The phoenix: in antiquity, it was a manifestation of longevity and perpetual regeneration, but it is also an appropriate symbol for the products manufactured by Phoenix Zement. Just as the bird was regenerated in fire, the company uses the same element to transform 80 million-year-old marl into a modern and dynamic construction material.

The company, Phoenix Zementwerke Krogbeumker GmbH & Co. KG, was founded in 1914. In 1964, the Lepol kilns were replaced by a heat exchanger kiln and, in 2005, the cyclones of the 4-stage preheater were replaced by state-of-the-art cyclones, along with the exhaust fan, resulting in a distinct improvement in system efficiency. The two cement mills today produce up to 500 000 tpa of the CEM I, CEM II and CEM III.

The company, which employs about 100 people, has also optimised the production process over the years, particularly improving environmental protection. As well as focusing on clean air, water and noise reduction, it has also put a heavy emphasis on measures for environmentally-friendly mining and re-cultivation or returning mined-out quarries to a natural state. Furthermore, the company has implemented procedures to reduce fuel and power consumption, and consistently uses non-hazardous alternative fuels to minimise the fossil fuel burnt at the plant.

From 1993 onwards, the production process at the plant was controlled by a Cemat V2 control system. However, the switch was made to the modern control system Cemat V6 based on Simatic PCS7 in 2001, for the cement mills, and 2004, for the kiln and preheater.
The project

Phoenix Zement Production manager Kai Wagner was clear about the scope of the project: “We wanted a safe way to acquire and archive account-relevant data, an automated written report, and efficient analysis tools that our co-workers could use at their PCs.” The company also required continuous calculation of key values (key performance indicators) with data from different sources. It decided on Cemat MIS V6 based on Simatic IT because it could fulfill these requirements while being simple to integrate into the existing infrastructure.

Multiple versions of Cemat control technology are installed in the individual subsystems of the plant. One subsystem already included an information system, but its functions no longer meet current requirements. Therefore, in mid-2005, Phoenix Zement decided to deploy a new management information system (MIS), with the following functions:

- Connection to the control systems and relevant data handling.
- Long-term storage of process values and alarms.
- Air-tight data recording of information relevant to billing.
- Recording of long-term counting values.
- Calculation of key performance indicators (KPI).
- Powerful ad hoc and scheduled reporting systems.
- Reports that personnel can easily create and modify.
- A display module for analysis of the temporal course of measurements.
- Online display of parameters on the office PC.
- Analysis tool for selection and analysis of the alarm lists, including statistical analyses.

Several additional constraints also needed to be observed:

- Replacement of the old system’s existing applications.
- Transfer of the archived historical data to the new system.
- Integration into the current Cemat / PCS7 version.
- Simultaneous integration of the existing systems.
- Integration of the client software in the modern office landscape under Windows XP.
- Preparation of low-effort, step-by-step migration of the old systems to Cemat V6 with PCS7.

The scope of delivery encompassed engineering, startup, training and a service contract. The hardware used included a Fujitsu Siemens Server PC with a Raid 1 and four x 250 GByte hard disks; interfaces for the transfer of process values and alarms from all parts of the system; and Cemat V2, Cemat V4 and Cemat V6 based on PCS7.

Recording alarms from the old systems was implemented using adapters at the printer interfaces. This enabled recording of the continuous printer logs, which were converted to the new formats and stored in the new alarms database. This method offers a significant advantage in that the alarm system in general remains; only the general functionality needs to be checked during commissioning. In other words, migration steps do not require additional engineering effort, because the respective alarms are generated by another source.

The analogue and digital process values are aggregating, archiving and reporting data on KPIs such as equipment performance, productive time, costs, overall equipment efficiency and downtime management. It also provides tools for data analysis and optimisation of resources.

Further modules of Simatic IT enable the integration and synchronisation of production, quality and supply chain. It provides an infrastructure to easily automate the laboratory processes and centralise all quality information, as well as modelling test plans, recording the test results, and storing them for later analysis and reporting.

Simatic IT, the manufacturing execution system (MES) from Siemens, is designed to support the cement industry in delivering optimum quality, lowering production costs and increasing output.

It manages the production lifecycle by bridging the gap between enterprise business systems and the plant floor, and is an integral part of totally integrated automation. Its modular, object-oriented, open and scalable architecture, based on the ISA-95 standard, enables standardisation of processes at a high level.

The system enables total plant transparency and the monitoring of lifecycle costs by collecting,
recorded primarily via the PCS7 control system. Values from the older parts of the system are transferred there by a cross-connection. The prerequisites for the later smooth migration of the old control technology to Cemat V6 based on PCS7 are also created here.

Consistent archive
The principle of data acceptance ensures consistently archived data. Process values and alarms are buffered in Cemat V6 in redundant archives, serving as input for the long-term archive of Simatic IT Historian. If the connection to the Historian server is interrupted, the buffered data is automatically transferred after the connection has been re-established. The central server is equipped with a Raid system. Defective hard disks can be exchanged during ongoing operations. The distributed data storage system ensures that no data is lost. The hard disk capacity is dimensioned in a way that data can be stored for several years. Thanks to the intelligent compression methods for process values, the Simatic IT Historian needs relatively little storage capacity, even when sampling values in a second cycle.

The archived process data contains important information on the overall production process. This includes parameters relevant to quality, information of the respective process, or other data, such as type of fuel, energy consumption, quantity balances, etc. Those data represent the production in respect of course of time. The existing old archives are transferred to the new system and can be processed there just like all the new data.

Naturally, this data also contains information on the production process and especially on the relationships among the individual parameters that influence the process. The challenge is to learn from the historical data and to use this knowledge to optimise current production. To support this process, Cemat MIS V6 based on Simatic IT offers easy-to-use tools that enable the user to prepare and display the data in the form needed with minimal effort.

Key performance indicators
Cemat MIS V6 also offers a convenient environment for calculating parameters. In the Simatic IT Plant Performance Analyser, calculated values are determined and archived cyclically or based on events. They are thus available for all applications, just like all other values. These key performance indicators (KPI) help to show the important specific values at a glance.

This platform is the ideal environment for calculation of such values, because this is the only place that data from all subordinate systems is available together, in high precision and with an exact timeline.

Central alarm overview
The alarm logging serves as the central database for all alarms from the various subordinate systems and thus makes them available for joint analyses. The alarm logging facilitates both the analysis of the archived alarms and the online display of current reports. The alarms from all parts of the system come together in this database and thus offer a unique overview. By setting filters and selection criteria that can be combined as desired, users can reduce the overall alarm data set to only those that are relevant to them.

Process display
The analysis of the process values mainly uses the curve illustrations in Simatic IT Historian Data Display (HDD). Users can display not only raw data but also calculated values. Normally, curve groups are displayed on a timeline. To compare the temporal development of measured values for different time periods, the Simatic IT Historian offers the time overlay trend function. Another variant is provided by the X/Y trend, which is particularly well-suited for illustrating the relationships between two process values. The trend functions are used not only to analyse historical values, but also for online display on a monitor in the control centre. Based on the simple and intuitive operation of the interface, the illustration of trends tends to be quickly accepted and used by the control centre personnel. All employees can create individual curve groups from all available data, which they can then use to help them carry out their tasks.
The Simatic IT system has enabled the plant operators to precisely analyse the current operating parameters, as well as being able to compare the results with historical data. It has thus enabled them to optimise the electrical energy consumption at the plant. By optimising process engineering and analyses of the flow chart, Wagner now wants to achieve a further reduction, especially of the power requirement per t of clinker.

The same also applies to the optimisation of the fuel consumption per t of clinker. Phoenix Zementwerke burns different spare fuels due to their different characteristics such as grain size, heat value, composition etc. for different influences on the kiln performance. The Simatic IT greatly increases the speed of analysis. “With the new system, these influences can be quickly analysed rather than waiting for the data to be elaborately prepared by co-workers,” explains Wagner.

Continuous reporting
An important function of the MIS is the reporting system. Automated reporting often results in considerable savings. Reports calculate, compress and present important parameters in table form. The layouts of reports used up until now have not been changed. The existing Excel reports were used as a basis, with the supply of data directly linked to the data source, simply using the Simatic IT Historian Excel Add-In. This user-friendly tool can also be used to create ad hoc tables. An assistant (wizard) leads the user through the process of configuring the report. Not every cell has to be configured individually; the user can configure entire cell ranges at once. Even the design of the report can be varied. For example, input or output fields can be prescribed for the variables or time ranges to be displayed. The Excel Add-In can also be used simply to create input screens for manual recording of values. Simatic IT Historian also permits display of ‘intermediate results’. For example, this makes it possible to create dynamic monthly reports that fill up over the course of a month and update monthly production continuously.

The continuous calculation of KPIs (key performance indicators) in Simatic IT enables users to view the development of the parameters over time, as needed at any particular moment. In reporting, too, all individual users can design the presentation of contents important to them as they wish.

The simple operation of the client applications means that new analyses can be created with minimal effort. This gives employees new options. A new idea or a hunch can be checked quickly by configuring a curve group or performing a tabular illustration using archived data. In the past, this would often have required a significant effort and was simply not done.

“We use the diagram curves and tables for subsequent analysis of our production processes as a basis for optimisation measures,” explains Wagner. “Relevant process variables can be shown in Excel with minimum expenditure, while the statistical evaluation of the alarms helps us with our analysis of disturbances, and with planning maintenance measures.”

Conclusion
Cemat MIS V6 based on Simatic IT is a powerful system to facilitate the cement production process. Easy to operate applications provide information adapted to the operator’s needs, as well as secure data handling and extensive reporting capability. Smart tools allow the users to determine the process by analysing both process values and alarms, establishing a continuous improvement in the plant’s performance.

By implementing this common information system, Phoenix Zement has been able to simply, quickly and reliably provide reports and evaluations, significantly cutting expenditure in this area. Additionally, it uses the key performance indicators and the curve trends to optimise processing performance. Going forward, the company is considering extending the system to handle its laboratory data, and using the system to integrate all data for evaluating and trading CO₂ emissions.