Modernized not Scrapped

An aging glost firing kiln is transformed into a flexible and efficient firing unit

Unfortunately, there has been less and less good news from the tradition-steeped German porcelain industry in recent years. But here too you can find “hidden champions”, companies holding their own and operating successfully in these difficult times. One of these is the medium-scale family business named “Erste Bayreuther Porzellanfabrik WALKÜRE”. The eventful history of this porcelain manufacturer stretches back over 100 years. Today high-quality porcelain for caterers, hotels and restaurants is the focus of its product range. With creativity, innovative products and investment in modern, flexible production, the company has paved its way for the future. Four components not only assure the company’s economic success, but have made the “WALKÜRE” porcelain factory one of the world market leaders:

1. Specialization in high-quality heat-resistant and professional tableware,
2. First-class brand quality,
3. Contemporary design and
4. A fast response to customer requirements.

Enabling these goals is a systematic use of state-of-the-art technology. The machines and technology have long been carefully geared to achieving these goals. Back in the mid-1990s the company arrived at a point at which the installed firing technology was called into question for the first time. The tunnel kiln installation built in 1959, with one biscuit firing and one glost firing kiln, is the heart of the factory. Should the company make changes here, switch to modern fast firing, with big investments in completely new kiln furniture and the associated changes in the upstream and downstream production?

Where was the company to get the required space, how could it avoid rebuilding the facility, how was it to compensate for the weeks- or month-long shortfall in production and sales if the old kilns were demolished and replaced with new ones? All feasible scenarios were considered and played through, including the introduction of several small intermittent kilns in a common automation line. But, whichever way the company looked at it, the investment costs were not in healthy proportion to the goals set. From today’s point of view, it was certainly right that the company did not unconditionally follow the trend at that time of radical automation but first waited,” professes Siegmund Meyer, who is managing the company in the fourth generation of the owner family. Gradually another solution came to mind, although the company did not initially believe that it could lead to the desired success – a conversion of the old tunnel kilns. It was an idea that threw up many questions. It is technically possible to convert an old, slow 60-m-long glost firing tunnel kiln into an intermittent fast-firing kiln? How do you ensure the flexibility so absolutely essential for the typical product range and market situation, how do you obtain much better temperature uniformity in a relatively high kiln channel and how do you achieve an energy saving high enough to justify such an investment? What timeline should the conversion follow and what impact will any restrictions on production have? And should the company invest at all in a time that from today’s point of view is not really opportune for making any great leaps forward?

CTB ceramic technology GmbH, a Berlin-based company with many years of experience and innovative ideas in the “making new from old” business presented a concept that provided the answers to these questions and proved convincing both in technical and economic terms, also the Bavarian Ministry of Economic Affairs had approved funding. The right partner had been found.
The Concept
The modernization rested on two mainstays: the installation of “intelligent firing technology” for fully automatic operation and the elimination of all “energy guzzlers”. The goal: energy savings and emission reductions of up to 40 %, with increased flexibility in production in combination with production increases.

The Firing Technology Installed
The control of individual burners is nothing new. Crucial for kiln performance are, however, the precision and speed with which the burners are controlled. The latest CTB firing technology is based on precise temperature- and pressure-compensated gas and air mass flow measurements at the burner. This enables the precise supply of the required gas and air mass flow to each burner. An optimal firing curve can therefore be achieved in terms of time, temperature and kiln atmosphere in line with the product-specific requirements. For this purpose, all installed burners were switched to individual control and equipped with automatically controlled gas and air mass flow controls. Instead of the gas rotameter and combustion air measuring orifices of the main burner, mass flow controllers and mass flow sensors were installed, while in the preheating zone all burners were replaced with new burners featuring automatic gas firing.

With the use of this technology, both manual burner setting and software conversions are superfluous. The kiln atmosphere can be adjusted very precisely. Even varying environmental influences such as air pressure, temperature and moisture are recorded by a weather station and processed accordingly by the control system. In logical consequence, the temperature of every kiln zone is controlled with the help of the above-mentioned measurement and control technology and allowance is made even for the temperature differences of burners installed opposite each other. As part of the conversion, all existing combustion air and gas lines of the burner groups were removed and replaced with a closed circular gas pipeline and a central combustion air supply line. The old fans could be left, but were equipped with soft starters and frequency converters. This opened up further energy saving potential on the electrical side.

Flexible Operation in the Tunnel Kiln
A fast response to different products and varying production rates to maintain energy efficiency with variable firing curves is a precondition for the cost efficiency of production and had to be enabled here too. The realization of variable cycle times in standard tunnel kilns is generally very difficult, as the zones can only be operated in a steady-state mode. The specific energy consumption will double around at half production level. With the modernization concept realized by CTB, the zones can be locally varied depending on the pushing time. Only the transition from firing zone to cooling zone is kept constant for practical reasons. The firing curve automatically adapts to the production rate, ensuring optimal energy consumption.

Control, Monitoring, Back-Up
Particular attention was paid to the easy operation and maintenance of the new kiln technology. With the measurement and control system installed by CTB, as mentioned above, no manual adjustments of the burners are necessary, not after installation, nor after several years of operation and nor after replacement! A high-performance Siemens S7-400 PLC, housed in the new power and control switch cabinets, is used for kiln control. In a clear and well-laid out display the actual kiln functions are shown on screens and the firing data of every individual kiln car archived. In this way it is possible even after years to find out when and on which kiln car each product has been fired - a key precondition for effective quality management. An uninterruptible power supply (UPS) guarantees uninterrupted firing even with short-term power cuts or voltage fluctuations.
For efficient and flexible operative deployment and as an additional back-up module, a telephone and messaging system was installed on the control computer, which is operational round the clock. This signals any alarms via fixed net and mobile telephones, automatically generating and sending SMS alerts. The responsible kiln operative can interactively receive alarm information and data reports through the industrial automation software systems from any fixed network or wireless telephone. The operative can monitor and also confirm the alarms.

**Project Timeline, Dates**

Tightly scheduled and well prepared, the entire conversion project could be completed in just three weeks. The conversion was performed during the scheduled factory break in summer 2008 and production shortfall avoided. With the subsequent reheating and commissioning of the glost-firing tunnel kiln, the specified maximum downtime of 4 weeks could be easily complied with.

**Summary**

In many cases the modernization of old firing units and plants certainly not only presents an alternative but the “best solution” in economic and technical terms. Crucial for success is the experience and creativity needed to combine the latest innovative technologies with old systems, in order to guarantee the customer optimum efficiency, safety and flexibility for the future.