Cementizillo calciner upgrade

by A Tec GmbH, Austria

A Tec has recently been involved in the upgrade of the Cementizillo plant in Fanna, Italy. Cement capacity has been raised from 1700tpd to 2400tpd by modernising the preheater and precalcining systems, and by utilising 100 per cent petcoke fuel. NO_x emissions and sulphur levels have also been reduced during this upgrade period.

Cementizillo SPA was founded in 1882 by Mr Domenico Zillo, who took advantage of the existing limestone deposit of the Euganei Necks, and began the cement production in the localities of Este, Cinto Euganeo and Baone.

In 1921 Cementizillo began to utilise local marls producing the natural concrete. Since this time the company has been a manufacturer of cement and lime. The company of Este was subsequently changed into a modern cement plant, and in 1974 the cement plant at Fanna (PN) was started.

Towards the mid-80's the company, under the leadership of its present President Mr Comm Giovanni Zillo Monte Xillo, promoted the use of the concrete in the vicinity of the two cement plants. Today, the company is still expanding. The most advanced technologies have continuously been used in the systems; in addition, the respect of the environment has guided the company; therefore its production has increased as well as the quality of the products thus resulting in a strong development.

Targets of the project

- increased capacity of the kiln from 1700tpd to more than 2400tpd
- use of 100 per cent petcoke with a maximum sulphur content of up to six per cent
- reduction of the NO_x emission from 2000mg/Nm³ to a maximum 1000mg/Nm³.

Situation before modification

During normal operation, the following limitations to reach a production of 2400tpd were found:

- clinker cooler capacity
- fuel grinding plant
- thermal load of the kiln
- preheater retention time

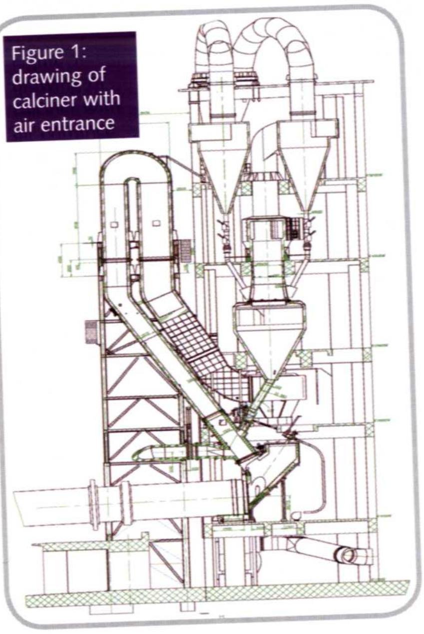


Figure 1: drawing of calciner with air entrance

- raw grinding plant
- exhaust gas handling and dedusting plant.

General description of the main modifications

- clinker cooler modification consisting of a new kiln hood, a modified cooler entrance and new cooling air fans
- completely new coal grinding plant consisting of a new ball mill including new separator, dedusting, dosing and conveying system
- new tertiary air duct
- kiln shortening by 1.5m and a new kiln inlet sealing
- new A Tec GmbH Low-NO_x calciner
- preheater modification at the bottom (stage 1) and 3rd stage cyclones
- new hot gas duct
- new preheater fan
- new raw mill (ball mill)
- new bag filter (kiln and mill dedusting).

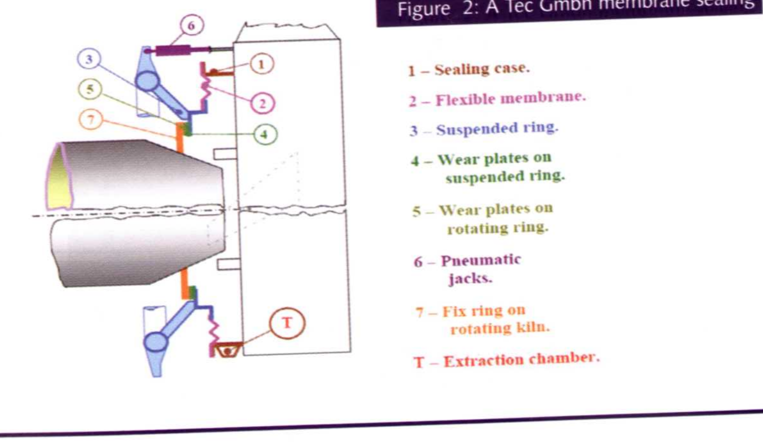
Modifications on preheater and precalcining systems

A tertiary air duct has been installed in order to reduce the velocity at the kiln inlet. The tertiary air is divided into three ducts, two ducts are connected to the calciner in the area of the calciner burners and the third duct is connected to the calciner above the burners.

All ducts have a separate tertiary air control gate in order to create locally carbon monoxide. With this calciner arrangement (Figure 1) NO_x formed by the main burner in the hot temperature area could be converted.

Since the Fanna plant is located in a high seismic zone, the calciner must have a separate foundation and structure with a minimum distance to the existing building of 1.5m. As a result, it was necessary to

Figure 2: A Tec Gmbh membrane sealing



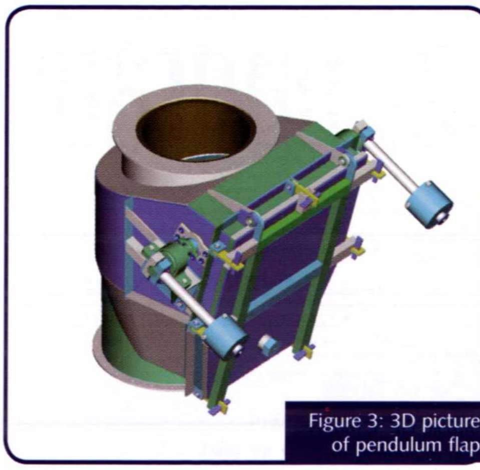


Figure 3: 3D picture of pendulum flap

cut the kiln by approximately 1.5m in order to install the calciner outside the existing building and avoid critical slope. Furthermore, it was necessary to move the existing kiln inlet chamber to the new kiln end position. During the site work a new kiln inlet sealing 'Airstop' (Figure 2) was installed.

The kiln riser duct to the bottom cyclones was cut and a roof was installed. The remaining part is used as a combustion chamber where the lower calciner burner is installed. The calciner itself is connected to the remaining part and outside the existing preheater building. A second calciner burner is installed after the inclined calciner portion. The down-stream calciner is split in order to enter into the existing two bottom cyclones. The entrances of the bottom cyclones were adapted in accordance to the calciner end. New and bigger meal ducts and pendulum flaps (Figure 3) were installed to reduce potential blockage in this area.

A 'Lomas' gas analysing system (Figure 4 and 5) has been installed at the outlet of the bottom cyclone. The Lomas system is equipped with oxygen, carbon monoxide, and nitrogen monoxide analysers for continuous measurement. These data are very important for optimising the combustion conditions as well as for optimising the NO_x-conversion.

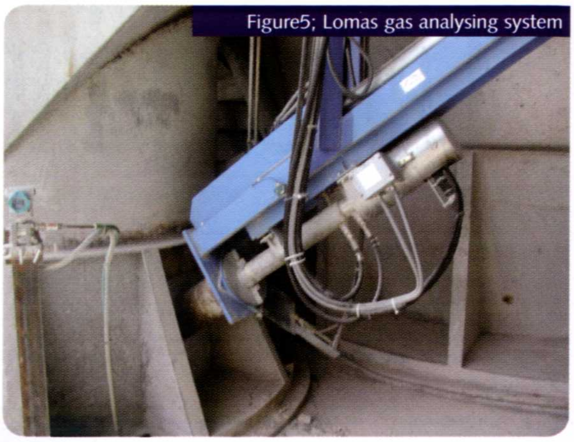


Figure5; Lomas gas analysing system

The system includes:

- an automatic probe pull-out system with pneumatic cylinder, valves, limit switches and automatic shut-off flap (the probe will automatically be removed if the cooling water flow or pressure is low or the cooling water temperature is high)
- a sample probe cooling water station with water/water heat exchanger and two cooling water circle pumps (automatic pump changing in the event of too low cooling water flow)
- for the best response time, approximately 500lt/hr of sampling gas will be drawn by a gas compressor, whereby approximately 60–80 lt/hr will be used by each analyser
- automatic cleaning of the filters
- continuous measurement with no oxygen peaks on the display during the jet-cleaning operation.

A new meal pipe including a pendulum flap from the seconnd stage cyclone to the calciner was installed, with a special design splash box (Figure 6), to distribute and feed the material into the calciner.

A new riser duct from the stage 2 to the stage 3 cyclones and an enlarged entrance to the stage 3 cyclones were installed because of the very high velocity and pressure drop of the existing equipment in this area. To handle the higher capacity, a new hot gas duct and a new preheater fan were also installed.

Erection

Civil work consists mainly of the foundation for the tertiary air duct and the calciner. Then a completely galvanised steel structure was erected. The main parts of the calciner, tertiary air duct, hot gas duct, preheater fan (new position), and all

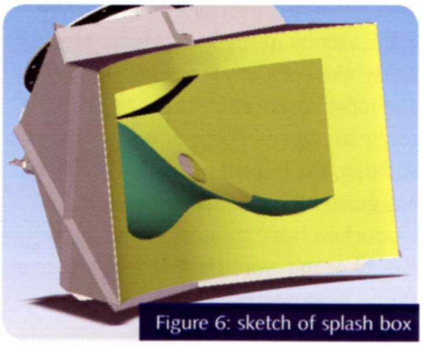


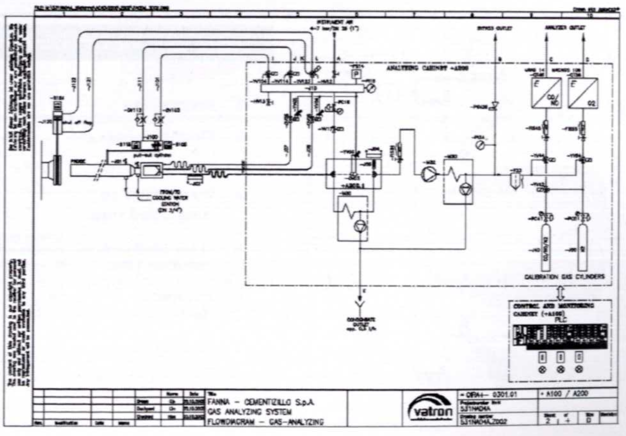
Figure 6: sketch of splash box

the other parts not directly connected to the existing kiln system (and the necessary refractory) had been erected during normal kiln operation.

During the kiln stoppage the following activities took place. For the kiln stop period following was necessary:

- connection of the tertiary air duct to the cooler
- kiln cutting and moving the kiln inlet chamber
- connection of calciner to kiln inlet chamber
- modification works in the preheater tower
- connection of preheater fan to exhaust gas handling

Figure 4: Lomas gas analysing system



- refractory lining of the remaining parts.

Start-up

After the cold test and some adjustment of the peripheral equipment, the system could produce at nominal capacity within a few days. After a few weeks running, the theoretical correlation of sulphur binding and free lime content in clinker could be detected.

Due to the type of fuel used in the plant (petcoke with sulphur content up to six per cent) a high sulphur input of approximately 500kg/h (which corresponds to approximately 1250kg/h SO_3 or 1.25 per cent SO_3 in clinker during nominal production) is occuring.

Due to this fact, it is very important to avoid the over burning of clinker and Carbon monoxide in the kiln atmosphere.

A fuel division of approximately 50:50 per cent between the calciner burners and the kiln burner as well as a division 50:50 per cent between the two calciner burners give good performance results.

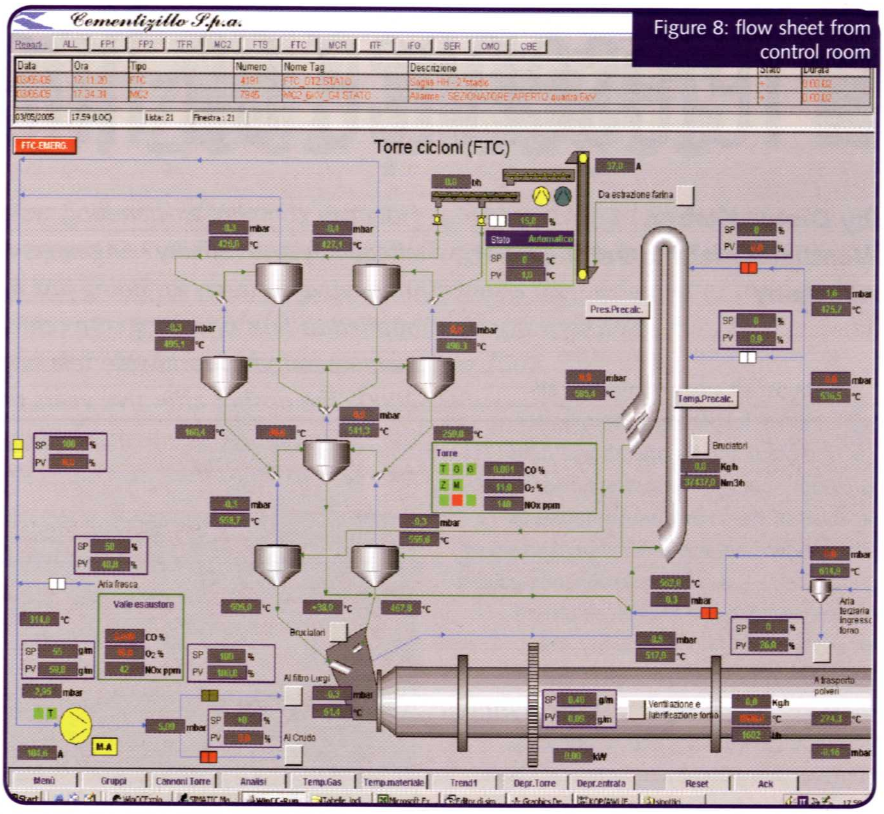


Figure 8: flow sheet from control room

Results and conclusion

The average production amounts to approximately 2450tpd at 70-80 per cent preheater exhaust fan capacity and 2.7rpm on kiln main drive.

The NO_x emission was decreased, on average, down to 600mg/Nm³ (500 – 800mg/Nm³) when using 100 per cent petcoke.

The preheater and precalcining system would be able to handle a capacity between 2700 and 2800tpd. Further reduction of NO_x emissions to a level of approximately 400–500mg/Nm³ is achievable. The actual limitations for higher production are the bucket elevator for the preheater feed, the false air entrance in the old electrostatic precipitator, which is in front of the new bag house filter, and the cooler exhaust gas handling system.

Therefore the next steps are the installation of an air lift (using the bucket elevator as standby), the installation of a duct in order to bypass the electrostatic precipitator (using the electrostatic precipitator only in case of damaged bags), and adding three cooling fans to the heat exchanger in front of the cooler exhaust gas filter in order to avoid cooling of exhaust air by opening the fresh air flap.

Figure 7: work on the foundations for the tertiary air duct and calciner begin

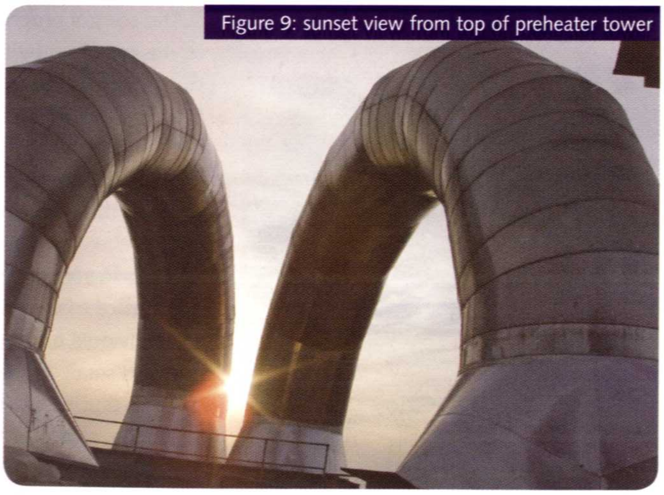


Figure 9: sunset view from top of preheater tower