m EG_{m,y}}$$ [Eq.12 of Methodological Tool :v 1]

Where:

$EF_{Grid,\ BM,\ y}$ is the Build Margin CO_2emission factor in the year y (tCO_2/MWh)

$EG_{m,y}$ is the net quantity of electricity generated and delivered to the grid by power unit m in the year y (MWh)

$EF_{EL,m,y}$ is the CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m are the power units included in the build margin

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in step 3 (a) for the simple OM, using options B1, B2 or B3, using for *y* the most recent historical year for which power generation data is available, and using for m the power units included in the build margin. On the basis of the data available, option B2 is used:

Using this method, the $EF_{Grid,\ BM,\ BL}$ in Pakistan is calculated as 0.24198 tCO_2/MWh.

Step 6 - Calculation of the combined margin emission factor

The combined margin emission factor is calculated as follows:

$EF_{ELEC,CM,BL} = w_{OM} * EF_{ELEC,OM,BL} + w_{BM} * EF_{ELEC,BM,y}$ [Eq.13 of Methodological Tool :v 1]

Where:

$EF_{Grid,\ BM,\ y}$ is the build margin CO_2 emission factor in the year y (tCO_2/MWh)

$EF_{Grid,\ OM,\ BL}$ is the operating margin CO2 emission factor in the baseline period (tCO_2/MWh)
w_{OM} is the weighting of operating margin emissions factor (%)

w_{BM} is the weighting of build margin emissions factor (%).

The default weights are as follows: $w_{OM} = w_{BM} = 0.5$.

On the basis of these weights the combined margin emission factor is calculated, and fixed *ex-ante*:

$EF_{Grid,CM,BL}$ = 0.48290 tCO_2/MWh

Annex 4

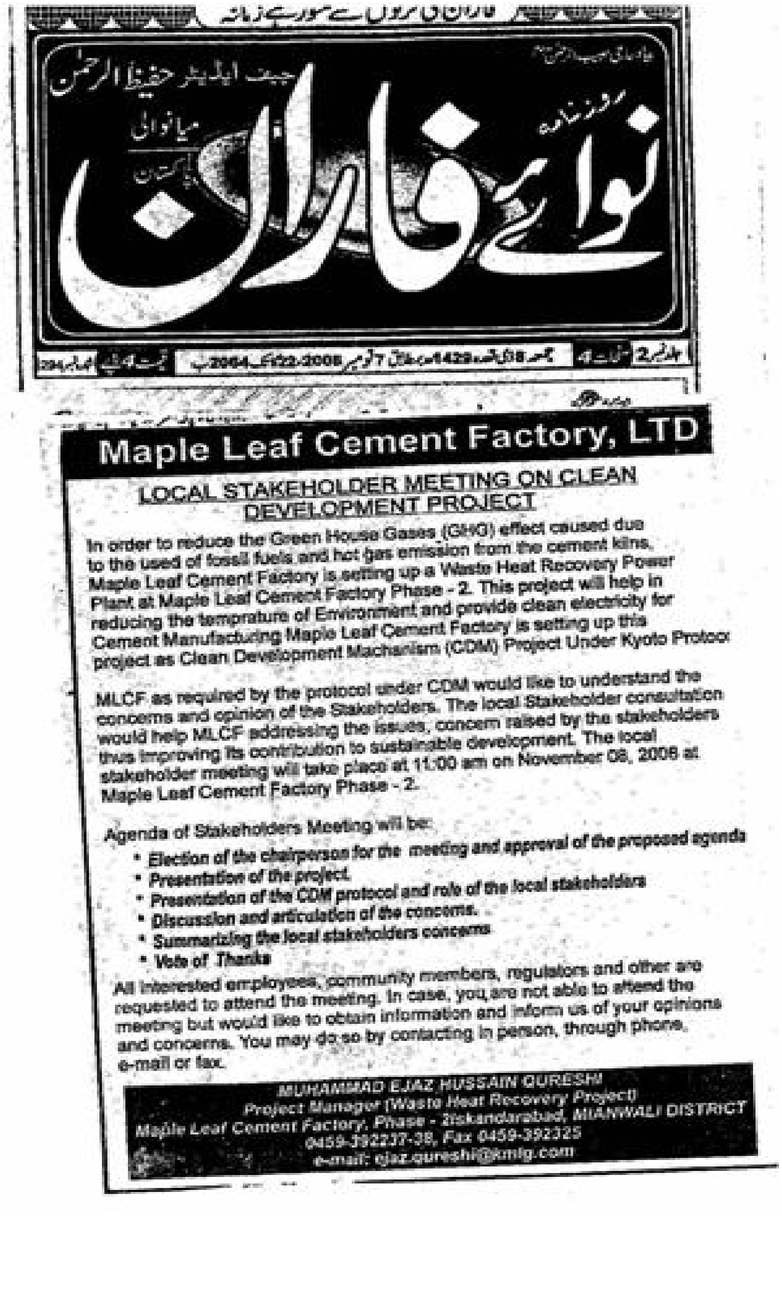
MONITORING INFORMATION

All the monitoring information has been provided in section B.7.2.

Annex 5

Stakeholders' Consultation Meeting Details

Advertisement for stakeholders' consultation meeting is shown below.



Maple Leaf Cement Factory, LTD

LOCAL STAKEHOLDER MEETING ON CLEAN DEVELOPMENT PROJECT

In order to reduce the Green House Gases (GHG) effect caused due to the used of fossil fuels and hot gas emission from the cement kilns, Maple Leaf Cement Factory is setting up a Waste Heat Recovery Power Plant at Maple Leaf Cement Factory Phase - 2. This project will help in reducing the temprature of Environment and provide clean electricity for Cement Manufacturing Maple Leaf Cement Factory is setting up this project as Clean Development Machanism (CDM) Project Under Kyoto Protoco

MLCF as required by the protocol under CDM would like to understand the concerns and opinion of the Stakeholders. The local Stakeholder consultation would help MLCF addressing the issues, concern raised by the stakeholders thus improving its contribution to sustainable development. The local stakeholder meeting will take place at 11:00 am on November 08, 2006 at Maple Leaf Cement Factory Phase - 2.

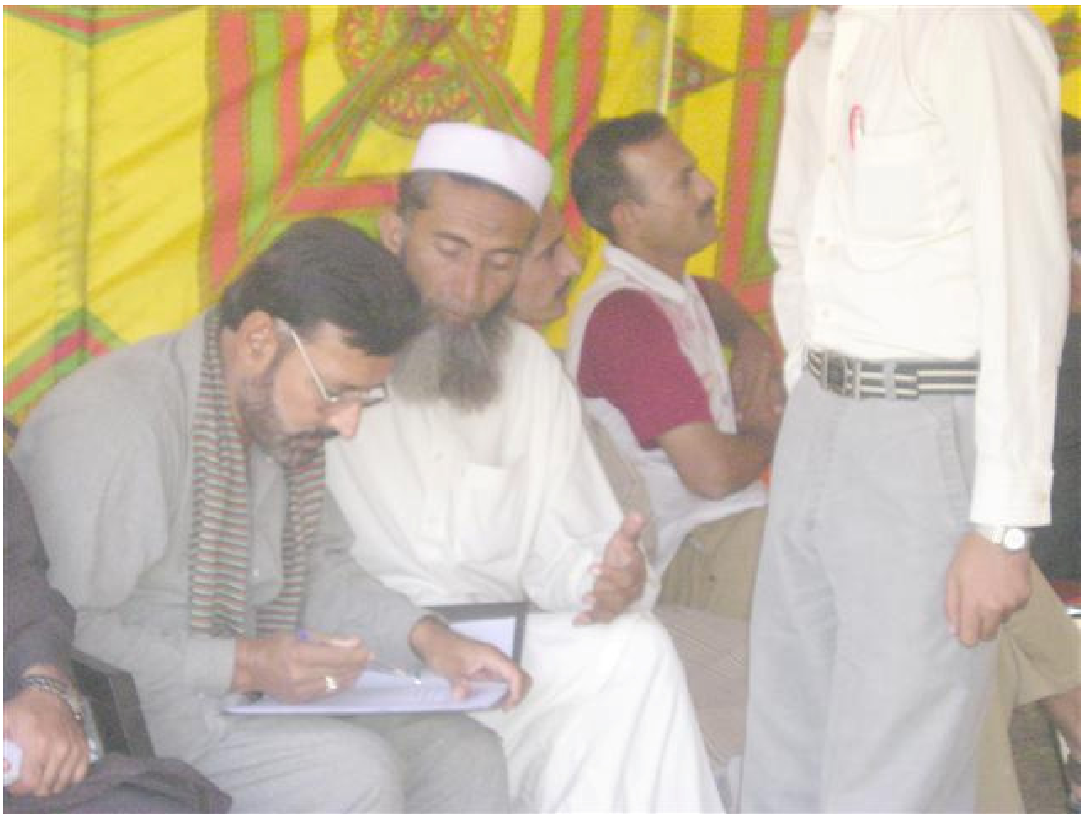
Agenda of Stakeholders Meeting will be:

- *Election of the chairperson for the meeting and approval of the proposed agenda*
- *Presentation of the project.*
- *Presentation of the CDM protocol and role of the local stakeholders*
- *Discussion and articulation of the concerns.*
- *Summarizing the local stakeholders concerns*
- *Vote of Thanks*

All interested employees, community members, regulators and other are requested to attend the meeting. In case, you are not able to attend the meeting but would like to obtain information and inform us of your opinions and concerns. You may do so by contacting in person, through phone, e-mail or fax.

MUHAMMAD EJAZ HUSSAIN QURESHI
Project Manager (Waste Heat Recovery Project)
Maple Leaf Cement Factory, Phase - 2Iskandarabad, MIANWALI DISTRICT
0459-392237-38, Fax 0459-392325
e-mail: ejaz.qureshi@kmlg.com

Pictures of stakeholders' consultation meeting are shown below.




Local Stake
Meeting
Heat. Reco
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Local
Waste
For

Annex 6

Approval letter from EPA Pakistan

Page 1 of 1

ENVIRONMENT PROTECTION DEPARTMENT

National Hockey Stadium, Ferozpur Road, Lahore

NO. DD(EIA)/EPA/F-110(IEE)/2409/2008/ 5
Dated: 17/10/2008

To

The Chief Operating Officer,
M/s Maple Leaf Cement Factory
(Waste Heat Recovery Power Plant),
42-Lawrance Road,
Lahore.

Subject: **ENVIRONMENTAL APPROVAL**
(Under Section 12 of PEP Act, 1997 read with IEE/EIA Regulations, 2000)

1. Description of Project: Installation of 16MW Waste Heat Recovery Power Plant.
2. Location of the Project: The site is located at Iskandarabad (near Daudkhel) District Mianwali.
3. Date of submission 22.08.2008.

4. After review of the Initial Environmental Examination (IEE) Report, the Environmental Protection Agency, Punjab has decided to accord its approval for construction phase of the project subject to the following conditions:

i. The proponent shall ensure compliance of National Environmental Quality Standards (NEQS).
ii. Mitigation measures suggested in the IEE Report & Environmental Management and Monitoring Plan (EMMP) should be strictly adhered to minimize any negative impacts on soil, groundwater, air and biological resources of the project area.
iii. Monitoring shall be carried out during the entire period of the project activities. Monitoring reports of the whole operation should be submitted to EPA, Punjab on monthly basis.
iv. Camping sites should be located at a suitable distance from any settlement to avoid disturbance to the local people. Sewage generated from camping sites should be treated in septic tanks and soak pits or by other appropriate methods. The septic tanks and soak pits should be constructed at a suitable distance from any permanent or seasonal water source. Septic tank and soak pits should not be located in the areas where high ground water table exists.
v. At least 90% unskilled and to the extent possible skilled jobs shall be given to locals after providing them proper training.
vi. Compensation should be provided to inhabitants in case of loss of agricultural land, crop, property, etc. in accordance with the rates that are agreed upon. All conflicting issues regarding compensation, etc should be settled amicably before or during the project activities.
vii. Proponent will submit a Community Development Plan for the benefit of communities of the project area to Punjab, EPA within two months of start of the project construction phase.
viii. The proponent will not discharge untreated wastewater in any water body.
ix. The proponent shall ensure that strict and efficient health and safety measures are in place for protection of workers backed by a comprehensive emergency response system.
x. The proponent shall carry out extensive tree plantation, especially of indigenous species in and around the project area i.e. at least 15,000 trees of minimum height 6-7 feet may be planted on available space in consultation with District Forest Officer and District

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xiii. The proponent will obtain NOC / clearance from all other concerned departments before commencement of work. The proponent will install proper pollution abatement equipments to ensure compliance of National Environmental Quality Standards.

xiv. The proponent shall convey the name of the Environmental Manager of the project along with his complete Mailing Address and Phone Numbers.

5. The proponent shall be liable for correctness and validity of the information supplied by the environmental consultant.

6. The proponent shall be liable for compliance of Sections 13, 14, 17 and 18 of IEE/EIA Regulations, 2000, regarding approval, confirmation of compliance, entry, inspections and monitoring.

7. This approval is accorded only for the installation/construction phase of the project. The proponent will obtain approval for operation of the Power Plant in accordance with Section 13(2)(b) and Section 18 of the IEE/EIA Regulations, 2000.

8. Any change in the approved project shall be communicated to EPA, Punjab and shall be commenced after obtaining the approval.

9. This approval shall be treated as null and void if all or any of the conditions mentioned above, is/are not complied with. This approval does not absolve the proponent of the duty to obtain any other approval or consent that may be required under any law in force and is subjudice to legal proceedings in any legal fora / court.

10. This approval shall be valid (for commencement of construction) for a period of three years from the date of issue under Section 17 of IEE / EIA Regulations, 2000.

ASSISTANT DIRECTOR (EIA)
for Director General, EPA, Punjab

NO. & DATE EVEN.

A copy is forwarded for information to:

1. The District Officer (Environment), Mianwali, w.r.t. his letter No. 381/DOE/MI dated 13-09-2008. He is directed to ensure compliance of the above conditions under intimation to this office.

ASSISTANT DIRECTOR (EIA)
for Director General, EPA, Punjab

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