

CEMENTABILITY

SICEMENT – solutions for the next level of productivity

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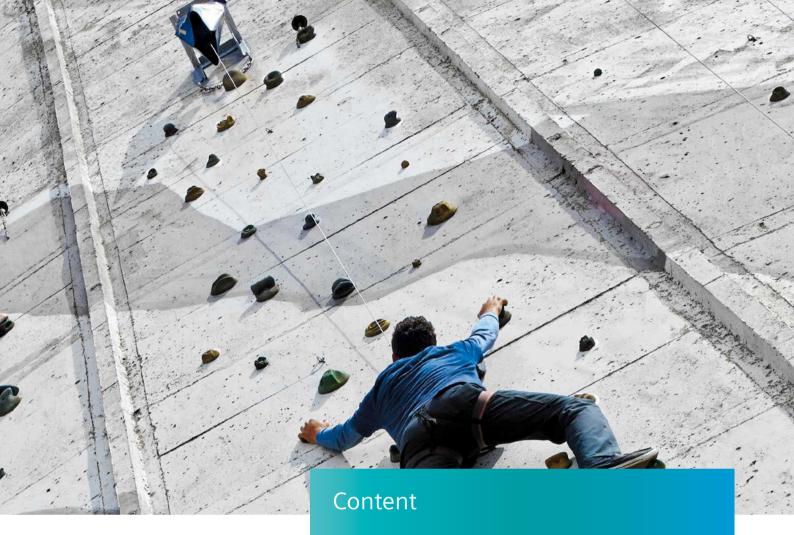
CEMENTABILITY

SICEMENT – solutions bring you to the next level of productivity. Siemens supplies solutions, systems, products and services along the entire production chain.

> Companies in the global cement industry are facing major challenges: If they are to improve productivity while simultaneously decreasing costs, they need high performance products that are also energy efficient and offer maximum availability and flexibility. These products also need to comply with environmental regulations while providing maximum safety for employees, machines, and material.

The SICEMENT portfolio encompasses electrification, automation and digitalization of core production and secondary processes ranging from system solutions right up to completely integrated electrical installations. The main focus of portfolio is to provide unique value-add to customers by seamless integration of innovative solutions along the entire production chain.

In its SICEMENT product family, Siemens links automation, drive, and power supply systems to form one overall solution. The portfolio can be used for primary tasks like extracting, transporting, and processing raw materials as well as for secondary processes like supplying power for plant servicing and maintenance.



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Welcome to a sustainable partnership ...

Siemens' mission is simple: to be your number one partner for ensuring profitable, environmentally compatible cement production. This is what's behind our CEMENTABILITY approach.

First of all, CEMENTABILITY stands for reliability – ranging from dependable plant processes to our long-term, trustworthy and locally available partnership. Secondly, it includes the ability to continuously optimize methods, technologies, and outputs in an integrated manner. And third, we are "cement people" – with a deep commitment to your industry, backed by the experience of our cement experts throughout the entire cement process chain.

We understand your business because we know your processes. Let's take a look!

... throughout your entire process chain.

E DS A D

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E DS A D Rotary kiln

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Limestone is the predominant raw material. The material is delivered to the crusher where it is reduced to chunks by crushing.

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E DS A D

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2 Crushed limestone and the other raw materials are stored in a hall to protect them from moisture. In most cases the quarry and the cement plant are in different locations. Therefore separate or standalone electrical supply equipment will be required.

Raw-material preparation

- 3 In the raw mill, the material chunks are ground finer to allow high-quality blending. As the raw mill is one of the biggest energy consumers in the cement process, it is important to adjust the grinding plant in order to minimize energy losses.
- 4 It is essential to use a process automation system to optimize the mill process, which in turn minimizes energy consumption. The raw material is finally transported to the homogenization silo.
- **Clinker** production

AD

- The pyroprocessing system involves three steps: preheating, calcining and sintering. Calcination is the core portion of the process. The raw material is continuously weighed and fed into the top cyclone of the preheater. The material is heated by hot air rising from the kiln. Inside rotary kilns, the raw material is transformed into clinker at 1,450° C.
- From the kiln, the clinker goes to the clinker cooler and then via a pan conveyor to the clinker silo for storage.

The main requirement for low emissions and low energy consumption is an optimized kiln operation. Therefore, the burning process must be monitored continuously using modern process technology, e.g., gas analyzers.

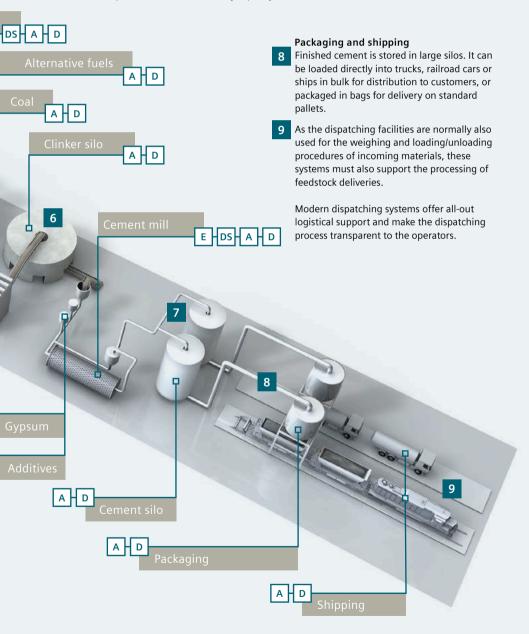
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Clinker grinding and storage

Clinker is extracted from the clinker storage and sent to feed bins for further proportioning with gypsum and additives before passing the cement mill.

During finish milling, the clinker is ground with other materials (for special finished product characteristics) into a fine powder. Many plants use a roller press to pregrind the clinker and the gypsum. These materials are sent through ball or vertical mills which perform the remaining grinding. The grinding process occurs in a closed system with an air separator that sorts the cement particles according to size. Material that has not been completely ground is sent through the system again.

The highly energy-consuming process needs automation and optimization to ensure today's quality demands.



Our SICEMENT solutions, products and services portfolio:



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- SICEMENT Electrification

As main electrification contractor Siemens offers you complete lowmaintenance power distribution solutions for your cement plant. In a cement facility the entire electrical system is installed in electrical rooms. In special cases a container solution is also possible.



- Main drive contractor
- Motors
- Frequency converters
- Converter transformers
- Control & monitoring cabinets
- Gearless & geared drives



- Main automation contractor
- CEMAT based on SIMATIC PCS 7
- Advanced process controlProcess instrumentation
- Process analytics
- riocess analytics

- SICEMENT Digitalization Siemens supports cement

customers supports centent customers with our IT competence and process know-how to achieve higher availability, efficiency and productivity, e.g. predictive maintenance, advance process control, dashboarding and operational intelligence.

SICEMENT Services

With Siemens as your main service contractor with a global support network you can be sure to always have experts at your service for operational support and maintenance to maximize the life span of your equipment – and, if needed, for your modernization plans as well.

... for increased productivity.

It is a long way from stock piles to packed cement with many intertwined processes. With our SICEMENT portfolio, we help you optimize every single process step as well as the efficiency of the overall process.

- Quarry
- Raw-material preparation
- Clinker production
- Clinker grinding and storage
- Packaging and shipping





SICEMENT solutions for the next level of productivity

Comprehensive SICEMENT solutions for the entire process chain

Cement plants consist of multilayered subsystems and complex processes. But what ultimately counts is the efficiency of the overall concept. That's why you need a global partner who combines technical expertise with a focus on business.

Digitalization

As a trusted partner to the cement industry, we support operational excellence first and foremost with our proven products, systems, services and solutions for electrification and automation. These solutions are complemented by our digitalization offerings. With our leadership in digitalization, we support cement customers with our IT competence and process know-how to achieve higher availability, efficiency and productivity. Among many, some examples are predictive maintenance, advance process control, dashboarding and operational intelligence.

CEMAT: more than 40 years of experience

CEMAT based on SIMATIC PCS7, specifically designed for the cement industry, has been well accepted and proven in the harsh environment over many years. Siemens has designed the CEMAT control system from their extensive know-how in the field of cement production, established together with global key cement manufacturers.

CEMAT is based on mainstream process control system, SIMATIC PCS 7, which offers a unique open architecture for modern, future-proof and economic solutions for the cement industry.



Process instrumentation

Precise monitoring of production rates, accurate dosing and pinpoint measurement are vital for maximum productivity. Effective measurement and control increase availability, reduce waste, save time and increase output. Siemens supplies a complete set of instrumentation – designed to work seamlessly together.

Drives – perfectly coordinated

The process chain of cement plant requires supreme performance and efficiency. Siemens offers both standard systems and customized solutions to meet individual cement production needs. The perfectly matched motors, converters and gearboxes transfer high levels of power and force reliably and efficiently.

Electrification –

never run out of power

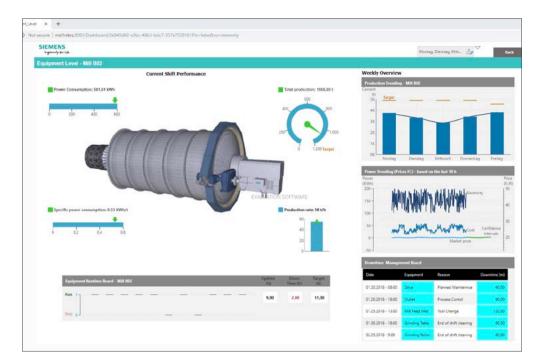
Siemens comprehensive expertise in energy planning, configuration and management ensure reliable, safe and economical power supply and optimal power flow. Every stage of the power supply lifecycle of the facility is comprehensively taken into consideration.

Siemens offers

- High voltage switchgear
- Transformers
- Medium voltage power distribution
- Low voltage power distribution
- Power monitoring, management and control systems

Integrated engineering, project management and services

Siemens boasts a high level of expert knowledge for turnkey projects, expansions, conversions and modernization. Our portfolio covers the delivery and installation of electrical equipment and integrated solutions including design, planning, engineering, project management, manufacturing, installation, testing and commissioning. Furthermore, training, after-sales services and maintenance are among the many customer services Siemens provides. The combination of product related know-how and cement process knowledge allows our experts to support you in developing the full potential of your plant.



Tap the full potential of your cement plants

Digitalization – leverage operational efficiency in the cement industry.

For many branches of industry, the Internet of Things (IoT) is seen as a spearhead for a revolution in manufacturing. IoT is an essential part of an initiative called Industrie 4.0 – an initiative of the German automation industry. Its objective is to define the way forward for manufacturing companies in the Internet age. A core element is that process industries become more intelligent. Cement companies too can profit from digitalization which helps tackle the challenges facing the industry e.g. demand for increased productivity, efficiency, optimization and lifecycle time. Digitalization is a journey Siemens takes together with the cement customers.

Integrated plant engineering – connecting data

Siemens integrated plant engineering provides different disciplinary of plant engineers with a continuous flow of data that meet their specific needs across the complete design phase. This connected data gives the chance of taking a 3D tour inside the plant via the plant's digital twin created in the course of engineering process before the real plant comes into existence, and provides training beforehand. With the help of the connected data, the automation project can be generated eliminating need of high effort of manual engineering works.

These highly integrated data can be used as data source for the future plant maintenance management.



Automation: the rock-solid basis

In the cement industry, the groundwork for the journey toward digitalization starts with automation. Therefore automation can be seen as the brain, which collects all the data with a closely knit network of sensors and instruments as the eyes and ears, and integrated drive systems as the muscles. Digitalization is possible only with a solid automation solution. CEMAT based on SIMATIC PCS7, Siemens' well-proven process control system perfectly fits to this requirement.

Advanced Process Control (APC)

SIMATIC PCS 7 / CEMAT includes a standard library containing a wide range of different types of APC control functions, making it possible to address the majority of complex closed-loop control tasks in the cement industry. This provides the user with easy access to an advanced function at no extra cost. Customer's expertise can be easily integrated, planning and implementation are minimized and furthermore, the system is modular and open to future extensions and implementation of artificial intelligent solutions.

Kiln Control System (KCS)

To manage process, the operators are spending a lot of time, efforts and have to permanently monitor the process very carefully. The goal of the Kiln Control System is to increase the quality as well as efficiency of clinker production. KCS ensures varying reactions exactly adapted to the actual process condition so that the plant is always in the most optimized and stable operation.

• Mill Control System (MCS)

Cement milling is in particular a highly energy-intensive process, there are potential energy savings available through the use of Mill Control System. The MCS is a software system that draws conclusions about the quality levels of the production plant through a knowledge-based approach using current plant data. The objective of the MCS is to increase the quality and efficiency of milling.

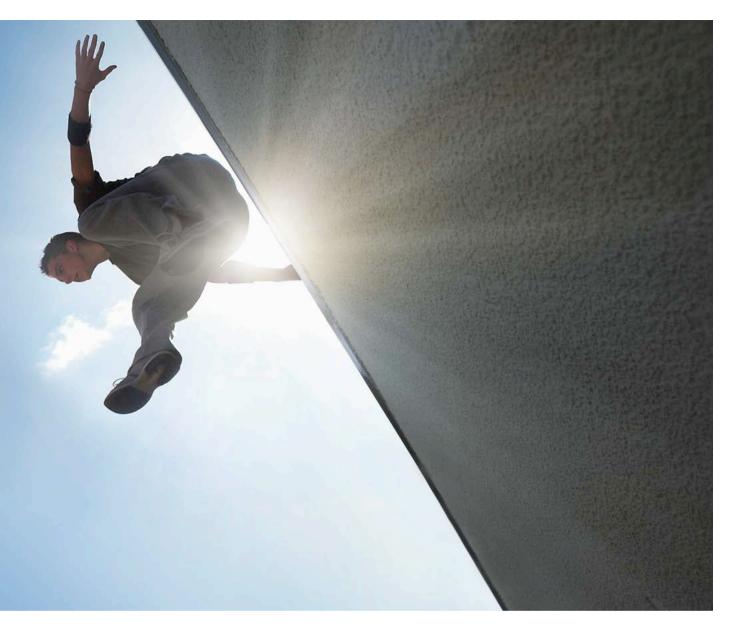


Minerals Process Analyzer (MPA)

Minerals Process Analyzer is a long term achieving system which can be integrated to CEMAT based on SIMATIC PCS 7 or other process control systems, providing data for further analysis and evaluations. MPA helps cement manufacturers benefit from its many features for example: increased productivity by data comparison, cost saving and quality improvement through the analysis of the alarms and the integrated report system.

Process simulation

The cement process simulator is an option to be integrated into CEMAT based on SIMATIC PCS 7, enables a realistic reconstruction of the behavior of a cement plant. The digital twin offers virtual commissioning, operator training and seeing the plant behavior by changing the process parameters before launching into real production. For the cement customers that equals safety, lower costs and higher efficiency.



Operations Intelligence – better information, better results

Siemens operations intelligence is a tailormade solution, which is based on your installations of automation IT infrastructure. This solution will collect, analyze and present operational and business data for plant dashboarding, thereby enabling realtime performance management and decision support at higher management level. This data transparency can help cement companies optimize their entire supply chain, not only for cement production, but also complete material value chain and speeds up the decision making process up via smart and connectible field devices, cloud solutions and realtime plant data. Through the comparison of assets between the plants, it enhances the visual quality of the cost factors. Needless to say, Siemens state-of-the-art solutions fulfill the industrial IT security requirements.



CEMAT – boost your process quality

CEMAT has been specifically developed for the Cement Industry for excellent process automation and to provide a solid base for Digitalization. With CEMAT, you can seamlessly control all horizontal and vertical processes – from crushing the raw materials to delivering the finished product, from resource management to productivity control.

Reliable standards – specific expertise

CEMAT draws on Siemens' more than 40 years of experience and collaboration with the world's leading cement companies – at present it proves itself in over 900 installations worldwide. The combination of indepth process expertise with standardized hardware and software makes CEMAT a strong backbone for successful plant operation.

Increasing performance - for a lifetime

CEMAT enables superior plant performance, both today and tomorrow. Thanks to a near realtime overview, you can easily control all processes. The system also detects faults before they can turn into cost-extensive problems.

With CEMAT you get concise information – for example, about quality, production, and energy – that enables you to always make the best decision. At the same time, CEMAT helps you improve process quality and energy efficiency – with facts-based recommendations for future modifications and modernizations.

- Cement specific faceplates and picture library
- User optimized alarm concept
- Advanced information dialog
- Easy fault diagnostics
- Integrated Maintenance features
- Simulation functionality
- Integrated Advanced Process Control (APC)

Benefits

- Centralized management of cement recipes
- Recipe related operation allows easy operations
- Easy Silo management
- Automated routes and conveying ways
- Automated production of different cement types



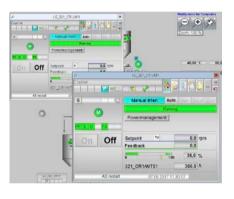
Upgrade – smooth and future-proof

Over the years, the requirements in your cement plant will change. It's good to know that CEMAT is optimally prepared for updates, modernizations, and expansions. Continuous innovation ensures that you always have a state-of-the-art system.

If necessary, we also integrate existing system modules into any new configuration. Do you know any other system that is compatible with all previous versions, going back as far as 1976?

Benefits

- Increased readability
- User can size faceplates individually
- No additional engineering besides copying buttons



CEMAT V9.0 faceplate

Diagnostic dialog offers fast fault finding to achieve minimized downtime and improved operational efficiency.

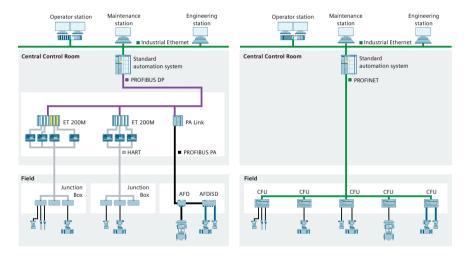


SIMATIC process control equipment Offers more reliability and highest performance across your entire system and the entire lifecy-

cle of your plant.



Always be connected...



SIMATIC PCS 7 process control system supports the world leading Industrial Ethernet standard Profinet with distributed I/O lines for greater digitalization right down to the field level, as well as extensive new software functionality.

Plant operators also benefit from greater flexibility, convenience, future-proofing and wide-ranging compatibility with legacy installations.

Decentralized I/O approach

Achieve highest flexibility through modularization of your plant.

Freely-configurable I/O

Benefit from highly comfortable software wiring – late signal binding.

Simple device integration Plug-and-Produce instead of

Trial-and-Error.

Standardized solutions

Allows full cost control over the whole plant lifecycle.



... always in control

Instrumentation – measure your gains

For process instrumentation, process analytics, weighing and dosing systems and production sensors – the Siemens portfolio has a suitable measuring instrument for every stage of production throughout the cement process.



With Siemens, you can be sure to measure accurately. Your benefits range from more stable kiln operation to higher efficiency in the burning process. By reducing air pollution and dangerous exhaust gases, you can also support the environmental compatibility of your cement operation.



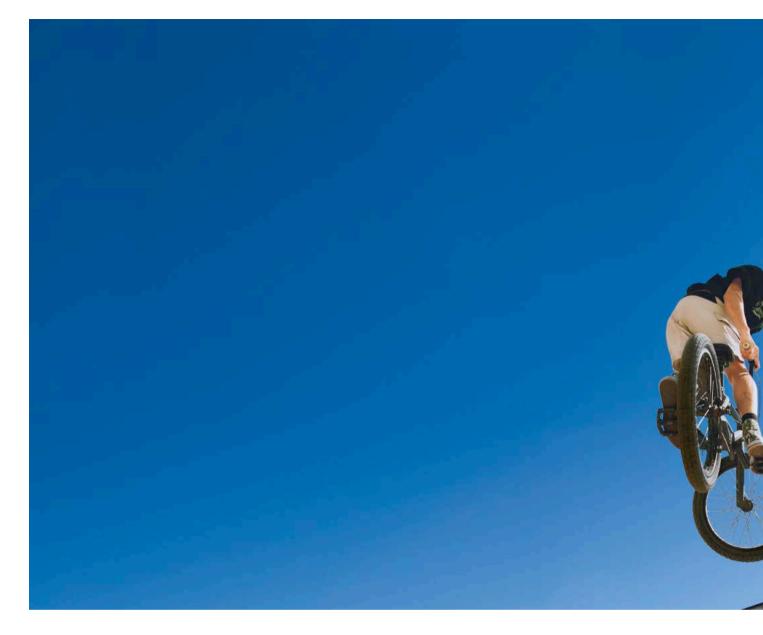


SITRANS LR560

2-wire, 78-GHz FMCW radar level transmitter for continuous monitoring in silos (dusty environment) to a range of 100 m (328 ft) as well as clinker cooler bed depth measurement.

Gas analyzer

Standardized emission monitoring system which covers all requirements associated with sampling, sample preparation, and gas analysis.



Leverage your plant's dynamics

Throughout the cement production plant, hundreds of drive systems of all sizes perform indispensable tasks. They serve as the interface between your electrical and mechanical components – and they often come from multiple vendors. Our cement process expertise and engineering help you address all your drive requirements with a coordinated portfolio: the SICEMENT Drives. With the right drive solution in the right place, we can leverage your potentials for increased reliability, productivity, and energy efficiency – always with your entire process chain in mind.





Drive your productivity

Get the right dimension

Whether for the raw mill, kiln, belt conveyer or fine milling, it is important to select the correct drive model and dimensioning to achieve uninterrupted and energy-efficient operation. The SICEMENT Drives include specific drive solutions for all normal cement production processes. Despite the wide power spectrum, standardization allows them to be completely incorporated into an integrated power supply network and control system. This is vital to guarantee safe and transparent operation of processes throughout the cement works.

Power of integration

SICEMENT Drives offer the world's first true one-stop solution for entire drive systems – frequency converters, motors, couplings and gear units from a single source. All of these components are perfectly integrated and interact smoothly. SICEMENT Drives seamlessly integrate any automation environment, and throughout the entire lifecycle. This leads to reduced time to market and time to profit. And you can also leverage the full productivity potential of a harmonized technology landscape, increase energy efficiency, and enjoy reliable system performance in a variety of automation environments.

High availability and reliability

With modular drive systems, you can flexibly respond to any demand in vertical and ball mills. Our MultipleDrive concept allows you to choose the number and size of components that precisely match the power requirement of your application. Further advantages of the MultipleDrive concept are the outstanding availability and reliability – through continuous condition monitoring and the ability of the mill to keep running even if one of the drives requires maintenance.



Save energy and costs

A system design incorporating SICEMENT Drives give you the best output and power utilization. Because we offer such a large selection, you can choose the optimum drive to fulfill each particular mechanical task. Our design ensures potential for major savings in many areas of application, for example

- Speed-controlled drives reduce mechanical impact load because of their soft start feature.
- Frequency converters with feedback capability put power back into the grid during breaks.
- Gearless motors also offer the unique benefit of saving space.
- Variable-speed drives help you save up to 70 percent of fans' electricity consumption and this typically pays off in just 9 to 24 months.



SIMOTICS GP General-Purpose Motors High-efficiency motors



FLENDER Standard Helical Gear Units Maximum efficiency and highest possible reliability



ROBICON Perfect Harmony Easy upgrade to variable speed. It offers also increased availability because of its modular design and ability to bypass any one cell during operation while maintaining the full output voltage.



Never run out of power

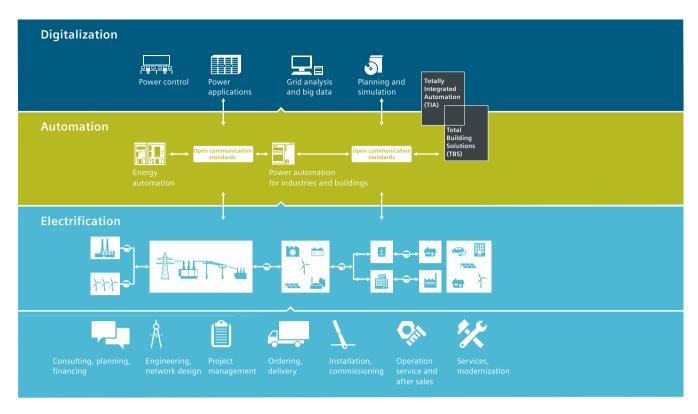
In cement production, electrical power has always to be where and when you need it. To safeguard a reliable supply under all conditions, it's a good decision to build on electrification solutions from Siemens – the company where electricity has been a core business since 1847.

Leading-edge solutions

Electrical distribution in cement plants is highly diverse – from kilowatts to megawatts, from high-voltage to low-voltage switchgear. Together with our customers, we analyze your requirements for energy systems and develop tailored solutions that address your challenges along the entire energy conversion chain. SICEMENT Electrification includes technology and expertise for an economically efficient and reliable power supply, which accounts for resource scarcity and helps to protect the climate.

Complex demands call for specific know-how

Our largely electrified, automated, and digitalized world places greater demands on power supply systems than ever before. Electricity has proven to be a clean, efficient, and highly versatile power carrier that meets the high-profile requirements of industrial applications. Totally Integrated Power (TIP) is the key to reliable, safe, and efficient power supply in increasingly complex transmission and distribution environments.



Benefit from rugged design

It's a simple law of electricity that the lower the losses, the higher the efficiency. It therefore makes sense to install electrical substations as close to the various plant areas as possible. With their compact and maintenance-free design, all TIP components can be decentralized and near the loads. This allows for economically optimized system layouts and helps you reduce your CO₂ footprint. Sooner or later, older electrical systems need an upgrade. As your partner from consulting to plant engineering, Siemens connects you with the future.

The future is digital

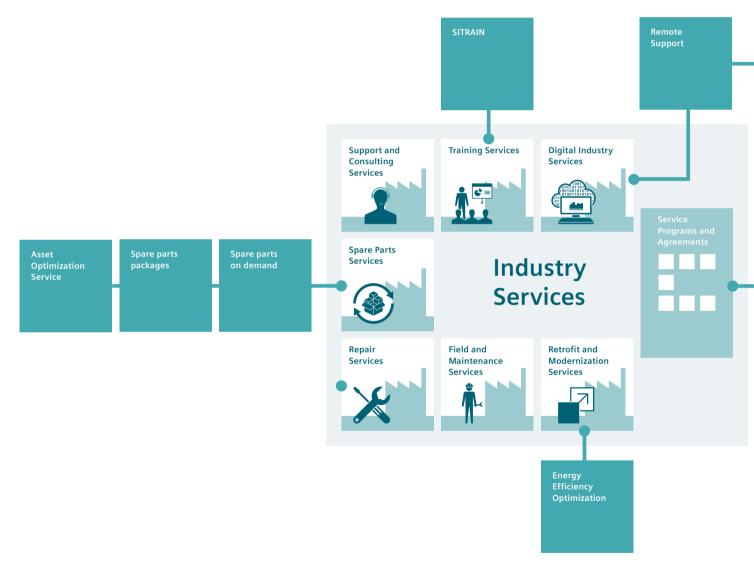
Digitalization is one of the most fundamental revolutions of our time – simply because the benefits of digitalization help to reduce costs over the long term. By recording the energy flows and the key cost flows in your company, you will benefit from the data analysis – through low energy costs and competitive prices for your products. Our power monitoring system helps you to establish an operational energy management.

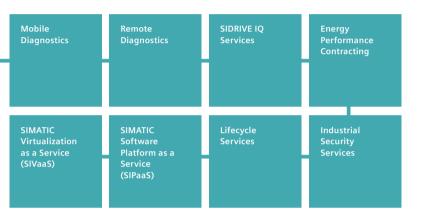
More value with Siemens power generation equipment

Putting resources to the best possible use is crucial, but many plants only utilize a fraction of their fuel's energy. To remain successful, each industry needs stable production processes and, ideally, zero downtime. Energy reserves must be readily available, and reliable power supply is essential. It makes sense to invest in sustainable technology. Not only to significantly minimize CO2 emissions and comply with regulations, but also to make the most of the resources at hand. With a comprehensive portfolio of gas and steam turbines and extensive plant construction expertise, Siemens is a leading player in the industrial power market, and field proven in more than 80 gas and steam turbines delivered to cement plants globally in the past three decades.

Increase your performance – with Industry Services

Now more than ever, increasing complexity, constantly rising rawmaterial prices and ever stricter environmental regulations are making resource and cost-optimized production vital. How can a company master these challenges in order to succeed in global competition?





Drive Train Management Program

Industry Services: integrated, intelligent, customized

Siemens Industry Services enables you to unleash hidden potential and increase the performance of machines and plants. We offer a complete portfolio of product, system, and application-related services that cover the entire lifecycle of machines and plants - planning and development, operation, and even modernization. All our services, such as online support, spare parts, maintenance, repair, training and digital services, are optimally matched to our products and systems, thus helping to enhance availability and secure your investment. We also offer services such as remote condition monitoring, energy and environmental services, maintenance management and plant security services that track and secure your production processes

comprehensively – for greater productivity and efficiency. Industry Services fulfills both industry-specific requirements and individual customer needs. Thus, machine builders and plant operators each receive precisely the services they need.

Our knowledge - your success

As a partner of manufacturing and process industries, we have a global network of experts at our disposal. Right from day one, you benefit from our comprehensive technological know-how and the industryspecific competence of our service experts.

The result: reduced lifecycle costs for your machines and plants – combined with higher performance levels.

St Marys Cement Plant



The task

Facing increased demand, St Marys sought to expand their production capacity by adding cement and coal mills, clinker kilns, and retrofitted cooling systems and to modernize the existing raw mill.

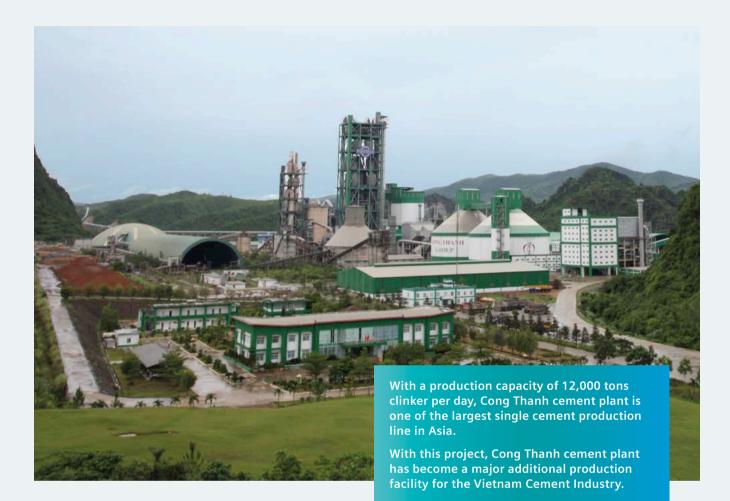
The solution

In addition to creating a comprehensive engineering scheme, Siemens supplied more than \$12 million of cutting-edge electrical equipment. This included the installation of a process control system with CEMAT, medium-voltage switchgear type GM-SG-AR, as well as custom built e-House substations.

The result

- Increased production capacity by 40%
- · Expanded and modernized plant systems
- Reliable energy supply and higher energy efficiency
- Reduced operational and maintenance costs

Cong Thanh Cement Plant



The task

The cement plant is built to meet the increasing demand for cement consumption during the process of the national modernization and industrialization.

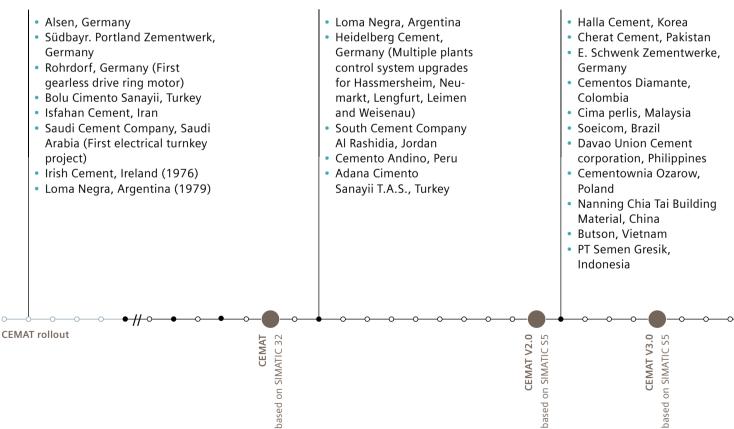
The solution

Siemens supplied the complete range of the product portfolio for equipping cement works including electrical equipment and automation systems for the new line and the supervision of installation and commissioning from the service team.

The result

- Maximum productivity
- Turnkey solution including all electrical packages and services from a single source
- Higher energy-efficiency
- Reduced operational and maintenance costs





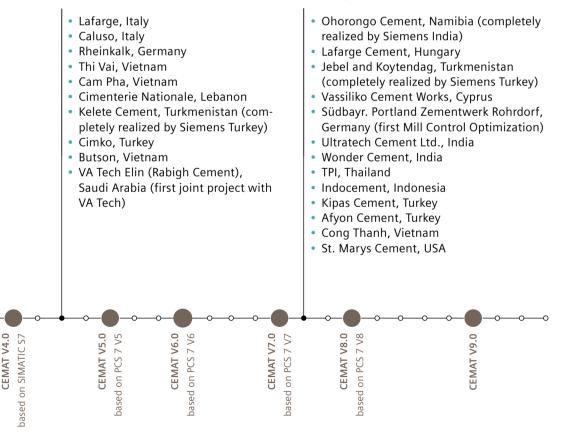
Milestones – always striving for better performance

In globalized markets, there is no alternative to the continual optimization of productivity and efficiency in production lines.

Constant innovation and always striving for better performance are what makes Siemens the perfect partner for everyone in the cement industry who wants to be one step ahead: because that's what we've always been.

2000

2010 until today



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