CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

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

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Waste Heat Recovery and Utilization for Power Generation at Lucky Cement Limited Pezu Plant
Version 09
Date: 27/04/2012

Table A.1.1: PDD versions

Version	Issue Date	Rationale
01	10/07/2009	First issuance for Global Stakeholder Consultation (as large scale project – with AM0024 / Version 02.1)
02	01/02/2010	Issuance in response to the AM0024 based Validation Protocol
03	20/07/2010	Issuance in response to the AM0024 based Validation Protocol, 2nd loop
04	27/09/2010	Issuance in response to technical review observations by the DOE
05	23/06/2011	First issuance for Global Stakeholder Consultation (as small scale project – with AMS-III.Q. /Version 04)
06	05/07/2011	Issuance in response to the AMS-III.Q. based Validation Protocol, 2nd loop
07	08/10/2011	Issuance in response to additional queries raised by the DOE
08	30/11/2011	Issuance in response to final technical review by the DOE
09	27/04/2012	Issuance in response to Request for Review

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

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Lucky Cement Limited has been sponsored by Yunus Brothers Group (YB) which is one of the largest business groups of Pakistan. The company has grown rapidly to become the leader among Pakistani cement manufacturers with the largest production capacity, highest sales and greatest market share. Lucky Cement Limited operates two plants and manufactures Ordinary Portland Cement (OPC), Sulphate Resistant Cement (SRC), and Slag Cement. One plant of Lucky Cement Limited is at Pezu (District Lakki Marwat) and other is at Karachi.

The waste heat recovery equipment will be installed on Unit II (Kilns C & D). The project activity involves installation of waste heat recovery systems for power generation HRSGs (Heat Recovery Steam Generators) & steam turbo-generator at Unit II of Pezu plant. HRSGs shall be installed at Preheater (PH) and Air Quenched Cooler (AQC) ends of the kilns. The Pezu plant came into existence in 1996 with a daily production capacity of 4200 TPD (Tonnes Per Day). Later in 1999, the capacity of plant was increased to 4800 TPD and it (Kilns A & B with 2400 TPD each) is known as Unit I. During year 2005/06, Unit II of the plant was commissioned comprising Kiln C & D having capacity of 3300 TPD each. The plant holds ISO 9001:2000 certification for Quality Management System.

Currently at Lucky Pezu Plant, almost all the waste heat from the clinker production process is vented to atmosphere; only a small portion of the waste heat from the feed ends of clinker production kilns is recycled to heat up incoming raw material. Power demand is met by captive power plant; there is no grid connection for electricity imports/exports. The captive power plant constitutes 10 dual fuel (3 x 12V46 + 7 x 18V32) Wartsila generator sets consuming natural gas (NG) & HFO (Heavy Fuel Oil).

The project activity involves installation of four HRSGs (two on each kiln) of total capacity 47.34 tph (tonnes per hour) and one steam turbo-generator of 10 Megawatt (MW) capacity. Details of the project equipment are given in Table A.4.2.3. The hot exhaust of HRSGs will still be utilized to preheat the incoming raw materials. Steam turbo-generator and allied equipment will be transferred from China; hence the project activity involves technology transfer.

The project activity was commissioned in September 2010; net electricity generated by the project activity (58,291 Megawatt hour per year (MWh/yr) will displace captive electricity and result in 29,918 tonnes of CO_2 equivalent emissions reduction per annum. No fuel will be used at HRSGs for steam production.

In the absence of project activity, Lucky Cement Limited would continue to get all of its power demand from the dual fuel based captive power plant because this is the baseline scenario as identified in §B.4.

The project activity is in compliance with the national laws and results in sustainable development as evaluated by following criteria.

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 emission concentrations of heavy metal particles, SO_x, NO_x, and Carbon Oxides[1]
- ✓ conservation of local fossil fuel resources by avoiding fossil fuel based electricity generation

Social Development

- ✓ alleviation of poverty by providing labour employment opportunities to the local community during construction phase
- ✓ creation of new permanent jobs during construction and operation phase
- ✓ less degradation of roads because HFO is transported to the cement factory in heavy oil tankers causing a lot of damage to local roads. The project activity will completely avoid HFO based generation hence resulting less degradation by oil tankers.

Economic Development

- ✓ less import of HFO to relief burden on national economy
- ✓ less consumption of natural gas will conserve national resources
- ✓ cost reduction for generating electricity as no additional fuel is used

Technology Development

- ✓ introducing modern technology in the country
- ✓ setting up an example of sustainable development to be followed by other cement factories

[1] Source: IEE (Initial Environmental Examination) Report of the project activity. A copy of the IEE Report has been provided to DOE.

A.3. Project participants:

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The table below 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)	Lucky Cement 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 small-scale project activity:

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

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A.4.1.1. Host Party(ies):

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Islamic Republic of Pakistan

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

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Khyber Pakhtunkhwa; formerly North-West Frontier Province (NWFP)

A.4.1.3. City/Town/Community etc:

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The project is located at:

Lucky Cement Factory,
Pezu, District Lakki Marwat,
Khyber Pakhtunkhwa (formerly N.W.F.P.), Pakistan.

The company is headquartered at:

6 – A, M Ali Housing Society,
A. Aziz Hashim Tabba Road,

Karachi 75350, Sindh, Pakistan

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

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Pezu plant of Lucky Cement Limited is located in District Lakki Marwat, Khyber Pakhtunkhwa (formerly N.W.F.P.), Pakistan. This is illustrated by the figures below.

Exact location of the project activity in geographical coordinates is:
Latitude: 32º 17´ 43" N
Longitude: 70º 44´ 00" E

Figure A.4.1.4.1: Cement factories of Lucky Cement Limited

Figure A.4.1.4.2: Photograph of Lucky Cement Pezu Plant

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

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In accordance with *Appendix B of* the *Simplified Modalities and Procedures for Small-Scale CDM Project Activities,* the project activity falls under the following type and category:

Type III: Other project activities
Category Q: Waste energy recovery (gas/heat/pressure) projects
Sectoral Scope 4: **Manufacturing industries**

Pezu plant of Lucky Cement Limited has two units. Unit I was commissioned in 1996 and Unit II started its operation during the year 2005/06. Initially Unit I had low production capacity and was upgraded in 1999. Current capacity of the plant is given below in Table A.4.2.1.

Table A.4.2.1: Plant capacity

Unit I		Unit II	
Kiln A	2400 TPD	Kiln C	3300 TPD
Kiln B	2400 TPD	Kiln D	3300 TPD

The plant produces Ordinary Portland Cement (OPC), Sulphate Resistant Cement (SRC), and Slag Cement by dry process. The kilns primarily consume coaland a small amount of HFO is used for elevating temperature at start up. In the baseline situation, almost all the waste heat from the clinker production process is vented to atmosphere; only a small portion of the waste heat from the feed ends of clinker production kilns is recycled to heat up incoming raw material. All the power demand is met by a captive power plant as there is no grid connection.

Historically, the captive power plant has been consuming primarily HFO, and diesel as an auxiliary fuel (for washing, stopping, and start-ups). Lucky Cement Limited made a contract with Wartsila Finland on April 13, 2007 to convert the existing HFO engines to dual fuel (natural gas & HFO) mode. This conversion from HFO to natural gas operation results in a slight capacity degradation of engines. Therefore, a new natural gas based generator set (Wartsila 20V34SG) was ordered to make up this

difference in generation capacity. Conversion of existing generator sets was completed in Dec 2008, before the commissioning of WHR project activity. However, later on the order of new engine Wartsila 20V34SG was cancelled due to insufficient supply of natural gas for this engine. This recent retrofitting of engines by OEM (Original Equipment Manufacturer) assures that captive power plant will successfully run at least till the end of the crediting period.

In the project situation, operation of captive power plant on natural gas and HFO will be 65% and 35% respectively due to curtailment of natural gas during winter. Consumption of diesel as an auxiliary fuel will continue. Important data of generator sets is given below in Table A.4.2.2.

Table A.4.2.2: Generator sets at power house

Generator Set	Quantity	Capacity (kW_e)		Efficiency (%)	
		Natural gas	HFO	Natural gas	HFO
Wartsila 18V32	7	5,390	5,584	40.04%	41.33%
Wartsila 12V46	3	9,380	10,090	44.12%	41.14%
Total	**10**	**65,870**	**69,358**		

The project activity involves installation of waste heat recovery systems (HRSGs and steam turbo-generator) for power generation at Unit II (kilns C & D) only. The project equipment is brand new and uses state of the art technology. The technology is environmentally safe as no additional or secondary fuel is used for power generation by waste heat recovery system. The technology will be transferred from China. A list of major equipment of project activity is given below in Table A.4.2.3.

Table A.4.2.3: Project equipment

Specifications of Heat Recovery Steam Generators			
Equipment	**Manufacturer**	**Capacity**	**Temperature**
HRSG 1 At PH end of kiln C	Sinoma	16.44 tph	400 ºC
HRSG 2 At AQC end of kiln C		7.23 tph	400 ºC
HRSG 3 At PH end of kiln D		16.44 tph	400 ºC
HRSG 4 At AQC end of kiln D		7.23 tph	400 ºC
Specification of Steam Turbine			
Manufacturer			HCTC
Type			Condensing
Rated power output			10 MW
Auxiliary consumption			8%
Shaft revolution			3000 rpm
Turbine inlet temperature			320 ºC
Turbine inlet pressure			1.25 MPa

Table A.4.2.4: Operational characteristics of steam turbo-generator

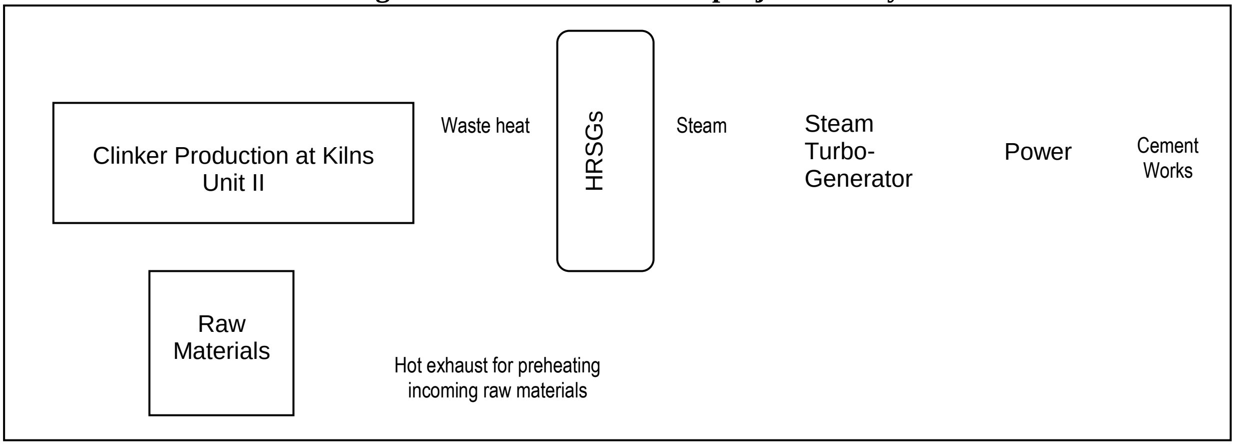
Operational Characteristics of Steam Turbo-Generator	
Operational days per annum	330
Operational hours per day	24

Average load factor	80%
Gross electricity generation (MWh/year)	10*330*24*80% = 63,360
Auxiliary consumption (MWh/year)	63,360 * 8% = 5,069
Net electricity generation (MWh/year)	63,360 – 5,069 = 58,291

The project uses state of the art technology from China. The project technology is not likely to be substituted by other or more efficient technologies within the crediting period of the project activity.

All the waste heat from pre-heater and cooler end of kiln will be recovered for steam generation by four HRSGs (two on each kiln) which will be fed to a 10 MW steam turbo-generator for electricity generation. Hot exhaust of the HRSGs will still be used to preheat the incoming raw material. The net electricity generated by the project activity (58,291 MWh/yr) will partially displace fossil fuel (natural gas & HFO) based captive electricity and will result in, on average 29,918 tonnes of CO_2 e emissions reduction per annum. Following is the schematic of project activity.

Figure A.4.2.1: Schematic of project activity



In the absence of the project activity, Lucky Cement Limited would continue pre-project scenario because it is the baseline scenario as identified in §B.4. Since Lucky Cement Limited does not plan any capacity expansion of the cement plant in the near future, any sharp deviation of electricity demand from the historical levels is not expected. However, the cement plant operation may increase or decrease depending upon the variable demand of the product in the market.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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The annual & total estimation of emission reductions for the fixed crediting period of 10 years (from 01/02/2012 to 31/01/2022) is provided below in Table A.4.3.1.

Table A.4.3.1: Emission reductions over the crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2 e
Year 1	**29,918**
Yaer 2	**29,918**
Year 3	**29,918**
Year 4	**29,918**
Year 5	**29,918**
Year 6	**29,918**
Year 7	**29,918**
Year 8	**29,918**
Year 9	**29,918**
Year 10	**29,918**
Total estimated reductions (tonnes of CO_2 e)	**299,180**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**29,918**

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

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There is no public funding involved in the project activity.

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

Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities defines the following rules to determine whether the small-scale project activity is a debundled component of a large scale project activity or not:

"A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:
(1) With the same project participants;
(2) In the same project category and technology/measure;
(3) Registered within the previous 2 years; and
(4) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point."

The project activity is not a debundled component of a large project activity as there is no small scale CDM project activity, or an application registered by Lucky Cement Limited in the same project category in the last two years within 1 km of the project boundary of the proposed small-scale 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 small-scale project activity:

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AMS-III.Q.: Waste Energy Recovery (gas/heat/pressure) Projects / Version 04
Valid from April 29, 2011

The methodology also refers to "ACM0012: Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects" for the estimation of the capping factor. Therefore, corresponding section of ACM0012 / Version 04.0.0 (valid from April 15, 2011) is used.

B.2 Justification of the choice of the project category:

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The present project activity involves waste heat recovery from cement manufacturing kilns. For the waste heat from the kilns, AMS-III.Q is applicable. Here below the applicability conditions of the applied methodology are checked.

Table B.2.1: Applicability check

Applicability Condition	Applicability Check
1. The category is for project activities that utilize waste gas and/or waste heat at existing facilities as an energy source for: (a) Cogeneration; or (b) Generation of electricity; or (c) Direct use as process heat; or (d) Generation of heat in elemental process (e.g. steam, hot water, hot oil, hot air); or (e) Generation of mechanical energy.	The project utilizes waste heat from existing kilns as energy source of generation of electricity (case b). **Condition is fulfilled.**
2. The category is also applicable to project activities that use waste pressure to generate electricity at existing facilities.	This **condition is not relevant** for the present project because waste pressure is not recovered.
3. The recovery of waste gas/heat/pressure should be a new initiative (no waste gas/heat/pressure was recovered from the project activity source prior to the implementation of the project activity).	No waste heat was recovered for energy generation purpose from the project activity source prior to the implementation of the project activity, only a small portion of the waste heat from the feed ends of clinker production kilns is recycled to heat up incoming raw material. So the project activity is a new initiative. **Condition is fulfilled.**
4. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	The project activity results in emission reductions 29.862 kt CO_2 equivalent annually which is less than 60 kt CO_2. **Condition is fulfilled.**
5. (a) The energy produced with the recovered waste gas/heat/or	The electricity produced by the

waste pressure should be measurable;	project activity is measurable as indicated in §B.7. of the PDD. **Condition is fulfilled.**
5. (b) Energy generated in the project activity may be used within the industrial facility or exported to other industrial facilities (included in the project boundary);	The energy generated in the project activity is used within the industrial facility. **Condition is fulfilled.**
5. (c) Electricity generated in the project activity may be exported to the grid or used for captive purposes; However, the methodology is not applicable to projects where the waste gas/heat/pressure recovery project is implemented in a single-cycle power plant (e.g. gas turbine or diesel generator) where heat (energy) generated on site is not utilizable for any other purposes on-site except to generate power. Such project activities shall consider AMS-III.AL "Conversion from single cycle to combined cycle power generation". The projects recovering waste energy from such power plants for the purpose of generation of heat only can apply this methodology;	The electricity generated in the project activity is used for captive purposes. Waste heat for power generation is implemented in cement manufacturing kilns instead of in any single-cycle power plant. **Condition is fulfilled.**
5. (d) For a project activity which recovers waste gas/heat/pressure for power generation from multiple sources (e.g. kiln and single-cycle power plant), this methodology can be used in combination with AMS-III.AL provided that: (i) Within the project activity it is possible to distinguish two distinct waste energy sources such that: • Waste energy source-I (e.g. kiln) belongs to such waste heat sources which are eligible under AMS-III.Q; • Waste energy source-II (e.g. single-cycle power unit) belongs to such waste heat sources which are eligible under AMS-III.AL; (ii) It is possible, for each waste energy source, to determine the baseline according to the specific methodology referred to; (iii) It is possible to objectively allocate the electricity produced in the project activity to each waste energy source, by means of one of the following methods: • Through separate measurements of the electricity produced by utilizing waste energy from each waste energy source; or • Through separate measurements of the energy content of the waste energy carrying medium (WECM) streams used for electricity production; or • Through separate measurements of the energy content of the waste energy streams that are associated with each waste energy source and used for electricity production or for the WECM generation in a common waste heat recovery system (e.g. if steam is generated by waste heat from a kiln and waste heat from an internal combustion engine in a common waste heat recovery boiler);	This **condition is not relevant** because the project activity recovers waste heat for power generation from single waste heat type source, cement manufacturing kilns only.
5. (e) The emission reductions are claimed by the generator of	The emission reductions are claimed

energy using waste energy;	by Lucky Cement Limited, which is the generator of the waste heat. **Condition is fulfilled.**
5. (f) In cases where the energy is exported to other facilities (included in the project boundary), the following are required: (i) All historical information from the recipient plants; (ii) An official agreement exists between the owners of the project energy generation plant (henceforth referred to as generator, unless specified otherwise) with the recipient plant(s) that the emission reductions would not be claimed by the recipient plant(s) for using a zero-emission energy source;	This **condition is not relevant** because energy is not exported to other facilities but used by the same facility where waste energy is recovered.
5. (g) For those facilities and recipients included in the project boundary, that prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods: (i) The remaining lifetime of equipment currently being used; and (ii) Crediting period;	The sources of energy in the baseline are the kilns which have a technical lifetime that extends beyond the crediting period. Therefore the credits are claimed for the whole duration of the selected crediting period (10 years). **Condition is fulfilled.**
5. (h) The waste gas/heat/pressure utilized in the project activity would have been flared or released into the atmosphere in the absence of the project activity. This shall be proven by one of the following options: (i) By **direct measurements** of energy content and amount of the waste gas/heat/pressure for at least three years prior to the start of the project activity; (ii) **Energy balance** of relevant sections of the plant to prove that the waste gas/heat/pressure was not a source of energy before the implementation of the project activity. For the energy balance the representative process parameters are required. The energy balance shall demonstrate that the waste gas/heat/pressure was not used and also provide conservative estimations of the energy content and amount of waste gas/heat/pressure released; (iii) **Energy bills** (electricity, fossil fuel) to demonstrate that all the energy required for the process (e.g. based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g. balance sheets, profit and loss statement) that no energy was generated by waste gas/heat/pressure and sold to other facilities and/or the grid. The bills and financial statements should be audited by competent authorities; (iv) **Process plant** manufacturers' original specification/information, schemes and diagrams from the construction of the facility could be used as an estimate of quantity and energy content of waste gas/heat/pressure	The waste heat utilized in the project activity would have been released into the atmosphere in absence of the project activity. This is proven by the annual financial reports of the company, audited by a competent third party, which demonstrate that all the energy required for the process has been procured commercially (option iii). **Condition is fulfilled.**

produced for rated plant capacity per unit of product produced.	
6. For the purpose of this category waste energy is defined as: a by-product gas/heat/pressure from machines and industrial processes having potential to provide usable energy, for which it can be demonstrated that it was wasted. For example gas flared or released into the atmosphere, the heat or pressure not recovered (therefore wasted). Gases that have intrinsic value in a spot market as energy carrier or chemical (e.g., natural gas, hydrogen, liquefied petroleum gas, or their substitutes) are not eligible under this category.	The project activity utilizes waste energy (heat) from cement manufacturing kilns (industrial process). **Condition is fulfilled.**

B.3. Description of the project boundary:

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According to paragraph 7 of AMS-III.Q. / Version 04, “the physical, geographical site of the facility where the waste gas/heat/pressure is produced and transformed into useful energy delineates the project boundary.

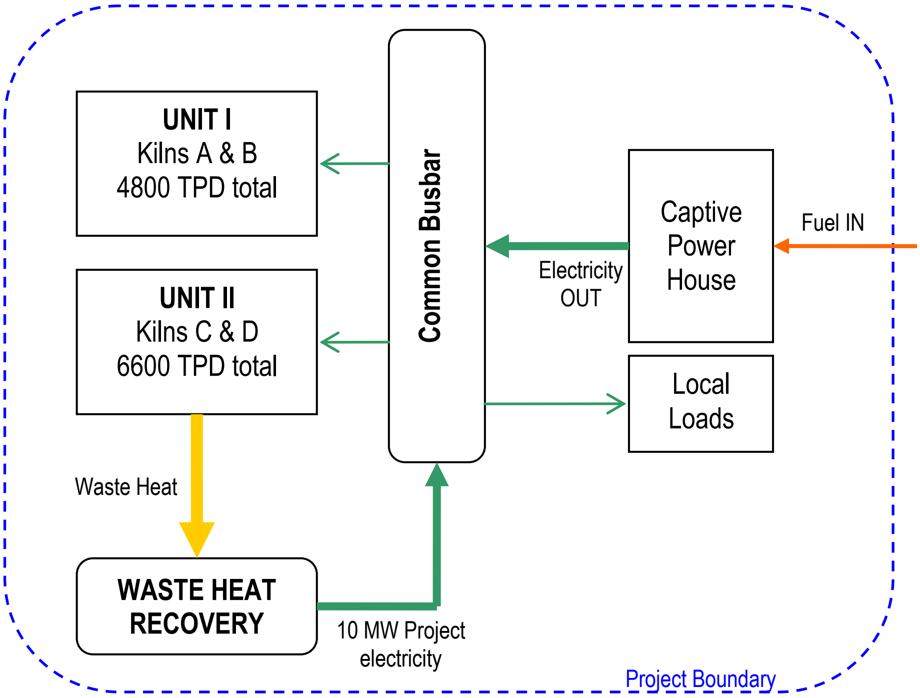
The geographical extent of the project boundary shall include the following:

(a) The industrial facility where waste energy is generated, including the part of the industrial facility where the waste gas was utilized for generation of captive electricity prior to implementation of the project activity;
(b) The facility where steam/process heat in the element process/electricity/mechanical energy is generated (generator steam/process heat/electricity/mechanical energy). Equipment providing auxiliary heat to the waste energy recovery process shall be included within the project boundary; and
(c) The facility(ies) where steam/process heat in the element process/electricity/mechanical energy is used (the recipient plant(s)) and/or grid where electricity is exported, if applicable.

This means that Unit II (kilns C & D) where the waste heat is generated, the entire cement plant where the electricity is consumed, and the waste heat recovery system are to be included in the project boundary.

The physical boundary of the project is fuel consumption and electricity generation by captive power plant, clinker production process at Unit II (kilns C & D), and electricity generated by the waste heat recovery project. This is illustrated below in Figure B.3.1.

Figure B.3.1: Project boundary



B.4. Description of baseline and its development:

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In the baseline situation, the high temperature exhaust of the kilns is vented to the atmosphere; only a small portion of waste heat is circulated and used for drying & preheating the incoming raw materials & fuel. There are no other potential alternatives of waste heat utilization in the vicinity of the factory. So in the absence of project activity the only possible baseline scenario is that the waste heat is released to the atmosphere and the project electricity used by cement plant is supplied by the existing fossil fuel based captive power plant.

Hence continuation of the current practice, venting the waste heat from kilns into the atmosphere and supply from existing capacity of captive power plant, is the baseline scenario in the absence of proposed CDM project activity.

For emission reduction calculations, power plant data of three years (from October 2004 to September 2007) prior to investment decision of the proposed CDM project activity has been taken. Investment analysis of the project is based on one complete year of data (from October 2006 to September 2007) prior to the investment decision. The historical data is given in Annex 3.

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 small-scale CDM project activity:

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CDM consideration before starting date of the project and continued effort to secure CDM status

The starting date of the project activity is the May 07, 2008 which corresponds to the date of signing contract between Lucky Cement Limited and Sinoma Energy Conservation Ltd. Lucky Cement was aware of CDM since Feb 2007 and it played an instrumental role in the investment decision taken on the October 22, 2007 to implement the project[2]. Discussions with CDM consultants started in August 2007 with Factor Consulting (later First Climate (Switzerland) AG) and Carbon Services (Private) Ltd. During the whole implementation phase before validation, Lucky Cement was accompanied by the CDM consultants.

Table B.5.1: Project timeline

Milestone	Date	Source
CDM Awareness	Since Feb 2007	Letter from Director of Carbon Services (Pvt) Limited to Technical Director of Lucky Cement Limited
Proposal from CDM Consultant	Aug 02, 2007	Proposal of CDM Service Agreement between Factor Consulting + Management AG (now First Climate) and Lucky Cement Limited
Investment Decision	Oct 22, 2007	Extract from the minutes of the Board's Meeting
Project Start Date	May 07, 2008	Contract between project proponent and contractor
Environmental approval from Environmental Protection Agency (EPA) of N.W.F.P.	Feb 07, 2009	Environmental approval
Request for revision of AM0024 / Version 02.1	Mar 11, 2009	AM_REV_0141
Request for quotation for CDM validation to DOE as large scale project – with AM0024 / Version 02.1	Mar 17, 2009	Request for quotation for CDM validation to TUEV SUED Industrie Service GmbH
Quotation for CDM validation from DOE as large scale project – with AM0024 / Version 02.1	Jun 25, 2009	Quotation for CDM validation from TUEV SUED Industrie Service GmbH
CDM validation order to DOE as large scale project – with AM0024 / Version 02.1	Jul 10, 2009	CDM validation order to TUEV SUED Industrie Service GmbH
First issuance for Global Stakeholder Consultation (as large scale project – with AM0024 / Version 02.1)	Jul 10, 2009	

[2] Proofs for CDM awareness and consideration have been provided to DOE.

Application for Host Country Approval	Jul 25, 2009	
Start of Global Stakeholder Process (GSP) as large scale project – with AM0024 / Version 02.1	Aug 06, 2009	UNFCCC CDM website
Start of Civil Works	Aug 13, 2009	Work order for civil works made by Lucky Cement Limited to the contractor
Issuance of Host Country Approval	Oct 14, 2009	
Project Commissioning	September 2010	Company Information
Reply to AM_REV_0141 (methodology to be merged with ACM0012, but issues not addressed)	Nov 16, 2010	AM_REV_0141
Request for revision of AMS-III.Q. / Version 03	Dec 10, 2010	SSC_497
Approval of request for revision and issuance of AMS-III.Q. / Version 04	Apr 15, 2011	Annex 22 to EB 60

According to Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activity categories, “project participants shall provide an explanation to show that the project activity would not have occurred anyway due at least to one of the following barriers:” investment barrier, technological barrier, prevailing practice barrier or other barriers.

The investment barrier is chosen to demonstrate the financial unattractiveness of the project activity. Below it is demonstrated that the Internal Rate of Return for the project activity (project IRR) is lower than the benchmark return (which corresponds to the minimum opportunity cost of capital invested in the project activity), and the project IRR surpasses the benchmark return only with an additional revenue stream from sale of Certified Emission Reductions (CER) generated under the project activity.

As mentioned in section B.4, the only possible use of the waste heat from the kilns was electricity generation. However, without CDM, this option faces a financial barrier, as it is not financially attractive. Given that this option is to be checked against the option without any investment (baseline scenario, where electricity is continued to be sourced from the existing captive power plant), the Benchmark approach is deemed adequate for the investment analysis. As shown below, in the absence of the CDM revenues, the project activity would have not happened due to a financial barrier, i.e. the project would have not been considered financially attractive, as the savings provided by the increased efficiency were not sufficient to justify the investment needed.

Description of Investment Analysis

The reasoning provided in the following paragraphs clearly reveals that the criteria employed for the selection of type of IRR and the corresponding benchmark are as per the guidance provided in *paragraphs 12-14 of Annex 5 to EB 62* and that the approach with respect to the selection of the benchmark is conservative:

Selection of Type of IRR and Benchmark

It is stated in *Paragraph 12 of Annex 5 to EB 62* that *“in cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or*

weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented"

Furthermore, *Paragraph 13 of Annex 5 to EB 62* states that *"in the cases of projects which could be developed by an entity other than the project participant the* ***benchmark*** *should be based on parameters that are standard in the market"*

With regard to the proposed CDM project activity:

- The investment analysis is in compliance with the requirements of *Paragraph 12 of* Annex 5 to EB 62 as it is based on the calculation of project IRR and its comparison with the commercial lending rate (11.73%) evaluated at the time of investment decision.

- The chosen benchmark is in compliance with the requirements of *Paragraph 13 of* Annex 5 to EB 62 as the project activity could have been implemented by an entity other than Lucky Cement Limited. For instance, Lucky Cement Limited could have hired the services of an Energy Service Company (ESCO) who would bear all the project related costs and recover its investment by claiming a portion of savings generated by the project activity.

- As per guidance provided in *Paragraph 14 of* Annex 5 to EB 62*, "internal company benchmarks/expected returns (including those used as the expected return on equity in the calculation of weighted average cost of capital-WACC) should only be applied in cases where there is only one possible project developer..."* The reasoning provided in the preceding paragraph clearly shows that this is not the case; therefore, use of equity IRR or internal benchmark is not appropriate the context of the current project activity.

The discussion provided above clearly shows that the selection of project IRR and the corresponding benchmark are appropriate for the purpose of conducting investment analysis of the project activity.

Description of the Chosen Benchmark (Commercial Lending Rate): The local lending and borrowing rates in Pakistan are based on Karachi Inter-bank Offered Rate (KIBOR) plus the credit spread over the KIBOR charged by the local bank. In February 2004, KIBOR was officially introduced by State Bank of Pakistan (SBP) as a reference rate for all corporate lending in Pakistan[3]. Thus the KIBOR portion of the commercial lending rate is always determined by SBP. The credit spread calculation is performed by local banks which determine it based on various project specific risks or characteristics of a project type.

For the determination of the benchmark (commercial lending rate) for the project activity, Lucky Cement Limited considered a 3 month tenor average KIBOR of 9.73 % for September 2007[4] and assumed a credit spread of 200 basis points which was based on a loan offer extended to Lucky Cement by Habib

[3] Press release by State Bank of Pakistan: http://www.sbp.org.pk/press/2004/jan-21-04.pdf

Third Quarterly report of State Bank of Pakistan FY04: http://sbp.org.pk/reports/quarterly/fy04/thirdQtr/Money%20Market.pdf

[4] KIBOR rate of 2007 are available at the website of State Bank of Pakistan: http://sbp.org.pk/ecodata/kibor/2007/

Metropolitan Bank Limited, a local bank in Pakistan[5]. The benchmark thus evaluated was (9.73 % + 2.0%) 11.73 %.

This corporate lending rate calculation is in line with the guidance provided by Citibank[6] which estimates a credit spread between 200 to 350 basis points above the 3 or 6 month KIBOR as appropriate for a 7 year term loan (including 2 years grace period), for a loan amount over PKR 100 million.

Furthermore, the chosen benchmark value (11.73 %) is conservative as it is below the range of commercial lending rate of 12.57-13.57 %, prevalent at the time of investment decision[7].

Comparison of the Chosen Benchmark with Other Benchmarks

As per guidance provided in *Paragraphs 12 and 13 of* Annex 5 to EB 62 **,** Weighted Average Costs of Capital (WACC) and benchmark determined by relevant national authority are also appropriate benchmarks for a project IRR which could be used to conduct the investment analysis for the project activity; the appropriateness, conservativeness and relevance of these benchmarks is discussed below:

Weighted Average Costs of Capital (WACC): The WACC for financial year 2007 for Lucky Cement is 13.10%[8]. However, it is less conservative when compared with the commercial lending rate of 11.73%.

Benchmark determined by relevant national authority: There is no benchmark established by the Government of Pakistan for WHR based power projects. Benchmarks do exist for hydropower and thermal power projects, but those are ROE (required/expected return on equity) based benchmarks, hence irrelevant in the context of the current project activity.

In view of the aforementioned facts it can be concluded that the benchmark chosen for the project activity- commercial lending rate of 11.73% - is in compliance with the guidance provided in *paragraphs 12-14 of* Annex 5 to EB 62 and is both appropriate and conservative.

Calculation and comparison of the project IRR with the selected benchmark

The following general assumptions have been made to calculate the project IRR of the project activity:

Table B.5.2: General assumptions for project IRR calculation

General Information	Value	Unit	Source of data
Exchange rate US $ --> PKR	60.00	PKR	Feasibility study
Depreciation period	20	years	Feasibility study
Technical lifetime of the plant	20	years	Feasibility study
Tax on net income	35%		Feasibility study

[5] A copy of the Habib Metropolitan Bank Limited's loan offer letter to Lucky Cement has been provided to DOE

[6] Citibank letter has been provided to the DOE.

[7] This is evidenced by a news article a copy of which has been provided to DOE. The article is also available at http://www.dawn.com/2007/05/24

[8] Pakistan cement sector review report by IGI Pakistan: http://www.igisecurities.com.pk/pdf/Pakistan-Cement-Sector-Review-May-2007.pdf

The total investment amount to implement the project is 960,000,000 PKR. This includes machinery and material, training, management and technical services, duties, taxes and freight charges as well as local costs. As the analysis period corresponds to the depreciation period of 20 years, the fair value of the project investments will be 0 at the end of the analysis period. Depreciation and financial expenses are only used for tax calculation and added back to net profits for the calculation of the project IRR.

Concerning the fuel consumption and costs, the calculations were based on the historical values from October 2006 until September 2007. Since kiln D was commissioned in May 2006, therefore historical data of one complete year (Oct 2006 to Sep 2007) is selected for the calculation of baseline data. The following table describes the baseline and project fuel costs for the total captive power generation.

Table B.5.3: Fuel costs for electricity generation

		Baseline	Project
Captive Power Generation	MWh/yr	412,835	354,544
HFO			
HFO consumption	tons/yr	30,359	26,073
Cost of HFO	PKR/yr	772,686,658	663,585,423
Natural Gas			
NG consumption	Nm^3/yr	71,379,210	61,300,661
Cost of NG	PKR/yr	694,896,893	596,779,359
Diesel			
Diesel consumption	Ltrs/yr	16,046	13,781
Cost of Diesel	PKR/yr	587,392	504,454

The Operation and Maintenance Costs considered for the project activity represent 5% of the total investment costs with an annual increase of 10% due to rapidly increasing labour wages and costs associated with technical services. After every 5 years, an overhaul is necessary. This represents 3% of the investment costs indexed by the annual increase of 10% of the Operation and Maintenance Costs.

The increase of the fuel costs is evaluated on the basis of the Annual Energy Outlook 2006 (AEO 2006) prepared by the Energy Information Administration available on the www.eia.doe.gov and fuel prices data provided in Pakistan Energy Year Book 2006; five years historical data (2002 to 2006) for fuel prices both in the indigenous (national) and international market as well as the projected international fuel prices (2007 to 2026), from Annual Energy Outlook, were used to forecast the increase in fuel prices. The results of the future price increase as estimated in Energy Prices Future Evolution Calculation were adjusted by the yearly inflation rate and by the change rate between US Dollars and the Pakistani Rupee. The average price increase (from 2007 to 2026) resulted in 1.92% for HFO, 0.93% for Diesel and 0.21% for Natural Gas. Detailed calculations are presented in the separate Excel-File. Table B.5.4 resumes the information concerning the Operation and Maintenance Costs as well as the Estimated Cost Increases of fuel costs.

Table B.5.4: Operation & Maintenance (O&M) costs and fuel cost increases

	Value	Unit	Source of Data
O&M Cost	48,000,000	PKR/yr	Consultant's Letter
O& M Overhaul Cost (every 5 years)	28,800,000	PKR	Consultant's Letter
Price Increase O&M Costs	10%	per year	Feasibility study
Price Increase HFO	1.92%	per year	Energy Prices Future Evolution

			Calculation
Price Increase Diesel	0.93%	per year	Energy Prices Future Evolution Calculation
Price Increase Natural Gas	0.21%	per year	Energy Prices Future Evolution Calculation

The resulting project IRR of the project saving potential by introducing the project activity is 7.73%. As the benchmark is determined at 11.73%, the project activity would not be implemented. Considering the CER revenues, the project IRR would come up to 11.96% and so gets an economically attractive investment option for Lucky Cement.

Sensitivity analysis

To show the robustness of the results, a sensitivity analysis is carried out for the variation (+/- 10%) of the decisive variables of the project activity. These are the initial project investment, HFO cost, natural gas cost, O&M cost and the load factor of steam turbine. 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	9.99%	7.73%	5.82%
Benchmark	11.73%	11.73%	11.73%
Break Even Point	-16.58%		

HFO Price	**-10%**	**Base Case**	**10%**
Net Saving Cash Flow w/o CER	5.26%	7.73%	9.57%
Benchmark	11.73%	11.73%	11.73%
Break Even Point	24.35%		

NG Price	**-10%**	**Base Case**	**10%**
Net Saving Cash Flow w/o CER	5.85%	7.73%	9.23%
Benchmark	11.73%	11.73%	11.73%
Break Even Point	30.30%		

O&M Cost	**-10%**	**Base Case**	**10%**
Net Saving Cash Flow w/o CER	9.38%	7.73%	5.42%
Benchmark	11.73%	11.73%	11.73%
Break Even Point	-29.70%		

Load Factor	**-10%**	**Base Case**	**10%**
Net Saving Cash Flow w/o CER	2.72%	7.73%	10.82%
Benchmark	11.73%	11.73%	11.73%

The sensitivity analysis shows that the results are robust, even a variation of +/- 10% in the abovementioned parameters does not make economically additional without the CDM benefits. For the project investment, the limit of financial viability is situated at a total investment cost decrease of 16.58%.

This is highly unlikely in the present project. Likewise, an increase of more than 24.35% in HFO price, an increase of more than 30.30% in NG price or a decrease of 29.70% in O&M costs would turn the project additional; however, it is highly unlikely that variations of such magnitude (in the fuel prices or O&M costs) would occur.

As explained in the investment analysis, the present project would not be economically attractive without the consideration of the CER revenue and would not be realised. We can make a conclusion that the proposed CDM project activity is fully additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The emission reductions of the project activity were calculated according to AMS-III.Q. / Version 04.

Baseline emissions

In the situation where the electricity is obtained from a specific existing power plant or from the grid, baseline emissions can be calculated as follows:

$$BE_{elec,y} = f_{cap} * f_{wcm} * \sum_{j} \sum_{i} (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \textbf{(1)}$$

Where:

$BE_{elec,y}$	Baseline emissions due to displacement of electricity during the year *y* in tons of CO_2
$EG_{i,j,y}$	The quantity of electricity supplied to the recipient *j* by generator, that in the absence of the project activity would have been sourced from *i*th source (*i* can be either grid or identified source) during the year *y* in MWh
$EF_{elec,i,j,y}$	The CO_2 emission factor for the electricity source *i* (*i*=gr (grid) or *i*=is (identified source)), displaced due to the project activity, during the year *y* in tons CO_2/MWh
f_{wcm}	Fraction of total electricity generated by the project activity using waste energy. This fraction is 1 if the electricity generation is purely from use of waste energy. If the boiler providing steam for electricity generation uses both waste and fossil fuels, this factor is estimated using equation (7). If the steam used for generation of the electricity is produced in dedicated boilers but supplied through common header, this factor is estimated using equation (7)/(9). Note: For project activity using waste pressure to generate electricity, electricity generated from waste pressure use should be measurable and this fraction is 1
f_{cap}	Capping factor to exclude increased waste energy utilization in the project year *y* due to increased level of activity of the plant, relative to the level of activity in the base years before project start. The ratio is 1 if the waste energy generated in project year *y* is same or less than that generated in base years. f_{cap} shall be estimated according to the corresponding section of ACM0012 “Consolidated baseline methodology for GHG emission reductions from waste

energy recover projects”

The baseline generation source is an identified existing plant, the parameter $EG_{i,j,y}$ corresponds to $EG_{is,y}$ and the emission factor $EF_{elec,i,j,y}$ corresponds to $EF_{Elec,is,y}$. The CO_2 emission factor shall be determined as follows:

$$EF_{Elec,is,j,y} = \frac{EF_{CO2,i,j}}{\eta_{Plant,j}} \times 3.6*10^{-3} \qquad \textbf{(2)}$$

Where:

$EF_{CO2,i,j}$	The CO_2 emission factor per unit of energy of the fossil fuel used in the baseline generation source *i* in (tCO_2/TJ), obtained from reliable local or national data if available, otherwise, taken from the country specific IPCC default emission factors
$\eta_{Plant,j}$	The overall efficiency of the existing plant that would be used by j^{th} recipient in the absence of the project activity
$3.6*10^{-3}$	Conversion factor, expressed as TJ/MWh

In case in the baseline situation more than one type of fossil fuel is used in the captive power plant, the relative contribution to the total output of each fossil fuel shall be considered and the formulas for baseline emissions shall be adjusted accordingly.

Since the captive power plant consumes more than one type of fossil fuel (HFO, NG, and diesel) therefore CO_2 emission factor per unit of energy of the fossil fuels used in the baseline shall be weighted emission factor calculated as follows:

$$EF_{CO2,i,j} = \frac{\sum_i (FC_{i,y} \times NCV_i \times COEF_i)}{\sum_i (FC_{i,y} \times NCV_i)} \qquad \textbf{(3)}$$

Where:

$EF_{CO2,i,j}$	The CO_2 emission factor per unit of energy of the fossil fuels used in the baseline generation source *i* in (tCO_2/TJ), obtained from reliable local or national data if available, otherwise, taken from the country specific IPCC default emission factors
$FC_{i,y}$	Consumption of fossil fuel (mass or volume unit) in project situation at captive power plant
NCV_i	Net calorific value (energy content per unit mass or energy content per unit volume units) of fossil fuel used in baseline
$COEF_i$	Coefficient of fossil fuel (tCO_2/TJ) used in baseline situation
i	Fossil fuel type

Efficiency of existing captive plant

According to AMS-III.Q / Version 04, efficiency of the power plant ($\eta_{plant,j}$) shall be one of the following:

(i) Assume a constant efficiency of the captive plant and determine the efficiency, as a conservative approach, for optimal operation conditions i.e., design fuel, optimal load, optimal oxygen content in flue gases, adequate fuel conditioning (temperature, viscosity, moisture, size/mesh etc.), representative or favorable ambient conditions (ambient temperature and humidity); or

(ii) Highest of the efficiency values provided by two or more manufacturers for power plants with specifications similar to that that would have been required to supply the recipient with electricity that it receives from the project activity; or

(iii) Assume a captive power generation efficiency of 60% based on the net calorific values as a conservative approach.

The efficiency of the captive plant has been determined according to option (i) mentioned above. The existing captive power plant has two types of gensets as listed in Table A.4.2.2. As a conservative approach, the highest optimal operation (designed) efficiency among the two types of gensets is selected as constant efficiency of the existing captive plant.

Table B.6.1.1: Efficiency of existing captive plant

Wartsila 12V46 Gensets		
Heat rate of Wartsila 12V46 gensets on NG	kJ/kWh	8,160
Efficiency of Wartsila 12V46 gensets on NG	%	44.12%
Heat rate of Wartsila 12V46 gensets on HFO	kJ/kWh	8,750
Efficiency of Wartsila 12V46 gensets on HFO	%	41.14%
Wartsila 18V32 Gensets		
Heat rate of Wartsila 18V32 gensets on NG	kJ/kWh	8,990
Efficiency of Wartsila 18V32 gensets on NG	%	40.04%
Heat rate of Wartsila 18V32 gensets on HFO	kJ/kWh	8,710
Efficiency of Wartsila 18V32 gensets on HFO	%	41.33%

Efficiency of each type of genset on each fuel has been calculated from the heat rate values provided in specifications sheets provided by Original Equipment Manufacturer. The calculation of efficiency has been done in the emission reduction calculation excel sheet and the relevant evidences have been provided to DOE.

The highest efficiency among all the gensets of the captive power plant is of Wartsila 12V46 gensets on NG. As a conservative approach, a constant efficiency of 44.12% for the captive power plant is selected as per option (i) for efficiency of power plant. Hence

$\eta_{plant,j}$ = 44.12%

Calculation of f_{wcm}

The electricity generation of the project is purely from use of waste heat, then according to the methodology f_{wcm}= 1.

Calculation of f_{cap}

According to the requirements of AMS.III.Q / Version 04 the capping factor f_{cap} should be calculated using proper equations from ACM0012 “Consolidated baseline methodology for GHG emission reductions from waste energy recover projects”

The methodology requires the baseline emissions to be capped irrespective of planned/unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuel type and quantity resulting in an increase in generation of waste energy. The cap can be estimated using the three methods described below, following this hierarchy: (i) Method-1 can be used to estimate the capping factor if required data is available; (ii) if the project activities implemented in a Greenfield facility, or in existing facilities where the required data is unavailable Method-2 shall be used; (iii) If the project proponents demonstrate technical infeasibility in direct monitoring of waste heat / pressure of waste energy carrying medium (WECM), then Method-3 is used.

Method-1

Where the historical data on energy released by the waste energy carrying medium is available, the baseline emissions are capped at the maximum quantity of waste energy released into the atmosphere under normal operation conditions in the three years previous to the project activity.

Method-2

If three-year historical data is not available, the manufacturer's data for the facility shall be used to estimate the amount of waste energy the facility generates per unit of "product". The "product" is produced by the process that generates waste energy (departmental process or process of entire project facility, whichever is more justifiable and accurate). If any modification is carried out by the project proponent or if the manufacturer's data is not available for an assessment, this should be carried out by independent qualified/certified external process experts such as a chartered engineer on a conservative quantity of waste energy generated by the project facility per unit of product manufactured by the process generating waste energy. The value arrived at based on above sources of data, shall be used to estimate the baseline cap (f_{cap}). Under this method, the following equations should be used to estimate $f_{cap.}$

Method-3

In some cases, it may not be possible to measure the waste energy (heat, sensible heat, heat of reaction, heat of combustion, etc.) enthalpy or pressure content of WECM (Method-1 requirement), nor the specific amount of WECM per unit of product (Method-2 requirement). In such cases, the capping shall be based on indirect information about specific parameters allowing to estimate the amount of waste energy available. These parameters should be related to the characteristics of a product or a by-product of the facility from which waste energy can be recovered (e.g. volume and heat content of hot clinker produced by a kiln in a cement plant, if this heat can be recovered using air as the WECM). These cases may be of the following two types.

Case 1: The energy is recovered from WECM and converted into final output energy through a waste heat recovery equipment. For example, the useful energy (e.g., steam) is produced using waste energy generated by a chemical reaction. For such cases f_{cap} should be the ratio of maximum energy that could be recovered (MER) by the waste heat recovery equipment implemented under the CDM project activity and the actual energy recovered under the project activity (using direct measurement). The MER should be based on information on the characteristics of the key product/by product. For existing facilities this can be obtained from historical information and for Greenfield facilities, manufacturer's specifications on these key parameters can be used.

Case 2: The energy is recovered from WECM in an intermediate energy recovery equipment using an intermediate source. For example, an intermediate source to carry energy from primary WECM may include the sources such as water, oil or air to extract waste energy entrapped in chemicals (heat of reaction) or solids (sensible heat), which is further recovered in the waste heat recovery equipment to

generate final output energy. For such cases f_{cap} should be the ratio of maximum energy that could be recovered (MER) by waste heat recovery equipment implemented under the CDM project activity (considering the losses due to exchange of energy) and actual intermediate energy recovered under the project activity (using direct measurement). The MER should be based on information on the characteristics of the key product/by product. For existing facilities this can be collected from historical information and for Greenfield facilities, manufacturers specifications on these key parameters can be used.

Since there is no historical data on parameters of the waste energy from the clinker production and it is not possible to measure it due to different technical reasons Method-3 for f_{cap} calculation is chosen.
Since the waste energy from the WECM (i.e. heated air from the kilns) is recovered and converted into useful energy (the electricity output) in a single set of waste heat recovery equipment (without any additional intermediate energy recovery equipment), Case 1 of Method-3 for f_{cap} calculation is applicable.

Following equation (40) of ACM0012 / Version 04.0.0 is used to determine f_{cap}:

$$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}} \qquad \textbf{(4)}$$

Where:

$Q_{OE,BL}$	=	Output/intermediate energy that can be produced (TJ), to be determined on the basis of maximum energy that could be recovered from the WECM (MER), which would have been released (or WECM would have been flared or energy content of WECM would have been wasted) in the absence of CDM project activity.
$Q_{OE,y}$	=	Quantity of actual output/intermediate energy generated during year *y* (TJ)

In the proposed project, the theoretical electricity output $Q_{OE,BL}$ is calculated as follows

Gross capacity of Steam Turbine = 10 MW (Waste Heat Recovery Plant design value provided by the equipment supplier, which represents maximum waste heat recovery potential of the waste heat recovery equipment))

Based on 80% load factor and 330 days/year of clinker production/kiln operation
Gross electricity generation is thus equal to 10*0.8*330*24 = 63,360 MWh/year
Thus, maximum energy that could be recovered by waste heat recovery equipment,
$Q_{OE,BL}$ = 63,360 MWh/yr * 3600 * 10^{-6}= 228.096 TJ electrical.

The actual output electricity $Q_{OE,y}$ will be determined ex post by actual measurement. As per project plan, there is no reason to believe that the energy recovered will be different from the theoretical value for which the waste heat recovery system has been designed. Therefore, the ratio is assumed to be 1 for ex ante calculations and will be settled ex post.

Project emissions

Regarding project emissions, paragraph 13 & 14 of AMS-III.Q / Version 04 are quoted below:

13. Project Emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and emissions due to consumption of electricity by the project activity.

14. If the waste gas contains carbon monoxide or hydrocarbons, other than methane, and the waste gas is vented to the atmosphere in the baseline situation, project emissions have to include CO_2 emissions due to the combustion of the waste gas.

Leakage

Paragraph 15 of AMS-III.Q / Version 04 states that:

15. If equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(5)}$$

Where:

ER_y	Emission reductions in year *y* (t CO_2e/yr)
BE_y	Baseline emissions in year *y* (t CO_2e/yr)
PE_y	Project emissions in year *y* (t CO_2/yr)
LE_y	Leakage emissions in year *y* (t CO_2/yr)

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

Data / Parameter:	**NCV_{HFO}**
Data unit:	TJ/t (Tera joule per metric tonne)
Description:	Net calorific (lower heating) value of HFO
Source of data used:	Laboratory analysis
Value applied:	0.040
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory test on HFO sample was performed by external lab, and reported net calorific value 17,120 BTU/lb. This value was converted into TJ/ton units by following procedure. NCV in TJ/ton = NCV in BTU/lb * 0.001055056 / (0.0004535924 * 10^6)
Any comment:	Laboratory test is available with the project proponent

Data / Parameter:	**NCV_{NG}**
Data unit:	MJ/Nm^3 (Mega joule per normal cubic meter)
Description:	Net calorific (lower heating) value of natural gas
Source of data used:	Laboratory analysis
Value applied:	36.44
Justification of the choice of data or description of	Laboratory test on natural gas sample was performed by external lab, and reported GCV (Gross Calorific Value) 977.96 BTU/ft^3. The NCV is considered as 90% of GCV following the IPCC guidelines. This value was converted into

measurement methods and procedures actually applied :	MJ/Nm^3 units by following procedure. NCV in MJ/Nm^3 = NCV in BTU/ft^3 * 0.001055056 / 0.02831685
Any comment:	Laboratory test is available with the project proponent

Data / Parameter:	**$Density_{diesel}$**
Data unit:	Kg/l (kilogram per litre)
Description:	Density of diesel
Source of data used:	Laboratory analysis
Value applied:	0.8509
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory test on diesel sample was performed by external lab
Any comment:	Laboratory test is available with the project proponent

Data / Parameter:	**NCV_{diesel}**
Data unit:	MJ/l (Mega joule per litre)
Description:	Net calorific (lower heating) value of diesel
Source of data used:	Laboratory analysis
Value applied:	35.94
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory test on diesel sample was performed by external lab and reported gross calorific value 19,114 BTU/lb. NCV was calculated as 95% of GCV following the IPCC guidelines. This value was converted into MJ/Ltr units by following procedure. NCV in TJ/ton = NCV in BTU/lb * 0.001055056 * $Density_{diesel}$ / 0.4535924
Any comment:	Laboratory test is available with the project proponent

Data / Parameter:	**NCV_{coal}**
Data unit:	TJ/t (Tera joule per metric tonne)
Description:	Net calorific (lower heating) value of coal (Type: other bituminous 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 :	Laboratory test coal sample was performed by Quality Control Department of Lucky Cement Limited, and reported gross calorific value 6,114 kCal/kg. NCV was calculated as 95% of GCV following the IPCC guidelines. This value was converted into TJ/ton units by following procedure. NCV in TJ/ton = NCV in kCal/kg * 0.0041868 / 1000
Any comment:	Laboratory test is available with the project proponent

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:	IPCC 2006 default value: "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 $kgCO_2/TJ$.
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Local value is not available so IPCC default value is used which is permissible by the applied methodology AMS-III.Q / Version 04. Value in $kgCO_2/TJ$ was converted to tCO_2/TJ units by following procedure. Value in tCO_2/TJ = Value in $kgCO_2/TJ$ / 1000
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:	IPCC 2006 default value: "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 $kgCO_2/TJ$.
Value applied:	56.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Local value is not available so IPCC default value is used which is permissible by the applied methodology AMS-III.Q / Version 04. Value in $kgCO_2/TJ$ was converted to tCO_2/TJ units by following procedure. Value in tCO_2/TJ = Value in $kgCO_2/TJ$ / 1000
Any comment:	

Data / Parameter:	**$COEF_{diesel}$**
Data unit:	tCO_2/TJ (metric tonnes of Carbon Dioxide per Tera joule)
Description:	Emission coefficient of HFO
Source of data used:	IPCC 2006 default value: "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 $kgCO_2/TJ$.
Value applied:	74.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Local value is not available so IPCC default value is used which is permissible by the applied methodology AMS-III.Q / Version 04. Value in $kgCO_2/TJ$ was converted to tCO_2/TJ units by following procedure. Value in tCO_2/TJ = Value in $kgCO_2/TJ$ / 1000
Any comment:	

Data / Parameter:	**$E_{HFO,historical}$**
Data unit:	MWh/yr (Mega watt hours per year)
Description:	Electricity generated by captive power plant in historical year
Source of data used:	Historical data provided by Lucky Cement Limited

Value applied:	Oct 2004 to Sep 2005: 192,915 Oct 2005 to Sep 2006: 301,511 Oct 2006 to Sep 2007: 355,508
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been taken from power generation log sheets of Oct 2006 to Sep 2007, QMS procedures are followed in measurement and reporting this value.
Any comment:	

Data / Parameter:	**$FC_{HFO,historical}$**
Data unit:	t/yr (metric tonnes per year)
Description:	HFO consumption by captive power plant in historical year
Source of data used:	Historical data provided by Lucky Cement Limited
Value applied:	Oct 2004 to Sep 2005: 43,425 Oct 2005 to Sep 2006: 63,627 Oct 2006 to Sep 2007: 74,696
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been taken from power generation log sheets of Oct 2006 to Sep 2007, QMS procedures are followed in measurement and reporting this value.
Any comment:	

Data / Parameter:	**$FC_{diesel,historical}$**
Data unit:	l/yr (Litres per year)
Description:	Diesel consumption by captive power plant in historical year
Source of data used:	Historical data provided by Lucky Cement Limited
Value applied:	Oct 2004 to Sep 2005: 23,366 Oct 2005 to Sep 2006: 29,388 Oct 2006 to Sep 2007: 13,818
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been taken from power generation log sheets of Oct 2006 to Sep 2007, QMS procedures are followed in measurement and reporting this value.
Any comment:	

Data / Parameter:	**$Q_{OE,BL}$**
Data unit:	TJ/y
Description:	Maximum recoverable energy by the waste heat recovery equipment implemented under the CDM project activity
Source of data used:	Calculated based on the project technical data (10 MW x 80% load factor x 330 days/y of clinker production x 24 h/d x 3600 MJ/MWh x 10^{-6} TJ/MJ)

Value applied:	228.096
Justification of the choice of data or description of measurement methods and procedures actually applied :	In case, during the project activity, the waste heat is increased, this parameter is used to cap the emission reductions according to the waste heat quantity in the baseline scenario.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

>>

Ex-ante calculation of emission reductions is based on AMS-III.Q / Version 04. The equations involved in *ex-ante* calculations are enumerated in section B.6.1. Details of parameters and notations are referred in Annex 3.

Baseline emissions

Baseline emissions are calculated as:

$$BE_{elec,y} = f_{cap} * f_{wcm} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \quad \textbf{(1)}$$

= 1 * 1 * 58,291 * 0.51

= 29,918 t CO_2/yr

The baseline generation source is an identified existing plant, the parameter $EG_{i,j,y}$ corresponds to $EG_{is,y}$ and the emission factor $EF_{elec,i,j,y}$ corresponds to $EF_{Elec,is,y}$. The CO_2 emission factor shall be determined as follows:

$$EF_{Elec,is,j,y} = \frac{EF_{CO2,i,j}}{\eta_{Plant,j}} \times 3.6 * 10^{-3} \quad \textbf{(2)}$$

= 62.898 / 44.12% * 3.6 * 10^{-3}

= 0.51 t CO_2/MWh

Since the captive power plant consumes more than one type of fossil fuel (HFO, NG, and diesel) therefore CO_2 emission factor per unit of energy of the fossil fuels used in the baseline is weighted emission factor calculated as follows:

$$EF_{CO2,i,j} = \frac{\sum_i (FC_{i,y} \times NCV_i \times COEF_i)}{\sum_i (FC_{i,y} \times NCV_i)} \quad \textbf{(3)}$$

= (26,731 * 0.040 * 77.4 + 62,364,454 * 36.44/10^6 * 56.1 + 30,427 * 35.94/10^6 * 74.1) / (26,731 * 0.040 + 62,364,454 * 36.44/10^6 + 30,427 * 35.94/10^6)

= 62.898 t CO_2/TJ

Following equation is used to determine f_{cap}:

$$f_{cap} = \frac{Q_{OE,BL}}{Q_{OE,y}} \quad \textbf{(4)}$$

= 228.096 / 228.096
= 1

Project emissions

There is no auxiliary fuel combusted in the project activity to supplement waste gas and the waste heat recovery system consumes its own electricity for auxiliary needs. Similarly, the project activity does not incinerate any waste gas to generate energy. Therefore, the project emissions are considered zero.

$$PE_y = 0$$

Leakage

The project activity involves only installation of new equipment; no retrofit or replacement will take place and hence no existing equipment can be transferred outside the project boundary. Since no transfer of equipment is considered in the project activity, the leakages are zero.

$$LE_y = 0$$

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(5)}$$

= 29,918 – 0 – 0

= 29,918 t CO_2 / yr

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

>>

A summary of the ex-ante estimation of emission reductions for the fixed crediting period of 10 years (from 01/02/2012 to 31/01/2022) is provided below.

Table B.6.4.1: Ex-ante estimation of emission reductions

Year	Estimation of project activity emissions	Estimation of baseline emissions	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions

	(tonnes of CO_2 e)	**(tonnes of CO_2 e)**		**(tonnes of CO_2 e)**
Year 1	0	29,918	0	29,918
Year 2	0	29,918	0	29,918
Year 3	0	29,918	0	29,918
Year 4	0	29,918	0	29,918
Year 5	0	29,918	0	29,918
Year 6	0	29,918	0	29,918
Year 7	0	29,918	0	29,918
Year 8	0	29,918	0	29,918
Year 9	0	29,918	0	29,918
Year 10	0	29,918	0	29,918
Total (tonnes of CO_2 e)	**0**	**299,180**	**0**	**299,180**

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

B.7.1 Data and parameters monitored:

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:	IPCC 2006 default value: "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 $kgCO_2/TJ$.
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Local value is not available so IPCC default value is used which is permissible by the applied methodology AMS-III.Q / Version 04. Value in $kgCO_2/TJ$ was converted to tCO_2/TJ units by following procedure. Value in tCO_2/TJ = Value in $kgCO_2/TJ$ / 1000
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:	IPCC 2006 default value: "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 $kgCO_2/TJ$.
Value applied:	56.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Local value is not available so IPCC default value is used which is permissible by the applied methodology AMS-III.Q / Version 04. Value in $kgCO_2/TJ$ was converted to tCO_2/TJ units by following procedure. Value in tCO_2/TJ = Value in $kgCO_2/TJ$ / 1000

Any comment:	

Data / Parameter:	**$COEF_{diesel}$**
Data unit:	tCO_2/TJ (metric tonnes of Carbon Dioxide per Tera joule)
Description:	Emission coefficient of HFO
Source of data used:	IPCC 2006 default value: "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 $kgCO_2/TJ$.
Value applied:	74.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Local value is not available so IPCC default value is used which is permissible by the applied methodology AMS-III.Q / Version 04. Value in $kgCO_2/TJ$ was converted to tCO_2/TJ units by following procedure. Value in tCO_2/TJ = Value in $kgCO_2/TJ$ / 1000
Any comment:	

Data / Parameter:	**NCV_{HFO}**
Data unit:	TJ/t (Tera joule per metric tonne)
Description:	Net calorific (lower heating) value of HFO to be used in kilns and at captive power plant
Source of data to be used:	Fuel supplier or laboratory test
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.040
Description of measurement methods and procedures to be applied:	Monitoring method: External data Data type: Measured Archiving procedure: Electronic & paper Recording Frequency: Monthly Responsibility: Quality Control Department
QA/QC procedures to be applied:	At least every year fuel sample will be sent to any reputed lab for the determination of NCV of each fuel used in the project activity. If the NCV of the fuel reported by lab vary significantly (5%) from that provided by the fuel supplier then only that value of NCV will be used for the determination of GHG emissions reduction which are more conservative, otherwise NCV based on lab test report will be used.
Any comment:	

Data / Parameter:	**NCV_{NG}**
Data unit:	TJ/Nm^3 (Tera joule per normal cubic meter)
Description:	Net calorific (lower heating) value of natural gas
Source of data to be used:	Fuel supplier or laboratory test
Value of data applied	0.00003644

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Monitoring method: External data Data type: Measured Archiving procedure: Electronic & paper Recording Frequency: Monthly Responsibility: Quality Control Department
QA/QC procedures to be applied:	At least every year fuel sample will be sent to any reputed lab for the determination of NCV of each fuel used in the project activity. If the NCV of the fuel reported by lab vary significantly (5%) from that provided by the fuel supplier then only that value of NCV will be used for the determination of GHG emissions reduction which are more conservative, otherwise NCV based on lab test report will be used.
Any comment:	

Data / Parameter:	**$Density_{diesel}$**
Data unit:	kg/l (kilogram per litre)
Description:	Density of diesel
Source of data to be used:	Fuel supplier or laboratory test
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.8509
Description of measurement methods and procedures to be applied:	Monitoring method: External data Data type: Measured Archiving procedure: Electronic & paper Recording Frequency: Monthly Responsibility: Quality Control Department
QA/QC procedures to be applied:	At least every year fuel sample will be sent to any reputed lab for the determination of density.
Any comment:	

Data / Parameter:	**NCV_{diesel}**
Data unit:	TJ/l (Tera joule per litre)
Description:	Net calorific (lower heating) value of diesel
Source of data to be used:	Fuel supplier or laboratory test
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.00003594
Description of measurement methods	Monitoring method: External data Data type: Measured

and procedures to be applied:	Archiving procedure: Electronic & paper Recording Frequency: Monthly Responsibility: Quality Control Department
QA/QC procedures to be applied:	At least every year fuel sample will be sent to any reputed lab for the determination of NCV of each fuel used in the project activity. If the NCV of the fuel reported by lab vary significantly (5%) from that provided by the fuel supplier then only that value of NCV will be used for the determination of GHG emissions reduction which are more conservative, otherwise NCV based on lab test report will be used.
Any comment:	

Data / Parameter:	$Q_{OE,y}$
Data unit:	TJ / yr (Tera joule per year)
Description:	Electrical output generated by waste heat recovery based steam turbo-generator during year *y* in TJ
Source of data to be used:	Electricity generation report
Value of data	228.096
Description of measurement methods and procedures to be applied:	Monitoring Method: Electricity generation measurement Data type: measured in MWh and converted to TJ by multiplying with $3.6*10^{-3}$ Monitoring instrument: Energy meter Frequency of calibration: annually Frequency of measurement: continuous Frequency of recording: daily Archiving procedure: Electronic and Paper Responsibility: See Table B.7.2.2
QA/QC procedures to be applied:	QMS procedures shall be followed in measurement, recording, and reporting of the parameter.
Any comment:	

Data / Parameter:	$\mathbf{EG_{i,j,y}}$
Data unit:	MWh / yr (Megawatt hours per year)
Description:	Net electricity generated by waste heat recovery based steam turbo-generator
Source of data to be used:	Internal records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	58,291
Description of measurement methods and procedures to be applied:	Monitoring method: Energy measurement Data type: Measured Frequency of measurement: Continuous Monitoring instrument: Energy meter Calibration frequency: Annually Calibration done by: Third party Archiving procedure: Electronic & paper Recording Frequency: Daily

QA/QC procedures to be applied:	QMS procedures will be followed in recording & reporting of parameter.
Any comment:	

Data / Parameter:	**$FC_{NG,y}$**
Data unit:	Nm^3/yr (Normal cubic meter per year)
Description:	Natural gas consumption by captive power plant
Source of data to be used:	Internal records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	62,364,454
Description of measurement methods and procedures to be applied:	Monitoring method: Flow measurement Data type: Measured Frequency of measurement: Continuous Monitoring instrument: Flow meter Accuracy of the Instrument: ±99.95% (error: ± 0.05%) Archiving procedure: Electronic & paper Recording Frequency: Daily
QA/QC procedures to be applied:	QMS procedures will be followed in recording & reporting of parameter.
Any comment:	

Data / Parameter:	**$FC_{HFO,y}$**
Data unit:	t/yr (Metric tonnes per year)
Description:	HFO consumption by captive power plant
Source of data to be used:	Internal records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	26,731
Description of measurement methods and procedures to be applied:	Monitoring method: Level measurement Data type: Measured Frequency of measurement: Every 12 hours Monitoring instrument: Dip ruler Accuracy of the Instrument: ±99.5% (error: ±0.5%) Calibration frequency: The dip meter shall be replaced with new one when it shall be providing erroneous readings. Calibration done by: Operations department Archiving procedure: Electronic & paper Recording Frequency: Daily
QA/QC procedures to be applied:	QMS procedures will be followed in recording & reporting of parameter.
Any comment:	

Data / Parameter:	**$FC_{diesel,y}$**
Data unit:	l/yr (Litres per year)
Description:	Diesel consumption by captive power plant
Source of data to be used:	Internal records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	30,427
Description of measurement methods and procedures to be applied:	Monitoring method: Level measurement Data type: Measured Frequency of measurement: Every 12 hours Monitoring instrument: Dip ruler Accuracy of the Instrument: ±99.5% (error: ±0.5%) Calibration frequency: The dip meter shall be replaced with new one when it shall be providing erroneous readings. Calibration done by: Operations department Archiving procedure: Electronic & paper Recording Frequency: Daily
QA/QC procedures to be applied:	QMS procedures will be followed in recording & reporting of parameter.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

At fossil fuel based captive power plant, data will be collected by Plant Operators. They will record data of fuel consumption for power generation. The project electricity data of waste heat recovery based power plant will be collected at 12-hourly basis. Fuel consumption will also be recorded on 12-hourly basis except natural gas which will be recorded on daily basis. Log sheets of the collected data will be prepared daily by Shift Engineers which will be initially verified by Operations Manager. Final verification of the data will be done by Senior Manager, daily. Data auditing will be performed internally, at monthly basis. Stores, Accounts, and Power Generation Department will be responsible to perform the audit.

The monitoring plan also includes recording of NCVs of the fuels as provided by the fuel suppliers. At least every year, fuel samples (Natural Gas, Diesel, and HFO) will be sent to reputed laboratories for the determination of the NCV. If the NCVs reported by laboratory vary significantly (5% or more) from those provided by the fuel supplier, only the most conservative NCVs will be used for the determination of the emission reductions; otherwise, NCVs based on laboratory test reports will be used.

QMS (Quality Management System) shall be followed in reporting and recording of all the monitoring parameters described in Section B.7.1. In case some data is missing or incorrect, it will be reconstructed or rectified based on the information sought from the historical data record which is similar in terms of operating conditions and parameters. An electronic spread sheet model may be used for archiving electronic data.

Table B.7.2.1 shows the responsibilities of personnel monitoring the operation of proposed CDM activity.

Table B7.2.1: Designation of Personnel Involved in Monitoring

Parameter	Item	12-Hourly Data Collection	Daily Data Log Preparation	Initial Data Verification	Data Auditing	
					Designation	Frequency
Fuel Consumption	**Existing Captive Power Plant**	Shift Operator – Shift Supervisor	Shift Incharge	Incharge Power Plant	External Audit	Annual
Electricity Generation	**Existing Captive Power Plant**	Shift Operator – Shift Supervisor	Shift Incharge	Incharge Power Plant	External Audit	Annual
	Steam Turbo-generator	Shift Operator	Shift Incharge	Incharge Power Plant	External Audit	Annual

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

>>

Date of completion:
27/04/2012

Name of the responsible entities:

First Climate (Switzerland) AG
Stauffacherstrasse 45
CH-8004 Zurich
Switzerland
URL: www.firstclimate.com
Contact person: Mr Nikolaus Wohlgemuth
Email: nikolaus.wohlgemuth@firstclimate.com

Carbon Services (Private) Limited
19 Davis Road, 2nd Floor, Al Maalik, Lahore
Pakistan
URL: www.carbon.com.pk
Contact person: Mr Omar M 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:

>>
Starting date of the project activity is May 07, 2008 which is the date of signing contract between Lucky Cement Limited and Sinoma Energy Conservation Ltd.[9]

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

>>
20 years 0 months

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:

>>
Starting date of the crediting period is 01/02/2012 or the date of registration of the proposed activity as CDM project activity, whichever comes later.

C.2.2.2. Length:

>>
10 years 0 months

[9] Copy of the contract between Lucky Cement Limited and the supplier has been provided to DOE.

SECTION D. Environmental impacts

>>

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

>>

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

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.

The environmental analyses conducted by Lucky Cement Limited for 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.

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.

IEE Report (Initial Environmental Examination Report) and the accompanying approval request letter were submitted on February 06, 2009. Approval letter was issued on February 07, 2009. A copy is shown in Annex 5 as reference to the context. The approval letter does not raise any particular issue with regard to the environmental impact of the project.

SECTION E. Stakeholders' comments

>>

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

>>

The local stakeholders' consultation meeting is a requirement by Designated National Authority (DNA) of CDM Pakistan, as well as it is required for the CDM PDD. The DNA issues Host Country Approval to the project participants after the stakeholders' consultation meeting is conducted and all the evidences are provided to it.

Stakeholders were informed about the project activity through specific advertising published by the project owner in the local media (newspaper, public notice boards within and surrounding the Lucky Cement Pezu Plant). Advertisement is shown in Annex 6.

The Stakeholder consultation meeting was held on Jan 22, 2009 at Lucky Cement Limited Pezu Plant 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 7.

E.2. Summary of the comments received:

>>

Comments from the stakeholders were collected in written form during and after the meeting. These are summarized below Table E.2.1: Summary of the Comments

Table E.2.1: Summary of the Comments

Sr. No.	Stakeholder's Name	Designation/ Profession	Qualification	Address	Comments/Views about the Project
1	Khalid Khan	Private Service	F.A.	Pezu, Lakki Marwat, District Lakki	This is a modern project which will create awareness of education among the people. Lifestyle of people will improve. Fuel will be saved, and traffic rush on local road will decrease.
2	Allah Jan	Office Attendant	S.S.C.	Wanda Sharbat Pezu, Lakki Marwat	This project is for the betterment of area. Cheap electricity will be generated. Environment will be pleasant. Opportunities of employment will be created. Fuel will be saved. People will take interest in education, and life standard will be improved.
3	Taj Ali Khan	Farmer	Middle	Wanda Sharbat Pezu, Lakki Marwat	This project will help in progress of the local area. A new technology will be introduced. Fuel will be saved. People of the area will take

					interest in education, and we will get jobs in our area.
4	Kundal Khan	Farmer	Middle	Wanda Sharbat Pezu, Lakki Marwat	People will get jobs. Fuel will be saved and burden on national economy will be reduced.
5	Sarfaraz Khan	Shopkeeper		Pezu, Lakki Marwat	Local business will expand. Economy of the area will improve. The project will help in the eradication of unemployment.
6	Zar Wali Khan	Farmer	Primary	Wanda Ahmed Khan, Pezu, Lakki Marwat	In the existing power plant, furnace oil is used which is brought to the plant by oil tankers. Since no fuel will be used in the WHR project therefore traffic of tankers on the local roads will reduce and environment will not get polluted. Job opportunities will increase.
7	M. Farooq	Jr. Clerk	B.A.	Pezu, District Lakki Marwat	It’s an extremely beneficial project. People will get job in the locality. There will be no negative impact on the environment. Life standard of people will improve. People will pay attention to education.
8	M. Aslam Khan	Private Service	B.A.	Pezu, Lakki Marwat, District Lakki	It’s an environmental-friendly project which will help in lowering the ambient temperature. The project will prove to be helpful in the industrial progress of area. Jobless people will get jobs, and awareness about importance of education will increase.
9	Noor Shah	J.O.	M.A.	Pezu, District Lakki	This project will create job opportunities. Air pollution will decrease and environment will become more pleasant. Moreover, people will get awareness of education.
10	Haji Munawar Khan	Farmer	Under Matric	Wanda Ahmed Khan, Pezu, Lakki Marwat	It’s a very beneficial project. People of the area will get jobs and children will get opportunities of learning skills. People will tend to get education, and the area will progress.

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 Lucky Cement Limited 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 Lucky Cement Limited.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Lucky Cement Limited
Street/P.O.Box:	A. Aziz Hashim Tabba Street
Building:	6-A M. Ali Housing Society
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State/Region:	Sindh
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Country:	Pakistan
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E-Mail:	info@lucky-cement.com
URL:	www.lucky-cement.com
Represented by:	
Title:	Director Power Generation
Salutation:	Mr
Last name:	Haqqi
Middle name:	
First name:	Intisar ul Haq
Department:	Power Generation
Mobile:	+92-300-8550883
Direct FAX:	
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Personal e-mail:	intisarhaqqi55@yahoo.com

Organization:	Carbon Services (Private) Limited
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Postfix/ZIP:	
Country:	Pakistan
Telephone:	+92-42-36313235 / 36313236
FAX:	+92-42-36312959
E-Mail:	
URL:	www.carbon.com.pk
Represented by:	Mr. Omar M. Malik
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Salutation:	Mr
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Middle Name:	M
First Name:	Omar
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E-Mail:	info@firstclimate.com
URL:	www.firstclimate.com
Represented by:	
Title:	Board Member
Salutation:	Mr
Last name:	Lüchinger
Middle name:	
First name:	Alexander
Department:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in this project activity.

Annex 3

BASELINE INFORMATION

Fuel Characteristics

Fuel Characteristics				
NCV of HFO		BTU/lb	17,120	External analysis
NCV of NG		BTU/ft^3	977.96	Company info
GCV of diesel	GCV_{diesel}	BTU/lb	19,114	External analysis
NCV of diesel		BTU/lb	18,158	IPCC guidelines
Density of diesel	$Denisty_{diesel}$	kg/Ltr	0.8509	External analysis
GCV of coal	GCV_{coal}	kCal/kg	6,114	Company analysis
NCV of coal		kCal/kg	5,808	IPCC guidelines
NCV of HFO	NCV_{HFO}	TJ/ton	0.040	Conversion
NCV of NG	NCV_{NG}	MJ/Nm^3	36.44	Conversion
NCV of diesel	NCV_{diesel}	MJ/Ltr	35.94	Conversion
NCV of coal	NCV_{coal}	TJ/ton	0.024	Conversion
Emission Coefficient of HFO	$COEF_{HFO}$	tCO_2/TJ	77.4	IPCC default
Emission Coefficient of NG	$COEF_{NG}$	tCO_2/TJ	56.1	IPCC default
Emission Coefficient of diesel	$COEF_{diesel}$	tCO_2/TJ	74.1	IPCC default

Type of HFO:

The lab test report[10] of HFO sample shows following parameters:

Flash point: 68 ºC
Density: 0.9631 kg/l

According to Table 1.1 of Volume 2, Chapter 1 of IPCC 2006, these characteristics respond to "Residual Fuel Oil" which states that:

This heading defines oils that make up the distillation residue. It comprises all residual fuel oils, including those obtained by blending. Its kinematic viscosity is above 0.1 cm^2(10 cSt) at 80ºC. The flash point is always above 50ºC and the density is always more than 0.90 kg/l.

Hence the default emission factor provided for Residual Fuel Oil i.e. 77.4 t CO_2/TJ has been used for calculations. Local or country-specific value of emission factor is not available and it is permissible by the applied methodology AMS-III.Q / Version 04 to use the IPCC default emission factors for fuels

[10] The lab test report has been provided to DOE.

Historical Data

Historical Operation of Pezu Plant					
Total clinker production	tons/yr	3,069,095			
Total electricity consumed by cement plant	MWh/yr	355,508			
Specific consumption of electricity by cement plant	MWh/ton clinker	0.116			
Unit I					
		Oct 2006 to Sep 2007			
		Kiln A	**Kiln B**	**Total**	
Clinker production	tons/yr	613,955	621,330	1,235,285	
Unit II					
		Oct 2006 to Sep 2007			
		Kiln C	**Kiln D**	**Total**	
Clinker production	tons/yr	889,865	943,945	1,833,810	
HFO consumption	tons/yr	299	206	505	
Coal consumption	tons/yr	125,250	133,078	258,328	
Specific energy consumption for clinker production	GJ/ton clinker	3.4	3.4	3.4	
Specific consumption of HFO	tons/ton clinker	0.00034	0.00022		
Specific consumption of coal	tons/ton clinker	0.141	0.141		
	GJ/ton clinker				
Captive Power Plant					
		Oct 2004 to Sep 2005	**Oct 2005 to Sep 2006**	**Oct 2006 to Sep 2007**	**Average**
Generation	MWh/yr	192,915	301,511	355,508	283,311
HFO consumption	tons/yr	43,425	63,627	74,696	60,583
Diesel consumption	Ltrs/yr	23,366	29,388	13,818	22,191
Specific consumption of HFO	tons/MWh	0.23	0.21	0.21	0.22
Specific consumption of diesel	Ltrs/MWh	0.12	0.10	0.04	0.09

Comparison of Baseline & Project Situation

Baseline & Project Situation

Clinker production load on kiln A		TPD	2,400	
Clinker production load on kiln B		TPD	2,400	
Clinker production load on kiln C		TPD	3,000	
Clinker production load on kiln D		TPD	3,000	
Operational days of plant		days/yr	330	
Specific consumption of electricty		MWh/ton	0.116	
Specific consumption of NG by captive		Nm^3/kWh	0.271	
Specific consumption of HFO by captive		tons/MWh	0.215	
Specific consumption of diesel by captive		Ltrs/MWh	0.086	

Electricity Generation Comparison

			Baseline	Project
Electricity consumption of plant		MWh/yr	412,835	412,835
Gross electricity generation by ST		MWh/yr	0	63,360
Net electricity generation by ST		MWh/yr	0	58,291
Generation by captive power plant		MWh/yr	412,835	354,544
Generation on natural gas		%	65%	65%
Generation on HFO		%	35%	35%
Generation on natural gas	E_{NG}	MWh/yr	268,343	230,454
Generation on HFO	E_{HFO}	MWh/yr	144,492	124,090
Natural gas consumption by captive	FC_{NG}	Nm^3/yr	72,617,902	62,364,454
HFO consumption by captive	FC_{HFO}	tons/yr	31,125	26,731
Diesel consumption by captive	FC_{diesel}	Ltrs/yr	35,429	30,427

Clinker Production Comparison

			Baseline	Project
Clinker production by kiln A		tons/yr	792,000	792,000
Clinker production by kiln B		tons/yr	792,000	792,000
Clinker production by kiln C		tons/yr	990,000	990,000
Clinker production by kiln D		tons/yr	990,000	990,000
Total clinker production		tons/yr	3,564,000	3,564,000
HFO consumption by kiln C		tons/yr	333	333
Coal consumption by kiln C		tons/yr	139,344	139,344
HFO consumption by kiln D		tons/yr	216	216
Coal consumption by kiln D		tons/yr	139,571	139,571

Emissions Reduction Calculation

Emissions Reduction Calculation			
Baseline emissions	**EB_y**	**t CO_2/yr**	**29,918**
Project emissions	**PE_y**	**t CO_2/yr**	**0**
Leakage emissions	**LE_y**	**t CO_2/yr**	**0**
Emissions reduction	**ER_y**	**t CO_2/yr**	**29,918**
Baseline Emissions			
Electrical output that can be theoratically produced	$Q_{OE,BL}$	TJ/yr	228.096
Electrical output ex ante estimation	$Q_{OE,y}$	TJ/yr	228.096
Capping factor	f_{cap}		1.00
Fraction of total electricity generated using waste heat	f_{wcm}		1
Electricity supplied by project activity	$EG_{i,j,y}$	MWh/yr	58,291
Efficiency of the existing power plant	$\eta_{Plant,j}$	%	44.12%
Weighted average coefficient of captive power plant	$EF_{CO2,i,j}$	t CO_2/TJ	62.898
Baseline emission factor	$EF_{Elec,is,j,y}$	t CO_2/MWh	0.51
Baseline emissions	**$BE_{elec,y}$**	**t CO_2/yr**	**29,918**
Project Emissions			
Project emissions	**PE_y**	**t CO_2/yr**	**0**
Leakage Emissions			
Leakage emissions	**LE_y**	**t CO_2/yr**	**0**

Annex 4

MONITORING INFORMATION

Please refer to section B.7.1 and B.7.2.

Annex 5

Approval from Environmental Protection Agency

Environmental Protection Agency
Environment Department
Govt. of NWFP

No. EPA/IEE/WHRU/981
Date: 7-2-2009

To

M. Mansoor Laghari
Senior DGM,
Lucky Cement Ltd.

Subject: **Lucky Cement Waste Heat Recovery & Utilization Project.**

I am directed to enclose herewith Legal Environmental Approval/ Decision Note on IEE of Lucky Cement Waste Heat Recovery & Utilization Project District Lakki Marwat for your information and further implementation, please.

Deputy Director (EIA)

15-2-2009

3rd Floor, SDU Building, Khyber Road, Peshawar Cantt.
Telephone: 92 (91) 9210263, Fax: 92 (91) 9210280

SCHEDULE-V

Decision on IEE

1.	**Name, address of proponent**:	M. Mansoor Laghari Senior DGM, Lucky Cement Ltd. Phone No.0960580122 Fax No. 0969580124
2.	**Description of project.**	The Proposed Project is located at Pezu, District Lakki Marwat. The project aims at recovering the heat wasted from the kiln and use it as energy. The recover heat will be fed to 10 MW steam turbine to generate electricity.
3.	**Location of project.**	Lucky Cement Waste Heat Recovery & Utilization Project is located in District Lakki Marwat.
4.	**Date of filing of EIA.**	06/02/2009 (Ref: EPA/Dairy No. 445)

5. After a careful review, the Environmental Protection Agency, Govt. of NWFP has decided to accord Conditional approval of the Initial Environmental Examination for Lucky Cement Waste Heat Recovery & Utilization Project in District Lakki Marwat of NWFP, in line with the guidelines issued by Pak. EPA and IEE/EIA Regulations, 2000 subject to the following terms & conditions:-

a) The proponent will adopt all precautionary and mitigatory measures identified in IEE report as well as any un-anticipated impacts during the construction and operation phase of project.

b) Health and safety measures should be provided to the staff in the factory.

c) Plantation should be carried out in and outside the premises of the factory.

6. The proponent shall be liable for compliance of section 13, 14 & 18 of IEE/EIA Regulations 2000, which enunciate the conditions for approval, confirmation of compliance, entry, inspection and monitoring of the proposed project.

7. This approval does not absolve the proponent of duty to obtain any other approval or clearance that may be required under any other law in force.

8. In exercise of the power under Section 12 of Pakistan Environmental Protection Act, 1997, the undersigned is pleased to approve the IEE report of the project with above mentioned terms & conditions

Dated: Peshawar 7-02-2009

Tracking/File.No. EPA/IEE/WHRU/ 98/

DIRECTOR GENERAL
EPA, NWFP.
3rd Floor, SDU Building,
Khyber Road Peshawar.

Annex 6

Advertisement for Stakeholders' Consultation Meeting


Email:- subh@pes.comsats.net.pk

ABC CERTIFIED

صبح ازل یہ مجھ سے کہا جبرائیل نے ۔۔ جو عقل کا غلام ہو وہ دل نہ کر قبول (اقبال)

Member A.P.N.S

روزنامہ صبح پشاور پاکستان

چیف ایڈیٹر سہیل شمشاد

THE DAILY SUBH PESHAWAR PAKISTAN

TUESDAY 20 JANUARY,2009 Reg. P.N 468 ABC CERTIFIED

پشاور، راولپنڈی اور ایبٹ آباد سے بیک وقت شائع ہونے والا کثیر الاشاعت قومی اخبار

جلد 9	منگل 20 جنوری 2009ء، 22 محرم الحرام 1430ھ قیمت 7 روپے	شمارہ 19

Lucky Cement

Concrete Progress

لکی سیمنٹ لمیٹڈ

گرین ہاؤس گیسز کے اثرات کو کم کرنے کیلئے جو کہ قدرتی تیل سے بجلی پیدا کرنے کی وجہ سے ہوتی ہے۔ لکی سیمنٹ لمیٹڈ Waste heat recovcery and utilisatin سسٹم کے ذریعہ بجلی پیدا کرنے کا منصوبہ بنا رہا ہے۔ یہ منصوبہ سیمنٹ بنانے کے عمل میں گرین ہاؤس گیسز کے اخراج کو فضا میں کم کرنے میں مدد کرے گا۔ لکی سیمنٹ نے منصوبہ (سی ڈی ایم) کے مطابق کیوٹو پروٹوکول کے تحت کیا ہے سیمنٹ فیکٹری (سی ڈی ایم) کے تحت سٹیک ہولڈر کے خدشات اور رائے کو بھی لیتی ہے۔ مقامی سٹیک ہولڈرز ماہرین اس مسئلے پر خطاب کریں گے اور اس کی بہتری کیلئے کردار کو اجاگر کریں گے۔ مقامی سٹیک ہولڈر کی میٹنگ مورخہ 22-01-2009 کو دن گیارہ بجے لکی سیمنٹ فیکٹری میں ہوگی۔ سٹیک ہولڈر میٹنگ کا ایجنڈا یہ ہوگا۔

(1) میٹنگ کیلئے چیئرپرسن کا انتخاب اور ایجنڈے کی منظوری۔ (2) سیمنٹ فیکٹری کے منصوبے کی تفصیلات۔ (3) سی ڈی ایم پروٹوکول کی تفصیلات اور مقامی سٹیک ہولڈر کا کردار۔ (4) مسئلے پر بحث (5) چیئرپرسن کا مقامی سٹیک ہولڈر کے خدشات کا حاصل بحث (6) ووٹ آف تھینکس۔

تمام ملازمین اور عوام الناس اور دوسرے لوگوں سے شرکت کی التماس ہے۔ اگر آپ میٹنگ میں نہیں آسکتے اور مسئلے کے متعلق جاننا چاہتے ہیں تو اپنی رائے متعلقہ فون نمبر ای میل یا فیکس پر رابطہ کر سکتے ہیں۔

0969-58012325

0969-580122

محمد منصور خان افغانی جنرل منیجر لکی سیمنٹ فیکٹری ہیڈ کوارٹرز ضلع لکی مروت

Translation of the Advertisement

In order to reduce the effects of Green House Gases due to HFO based electricity generation, Lucky Cement Limited is working on the project of electricity generation by waste heat recovery systems. The project will help reduce emissions of Green House Gases into the atmosphere in the cement manufacturing process. Lucky Cement Limited has structured the project activity as Clean Development Mechanism Project (CDM Project) under the Kyoto Protocol.
As per CDM, the cement factory realizes importance of comments & concerns of stakeholders. Local stakeholders & experts will present their views on this project and would suggest measures for its further improvement.

Local stakeholder meeting will be held on 22-01-2009 at 11:00 A.M. at Lucky Cement Factory Power Plant.

Agenda of stakeholders' meeting is as following:

1. Election of the chair of the meeting and approval of the proposed agenda
2. Details of the project undertaken by Cement Factory
3. Details of CDM Protocol and role of the local stakeholders
4. Discussion on the CDM project
5. Articulation of concerns/comments of local stakeholders by the chair person
6. Vote of thanks

All employees and general public are requested to participate in it. If you are not able to attend the meeting and want to know about the CDM project then you may contact at the following phone numbers or fax your opinion/comments.

Muhammad Mansoor Khan Laghari
General Manager
Lucky Cement Factory
Darra Pezu, District Lakki Marwat
Phone Number: 0969-580123-25
Fax Number: 0969-580122

Annex 7

Pictures of Stakeholders' Consultation Meeting

ATTENDANCE LIST

Lucky Cement Ltd

Clean Development Mechanism Project

Stake Holders Meeting held in Power Plant of LCL

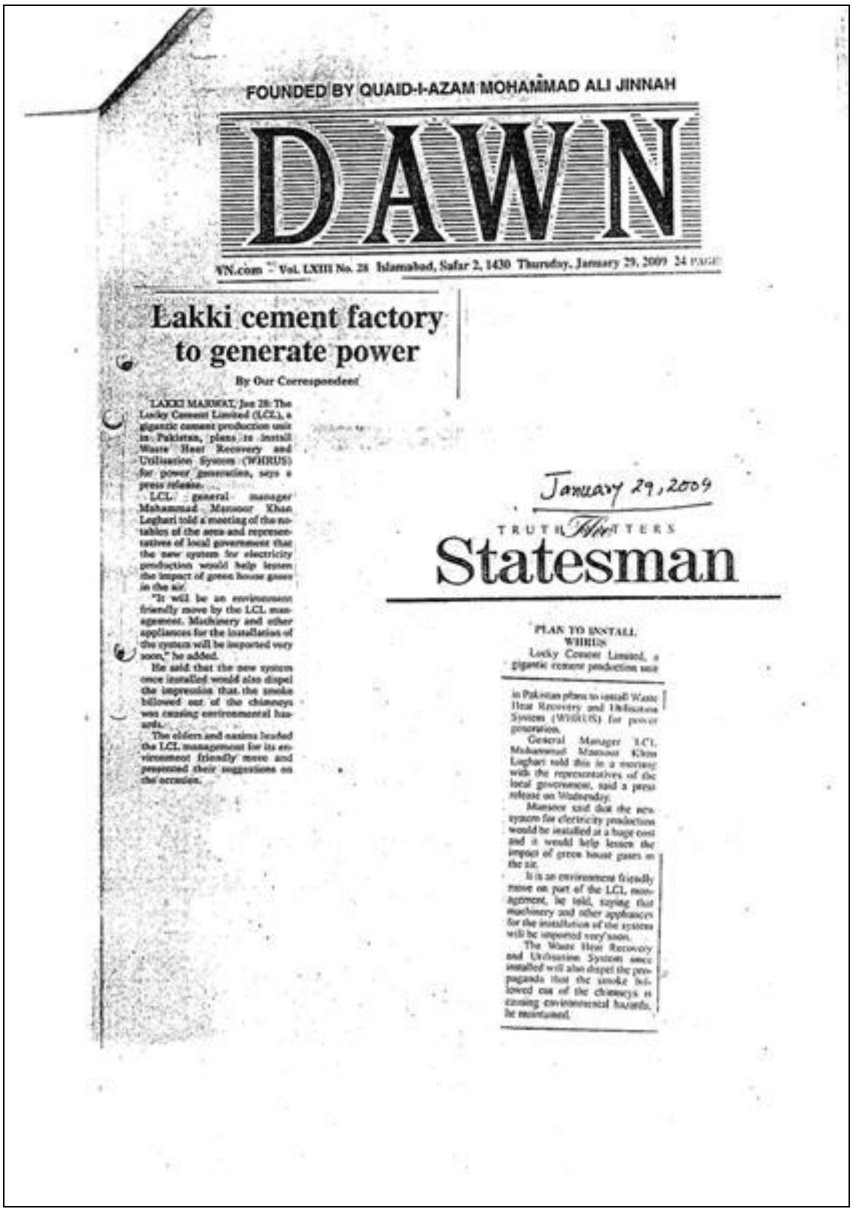
Election of Chairman of the Meeting:

Chairman: M. Mansoor Khan Leghari G.M. (P&A)

Proposed By: Shadi Khan Sr.D.M. (P&A)

Seconded By: Muhammad Ghulam Sr. A.M. (P&A)

Voters Signatures:



FOUNDED BY QUAID-I-AZAM MOHAMMAD ALI JINNAH

DAWN

VN.com – Vol. LXIII No. 28 Islamabad, Safar 2, 1430 Thursday, January 29, 2009 24 PAGES

Lakki cement factory to generate power

By Our Correspondent

LAKKI MARWAT, Jan 28: The Lucky Cement Limited (LCL), a gigantic cement production unit in Pakistan, plans to install Waste Heat Recovery and Utilisation System (WHRUS) for power generation, says a press release.

LCL general manager Mohammad Mansoor Khan Leghari told a meeting of the notables of the area and representatives of local government that the new system for electricity production would help lessen the impact of green house gases in the air.

"It will be an environment friendly move by the LCL management. Machinery and other appliances for the installation of the system will be imported very soon," he added.

He said that the new system once installed would also dispel the impression that the smoke billowed out of the chimneys was causing environmental hazards.

The elders and nazims lauded the LCL management for its environment friendly move and presented their suggestions on the occasion.

January 29, 2009

TRUTH … TTERS

The Statesman

PLAN TO INSTALL WHRUS

Lucky Cement Limited, a gigantic cement production unit in Pakistan plans to install Waste Heat Recovery and Utilisation Systems (WHRUS) for power generation.

General Manager LCL Muhammad Mansoor Khan Leghari told this in a meeting with the representatives of the local government, said a press release on Wednesday.

Mansoor said that the new system for electricity production would be installed at a huge cost and it would help lessen the impact of green house gases in the air.

It is an environment friendly move on part of the LCL management, he said, saying that machinery and other appliances for the installation of the system will be imported very soon.

The Waste Heat Recovery and Utilisation System once installed will also dispel the propaganda that the smoke billowed out of the chimneys is causing environmental hazards, he maintained.
