

# Lafarge's new kiln line

by **Alexander Adam,**  
**A TEC, Austria**

**B**ased on this situation and also facing future higher clients' demands on the quality of clinker, Lafarge decided to realise a major modernisation of the plant for 2008.

The first step before making such an expensive decision was a full investigation of the technical and commercial opportunities that a new kiln line on the local market might afford.

The study was carried out by Lafarge's own corporate office (CTEC) in Vienna together with the Austrian consulting company A TEC production & services GmbH. It was finished in the spring time 2007, defining the targets of the new kiln line on the technical side, the purchase strategy for the project and the sales strategies of the cements to be produced.

## Targets of the project

The necessary selection criteria for the preferred solutions of the project included, a short downtime period of maximum four months for the existing production lines and a shutdown schedule of 19 months to complete the realisation.

The best solution would incorporate the following targets:

- the capacity should be increased from 1600tpd to 2200tpd
- highest flexibility in respect to use of different kind of alternative fuels and raw materials
- improvement of cement quality (uniformity, strength development and strength level, workability) with a potential for advanced product portfolio
- reduction of specific CO<sub>2</sub> emissions
- to keep the investment costs on a low level by using the existing technical equipment wherever feasible.

Consequently, Lafarge opted for a dry-process, single-line five-stage preheater/precalciner kiln with a tertiary air duct and chlorine bypass system with the following

*Lafarge's Wössingen plant is located in the southern part of Germany near the cities of Karlsruhe and Stuttgart. The plant utilises two kiln lines, built in 1961 and 1971, which were operating with the semi-dry Lepol process. The production capacity of both kilns together was 1600tpd. The well-known disadvantages of the semi-dry process are the high fuel consumption and limited fuel flexibility. The kind of alternative fuel and also its rate were not satisfying the demands of a modern European plant in the Lafarge group.*



Installing the kiln and clinker filter

requirements:

- the fuel split between main burner and calciner is 40/60 per cent
- the clinker cooler and the filters have to be renewed with the old Kiln No 2 has to be reused in the new line
- raw mill and cement mills can be used after an upgrade.

In addition, one of the key success factors is the usage of high quantity, low-grade, alternative fuels. The new kiln therefore had to be able to handle an alternative fuel substitution rate of 95 per cent. Added to the well-known fuels mentioned above, a new type of fuel was planned. This material is a shredded, middle-calorific value plastic waste delivered mainly in 2D formation with a typical grain size of 50mm.

The challenge is the conveying to the calciner, which has to be done mechanically, because of the grain size of this material. After all, this material is the main fuel in the calciner and therefore



Lafarges Wössingen plant

amounts to approximately 60 per cent of the total heat input to the pyro-system.

These boundary conditions demand a highly-reliable calcination system in the preheater process and require a professional and experienced design.



### Solution in a well employed economy

The project study was finished in May 2007, a time when the world economy, and in particular the cement industry, was growing fast.

The task itself started in June 2007 and as was normal for any of the big manufacturers of cement, the focus of all operation staff was on the burgeoning cement demand. To respect this priority two different purchasing strategies were considered. The preferred option was the best technical solution executed by a turnkey contractor or by some main supplier.

In any case, an experienced consulting company should be contracted, supporting CTEC Vienna during the complete project. The scope for the consultant was to be the typical Engineering Procurement Construction Management (EPCM) Services. This includes the project management, overall engineering and the coordination of all the suppliers. The EPCM contract was awarded to A TEC production & services GmbH.

After publication of the request for proposals for the turnkey job, and after receiving the first offers, the concerns of the study team began to materialise. Apart from the commercial aspect, the suppliers

offered on average a time schedule of 22 months for completing the realisation. That meant three months longer than required and was therefore not acceptable for Lafarge.

Therefore, Lafarge was concentrating to the main-lot-strategy with the aim of pooling several orders, making them as large as possible.

Finally, the main project targets were only possible by electing to go for a lot-by-lot strategy, resulting in 45 main contracts and almost 900 purchase orders.

As a matter of course, not every cement manufacturer has the capability to switch to such an approach without any preparation time. But with the background of a strong site team and knowing the potential of its EPCM supplier, A TEC, Lafarge Germany and Lafarge CTEC Vienna agreed to go ahead. As a consequence it was necessary to have a strong project team on the side of CTEC and within A TEC.

### Main equipment and suppliers

The first equipment suppliers were nominated for the clinker cooler and preheater tower with calciner in the summer of 2007. Thereafter the contracts for the filter parts and the ducts as a

package were carried out, and then the main fans for kiln and filters.

For the clinker cooler the company IKN GmbH in Neustadt, Germany, was selected. Its concept of a pendulum grate cooler with a three-roller crusher was the best fitting solution for the limited space in the plant.

The preheater/precalciner system, including the chlorine bypass, was characterised by Lafarge's challenging expectations for the process guarantees. Especially challenging was the alternative fuel rate of 95 per cent and with it, the low specific heat consumption of below 3400MJ/t clinker at 60 per cent AF rate coupled with ambitious emission values (eg <math><500\text{mg NO}\_x/\text{Nm}^3</math> without SNCR treatment).

Lafarge chose A TEC to design the preheater/precalciner system and the bypass. The main reason for this decision was the experience of A TEC and its well-known reference project in Austria. This was also a modification from a Lepol system into a suspension preheater with calciner, including the precondition of more than 80 per cent alternative fuel usage.

Manufacturing and erection of the steel structure and the preheater equipment was done by the German company



At times five tower cranes and up to 10 mobile cranes were operating in parallel



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Hilgefert GmbH, Dinklage. The main filters needed a special solution. Because of the requirement, re-using as much of the existing equipment as possible, the original ESP-filter housings of the old kiln line had to be modified and equipped with modern bag filters for the kiln and raw mill and the bypass systems. Only the clinker cooler filter was a new ESP to ensure higher temperatures for cement grinding.

Redecam group of Italy was the selected company for the filters, including the associated gas ducts.

The supplier for the kiln ID fan, kiln filter fan, bypass filter fan and clinker cooler filter fan was the company Ventilatoren-Fabrik Oelde. IBAU Hamburg, Germany was chosen to supply main parts for the raw meal handling and the dust transports for bypass and kiln systems. Pfister Augsburg, Germany was nominated for the weighing equipment for raw meal, petcoke and alternative fuels. Refractory was delivered by Refratechnik Cement GmbH, Göttingen and was erected by Set-Linings GmbH, Duisburg.

All equipment outside the preheater tower was erected by company Oswald Metzen. GmbH, Bitburg.

Kiln No 2 was modified and is now the new Kiln No 3. Most parts of the rollers, and a large part of the cylinder, were reused but the main drive is new.

Modification works were done by Weimarer Spezialmontagen, Germany.

The electrical engineering and the most equipment were ordered from the French company SNEF and its German subsidiary ICER Berlin.

### Safety

Health and safety are absolute priorities for Lafarge. Lafarge aims to be among the safest companies in the world and strictly enforces safe behaviour.

On site a special safety team was installed. The Lafarge plant safety manager was supported by three supervisors and a medic. Each supplier had to identify the possible cause of risks in their work and to define the precautionary actions for minimising them before starting. No reportable incident occurred during the half million working hours in the project.

### Erection and commissioning

Civil works started in January 2008 with demolition of some buildings and initiation of the foundations for the preheater tower and the clinker cooler. The steel-structure tower and the equipment assembly began in April 2008 and was finished at the end of September 2009. The clinker cooler and the new kiln foundations were erected in parallel.

By the end of October all preconditions

for starting the 'hot phase', and the shutdown of Kiln No 2 were fulfilled. The shutdown time of 4.5 months was also the busiest period. More than 400 workers were employed to modify and replace the kiln, dismantle the old raw meal granulation and install the new one inside an existing building, disassemble the old ESPs and install new bag filters and all gas ducts. A special solution was required for the clinker cooler filter because of the limited space. The new ESP was erected on a bridge between two old kiln foundations beside the cooler.

After some delays around the Christmas period, the New Year of 2009 started with intensive action. The time schedule of each erection company was optimised to keep the overall milestone 'flame-on' for middle of March 2009. In this period, the most important job for the site team was controlling and coordinating the field to avoid any lag. The whole building area for

the 400 workers was smaller than a soccer field and sometimes five tower cranes and up to 10 mobile cranes were operating in parallel.

At the beginning of February, electrical, refractory and mechanical erections came to an end and the commissioning started with full power. During this time the radio traffic increase was enormous, but it did not impede the installation being a successfully completed.

On March 20, 2009 the first flame was ignited in the new kiln and 24h later first clinker was produced.

### First results

Mr. Gernot Kirchner, industrial director Lafarge Zement GmbH, published the first results of the new kiln line for the 6th International VDZ congress 2009 in Düsseldorf, Germany and Mr Lutz Weber, plant manger in Wössingen, presented them in the congress:

*The kiln starts very quickly. The rated capacity of 2200tpd was reached after only seven days. After two days, part of the fuel to the combustion chamber was switched to solid shredded waste which very soon reached a substitution rate of around 40 per cent.*

*The fuel split between the main burner and the calciner shifted up from 44/56 per cent at the start-up to the now standard 40/60 per cent. In the first six weeks, the percentage of alternative fuels in the main burner moved up to 25 per cent in stable operation. In the calciner section the substitution rate moved up to approximately 80 per cent. The ramp-*

**Table 1: contract values and first test results**

	Contract values @ 60% alternative fuel	First Test results
Kiln capacity (tpd)	2200	2320
Specific heat consumption (kJ/kg cli)	<3400	3277
NO <sub>x</sub> without SNCR (mg/Nm <sup>3</sup> ) dry @10% O <sub>2</sub>	<500	425
Alternative fuel rate (%)		60
Pressure drop preheater (mbar)	<62	54
Specific power consumption ID-fan and kiln main drive (kWh/t)	<10	9.4

*up of substitution rate is determined by regulatory issues.*

*The rated capacity is not an issue and the specific heat consumption ranges within the expected level. The very promising level of NO<sub>x</sub> emission, achieved without any secondary reduction measure, is a precondition to be able to reach lower emissions by using SNCR once it is required. A prerequisite for this low emission is an alternative fuel rate of at least 30 per cent.*

*Compared to the clinker of the former semi-dry process, the alite-content of the clinker from the new line shows an rise of approximately 25 per cent. This causes a significant increase of the early strength level. It allows the plant to reduce the specific power consumption as, taking into account customer requirements, cements can be produced at a lower level of fineness than before and easier grindability.*

### Conclusion

Some criteria have been crucial for the

success of this complex and challenging project:

- a strong and professional project management team
- an excellent coordination of works on site at different lots
- a dedicated safety team with no compromise on safety
- a fully-motivated plant team
- a strong start-up team.

The big advantage of preferred option was the possibility to realise the optimal solution, both technical and economic. Purchasing directly by the original equipment supplier allows to shorten the project time to a minimum and gave also the opportunity to get the best market price. The necessary interface clarification for this strategy was done by the EPCM supplier.

The first months of operation has already proved the excellence of the principal layout of the new kiln line and the high expectations regarding the fuel mix, the alternative fuel substitution rate and quality improvement have been proven to be realistic.

As the operation settles down, the plant team is carrying out the final adjustments in every area for improving quality, quantity and operating techniques.



Wössingen at night



The steel-structure tower and the equipment assembly began in April 2008 and was finished at the end of September 2009

