

Introduction and Project Description

HORMOZGAN CEMENT is in the process of planning the upgrade of the clinker cooler for kiln #2 in the Hormozgan Cement Plant, I.R. Iran.

The motivations for this project are:

- Reduction of unplanned kiln stoppages due to cooler breakdown
- Reduction of the heat consumption per produced ton of clinker
- Reduction of operational costs (production & maintenance) per ton of clinker
- Increase of the hourly clinker production rate
- Decrease of the electrical power consumption

The scope of work consists of the modification of the existing clinker cooler, by upgrading the existing equipment, the eventual replacement of the existing fans and other components wherever necessary.

Role of United Nations Industrial Development Organization (UNIDO)

In August 2012, the Global Environment Facility (GEF) agreed to provide funds for a project on Energy Efficiency in key Industrial Sectors in Iran. UNIDO has taken up the role as implementing partner of GEF. The objective of the program is to accelerate the uptake of energy efficiency (EE) by setting up voluntary energy agreements with industrial sectors, providing a framework for National Energy Management Standards, assisting in capacity building through training, developing targets, providing benchmarks and most importantly, by identifying technology improvement options to these high energy intensive industrial sectors. The "Hormozgan Cement" plant and its cooler project have been chosen as pilot for the program. UNIDO will enter into purchasing and delivery contracts on behalf of the "Hormozgan Cement" plant and therefore will be the contractual counterpart for suppliers.

Definition

- Project

The project title is "Upgrading of the grate clinker cooler by installing a static cooler inlet grate system in Kiln #2". The project scope is described in the following sections of this document.

- Beneficiary

The beneficiary is "Hormozgan Cement Company". The Project will be implemented at the beneficiary's primary industrial cement production site in Bandar Khamir, "Hormozgan" Province, Iran.

Actual Site Conditions

By signing the contract, the supplier confirms and accepts to have sufficiently inspected the site or to have received sufficient information (in form of technical information, drawings, flow sheets, etc.), so that the existing conditions for accessing the plant and maneuvering on site do not hamper or slow-down any ongoing production works. If necessary, the supplier will inspect the existing plant in order to evaluate the general situation and the possibility of re-using existing equipment (also partially). Alternatively, the supplier will ask for all information (and the plant will deliver all information) which is necessary for a reasonable assessment of the re-use possibilities of the existing machinery. The supplier is also requested to evaluate the design data and the conservation status of these parts, In order to enable the supplier to achieve the target of the project, any reservations with regards to the reuse of existing machinery and equipment have to be expressed before detailed contracts negotiations. No amendment or limitation to the agreed guarantee performance parameters will be accepted by the buyer after contract signature due to re-using existing equipment. The solution adopted by the supplier must guarantee a minimum interference with the plant running during pre-assembling and erection activities. The supplier shall declare to have obtained all necessary information as to risks, contingencies, actual and potential interferences, etc., which may influence or affect the performance of its obligations under the contract and to have acquired full knowledge of all law and regulations of I.R. Iran applicable to the performance of its obligations under the contract. The supplier shall also be deemed and declare to have ascertained and full knowledge of all applicable local & national standards, regulations, customs, etc., which

may affect the cooler design, installation schedule, choice of specialist supervisor personnel, etc.

No claim shall be permitted arising from the Supplier's potential failure to visit the site or to obtain the information referred to above. The supplier has the responsibility to check that the new solution doesn't cause any conflicts with the existing installed machinery. The supplier further has to consider and clearly express the compatibility of the existing building with the new load; the buyer will not accept any modifications with regards to this matter after having signed the contract.

In case the cooler PLC¹ is in need of any modifications after the installation the static cooler inlet, these amendments have to be performed by the bidder, as well.

The plant is based in I.R. Iran, below are some basic information about the plant location:

- Plant location: Bandar Khamir, I.R. Iran
- Erection altitude: + 40 m above sea level
- Ambient temperature: min. 12 °C, max. 50 °C

Currently Installed Equipment

Kiln 2 was erected by FCB in and has a five-stage single line preheater, which is equipped with a separate line calciner and a Claudius Peters grate cooler reaching a capacity of 3,200 t/day_{clinker}. The capacity should be increased step-by-step up to 4,000 t/day_{clinker}, one of the steps towards reaching this target is to improve the cooler performance. Several options are currently analyzed in how to reach the envisaged new capacity. The main is fired with mainly natural gas and fuel oil.

The heat consumption of kiln 2 is in the range of 850 kcal/kg clinker. Around 35-40% of the heat input to the kiln system is supplied through the main kiln burner and around 60-65% is supplied through the calciner system. The cooler's de-dusting system consists of an Electrostatic Precipitator (ESP).

Kiln System Supplier	FCB France
Current Capacity	3,000 tpd (nominal) -3,200 tpd (actual)

¹ PLC "Programmable Logic Controller"

- Grate load between 40-45 t/d*m²

Further, the following criteria should be met after the cooler inlet modification:

- No "Snowman" formation in the cooler.
- No "red river" formation
- Min. aeration of > 1.2 Nm³/m²s
- The cooler efficiency has to be increased to > 75%.
- Reduce maintenance and service costs to the lowest possible figure.
- Yearly cooler running time - operation days per year > 330 for the supplied equipment.
- No unplanned stoppage due to service and maintenance of the cooler upgrade package.
- Maximum noise level for the newly installed equipment shall be 80 dBA.
- Supplier has to indicate the specific power consumption of the static grate after modification.

Timing

A non-binding (commercial and technical) offer shall be submitted to the Buyer within 6 weeks after the tender submission (i.e. XX/XX/XXXX). The documentation consisting of the basic engineering (i.e. flow sheets, motor and sensor lists, static and dynamic loads, general arrangement drawing) must be delivered 4 weeks after the binding order. The documentation consisting of detailed engineering must be delivered 12 weeks after the binding order.

The delivery of the equipment to the site has to be finalized 6 months after effectiveness of contract with supplier. The mechanical and electrical installation activities have to be executed during a kiln line shut-down period. The shut-down time is fixed to 10 days (including banking holidays and weekends). The time for the shut-down period has to be discussed with the plant at least 1.5 months prior to the scheduled start of the installations.

Penalties in Case of Delivery Delays

For each full Calendar week of delay a penalty will be applied as described hereunder:

- Engineering: 0,5 % of the total contract volume for each full week of delay
- Actual supply of the Installations: 1 % of the total contract volume for each full week of delay

No more than 5 weeks of penalties will be charged. In case of a delay longer than 5 weeks, the buyer will have the right to cancel the contract with the supplier at its sole discretion.

Scope of Work

The scope of works comprises of the upgrading of the existing clinker cooler inlet section of kiln line #2 by installing a new static cooler inlet section and of the fulfillment of the design criteria and the required guarantee figures. The supplier is entirely free on proposing any further modifications (technically linked to the cooler operations), which - according to its experience - may improve the operation performance of the complete system further. The buyer is however entirely free in accepting or in rejecting further proposed modifications. In case modifications are proposed, these have to be presented (by means of technical explanations, drawings, cost overviews, etc.) separately from the initial and actual scope of work.

The scope of works includes the following tasks and deliverables:

1. Engineering
2. Equipment Supply
3. Inspection of existing equipment related to the project
4. Mechanical and electrical installation
5. Modification of the PLC of the existing system
6. Commissioning
7. Spare parts Supply
8. Training and Knowledge transfer
9. Measurement and Verification

1. Engineering

1.1. Basic Engineering

- Flow-sheet with e.g. actuators, limit switches, pressure switches, transducers, rotation controls, warning sirens, etc.
- Balance sheets showing pressures, temperatures and gas volumes.
- Diagram for cooling water (if any) and compressed air consumption.

- Project drawing (scale 1:100) with sections, static and dynamic loads and connections for cooling water, compressed air etc.
- Dimension drawing of the main machines, especially inlet fixed section and its inclination.
- List of electric consumers.
- List of measuring points and measuring instruments.
- Data sheets for the supplied equipment.
- Design data for all the auxiliary equipment.
- Specification of all used materials.
- Mass and heat balance of the cooler and calculation of potential water amounts for water injection.
- Specific (Nm^3/kg clinker) and absolute volumes (Nm^3/h) of secondary and tertiary air volume flows, and Nm^3/kg clin. of discharge gas from grate cooler to ESP (Cooler electrofilter).

1.2. Detailed Engineering

- Design of the structural steel works, gangways and stairs (if any amendments to the current design are necessary, in order to reach all spots for maintenance works and control installations).
- Static calculation of the structural steel works, gangways and stairs designed (if amendments to the current design are necessary); all the calculations have to be made in accordance with the national regulations.
- Workshop drawings of the ducts and piping.
- P&I, interlocking diagram (switch on/off sequences), basic engineering for automation and process control as per buyer's standard and requirements.
- Operating instructions.
- Erection drawing and technical specification for erection activities.
- Refractories detailed specification; it is agreed that the supplier works out specification of refractory, specification and positioning of anchors, fastening and supports of the refractory, positioning of the necessary flexible joints in the refractory and among others.
- Dust amount in secondary, tertiary air and discharge gas of grate cooler column (g/m^3 and g/Nm^3)
- Maintenance instructions with required assembly drawings, lubrication etc.
- List of spare-parts.

The technical documentation will be produced in electronic format in English language. The engineering activities do also include a detailed inspection and consequent report concerning the existing equipment, which is technically linked to the newly installed static cooler inlet system. Any reservations with regards to reusing or technically linking already existing equipment to the newly delivered equipment, has to be expressed by the supplier before contract signature. A deficiency list shall be developed by supplier. UNIDO/beneficiary will decide if the rectification of the deficiency list will become scope of work for the supplier. No limitation of the agreed guaranteed performance will be accepted by the Buyer after contract signature.

2. Equipment Supply

The supply of the new system consists partly of an upgrade of the existing equipment or its replacement, including components and instruments necessary to reach the scope of work and guaranteed operation performance. The supplier has full flexibility in choosing which of the existing equipment can be reused and/or converted and what has to be replaced by new devices. The scope of supply comprises:

- The mechanical equipment
- All necessary motors and drives
- All instruments shall be "profibus" type

The static inlet section shall be delivered together with the necessary cooling fans, aeration ducting, and distribution channels etc. The necessary cooling fans shall be provided with silencers and inlet and outlet compensators, the drives shall be equipped with frequency converter.

3. Mechanical and Electrical Installation

The dismantling of the existing cooler inlet section will be performed by plant personnel according to the instructions of the supplier. The supplier is however responsible for the installation of the new static kiln inlet section within a 10 day kiln shut down period (10 days include for all activities of the project).

The following tasks are included in the scope of the installation: mechanical and electrical erection, unloading, handling on site, transportation to and within site, unpacking, reporting of

damages/defects, storage, assembling, erection, alignment, welding, bolting, painting, cleaning, cables, cable trays etc.

The supplier has to include in the scope of the installation and supply all the ducts, electrical wires and connections, repairing and adjustment of the hydraulic jacks and their movement parts and in general all technical links between the existing and the newly installed equipment. Further, the supplier has to adapt the existing cooler PLC, if necessary.

The following activities are excluded from the scope of works and remain the responsibility of the buyer:

- Site Establishment
- Any civil work except for steel structure
- Refractories supply and erection
- Lighting

4. Commissioning

The supplier must assure technical supervision during the erection, cold tests, commissioning and start-up by either own or nominated specialists. The time for the commissioning and test runs is fixed to 2 calendar weeks. Any costs for travel and accommodation, are borne by the supplier. If the commissioning time exceeds the fixed period due to reasons out of supplier's responsibility (force majeure), each extra day will be charged at a daily rate of USD 700 and consequently be paid by the buyer.

5. Supply of Spare Parts

The supplier shall provide a detailed list and quotation of spare parts required for the proper functioning of the scope of supply for two years.

6. Training and Knowledge Transfer

6.1. The supplier will prepare and conduct an on-site training session (covering operation, maintenance, control and safety aspects of the newly installed device) for the beneficiary's experts, technicians, operators and maintenance personnel. For training purposes it is envisaged to conduct all steps of start-up, commissioning and any performance test in close collaboration with plant personnel with the purpose of knowledge transfer and to achieve the required guarantees and a smooth operation cycle.

6.2. Supplier will provide practical Training of Technical Energy Audit during conducting energy audit of grate cooler with involvement of trainees in main steps of conducting energy audit, along with theoretical concept of energy audit according to the level of knowledge of the trainees. The supplier is asked to provide an energy audit methodology or guideline specifically for the industry sector.

The trainees will include energy team/staff and other relevant staff of the beneficiary as well as number of energy experts designated by IFCO² (the national governmental partner of the project) and UNIDO.

The training should be held by experts from the supplier (and subcontractor(s) as required) on-site.

Documentation

The supplier is asked to provide the following documentation for the scope of supply to the buyer:

- Operating procedure for start-up, operation and shut down, interlocking diagrams, regulation loops, troubleshooting, etc.;
- Lubricating list;
- Detailed maintenance handbook containing the equipment drawings, part lists, maintenance instructions, detailed inspection instructions, check lists and lubrication specifications, mechanical datasheet, P&ID , PFD;
- As built documentation;
- Spare parts list for start-up and 2 years of operation;
- Wear part list for 5 years operation;
- all documents have to be delivered in English;

The documents provided by the supplier shall be delivered electronically. All design and engineering drawings shall be delivered as original format files and PDF³ files. Drawings shall be delivered as DWG - AutoCAD files.

Required Guarantees

The supplier guarantees the operations and agreed performance of the delivered equipment. For the grate system supplied the guarantee period is either 48 months from start-up and/or 54 months from delivery, whatever period ends first. For the remaining equipment, the guarantee

² IFCO: [Iranian Fuel Conservation Company \(www.ifco.ir/english\)](http://www.ifco.ir/english)

³ PDF: Portable Document Format

period should either be 18 months from start-up and/or 24 months from delivery, whatever period ends first.

Table 2: Guarantee Parameters

Parameter	Unit	Guarantee
Production Capacity	tpd	4,000
Cooler Efficiency	%	> 75 ⁴
Clinker temperature at cooler exit ⁵	°C	< 80 above ambient temperature ⁶
Max. noise level	dB(A)	80
Snow-Man Formation	-	None
Unplanned stoppages due to the newly installed system	-	None
Yearly running time	Days	> 330
Minimum amount of Energy Saving	KJ/kg clinker	> = 120

Wear Resistance

All wear-exposed parts (e.g. cooler plates, etc.) have to be designed in a way that guarantees a minimum lifetime of 36 months from the time of commissioning. The impellers of the newly installed fans shall have a lifetime of at least 36 months, as well.

Safety

All equipment and machines, conveyors, steel structures, buildings, gangways, hoisting devices, crane or lifting device for maintenance, electrical wiring, cabinet firing systems etc. have to be designed and manufactured according to the safety regulations and CE standard safety specification valid in Europe. All equipment shall have a “declaration of CE conformity” for the essential safety qualifications fixed in the Machine Directive 2006/42/CE (and further modifications thereof).

Tolerances

In case the guaranteed efficiency rate of the cooler is not reached after operation of the static cooler entry, the supplier accepts a penalty of 2%

⁴ @ 0.9 Nm/kg recuperation air

⁵ To be determined according to VDZ 02.623

⁶ To be measured at fan inlet by thermometer

of the total contract value for every 100 basis points of the actual efficiency below the guaranteed efficiency.

The minimum cooler efficiency accepted by the Buyer is 75% and the minimum energy saving is 120 kJ/kg clinker, In case of a lower actually reached efficiency or lower energy saving, the buyer is entitled to call for an improvement of the cooler efficiency at the cost of the supplier (see chapter Commissioning and Performance Test)

In case the actual clinker output temperature exceeds the guaranteed value, the supplier accepts the following penalties:

- Clinker temperature > 5 °C above the guaranteed value: 0,5 % of total contract value
- Clinker temperature > 10 °C above the guaranteed value: 0.5 % of total contract value for every 5°C above the benchmark

(So, for example, in case the clinker output temperature is 12 °C over the guaranteed value, the penalty is (0,5 % of total contract value for an excess over 5 °C + 1 time 0,5% for 2 °C over 10 °C =) 1 %).

The maximum clinker temperature accepted by the buyer is 95 °C (above ambient temperature). In case the clinker temperature sustainably stays above 95 °C, the buyer is entitled to call for an improvement of the system at the cost of the supplier (see chapter Commissioning and Performance Test).

The maximum penalty payment is however limited to 15 % of the total contract value.

Commissioning and Performance Tests

Since the guaranteed efficiency gains achieved by the project shall be demonstrated transparently, the supplier shall perform a full cooler performance test including technical energy audit according to VDZ⁷ guidelines VT10 prior to any amendments of the cooler under the current project scope ("TEST 1"). The supplier has to conduct such cooler performance test (with its own personnel and at its own cost, in cooperation with dedicated plant staff) and share its results with the beneficiary, UNIDO and IFCO.

⁷ VDZ ... Verein Deutscher Zementwerke (www.vdz-online.de/en)

Note: The supplier shall apply its own monitoring and data validation and shall not rely on data input from the Company.

After the completed installation, the plant and the cooler shall undergo detailed performance tests again, in order to verify the compliance with the guarantees accepted by the supplier. VDZ guidelines VT10 shall be applied for the cooler performance test ("TEST 2").

In general, the following procedure shall be followed:

For both TEST1 and TEST2, the plant behavior in operating condition shall be checked. The test phases will run over a time period of 72 hours, each. The average values measured during the test phases shall be the indicators for determining whether the guarantee values are met, or not. The maximum tolerated interruptions of any test phases shall not exceed 45 minutes and 2 interruptions per test phase are allowed.

If during the TEST2 runs the guaranteed values are not achieved, the test run will be repeated at a commonly agreed time at the cost of the supplier. Between the single test runs for TEST2, the supplier has the right for equipment optimization and general improvements works.

Two cycles for improvement works by the supplier are permitted for conducting TEST2. Each cycle has to be performed within a time period of three months (Next kiln Shut down if the kiln stoppage is necessary) after a commonly performed test run. Any works performed during the improvement cycles by the supplier or newly installed devices shall not be charged to the buyer. In case the guaranteed parameters cannot be met after the two optimization cycles, it's in the sole discretion of the buyer to ask for the full penalty payments (i.e. 15 % of the total contract volume) and/or to not release the Good Performance Guarantee.

Delivery

All the equipment has to be delivered CIF⁸ in BANDAR ABBAS port.

Bid Form

⁸ Cost, Insurance, Freight, according to Incoterm-Codes 2010

It is the plant's intention to source services and materials on the domestic market in I.R. Iran, whenever reasonable and possible. The supplier is therefore asked to differentiate between services / materials delivered directly by the supplier or international sub-contractors (i.e. imported to I.R. Iran) and services/materials which can be sourced in I.R. Iran.

Table 3: Weights and costs of imported or locally purchased products and services

	International Supply		Domestic Supply	
	Price [USD]	Weight [kg]	Price [USD]	Weight [kg]
Engineering				
Supply				
Installation				
Commissioning				

Communications

In case this document contains any ambiguities or causes questions, these can be posed in writing to UNIDO Procurement

Name: ...

E-Mail: ...

CC E-Mail: ...

Annex A

Survey of existing Clinker Cooler

Annex B

Drawings of Grate Cooler

Annex C

Time Scheduling of the Project