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

CONTENTS

Revision history of this document

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

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

Title: Waste Heat Recovery and Utilization for Power Generation at Cherat Cement Company Limited, Nowshera, Pakistan
Version: 11
Date: 25/10/2012

Table A.1.1: PDD versions

Version	Issue Date	Rationale
01	13/07/2009	First issuance for Global Stakeholder Consultation (as large scale project – with AM0024 / Version 02.1)
02	28/01/2010	Issuance in response to AM0024 based Validation Protocol
03	13/07/2010	Issuance in response to AM0024 based Validation Protocol, 2nd loop
04	05/10/2010	Issuance in response to further queries raised by the validator
05	19/05/2011	Reissuance for Global Stakeholder Consultation (as small scale project – with AMS-III.Q. /Version 04)
06	08/07/2011	Issuance in response to AMS-III.Q. based Validation Protocol
07	09/08/2011	Issuance for technical review by the DOE
08	08/10/2011	Issuance in response to additional queries raised by DOE.
09	23/12/2011	Issuance for update of start date of crediting period
10	05/01/2012	Issuance after final quality check before upload
11	25/10/2012	Issuance in response to the incompleteness message during registration

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

Cherat Cement Company Limited (hereafter Cherat Cement), a subsidiary of Ghulam Faruque Group (GFG), is a premier name in the field of cement manufacturing. It was incorporated in 1981 and started commercial production in 1985. The plant is located about 52 kilometres from Peshawar, near Nowshera. The factory is built on land bordering the Cherat Hills, the factory's source of high quality limestone. It is estimated that the limestone reserves are in excess of 400 million tonnes with more than sufficient quantity of slate.

Cherat Cement manufactures high quality grey Portland cement on the most modern and computerized production facilities and has an ISO 9001:2000 certification. It is equipped with the most updated production and quality control systems. Cherat Cement is one of the largest producers and suppliers of cement in Khyber Pakhtunkhwa (KPK) & Punjab. Through its exports, Cherat Cement has become Afghanistan's leading brand.

Cherat cement factory has a single kiln with clinker production capacity of 3200 tonnes per day (TPD). The kiln utilizes coal and Heavy Fuel Oil (HFO) as fuel. The waste heat from the kiln is currently vented to the atmosphere, with a portion of the heat recovered and recycled to heat up incoming raw material. At the time of investment decision, the factory had no grid connection and the only source of electricity was the captive power plant of capacity 27.89 MW which runs on HFO and Diesel. Cherat Cement connected to grid on March 1st, 2010 and will be using it as a backup power source.

The project activity involves the installation of three Heat Recovery Steam Generators (HRSGs), having total capacity of 27.1 TPH, on 3200 TPD kiln and utilize the steam for 7 MW electricity generation to displace the fossil fuels based electricity generated in the existing captive power plant. The project will reduce Greenhouse Gas (GHG) emissions by 25,761 t CO_2 per year and will lead to sustainable development.

In the absence of the project activity the existing situation will continue i.e. the waste heat from the clinker production process will be vented to the atmosphere with only a small portion recovered to heat the incoming raw materials and the fossil fuel based electricity from the captive power plant will be used at the plant.

The project activity will result in transfer of efficient and modern technology from China to the region. The successful operation of this new efficient technology will also encourage others to adopt similar technologies leading to further conservation of energy and sustainable development.

The project activity will result in:

Environmental Development

- significant reduction in the emissions of greenhouse gases within the project boundary
- improvement of the local environment by reduction in temperature of the vented hot air
- improvement of the local environment by less contamination through replacement of fossil fuel based electricity by non contaminating electricity source
- conservation of local fossil fuel resources by avoiding fossil fuel based electricity from the existing captive power plant

Social Development

- alleviation of poverty by providing employment opportunities to the local community during construction phase
- less health impact for the population through less emission of greenhouse gases and particles
- improvement of the skill set for local inhabitants through training and capacity building in order to grow their technical skills

Economic Development

- creation of new jobs during construction and operation phase of the project
- cost effective way of generating electricity since no additional fuel is used

Technology Development

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

A.3. Project participants:

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

Table A.3.1: Project Participants

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)

Islamic Republic of Pakistan (host)	Cherat Cement Company Limited (private entity)	No
Islamic Republic of Pakistan (host)	Carbon Services (Private) Limited (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:

A.4.1.1. Host Party(ies):

Islamic Republic of Pakistan

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

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

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

Nowshera

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

The project is located at:

Cherat Cement Factory,
P.O. Box 28, Village Lakrai,
Nowshera, Khyber Pakhtunkhwa, Pakistan

The company is headquartered at:

Modern Motors House
Beaumont Road
75530 - Karachi, Sindh, Pakistan.

Cherat Cement Factory is located at following geographical coordinates:
Latitude: 33.9063613º (33° 54' 22")
Longitude: 71.9103348º (71° 54' 37")

Fig A.4.1.4.1: Map of Pakistan [1]

Fig A.4.1.4.2: Location of the Project Site [2]

[1] Source: http://www.wikipedia.org

[2] Source: http://maps.google.com

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

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**

Cherat cement factory has a single kiln of 3200 TPD. The kiln is fossil fuel based and utilizes coal as primary fuel and HFO as secondary fuel. Currently, the waste heat from the kiln is vented to the atmosphere with only a small portion of waste heat recovered and recycled to heat up incoming raw material.

At the time of investment decision, the factory had no grid connection and the only source of electricity was the 27.89 MW captive power plant which has four HFO based Wartsila engines and four diesel based Caterpillar engines. Cherat Cement connected to grid on 01/03/2010 and will be using it as a backup power source.

Table A.4.2.1 below shows the details of HFO based Wartsila engines:

Table A.4.2.1: Detail of Wartsila Engines

Number of Gensets	**4**		
Manufacturer	**Wartsila Finland Oy**		
Model	**Wartsila Vasa 32**		
Engine Type	**Rated Output[3]**	**Date of Commissioning**	**Designed Efficiency**
VASA 16V32E	5100 kW	Feb 1996	41.04%
VASA 16V32E	5100 kW	Feb 1996	
VASA 16V32E	5100 kW	Feb 1996	
VASA 18V32 D	6750 kW	Jul 2006	45.09%

Table A.4.2.2 below shows the details of diesel based Caterpillar engines:

Table A.4.2.2: Detail of Caterpillar Engines

Number of Gensets	**4**		
Manufacturer	**Caterpillar**		
Engine Type	**Rated Output**	**Date of Commissioning**	**Designed Efficiency**
3516	1460 kW	1994	37.84%
3516	1460 kW	1994	
3516	1460 kW	1994	
3516	1460 kW	1994	

The project activity involves installation of three HRSGs and one steam turbine. Two HRSGs (3.7 TPH each) on pre-heater end and one HRSG (19.7 TPH) on cooler end of 3,200 TPD kiln will be installed. Table A.4.2.3 shows the technical characteristics of HRSGs.

[3] At 100% load

Table A.4.2.3: Technical characteristics of HRSGs

Manufacturer	National Wanda Boiler Co. Ltd		
Quantity	01	01	01
Location	Pre-heater end of the kiln	Pre-heater end of the kiln	Cooler end of the kiln
Capacity	3.7 TPH	3.7 TPH	19.7 TPH
Steam Pressure	1.6 MPa	1.6 MPa	1.6 MPa
Steam Temperature	290 ºC	290 ºC	400 ºC

The combined superheated steam generated by the three HRSGs is fed to 7 MW steam turbine to produce 5.35 MW net electricity[4]. Table A.4.2.4 shows the technical characteristics of steam turbine. The electricity generated by the project activity is fully consumed within the cement works.

Table A.4.2.4: Technical characteristics of steam turbine

Quantity	**1**
Manufacturer	**Hangzhou Chinen Steam Turbine Power Co. Ltd**
Type	**Condensing**
Capacity	**7 MW**
Max. temperature	**350 ºC**
Max. steam pressure	**1.5 MPa**

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. The generated electricity will displace 41,730[5] MWh/y import from the Captive Power Plant, and will result in 25,761 t CO_2 emission reductions per year.

In the absence of the project activity the existing situation will continue i.e. the waste heat from the clinker production process will be vented to the atmosphere with only a small portion recovered to heat the incoming raw materials and the fossil fuel based electricity from the captive power plant will be used at the plant.

National Wanda Boiler Co. Ltd is the manufacturer of HRSGs and Hangzhou Chinen Steam Turbine Power Co. Ltd is the manufacturer of Steam Turbine. Both companies are Chinese. Therefore the project involves transfer of Chinese technology to the region. The import of new equipments (steam turbo-generator, HRSG, and allied equipments) not merely means technology transfer but skill transfer as well. This kind of innovative and energy efficient technology would serve to demonstrate the operational efficiency of such systems and encourage others to adopt similar technologies leading to further conservation of energy, fuel and environment.

As the technology used in the project activity is new to the region, proper training was essential for successful operation of WHR (Waste Heat Recovery) equipment. Five personnel from Cherat Cement visited China in March-April 2009 to complete a one month training program from the experts of this technology. These personnel then provided further training to their subordinates at the plant.[6]

[4] According to the supporting document "Detailed calculation of performance guarantee of 7 MW Waste Heat Recovery Project at Cherat Cement Plant", an installed capacity of 7 MW can deliver, under optimal local conditions a gross capacity of 5.95 MW and, once auxiliary consumption is taken into account (10%), a net capacity of 5.35 MW.

[5] Performance guaranty value provided by the supplier (excluding auxiliary consumption) = 5.35 MW (supporting document provided to DOE)

Expected days of operation of the cement plant = 325 days

Power generated by steam turbine = 5.35 * 325 * 24 = 41,730 MWh

[6] All documents related to employees' training for new WHR system have been provided to the DOE.

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

The annual & total estimation of emission reductions for the fixed crediting period of 10 years is provided below in Table A.4.3.1.

Table A.4.3.1: Estimated emission reductions

Year	Annual estimation of emission reductions in tonnes of CO_2e
Year 1	25,761
Year 2	25,761
Year 3	25,761
Year 4	25,761
Year 5	25,761
Year 6	25,761
Year 7	25,761
Year 8	25,761
Year 9	25,761
Year 10	25,761
Total estimated reductions (tonnes of CO_2e)	**257,610**
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**25,761**

A.4.4. Public funding of the project activity:

No public funding is involved in this 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 Cherat Cement 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:

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

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:

The present project activity involves waste hear recovery from cement manufacturing kiln. For the waste heat from the kiln, 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 kiln 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 kiln 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 25.761 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 waste pressure should be measurable;	The electricity produced by the project activity is measurable as indicated in §B.7. of the PDD. **Condition is fulfilled.**

Applicability condition	*Applicability check*
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 and not in a 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 kiln only.
5. (e) The emission reductions are claimed by the generator of energy using waste energy;	The emission reductions are claimed by Cherat Cement Limited, which is the generator of the waste heat. **Condition is fulfilled.**

Applicability condition	*Applicability check*
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 equipments currently being used; and (ii) Crediting period;	The source of energy in the baseline is the kiln which has 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 produced for rated plant capacity per unit of product produced.	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.**

Applicability condition	*Applicability check*
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 kiln (industrial process). **Condition is fulfilled.**

B.3. Description of the project boundary:

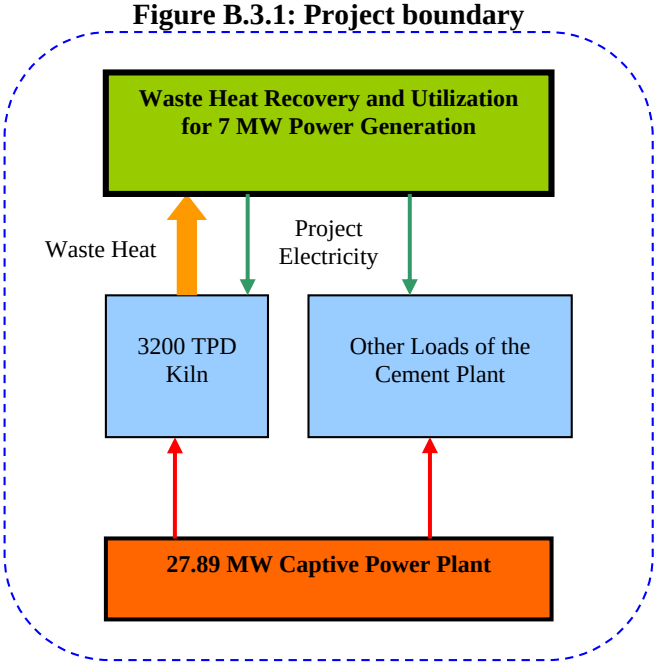
According to paragraph 7 of AMS-III.Q. / Version 04, "the physical, geographical site of the facility where the waste gas/heat/pressure is produced and transformed into useful energy delineates the project boundary."

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.

The physical boundary of the project is fuel consumption and electricity generation by captive power plant, clinker production process in the cement kiln, and electricity generated by the waste heat recovery project. This is illustrated below at Figure B.3.1.

Figure B.3.1: Project boundary



B.4. Description of baseline and its development:

In the baseline situation, the high temperature exhaust of the kiln 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 kiln 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 July 2004 to June 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 July 2006 to June 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:

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

The starting date of the project activity is 29/11/2007 when the contract was signed between Cherat Cement and supplier of WHR project equipment (Sinoma Energy Conservation Limited). The project proponent was aware of the CDM long before the start date of the project activity and CDM income proved to be a decisive factor in the investment decision taken on the 25/10/2007 to implement the project[7]. Discussions with CDM consultants started in January 2008 and during the whole implementation phase before validation, Cherat Cement was accompanied by CDM consultants.

Table B.5.1: Project Timeline

Milestone	Date	Source
CDM Awareness	Since Dec 06	Letter from Pakistan Sugar Mill Association (PSMA) to the Chief Executives of all sugar mills including Mirpurkhas Sugar Mill which is also a subsidiary of GFG group along with Cherat Cement and some other companies
Investment Decision	25/10/2007	Extract from Minutes of the Board of Directors Meeting
Contract with equipment supplier (Starting date of the project activity)	29/11/2007	Contract between Cherat Cement and Sinoma Energy Conservation Limited
Date of L/C	10/12/2007	L/C
Proposal from Factor Consulting[8]/Carbon Services	29/02/2008	Email from Mr. Omar Malik, Director Carbon Services to Mr. Azam Faruque, CE Cherat Cement.
Contract with First Climate/Carbon Services	Apr 2008	Email from Mr. Omar Malik, Director Carbon Services to Mr. Azam

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

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

		Faruque, CE Cherat Cement.
LOI for Civil Works	11/11/2008	Letter from Mr. S. Nasim Ahmad, Resident Director, Cherat Cement to A.S. Enterprises
Environmental approval from Environmental Protection Agency (EPA)	05/03/2009	Environmental approval
Request for revision of AM0024 / Version 02.1	11/03/2009	AM_REV_0141
Request for quotation for CDM validation to DOE as large scale project – with AM0024 / Version 02.1	03/03/2009	Request for quotation for CDM validation to TUEV SUED Industrie Service GmbH
Application for Host Country Approval	06/04/2009	
Quotation for CDM validation from DOE as large scale project – with AM0024 / Version 02.1	25/06/2009	Quotation for CDM validation from TUEV SUED Industrie Service GmbH
Issuance of Host Country Approval	10/06/2009	
CDM validation order to DOE as large scale project – with AM0024 / Version 02.1	10/07/2009	CDM validation order to TUEV SUED Industrie Service GmbH
First issuance for Global Stakeholder Consultation (as large scale project – with AM0024 / Version 02.1)	10/07/2009	
Start of Global Stakeholder Process (GSP) as large scale project – with AM0024 / Version 02.1	06/08/2009	UNFCCC CDM website
Project Commissioning	Feb 2010	Company information
Reply to AM_REV_0141 (methodology to be merged with ACM0012, but issues not addressed)	16/11/2010	AM_REV_0141
Request for revision of AMS-III.Q. / Version 03	10/12/2010	SSC_497
Approval of request for revision and issuance of AMS-III.Q. / Version 04	15/12/2011	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 kiln 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 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"*

- 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 (13.50%) 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 Cherat Cement For instance, Cherat Cement 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 in 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 as a reference rate for all corporate in Pakistan[9]. 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, Cherat Cement considered a 6 month tenor average KIBOR of 10.00 % for September 2007[10] and assumed a credit spread of 350 basis points which was based on a loan offer extended to Cherat Cement by United Bank Limited, a local bank in Pakistan[11]. The benchmark thus evaluated was (10.00 % + 3.5%) 13.50 %.

[9] 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

[10] KIBOR rate of September 2007 are available at the website of State Bank of Pakistan:
http://sbp.org.pk/ecodata/kibor/2007/Sep/index.asp

[11] A copy of the United Bank Limited's loan offer letter to Cherat Cement has been provided to DOE

This corporate lending rate calculation is in line with the guidance provided by Citibank [12] 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 (13.50%) is appropriate as it falls within the range of commercial lending rate of 12.57-13.57 %, prevalent at the time of investment decision[13].

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 Cherat Cement is 14.12%[14]. However, it is less conservative when compared with the commercial lending rate of 13.50%.

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 13.50% 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
Decision Moment	25/10/2007		Extracts form the Minutes of the Board of Directors Meeting held 25/10/2007
Exchange rate US $ --> PKR	61.00	PKR	Feasibility Study
Depreciation period	20	years	Company Information
Technical lifetime of the plant	20	years	Company Information
Tax on net income	35%		Tax rate document "Rates and Taxes for Companies"
Export Sales	40%		Company Information (Export Sales are exempted from taxes)

The total project investment is 966,090,433 PKR. This includes machinery and material, training, management and technical services, duties, taxes and freight charges as well as local costs.
Depreciation is calculated using proportional depreciation rate, the fair value of the project investments will be 117,332,767 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 IRR.

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

[13] This is evidenced by a news article a copy of which has been provided to DOE. The article is also available at http://archives.dawn.com/dawnftp/72.249.57.55/dawnftp/2007/05/24/ebr4.htm

[14] Company Information; supporting WACC calculation has been provided to DOE

Cherat Cement Factory's export sales of 40% are exempted form tax and are deducted for the tax calculation.
Concerning the costs for fuel consumption, the calculations were based on the historical values from July 2006 to June 2007. 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 generation on HFO	MWh/y	87,270.995	46,130.076
Captive generation on diesel	MWh/y	1,249.600	660.519
HFO			
HFO consumption	tons/y	21,798.52	11,522
Cost of HFO	PKR/y	474,401,191	250,761,012
Diesel			
Diesel consumption	Ltrs/y	386,419.88	204,255
Cost of diesel	PKR/y	12,249,510	6,474,899

The Operation and Maintenance (O&M) Costs considered for the project activity represent 5% of the total investment costs with an annual increase of 13% due to rapidly increasing labour wages and costs associated with technical services. Such increase has been estimated on the basis of the Consumer Price Index (CPI) values reported for years 2003 to 2007 in the State Pakistani Bank (SPB) Annual Report 2006-2007, and extrapolated with a logarithmic curve[15], as shown in the CPI Forecast spread sheet, included in the IRR calculation Excel file. From the estimated values for the 20 years following the investment decision, an average increase of 13% per year has been calculated. The approach of using CPI as an indicator of the inflation for wages and technical services is considered appropriate as it is in complete harmony with the method for determination of increase in O&M cost as specified in Cherat Cement technical service/maintenance contract with supplier of existing power generation equipment providing the same output as provided by the project activity. It is clearly mentioned in this contract that any increase in O&M cost would be determined based on the CPI prevalent at the time of determining such increase[16].

Also, every 5 years, an overhaul is necessary. This represents 4.5% of the investment costs indexed by the annual increase of 13%, same as Operation and Maintenance Costs; this assumption (13% increase in overhaul cost) is considered reasonable because inflation dynamics of major overhaul cost and O&M cost are similar as both depend on the domestic evolution of labour and technical service costs.

The increase of the fuel costs is not linked to the CPI but instead determined as per the guidance provided in Petroleum Policy of Pakistan according to which any future change in fuel prices in Pakistan is intrinsically linked to fluctuations in crude oil prices in the international market. Thus increase in fuel costs is evaluated on the basis of the Annual Energy Outlook 2006 (AEO 2006, a database of international fuel prices) prepared by the Energy Information Administration[17] and fuel prices data provided in the 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.[18]

[15] The choice of logarithmic curve for data extrapolation is appropriate as it yields the most realistic as well as conservative value for increase in CPI. Detailed CPI forecast analysis has been provided to DOE.

[16] Copy of CCCl Maintenance Agreement with Wartsila Pakistan has been provided to the DOE.

[17] www.eia.doe.gov

[18] It should be noted the fuel prices in Pakistan are set by independent national bodies who, as per Petroleum Policy, index these to crude oil prices in the international market. Therefore, forecasting any increase in the fuel prices solely on the basis of national historical fuel prices or CPI would not be appropriate. Thus, the future price evolution

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 exchange rate from US Dollars to Pakistani Rupee.[19]
The average price increase for 20 years (from 2007 to 2026) resulted in 1.92% for HFO and 0.93% for Diesel[20]. Table B.5.4 describes the information concerning the Operation and Maintenance Costs as well as the Estimated Cost Increases of fuels.

Table B.5.4 Operation and Maintenance Costs & Fuel Cost Increases

General Information	Value	Unit	Source of data
O&M Cost	48,304,522	PKR	Consultants Letter
Major Overhaul Cost Year 5	80,098,155	PKR	Consultants Letter
Major Overhaul Cost Year 10	147,575,659	PKR	Consultants Letter
Major Overhaul Cost Year 15	271,898,585	PKR	Consultants Letter
Price Increase O&M Costs	13.00%	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

The resulting IRR of the project saving potential by introducing the project activity is 7.60%. As the benchmark is determined at 13.50%, the project activity would not be implemented. Considering the CER revenues, the project IRR would come up to 14.07% and so gets an economically attractive investment option for Cherat 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, O&M cost[21], and the plant load factor. The results of the sensitivity analysis are shown in Table B.5.5.

Table B.5.5: Sensitivity Analysis

Sensitivity Analysis	-10%	Base Case	10%	Break Even Point
Project Investment	10.97%	7.60%	4.31%	-16.90%
HFO Cost	#NUM!	7.60%	13.08%	10.98%
O&M Cost	10.85%	7.60%	#NUM!	-45.45%
Plant load factor	#NUM!	7.60%	13.19%	10.72%

The sensitivity analysis shows that the results are robust: even a variation of +/- 10% in the key parameters is not sufficient to make the project economically attractive. For the project investment, the limit of additionality is situated at a total investment cost decrease of 16.90%. This could not be considered likely at the time of investment decision, due to the precise cost estimates sourced from

calculation is appropriate as it takes into account both international as well as national trends in fuel price variation hence more realistic.

[19] The analysis is based on the fuel prices (in real term) provided by AEO 2006, and firstly adjusts them with the inflation and then correlates them to fuels used in the project activity and their prices in Pakistan. A very high correlation is found (the statistical correlation factor R^2 is 99% and 96% for HFO and diesel respectively). This proves that the use of international prices is a correct proxy for the Pakistani price evolution, on the long term.

[20] Detailed calculations are presented in the separate Excel file, *Energy Prices Future Evolution Calculation*.

[21] Diesel cost and overhaul cost are not included in the sensitivity because, in line with clause 20 of the Guidelines on the assessment of investment analysis (v.05), only costs and revenues contributing to more than 20% of the total are to be considered. Diesel cost and overhaul cost have a marginal impact on the total project cost/saving (below 20%) so these can be neglected.

suppliers and the significant expected inflation, which could actually bring the total investment up, rather than down.[22]

Similarly, an initial HFO price increase of 10.98% or more would turn the project additional, but this is basically impossible, as the initial price is the actual historical data, so it cannot be changed. Also, its increase over time in a way that makes the project additional, is unlikely, given that the forecast of increase in fuel prices based on the AEO 2006 and Pakistan Energy Year Book data is much lower (1.92%).

The O&M costs would have to decrease by 45.45% to make the project economically attractive. This is clearly unlikely, as the projected inflation for technical services is in the order of +13%.

Lastly, an increase of the plant load factor of 10.72% would make the project IRR to reach the benchmark. But this would mean that, instead of 85%, the plant load factor would be 94.1%, which is a value unacceptable from the technical point of view, as steam turbines and power generation equipment in general are designed for continues operation in the range of 75-85%.

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:

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

[22] Evidences of actual project investment (993 million PKR) have been provided to DOE which show that it is more than what was originally assumed (966 million PKR) at the time of investment decision.

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:

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

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 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:

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

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 three types of gensets as described in section A.4.2. As a conservative approach, the highest optimal operation (designed) efficiency among the three types of gensets is selected as constant efficiency of the existing captive plant.

Table B.6.1.1: Efficiency of existing captive plant

Wartsila 16V32E Gensets		
Heat value of HFO for efficiency test	MJ/kg	42.5
Specific consumption of HFO	g/kWh	206.4
Heat rate of Wartsila 16V32E gensets	kJ/kWh	8,772
Efficiency of Wartsila 16V32E gensets	%	41.04%
Wartsila 18V32 Genset		
Heat value of HFO for efficiency test	kJ/kg	42.7
Specific consumption of HFO	g/kWh	187
Heat rate of Wartsila 18V32 genset	kJ/kWh	7,985
Efficiency of Wartsila 18V32 genset	%	45.09%
Caterpillar 3516 Gensets		
Capacity of genset	kW	1,460
Diesel consumption	Ltrs/hr	387
Specific consumption of diesel	Ltrs/MWh	265
Heat value of diesel for efficiency test	kJ/kg	42,780
Density of diesel for efficiency test	g/Ltr	838.9
Heat rate of Caterpillar 3516 genset	kJ/kWh	9,513
Efficiency of Caterpillar 3516 genset	%	37.84%

For Wartsila 16V32E gensets, the consumption and net calorific values of fuel have been taken from Test Protocol by OEM (Original Equipment Manufacturer). Heat rate and efficiency has been calculated based on the test record. Similarly for Wartsila 18V32 genset and Caterpillar 3516 gensets, the optimal operational values for calculation of efficiency have been taken from specifications sheets provided by corresponding OEM. 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 18V32 genset. As a conservative approach, a constant efficiency of 45.09% for the captive power plant is selected as per option (i) for efficiency of power plant. Hence

$\eta_{plant,j} = 45.09\%$

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 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 several technical reasons, Method-3 for f_{cap} calculation is chosen. Since the waste energy from the WECM (i.e. hot exhaust 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}:

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

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:

Installed Capacity of Steam Turbine = 7 MW
Gross capacity of Steam Turbine (under optimal conditions) = 5.95 MW which corresponds to a load factor of 85%

Gross electricity generation is thus equal to 5.95*325*24 = 46,410 MWh/y
Thus, maximum energy that could be recovered by waste heat recovery equipment,
$Q_{OE,BL}$ = 46,410 MWh/y * 3600 * 10^{-6} = 167.076 TJ/y electrical.

The calculation of maximum recoverable is conservative as $Q_{OE,BL}$ is based on gross capacity (5.95 MW) instead of installed capacity (7 MW).
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/y)
BE_y	Baseline emissions in year *y* (t CO_2e/y)
PE_y	Project emissions in year *y* (t CO_2/y)
LE_y	Leakage emissions in year *y* (t CO_2/y)

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 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 :	The value of NCV of HFO 17,184 BTU/lb was taken from laboratory test of HFO sample. For emission reduction calculations this value was converted into TJ/t using the following formula: NCV in TJ/t = NCV in BTU/lb *0.001055056/(0.0004535924*10^6) The value of NCV calculated by above formula is 0.040 TJ/t
Any comment:	

Data / Parameter:	**NCV_{diesel}**
Data unit:	MJ/l (Mega joule per litre)

Description:	Net Calorific Value of diesel
Source of data used:	Laboratory analysis
Value applied:	35.91
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of NCV of diesel 18,271 BTU/lb was taken from laboratory test of diesel sample. For emission reduction calculations this value was converted into MJ/Ltr using the following formula: NCV in MJ/l = NCV in BTU/lb*0.001055056/0.4535924*Density of diesel The density of diesel taken from the laboratory test report is 0.8449 kg/l The NCV calculated by above formula is 35.91 MJ/Ltr
Any comment:	

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. 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 diesel fuel
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. 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:	kWh/y (kilo watt hours per year)
Description:	Electricity generated on HFO by captive power plant in historical years
Source of data used:	Historical data from log sheets
Value applied:	Year 2004/05: 69,706,479.93 Year 2005/06: 55,712,090.44

	Year 2006/07 | 87,270,994.98
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 Jul 2004 to Jun 2007, QMS procedures are followed in measurement and reporting this value.
Any comment:	

Data / Parameter:	$E_{diesel,historical}$
Data unit:	kWh/y (kilo watt hours per year)
Description:	Electricity generated on diesel by captive power plant in historical years
Source of data used:	Historical data from log sheets
Value applied:	Year 2004/05 | 1,979,780 Year 2005/06 | 2,028,620 Year 2006/07 | 1,249,600
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 Jul 2004 to Jun 2007, QMS procedures are followed in measurement and reporting this value.
Any comment:	

Data / Parameter:	$FC_{HFO,historical}$
Data unit:	t/y (metric tonnes per year)
Description:	HFO consumption by captive power plant in historical years
Source of data used:	Historical data from log sheets
Value applied:	Year 2004/05 | 16,741.15 Year 2005/06 | 13,947.32 Year 2006/07 | 21,798.52
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 Jul 2004 to Jun 2007, QMS procedures are followed in measurement and reporting this value.
Any comment:	

Data / Parameter:	$FC_{diesel,historical}$
Data unit:	l/y (Litres per year)
Description:	Diesel consumption by captive power plant in historical years
Source of data used:	Historical data from log sheets
Value applied:	

	Year 2004/05	598,892.38	
	Year 2005/06	628,572.00	
	Year 2006/07	386,419.88	
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 Jul 2004 to Jun 2007, QMS procedures are followed in measurement and reporting this value.		
Any comment:			

Data / Parameter:	$Q_{OE,BL}$
Data unit:	TJ/y (Tera joule per year)
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 (5.95 MW x 325 days/y of clinker production x 24 h/d x 3600 MJ/MWh x 10^{-6} TJ/MJ)
Value applied:	167.076
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 input parameters and notations used in emission reduction calculations 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 * 41,730 * 0.62

= 25,761 tCO_2/y

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:

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

CDM – Executive Board

= 77.311 / 45.09% * 3.6 * 10^{-3}

= 0.62 tCO_2/MWh

The emission factor calculated as 0.62 tCO2/MWh is used for ex ante calculation of baseline emissions, (detailed calculations of emission factor are provided in ER Calculation sheet and also in Annex 3). It is based on the actual fuel mix used in the captive generation (see below), and on the highest efficiency (regardless the actual engine providing the captive electricity), which is the most conservative choice.

Fuel (HFO and Diesel) consumption of captive power plant and fuel NCVs will be monitored for ex-post calculation of emission factor of the captive power plant.

Since the captive power plant consumes more than one type of fossil fuel (HFO 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:

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

= (15,344 * 0.040 * 77.4 + 472,229 * 35.91/10^6 * 74.1) / (15,344 * 0.040 + 472,229 * 35.91/10^6)

= 77.311 tCO_2/TJ

Following equation is used to determine f_{cap}:

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

= 167.076/ 167.076 = 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:

CDM – Executive Board

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

= 25,761 – 0 – 0 = 25,761 tCO_2/y

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 is provided below.

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

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
Year 1	0	25,761	0	25,761
Year 2	0	25,761	0	25,761
Year 3	0	25,761	0	25,761
Year 4	0	25,761	0	25,761
Year 5	0	25,761	0	25,761
Year 6	0	25,761	0	25,761
Year 7	0	25,761	0	25,761
Year 8	0	25,761	0	25,761
Year 9	0	25,761	0	25,761
Year 10	0	25,761	0	25,761
Total (tonnes of CO_2 e)	**0**	**257,610**	**0**	**257,610**

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:	**$COEF_{diesel}$**
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 at captive power plant
Source of data to be used:	Laboratory analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.040
Description of measurement methods and procedures to be applied:	Monitoring method: Lab test Data type: Measured Archiving procedure: Paper and Electronic Recording Frequency: Annually
QA/QC procedures to be applied:	The fuel sample will be sent to a recognized laboratory at least once a year for analysis
Any comment:	The value of NCV of HFO 17,184 BTU/lb was taken from laboratory test of HFO sample. For emission reduction calculations this value was converted into TJ/t using the following formula: NCV in TJ/t = NCV in BTU/lb *0.001055056/(0.0004535924*10^6) The value of NCV calculated by above formula is 0.040 TJ/t

Data / Parameter:	**NCV_{diesel}**
Data unit:	TJ/l (Tera joule per litre)
Description:	Net calorific (lower heating) value of diesel to be used at captive power plant
Source of data to be used:	Laboratory analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.00003591
Description of measurement methods and procedures to be applied:	Monitoring method: Lab test Data type: Measured Archiving procedure: Paper and Electronic Recording Frequency: Annually
QA/QC procedures to be applied:	The fuel sample will be sent to a recognized laboratory at least once every month for analysis.
Any comment:	The value of NCV of diesel 18,271 BTU/lb was taken from laboratory test of

	diesel sample. For emission reduction calculations this value was converted into MJ/Ltr using the following formula: NCV in MJ/l = NCV in BTU/lb*0.001055056/0.4535924*Density of diesel The density of diesel taken from the laboratory test report is 0.8449 kg/l The NCV calculated by above formula is 35.91 MJ/Ltr

Data / Parameter:	$Q_{OE,y}$
Data unit:	TJ/y (Tera joule per year)
Description:	Electrical output generated by waste heat recovery based steam turbo-generator during year *y*
Source of data to be used:	Log sheets of Cherat Cement
Value of data	167.076
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: After every three years Frequency of measurement: Continuous Frequency of recording: Daily Archiving procedure: Electronic 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:	**$EG_{i,j,y}$**
Data unit:	MWh/y (Megawatt hours per year)
Description:	Net electricity generated by waste heat recovery based steam turbo-generator
Source of data to be used:	Log sheets of Cherat Cement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	41,730
Description of measurement methods and procedures to be applied:	Monitoring method: Electricity generation measurement Data type: Measured Monitoring instrument: Energy meter Frequency of calibration: After every three years Frequency of measurement: Continuous Frequency of recording: Daily Archiving procedure: Electronic Responsibility: See Table B.7.2.2
QA/QC procedures to be applied:	QMS procedures will be followed in measurement, recording, and reporting of the parameter.
Any comment:	The value applied for ex-ante calculation of emission reduction i.e. 41,730 MWh has been calculated using steam turbine performance guaranty value provided by the equipment supplier.

Data / Parameter:	**$FC_{HFO,y}$**
Data unit:	t/y (Metric tonnes per year)

Description:	HFO consumption by captive power plant
Source of data to be used:	Power generation log sheets of Cherat Cement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	15,344
Description of measurement methods and procedures to be applied:	Monitoring method: Flow measurement Data type: Measured Frequency of measurement: Continuous Monitoring instrument: Flow meter Calibration frequency: After every three years Archiving procedure: Electronic Recording Frequency: Daily
QA/QC procedures to be applied:	QMS procedures will be followed in measurement, recording, and reporting of the parameter.
Any comment:	

Data / Parameter:	**$FC_{diesel,y}$**
Data unit:	l/y (Litres per year)
Description:	Diesel consumption by captive power plant
Source of data to be used:	Power generation log sheets of Cherat Cement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	472,229
Description of measurement methods and procedures to be applied:	Monitoring method: Dip measurement Data type: Measured Monitoring instrument: Dip ruler Calibration frequency: The dip meter shall be replaced with new one when it shall be providing erroneous readings. Archiving procedure: Electronic Recording Frequency: Daily
QA/QC procedures to be applied:	QMS procedures will be followed in measurement, recording, and reporting of the parameter.
Any comment:	

B.7.2 Description of the monitoring plan:

Data will be collected daily by Shift Engineers at captive power plant and WHR based power plant. They will also prepare daily log sheets of electricity generation and fuel consumption for existing captive power plant. Electricity generated by the project activity (steam turbo-generator) shall also be recorded into log sheets by Shift Engineers. Initially the data will be verified by Manager. At final stage, Senior Manager will verify the data at the end of each month.

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

Table B.7.2.1 describes the devices used at Cherat cement factory to measure different parameters:

Table B.7.2.1: Monitoring Information

Item	Parameter	Recording Frequency	Description of equipment used	Calibration Mode		Calibration Frequency
				Internal Calibration	External Calibration	
Fuel Consumption at Captive Power Plant	HFO consumption	Daily	Flow meter	E&I Department	-	3 years
	Diesel consumption	Daily	Dip ruler	E&I Department	-	3 years
Project Electricity	Gross electricity generated by steam turbo-generator	Daily	Energy meter	-	By Third Party	3 years
	Net electricity generated by steam turbo-generator	Daily	Energy meter	-	By Third Party	3 years

Table B.7.2.2 shows the designation of the personnel involved in the monitoring plan.

Table B.7.2.2: Designation of personnel involved in monitoring plan

Parameter	Daily Data Log Preparation	Initial Data Verification	Data Verification	Data Auditing	
				Designation	Frequency
Fuel consumption at captive power plant	Shift Engineer	Manager	Sr. Manager	Auditors from GFG-Group (Head Office)	Annually
Electricity generation by steam turbo-generator	Shift Engineer	Manager	Sr. Manager	Auditors from GFG-Group (Head Office)	Annually

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:
25/10/2012

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:

>>
29/11/2007 [23]

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:

>>
01/12/2012

C.2.2.2. Length:

>>
10 years 0 months

[23] Date of the contract between Cherat Cement and the main equipment supplier

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 is 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 procedures are in place.

The environmental analyses conducted by Cherat Cement Factory 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 and the accompanying approval request letter were submitted to EPA on 24th February, 2009. Approval letter was issued on 5th March, 2009. A copy is shown in Annex 6. The approval letter does not raise any particular issue with regard to the environmental impact of the project.

SECTION E. Stakeholders' comments

>>

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

The stakeholder consultation meeting is required by the Designated National Authority (DNA) of Pakistan for issuance of Host Country Approval. The meeting was held on 20th November, 2008 at Cherat cement factory and was open to anybody willing to participate (private citizens, representatives of associations, interest groups, unions, public authorities, NGOs, etc.).

Stakeholders were informed about the project activity through specific advertising published on 19th November, 2008 by the project owner both in English (Daily The Frontier Star) and Urdu (Daily SURKHAB) local language newspapers. Advertisements are shown in Annex 5.

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

E.2. Summary of the comments received:

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

Table E.2.1: Translated Summary of the Comments

No	Stakeholder's Name	Qualification	Address	Comments/Views about the Project
1	Mehboob Khan	Matriculation	Speen Kana Village, District Nowshera	1. The local people will get jobs due to the project. 2. We will not have to go outside our village for work. 3. Everything is easily available here due to the plant. 4. Medical facilities are available due to the free dispensary.
2	Wasif Ullah	Matriculation	Shakhai Village, District Nowshera	1. Because of the plant, transport facility is available to us due to which our children can easily go to the city for education. 2. Free medical facilities are available to the poor people due to the free dispensary. 3. Job opportunities are available locally due to the project. 4. Our children will have opportunity to get technical education due to the project.
3	Shamroz Khan	Matriculation	Shakhai Village, District Nowshera	This is a very important project which will be useful not only for the factory but after its completion the emission of hazardous gases will be reduced which will be useful for the local population. The encouragement of such projects at government level will prove to be useful.

No	Stakeholder's Name	Qualification	Address	Comments/Views about the Project
4	Pervez Khan	Matriculation	Speen Kana Village, District Nowshera	1. Unemployment has considerably reduced in our area due to the project. 2. Transport is easily available to us due to the plant. 3. Free dispensary is available to us due to the plant, from where we can get all kind of medicines for free. 4. Due to the plant our children have got awareness of higher education.

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 Cherat Cement Factory 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 Cherat Cement Factory.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Cherat Cement Company Limited
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State/Region:	Sindh
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Country:	Pakistan
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URL:	www.cheratcement.com
Represented by:	
Title:	Chief Executive
Salutation:	Mr.
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Middle name:	
First name:	Azam
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Postfix/ZIP:	
Country:	Pakistan
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E-Mail:	
URL:	www.carbon.com.pk
Represented by:	Mr. Omar Malik
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Salutation:	Mr.
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Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been used in this project activity

Annex 3

BASELINE INFORMATION

Fuel Characteristics

Fuel Characteristics				
NCV of HFO		BTU/lb	17,184	Laboratory Test
NCV of diesel		BTU/lb	18,271	Laboratory Test
Density of diesel	$Denisty_{diesel}$	kg/Ltr	0.8449	Laboratory Test
NCV of HFO	NCV_{HFO}	TJ/ton	0.040	Conversion
NCV of diesel	NCV_{diesel}	MJ/Ltr	35.91	Conversion
Emission Coefficient of HFO	$COEF_{HFO}$	tCO_2/TJ	77.4	IPCC default
Emission Coefficient of diesel	$COEF_{diesel}$	tCO_2/TJ	74.1	IPCC default

HFO:

The lab test report of the fuel oil sample shows following parameters:

Density: 0.9455
Kinematic viscosity: 135 cSt at 50 ºC and 18 at 100 ºC
Flash Point: 84 ºC

According to table 1.1 of volume 2, chapter 1 of IPCC 2006, these characteristics correspond 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 $0.1cm^2$ (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 tCO_2/TJ has been used for calculations as local value of emission factor is not available. The value of NCV has been taken from the laboratory test report.

Historical Data

Historical Operation of Cherat Plant					
Annual Clinker Production	tons/yr	873,045.00			
Annual Electricity Consumption	MWh/yr	88,520.60			
Specific consumption of electricity by cement plant	MWh/ton clinker	0.101			
Captive Power Plant		**2004/05**	**2005/06**	**2006/07**	**Average**
Generation on HFO	MWh/yr	69,706.48	55,712.09	87,270.99	70,896.52
Generation on diesel	MWh/yr	1,979.78	2,028.62	1,249.60	1,752.67
Total Generation	MWh/yr	71,686.26	57,740.71	88,520.60	72,649.19
HFO consumption	tons/yr	16,741.15	13,947.32	21,798.52	17,495.66
Diesel consumption	Ltrs/yr	598,892.38	628,572.00	386,419.88	537,961.42
Specific consumption of HFO	tons/MWh	0.24017	0.25035	0.24978	0.24676
Specific consumption of diesel	Ltrs/MWh	302.50	309.85	309.23	307.20

Historical Proportion of Electricity Generated by Each Engine and Fuel Types Used

Engine Type	Historical Year			Fuel	
	2004 - 2005	2005-2006	2006-2007	Primary	Startup / Auxiliary
VASA 16V32E	32.68%	35.67%	25.94%	HFO	Diesel
VASA 16V32E	36.54%	34.48%	22.93%	HFO	Diesel
VASA 16V32E	28.14%	26.33%	20.31%	HFO	Diesel
VASA 18V32D	-	0.20%	29.47%	HFO	Diesel
3516	0.00%	0.03%	0.03%	Diesel	-
3516	0.98%	1.40%	0.39%	Diesel	-
3516	0.81%	0.84%	0.34%	Diesel	-
3516	0.86%	1.06%	0.58%	Diesel	-

Comparison of Baseline & Project Situation

Baseline & Project Situation				
Capacity of kiln		TPD	3,200	
Operational days of plant		days/yr	325	
Specific consumption of HFO by captive		tons/MWh	0.24676	
Specific consumption of diesel by captive		Ltrs/MWh	307.20	
Generation on HFO		%	97.59%	
Generation on diesel		%	2.41%	
Electricity Generation Comparison			**Baseline**	**Project**
Gross Capacity of ST		MW		5.95
Net Capacity of ST (after deduction of 10% auxiliary consumption)		MW		5.35
Gross electricity generation by ST		MWh/yr	0	46,410.00
Net electricity generation by ST		MWh/yr	0	41,730.00
Generation by captive power plant		MWh/yr	105,448.65	63,718.65
Generation on HFO	E_{HFO}	MWh/yr	102,904.70	62,181.44
Generation on diesel	E_{diesel}	MWh/yr	2,543.96	1,537.22
HFO consumption by captive	FC_{HFO}	tons/yr	25,393.19	15,344.15
Diesel consumption by captive	FC_{diesel}	Ltrs/yr	781,495.98	472,228.61

Emissions Reduction Calculation

Emissions Reduction Calculation			
Baseline emissions	**EB_y**	**t CO_2/yr**	**25,761**
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**	**25,761**
Baseline Emissions			
Maximun Recoverable energy by the WHR system	$Q_{OE,BL}$	TJ/yr	167.076
Electrical output ex ante estimation	$Q_{OE,y}$	TJ/yr	167.076
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	41,730.00
Share of Project Electricity that would have been generated on HFO		MWh/yr	40,723.26
Fuel Consumption of HFO for Electricity Generation	$FC_{HFO,y}$	tons/yr	10,049.04
Share of Project Electricity that would have been generated on Diesel		MWh/yr	1,006.74
Fuel Consumption of Diesel for Electricity Generation	$FC_{Diesel,y}$	Ltrs/yr	309,267.37
Efficiency of the existing power plant	$\eta_{Plant,j}$	%	45.09%
Weighted average coefficient of captive power plant	$EF_{CO2,i,j}$	t CO_2/TJ	77.311
Baseline emission factor	$EF_{Elec,is,j,y}$	t CO_2/MWh	0.62
Baseline emissions	**$BE_{elec,y}$**	**t CO_2/yr**	**25,761**
Project Emissions			
Project emissions	**PE_y**	**t CO_2/yr**	**0**
Leakage Emissions			
Leakage emissions	**LE_y**	**t CO_2/yr**	**0**

Annex 4

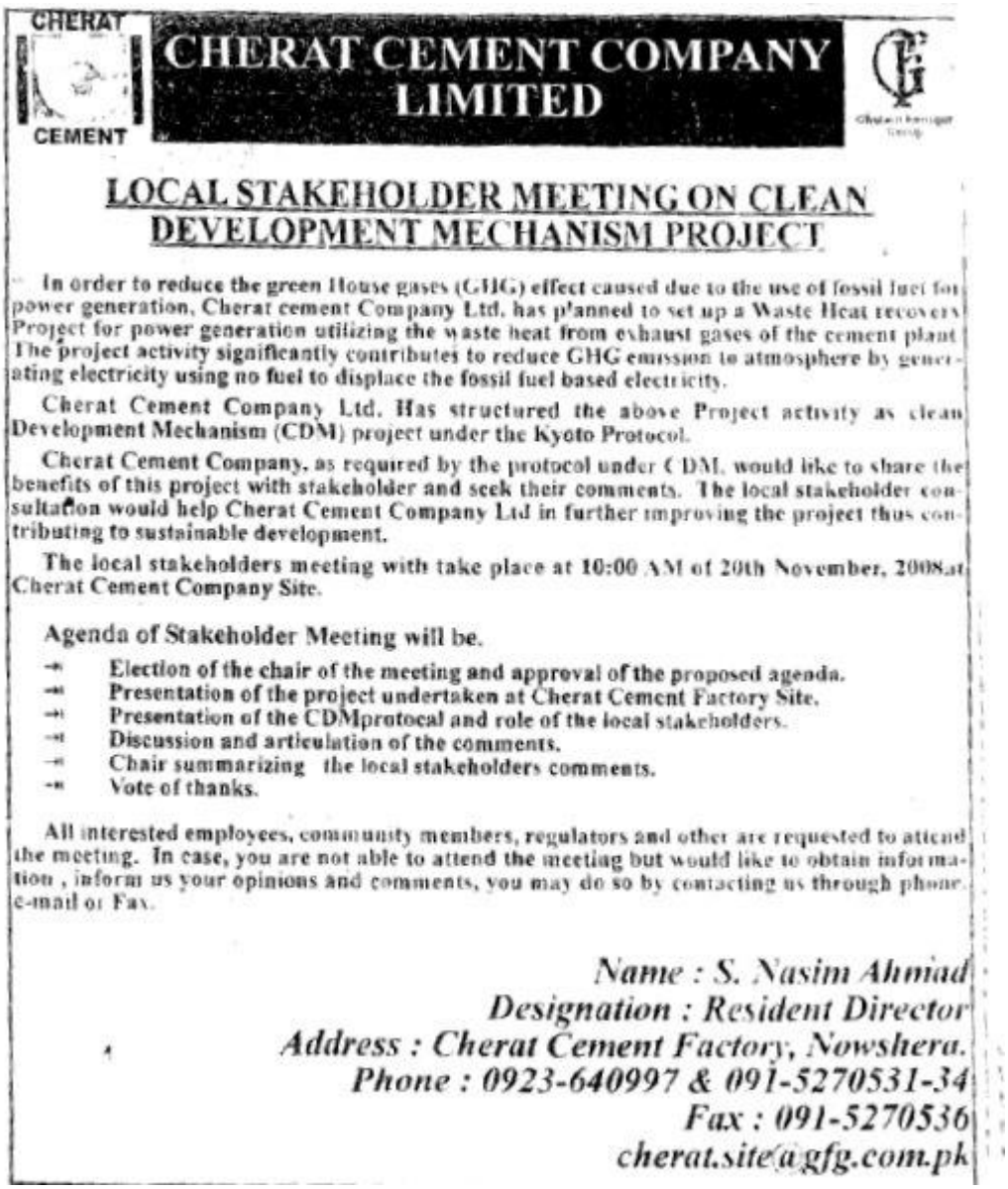
MONITORING INFORMATION

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

Annex 5

Details of Stakeholders' Meeting

Advertisements for stakeholders' consultation meeting are shown below.



CHERAT CEMENT COMPANY LIMITED

CHERAT CEMENT

LOCAL STAKEHOLDER MEETING ON CLEAN DEVELOPMENT MECHANISM PROJECT

In order to reduce the green House gases (GHG) effect caused due to the use of fossil fuel for power generation, Cherat cement Company Ltd. has planned to set up a Waste Heat recovery Project for power generation utilizing the waste heat from exhaust gases of the cement plant. The project activity significantly contributes to reduce GHG emission to atmosphere by generating electricity using no fuel to displace the fossil fuel based electricity.

Cherat Cement Company Ltd. Has structured the above Project activity as clean Development Mechanism (CDM) project under the Kyoto Protocol.

Cherat Cement Company, as required by the protocol under CDM, would like to share the benefits of this project with stakeholder and seek their comments. The local stakeholder consultation would help Cherat Cement Company Ltd in further improving the project thus contributing to sustainable development.

The local stakeholders meeting with take place at 10:00 AM of 20th November, 2008 at Cherat Cement Company Site.

Agenda of Stakeholder Meeting will be.

- Election of the chair of the meeting and approval of the proposed agenda.
- Presentation of the project undertaken at Cherat Cement Factory Site.
- Presentation of the CDMprotocal and role of the local stakeholders.
- Discussion and articulation of the comments.
- Chair summarizing the local stakeholders comments.
- Vote of thanks.

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

Name : S. Nasim Ahmad
Designation : Resident Director
Address : Cherat Cement Factory, Nowshera.
Phone : 0923-640997 & 091-5270531-34
Fax : 091-5270536
cherat.site@gfg.com.pk

CHERAT

CEMENT

چراٹ سیمنٹ فیکٹری لمیٹڈ نوشہرہ

چراٹ سیمنٹ فیکٹری لمیٹڈ نوشہرہ گرین ہاؤس گیسوں سے پیدا شدہ اثرات کو کم کرنے کیلئے فیکٹری حدود میں ایک پاور پلانٹ لگا رہی ہے یہ پاور پلانٹ فیکٹری کی اضافی گیسوں کو بروئے کار لا کر بجلی پیدا کرے گا۔ اس منصوبے کی بدولت گرین ہاؤس گیسوں کے اخراج میں خاطر خواہ کمی ہوگی۔ چراٹ سیمنٹ نے یہ منصوبہ (سی ڈی ایم) کے مطابق کیوٹو (KYOTO) پروٹوکول کے تحت کیا ہے۔ چراٹ سیمنٹ فیکٹری CDM کے تحت پروٹوکول کے تقاضوں کے مطابق سٹیک ہولڈروں کی رائے جاننا اور سمجھنا ضروری خیال کرتی ہے۔ مقامی سٹیک ہولڈروں کے مشورے چراٹ سیمنٹ فیکٹری کو اس سلسلے میں ممد و معاون ثابت ہونگے کہ سٹیک ہولڈروں نے جو مسائل اجاگر کیئے ہیں انکا مداوا کیا جا سکے۔

مقامی سٹیک ہولڈروں کی میٹنگ 20 نومبر 2008 کو دن 10:00 بجے چراٹ سیمنٹ فیکٹری پاور پلانٹ میں ہوگی سٹیک ہولڈر میٹنگ کا ایجنڈہ یہ ہوگا۔

- میٹنگ کیلئے چیئرمین کا انتخاب اور مجوزہ ایجنڈے کی منظوری
- چراٹ سیمنٹ فیکٹری کے منصوبے کی تفصیلات
- سی ڈی ایم پروٹوکول کی تفصیلات اور مقامی سٹیک ہولڈرز کا کردار
- منصوبے پر بحث اور حاصل بحث
- چیئرمین کا مقامی سٹیک ہولڈرز کی آراء تجاویز کا خلاصہ بیان کرنا
- ووٹ آف تھینکس

تمام علاقہ مکین عوام الناس اور دیگر متعلقین سے التماس ہے کہ وہ مذکورہ میٹنگ میں شرکت فرما کر اپنی آراء تجاویز سے آگاہ کریں۔ اگر آپ میٹنگ میں نہیں آ سکتے اور اس پروجیکٹ کے متعلق جاننا چاہتے ہیں یا اپنی رائے سے ہمیں آگاہ کرنا چاہتے ہیں تو ذیل فون نمبر، ای میل یا فیکس پر ہم سے رابطہ کر سکتے ہیں۔

سید نسیم احمد ریذیڈنٹ مینیجر	چراٹ سیمنٹ فیکٹری نوشہرہ
فون نمبر 0923-610997 (نوشہرہ)	فون نمبر 091-5270531-34 (پشاور)
فیکس نمبر 091-5270536	ای میل Cherat site@gfg.com.pk

Pictures of stakeholders' consultation meeting are shown below.

Annex 6

NOC from EPA Pakistan

Environmental Protection Agency
Environment Department
Govt. of NWFP

No. EPA/IEE/Cherat Cement/1211

Date: 05-03-2009

To

S. Nasim Ahmad,
Cherat Cement Factory.
P.O Box 28, Nowshera-24100, NWFP, Pakistan.
Phone No.091-5270531-34
Fax No. 091-5270536

Subject: **NO OBJECTION CERTIFICATE.**

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

Deputy Director (EIA)

SCHEDULE-V

Decision on IEE

1.	**Name, address of proponent**:	S. Nasim Ahmad Cherat Cement Factory. P.O Box 28, Nowshera-24100, NWFP, Pakistan. Phone No.091-5270531-34 Fax No. 091-5270536
2.	**Description of project**.	The Proposed Project is located near Lakari village, District Nowshera. Cherat Cement company plans to install a power plant based on stream driven turbo Generator with a rated capacity of 7 Mega Watt. The Power Plant will utilize the existing waste heat of the Cement Plant which is currently wasted as waste gas from steam production. The major impact of this project it will help in reduction of emission and/or mitigation of Green house Gas (GHS) considerably. .
3.	**Location of project**.	Cherat Cement Waste Heat Recovery & Utilization Project is located in District Nowshera.
4.	**Date of filing of IEE.**	24/02/2009 (Ref: EPA/Dairy No.599)

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

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 05-03-2007

Tracking/File.No. EPA/IEE/cherat Cement/ 1211

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