process news
The magazine for the process industry

China special 2014
A clear view of the future
Solutions for sustainable growth in China’s process industry
Focus on China

From China to the world stage: China is home to some of the most advanced and largest process industry sites on the world. In recent years, the industry has made a shift towards high-tech methods both in production and engineering – such as the cloning of plant designs as was performed during a recent project at the Nanjing site of BASF/YPC.

Cover photo: BASF SE / Detlef W. Schmalow

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China is one of Siemens’ most important markets

China’s process industry is maturing. In addition to a strong petrochemical base, increasing consumer spending creates growing demand for fine and specialty chemicals, leading to a diversification in the process industry. At the same time, companies need to address their operational performance, improve their resource efficiency, and reduce emissions in order to both address growing public concerns about environmental pollution and ready themselves for increasing cost pressures and competition on the market, both domestic and global. These challenges require not only new technology but also new strategies that will help these companies win more market share and customers against strong competition, especially in the global market, and respond to increasingly strict environmental regulations and ever-increasing labor and energy costs.

New technologies and concepts such as the digital plant are discussed as much here in China as elsewhere and are also a focus topic of this year’s sixth NAMUR Conference in China, in Shanghai. With our integrated solutions for engineering and process control with Comos and Simatic PCS 7, as well as powerful simulation tools such as our Simit software, we are proud to be at the forefront of these developments, exploring new opportunities together with our customers in the Chinese process industry.

China is one of Siemens’ most important markets global. Chinese customers not only require perfect products and technologies from suppliers but also care a lot about the level of localization. With our new Process Industries and Drives organization here in China, we will continue to develop tailored and advanced solutions for our process industry customers, drawing from a large pool of local talent and our China-based manufacturing and automation expertise. We have provided world-class engineering execution and service to Chinese customers in a wide range of fields, and you can find some examples of these successful projects in this special issue of process news.

I hope you enjoy the read. I am looking forward to a bright process industry future here in China.

Yours,

Dr. Jun Yao
General Manager of Process Automation Business Unit
Process Industries and Drives Division
Siemens China
Like two peas in a pod

Two continents, two locations, one plan. Two superabsorbent polymer plants – in Nanjing, China, and the other in Camaçari, Brazil – share not only their key plant and process figures but also a common design.
The idea is as simple as it is compelling: combining two plants with essentially identical tasks in a single, common project to produce synergies in the planning and construction processes – and reduce costs, too. However, there was still concern as to whether a twin project of this type would be practical and ultimately cheaper than “conventional” planning for two separate projects. “It’s not that uncommon to copy from other projects when building a plant,” says Arno Rychtr, who headed the twin plant project at BASF. “As engineers, we always use the best, most recently designed plant as our basis. What we’ve done here, however, is new: planning the main plants in two separate projects together and largely identically. There was just one common model up until the end of the detailed planning, which was then broken down and adapted to meet local requirements. The sister plants in Nanjing, China, and Camaçari, Brazil, are consequently almost identical. That’s why we use the term ‘cloning’ to describe the process.”

Copying is not new, but “cloning” in the present form has never been used on a project of this scale. Rychtr adds that “we have copied plants on several occasions, especially in projects in which time-to-market issues were paramount. But never before has one team worked on a joint project for two plants built for two companies at two locations on two different continents. We had to define the best way of bringing this to fruition at the development stage. The point was not just to plan a plant for one location and then copy it. From the outset, the two locations had to be carefully examined so that we could develop solutions that would ensure that the plants are as similar as possible.”

**Duplicates for two growth markets**

BASF intends to use the plant in Nanjing, built by the company in a joint venture with SINOPEC, and the identical one in Camaçari to consolidate and expand its market position with superabsorbent polymers based on acrylic acid and thus benefit from projected growth in the key markets of China and Brazil. The two plants have the same capacity and are designed to be world-scale plants for acrylic acid and superabsorbent polymers. In Brazil, a new location, a tank farm and necessary infrastructure had to be added – but the main plants at the two locations are identical. There are also almost no differences when it comes to the automation of the two plants; Siemens was the main automation vendor (MAV) on both projects. In addition to the cost savings achieved by the duplications at the plants, BASF wanted to take advantage of the duplication to ensure smooth knowledge transfer between the continents and a highly efficient and error-free overall project process. “Planning two plants as one identical plant, as it were, naturally yields cost benefits. In addition, we bought almost all the plant components for both sites from the same supplier, further driving down costs,” explains Rychtr. “Beyond this, simultaneous execution gives rise to diverse synergies and as a whole saves...”
manpower resources, which was also a major advantage in view of our very high engineering workload,” he adds. “In order to ensure high quality, we chose to award the contract to just one automation supplier, giving us a minimum of interfaces and ensuring top quality and functionality within the project. It goes without saying, of course, that the tendering process was carried out under a competitive system.

“The expectations we had of the cloning synergies have been met in full. I believe this has allowed us to achieve far-reaching benefits that go beyond the engineering phase.”

Arno Rychtr, Head of the Twin Plant Project, BASF

China makes the start

Siemens had previously performed well as MAV on other BASF projects in China. For the twin project, the company presented a compelling plan in which the projects in China and Brazil would be carried out with one international team. Phase 1 of the project began in China, where the design of the two plants was first developed. The Chinese team was already supported and assisted by staff from Brazil at this early stage to encourage a common understanding of the project and promote mutual expertise. This form of international collaboration was then stepped up in the following project phases. When work in Brazil commenced, staff from the Chinese team gradually relocated to South America, allowing the experience from Nanjing to be used at both locations, not only in the form of typicals and documents but also as actual manpower. This enabled Siemens to ensure excellent service quality at both locations from the very beginning, with employees who had worked on and knew the system from the start.

Standardized automation

In line with the MAV approach, Siemens was responsible for the entire automation solution. This included technical interface coordination with other project partners – for example, the integration of functional units such as waste material incineration and an interoperability test with the various field device manufacturers. Siemens developed and configured the systems for process control (distributed control system) based on Simatic PCS 7, the process safety system (safety instrumented system), and the
fire protection systems. Beyond this, the Siemens team also enabled the interface to the central production information system and provided on-site commissioning support. The company will support both systems with a lifecycle service agreement as well. To ensure that the project could be carried out both efficiently and to a high quality, Siemens used specific automation typicals for the configuration. This enabled the creation of recurrent control and automation tasks, which were used as templates for the individual measuring points. The PCS 7 library developed for BASF, known as the BASF Toolkit, was used in these software typicals. The library was developed by Siemens to meet the requirements of the BASF plant standard and is used in every PCS 7 project at BASF worldwide. In addition, the BASF standard also incorporates custom solutions, for example, the standardized linking to safety instrumented systems and the integration of the control system in BASF’s plant IT security system. The team also drew on the knowledge gained from previous plant projects, meaning that custom solutions from plants in Ludwigshafen and Antwerp could be reused.

Challenges for people and technology

On paper, the conditions for ensuring the efficiency of this major intercultural and intercontinental project had been clearly set out. However, in addition to the technical factors, other key issues needed to be resolved, as Rychtr explains: “Within a tight schedule, we had to deal with something very new – redefining processes, procedures, and responsibilities. That can only work out well with a very good team that displays a willingness to adapt to new approaches and foreign cultures. And on a project that is carried out in both China and Brazil, you have to account for trivial things, like a time difference of 11 hours, which makes direct communication within the team extremely difficult. And as always, it is the employees, and their skills and motivation, that determine success or failure; on this project, everyone involved did a fantastic job.”

Outstanding teamwork produces excellent synergies. This was the experience of the managers of the automation project, in which numerous functional improvements gleaned from the Chinese side could then, thanks to the staggered schedule, be used on the Brazil project. The Brazilian team thus improved the functionality of the solution and was able to meet the very tight deadline. For the Siemens staff in Brazil working for the first time on a project of this scale for BASF, this provided a genuine sense of accomplishment.

And now: start-up!

In April of this year, after only 19 months, BASF and SINOPEC celebrated the opening of the new plant in Nanjing. The project initiators are already very happy with the outcome: “The expectations we had of the cloning synergies have been met in full. I believe this has allowed us to achieve far-reaching benefits that go beyond the engineering phase,” concludes Rychtr.

![Diagram](image-url)

To ensure excellent quality, the projects in Nanjing and Camaçari also shared their teams, which in the course of the various phases moved between the two locations.
Mr. Lin, China is an important market for Siemens. What are the main challenges and drivers in the Chinese process industry?

Lin Bin: China’s growing economy, rising living standards, and increasing consumer expectations are placing higher demands on the process industry. But people are also becoming more worried about pollution. Most companies in the Chinese process industry are in densely populated but resource-deficient coastal and river delta areas. The scarcity of usable water leads to overuse of underground and river water, which is being polluted by manufacturing. More attention is being paid to drinking water quality, and production is subject to strict monitoring. Much money has been invested to treat sewage and wastewater, and we have been able to support some of these projects with our technology and expertise, for example, in Erdos City.

At the same time, companies in the process industry are facing pressure to shorten their time to market, promote digital production and transparent manufacturing, and improve efficiency.

And how can the industry achieve this?

Lin Bin: Manufacturing upgrades are crucial. The main challenge is to increase productivity, efficiency, and flexibility. The Chinese government is currently completing its “Made in China 2025” plan, and Chinese manufacturers are seeking out methods such as digital factories and integration solutions. There is a clear need for shortened time to market and transparent manufacturing. Siemens can shorten time to market through its industrial software, which aids efficient engineering design for the process industry. Siemens can promote transparent manufacturing through its open platform and standardized technologies and modules. Siemens can provide holistic digitalization and integration solutions from integrated engineering to integrated operations. Our Comos platform enables data integration and intelligent operation, and, with strong hardware such as a distributed control system and drive system, Siemens has already opened the door to progress. Comos reduces costs in every stage of production, and the Simit simulation software allows visual plant commissioning.

Do these trends also impact the field of electrical equipment?

Lin Bin: Definitely, especially in terms of resource efficiency. One example is the high-efficiency motor standard, which helps lower carbon emissions. The new extension of Siemens Motor Co. Ltd. China (phase II) began operation in May 2014. This new factory will provide 1 million efficient low-voltage motors and 20,000 servomotors every year. Upgraded motors can trigger upgraded drive systems, realizing higher energy efficiency. The new facility will also help Siemens give its Chinese customers the right products.

How would you assess the potential of product-driven and solution-driven business – is there a clear trend?

Lin Bin: Siemens has always been committed to providing its Chinese customers with creative, reliable, and competitive products, solutions, and services. China has many excellent general engineering contractors and systems integrators. Combining their expertise with Siemens’ products, we can provide superior systems and services. This mutually beneficial cooperation is important in serving the Chinese market and will continue to grow. Alternately, some customers want Siemens to engineer their automation systems. Siemens has provided this service to many such clients, including Volkswagen, BASF, SINOPEC, CNPC, and Budweiser. The Chinese market will grow rapidly, and various demands will increase. Therefore, our product business and solution business will both keep growing.
talents, we provide the Chinese process industry with added value, enabling companies to increase their efficiency over the whole value chain. We provide Chinese-customer-oriented, future-proof automation, drive technology, industrial software, and services based on best-in-class technology platforms like Totally Integrated Automation (TIA) and Integrated Drive Systems (IDS). Additionally, we have seven research and development (R&D) centers in China, with more than 160 R&D engineers. These centers concentrate on customer requirements and provide superior products and services.

Furthermore, we have 10 local production bases in China and strong engineering teams with more than 500 engineers. We continuously launch new products such as our coal scraper gearbox, Simogear geared motors, GH180 SMART drives, and much more. This gives Chinese customers help with engineering design, engineering execution, project management, and production operation.

Where do you see Siemens as a partner to the Chinese process industry in the next 5 to 10 years? Lin Bin: We will further strengthen our complete portfolio of products, systems, and solutions. We will build a specialized team to provide lifecycle services addressing engineering design, engineering execution, and lean operation. We have many loyal stakeholders that partner with us in product development and market promotion. Our Chinese competence center, comprised of an R&D team and an engineering team, will become stronger and more influential.

Mr. Lin, thank you for speaking with us.
Huaneng Ningxia Daba Power Plant, Ningxia

Cleaner, safer operation

With a reliable system for emission monitoring in its desulfurization and denitrification units, Huaneng Ningxia Daba Power Generation Co. Ltd. benefits from safe and continuous operation as well as compliance with national guidelines for emission monitoring.

The first 300-MW thermal power generating unit in northwestern China was put into operation at the Ningxia Daba Power Plant, and its construction was a key milestone in the development of the Ningxia power industry. From 2008, when the first desulfurizer was put into operation, to 2013, when the first denitrification system was put into operation, the plant has relied on continuous emission monitoring systems (CEMS) from Siemens, benefiting from the systems’ outstanding real-time performance, continuity, reliability, and accuracy of flue gas pollutant emission monitoring.

Reliable design

Each desulfurization and denitrification unit in the Daba Power Plant is equipped with four CEMS. At the core of each is an extractive Ultramat 23 infrared analyzer system using single-beam alternating infrared technology for simultaneous real-time measurement of up to three infrared-active components such as nitrogen oxide, sulfur dioxide, carbon monoxide, and oxygen. The analyzer automatically conducts zero calibration at a fixed time and supports easy calibration by providing an integrated calibration function as well. This results in very reliable system performance. Regular checks conducted at the Daba Power Plant have confirmed deviations of less than 1% of the measured value.

In line with requirements

The gas samples obtained in the flue gas inflow and clean gas outflow are conditioned to avoid clogging and fouling the analyzer to further improve reliability. Overall, this leads to an availability of the CEMS of 99.2% per year of operation. Although the CEMS already meet the plant’s requirements for monitoring and adjusting of the denitrification system and desulfurization system, the team at the Daba Power Plant has identified several staff training and maintenance measures to further improve the reliability of the CEMS – adopting a zero-defects policy in this crucial area of environmental protection.

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Flowmeters

Pipeline sentinels

Measurement of oil and gas leakage and loss during long-distance transport and precise measurement of interplant material transmission is vital for the efficient and safe operation of pipelines. The Sitrans F UH 1010 clamp-on ultrasonic flowmeter has become a reliable choice for meeting these challenges.

The flow of an oil pipeline is an important measure that needs real-time testing and monitoring, and the requirements on the flowmeter for real-time detection and monitoring increase with the increase in length of the pipeline, the pipe diameter, and the complexity of the work conditions at the booster station. If traditional mechanical volumetric flowmetering is adopted, opening the pipe will add to the operational risk and difficulty in construction, which is especially true for long-distance oil pipelines.

Clamp-on solution for in-depth measurement

The China Petroleum Pipeline Bureau (CPP), a specialized pipe engineering company under the China National Petroleum Corporation (CNPC), was faced with exactly this challenge: implementing a clamp-on flowmetering solution for its long-distance crude oil and oil-product pipelines. After extensive evaluations, the company found an appropriate solution in the advanced Sitrans F UH 1010 clamp-on ultrasonic flowmeters.

CPP has been using Siemens flowmeters since 2003. Today, almost 80% of CNPC’s long-distance pipelines are equipped with Siemens flowmeters. The latest projects comprised six pipelines, where nearly 90 clamp-on ultrasonic Sitrans F UH 1010 flowmeters were installed. Using clamp-on meters provides a number of obvious benefits: The meters can be installed without cutting the pipe or interrupting the flow, so they are easy and safe to install. As they cause no pressure loss in the pipeline, they are a very energy-efficient solution. And finally, the sensor does not require cleaning, so the system is also low-maintenance.

Perfect for a wide variety of conditions

The Sitrans F UH 1010 provides advanced measurement options for viscosity compensation and can therefore be used in a wide range of applications and products, making it an ideal standard solution for monitoring flow in oil and oil-products pipelines. The system is capable of leakage and interface detection, which also helps identify impurities or contaminants. As the devices can be replaced without interrupting the flow in the pipeline, they also ensure high operational performance. Leaks can be detected within just five minutes and located with high accuracy (within 100 m), which contributes not only to cost-effective pipeline operation but also to improved operational and environmental safety – and helps ensure high operational performance.

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Small devices, big savings: Tenglong Arene has equipped its plant in the Zhangzhou Gulei Petrochemical Industrial Zone with new positioners. The Sipart PS2 devices provide significant cost savings by reducing both energy consumption and plant shutdowns.
Tenglong Arene Co. Ltd. is a large petrochemical enterprise in the Zhangzhou Gulei Petrochemical Industrial Zone in China. The many hazardous areas in the plant pose major challenges to safe, stable operation. To complicate matters, the plant had to meet a five-year plan requiring a reduction in energy consumption and emissions. Meeting these demands presented a difficult balancing act to company leaders and engineers. As the saying goes, “Without small steps, one can’t cover a thousand-mile journey; without small streams, there can be no oceans or seas.” This also applies to saving industrial energy. Understanding this, the company sought process improvements wherever they could be gained – and Siemens was able to provide a successful solution with its intelligent Sipart PS2 valve positioner for pneumatic control valves.

Innovation = green savings

Pneumatic control valves play a significant role in process automation. The key to regulating them is the valve positioner, which runs on compressed air. Compressed air requires a great deal of electricity – normally, valve positioners each use about 1.5 kWh per day. The Tenglong Arene plant has more than 800 valve positioners, so this single type of component consumes more than 400,000 kWh per year. The Sipart PS2 smart valve positioner provides significant energy savings and decreased emissions, as well as excellent ease of use. Its operating principle is completely different from that of traditional valve positioners. When a Sipart PS2 valve positioner is in a steady state, its piezoelectric valve is closed and compressed air consumption is basically zero. This design allows the PS2 to use a fraction of the compressed air that a traditional valve uses, reducing energy consumption by 94%.

In addition to costing less, the energy savings make the operation greener. Assuming that 631 g of carbon dioxide (CO₂) are exhausted per kWh, the average CO₂ emissions of a traditional positioner are about 352 kg per year. Under the same conditions, a Sipart PS2 valve positioner creates CO₂ emissions of about 21 kg. Each valve positioner reduces CO₂ emissions by 331 kg per year, which is equal to the emissions of 100 cars.

Predictive maintenance = fewer shutdowns

Another reason for choosing the Sipart PS2 valve positioner is its diagnostics function, which allows for predictive maintenance. Predictive maintenance integrates equipment status monitoring, failure diagnosis, failure (status) forecasting, maintenance decision support, and maintenance activities.

Rather than scheduling maintenance according to the average life statistical data or mean time between failures (MTBF), predictive maintenance monitors operation status, efficiency, heat distribution, and other variables directly to determine the actual MTBF. Compared with prior maintenance modes, predictive maintenance has obvious advantages. It provides well-targeted maintenance based on actual status instead of “blind” updates and repairs, so overhauling costs are reduced. Predictive maintenance reduces shutdown (total maintenance) time, improves equipment reliability and availability coefficients, and extends equipment service life. It allows better adherence to the guidelines of safety first and breakdown prevention. It reduces the amount of maintenance needed as well as the work intensity. This facilitates efficient downsizing, which improves economic performance.

Jointly creating a green future

With the Sipart PS2 smart valve positioners, Tenglong Arene is in an excellent position to meet increasing energy savings demands. With its intelligent and energy-efficient design, the Sipart PS2 smart valve positioner brings sound economic benefits to businesses.

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Small devices, large gains

How can a company rapidly respond to the demands of market change? How can factories’ flexibility and transparency be increased? How can costs and energy consumption be reduced? With an integrated distributed control system and a safety instrumented system, Siemens has provided CNPC with a good technical foundation for answering these questions. A small but vital part of the automation solution is Sipart PS2 positioners that help reduce costs while ensuring safe operations.

With a production capacity of 10 million tons of refined petroleum and 1 million tons of ethylene, the refining and petrochemical complex in Fushun operated by CNPC China Fushun Petrochemical Company is one of the largest refinery and petrochemical plants in China’s northeastern region. The plant was equipped with the latest technology for ensuring safe and efficient operation – including an advanced integrated solution for process control and process safety based on the Simatic PCS 7 process control system. As the main automation vendor, Siemens also provided systems for gas detection, asset management, and process instrumentation, including Sipart PS2 intelligent electropneumatic valve positioners, Sitrans TH300 temperature transmitters, Sitrans LR460 FMCW radar level transmitters, Sitrans LVS200 and Sitrans LV200 level switches, and Sitrans FUS ultrasonic flowmeters.

Smart systems reduce compressed air consumption

In a plant the size of Fushun, even small devices can have a significant impact on overall operational efficiency through their sheer numbers. The valve positioner is one such piece of equipment. In total, Siemens has installed 4,000 intelligent Sipart PS2 positioners at various valves in different locations. The valves are operated with compressed air, and the compressed air consumption of the valve positioners can add up to a large expenditure for the enterprise. So choosing an efficient technology in this area can help cut costs – and it can even improve process and system performance.

Compared to conventional positioners, Sipart PS2 systems have an ex-
extremely low internal air consumption rate of only 0.036 m³/h. This is achieved by using a piezoelectric valve precontrol combined with a state-of-the-art microcontroller. The microcontroller compares the actual position value provided by the position sensor with the set point and corrects deviations through a five-way switch procedure to control the piezoelectric valve, which regulates the flow of air into and from the chambers of the pneumatic actuator or blows it in the opposite direction. This means that the positioner consumes air only when it is needed. Combined with the high-quality device design, this reduces the idle air loss to almost zero. Additionally, the piezoelectric valve helps achieve high positioning accuracy. The pilot element is a piezoelectric bending converter that switches the pneumatic main controller unit. The valve manifold is characterized by an extremely long service life, another significant benefit considering the large number of positioners installed in Fushun.

Advanced diagnostics and communication

Combining a digital field device with a highly integrated microcontroller also proves beneficial in terms of process monitoring and asset maintenance. The Sipart PS2 has various monitoring functions with which changes on the actuator and valve can be detected, triggering a notification or service alert if desired when a predefined limit has been reached or exceeded. Typical monitoring parameters include the travel integral, the number of changes in direction, the number of alarms, the end limit position for monitoring wear or deposits, the operating hours with temperature and travel range information, the operating cycles of the piezoelectric valves, and the valve positioning time. The status indications derived from the advanced monitoring functions signal active faults of the unit. Fault indications can be output either via the integrated alarm outputs of the positioner or via communication over HART, Profinet, or Foundation Fieldbus. Through an easy-to-use three-stage alarm system, the positioner can display the status in a simple color code to indicate the severity of the fault (“traffic light signaling,” symbolized by a wrench in green, yellow, or red) in Simatic PDM and in the Simatic Maintenance Station. Users can then take early action before a serious valve or actuator fault occurs that could result in a system shutdown.

Doing the math

By enabling preventive maintenance on valves, the intelligent positioners greatly reduce unnecessary regular maintenance, save manpower and material resources, and reduce the associated costs. For the Sipart systems, the team at Fushun has calculated the potential savings: in compressed air savings alone, the site can save up to 4 million yuan per year; the energy savings rate is over 95% compared to traditional positioners. These figures make a compelling case for taking a closer look at small components in a plant, as they can make a major contribution to overall energy and cost efficiency.

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Southwest Electric Power Design Institute (SWEPDI) is one of the most prestigious engineering companies in China, having been named one of China’s top 100 comprehensive engineering firms for more than 10 years and cited by Engineering News Record as one of China’s top 60 engineering design enterprises for 8 consecutive years. With an integrated engineering platform based on the Comos software, SWEPDI has further boosted its engineering efficiency and quality.

Founded in 1961, SWEPDI has designed power generation and transmission projects in more than 20 provinces in China and in more than 10 countries abroad, including India, Indonesia, Vietnam, and Bosnia and Herzegovina. The design and construction of such systems requires specialist knowledge, and SWEPDI has a very strong team of...
experts and professionals in all fields relating to the electrical power industry.

**An integrated solution for collaboration**

To further improve the company’s engineering processes and support its teams in their work, SWEPDI started an evaluation project to select an appropriate software platform to support the electrical, instrumentation, and control (EI&C) design processes. The main goals in implementing this software were to enhance collaboration among the teams and to improve engineering efficiency. On a larger scale, improving engineering efficiency and quality was seen as essential for SWEPDI to retain its competitive edge in the Chinese power industry.

After an extensive comparison of available systems, SWEPDI chose Comos. The main factors in favor of the software were that Comos offers a truly integrated engineering solution for all phases and disciplines of the engineering lifecycle. The object-oriented approach helps teams organize and manage all data related to a process or design object. Another detail that will be beneficial to SWEPDI is the 2-D/3-D visualization capability of Comos. The working layer technology allows parallel engineering, which helps optimize and streamline workflows. Teams can exchange information thanks to the uniform data platform and open system architecture, and the system provides a simple and intuitive interface for ease of use. All in all, this solution will help SWEPDI optimize global collaboration through access to consistent, up-to-date data – anytime, anywhere.

**Smooth implementation, first application**

After signing the contract, SWEPDI and Siemens started to customize the Comos software to perfectly meet SWEPDI’s specific requirements. The team created customized templates and tailored the software accordingly, both by enhancing existing features and by adding new features to effectively support the engineering processes in the company’s teams. Early in 2013, the system was fully implemented and ready for operation. The first project to be designed using the new Comos platform will be a 225-MW combined cycle power plant in a multishaft arrangement. So far, the experience with Comos has been very positive, as the project team at SWEPDI confirms. Yuan Yuan, Comos project manager at SWEPDI, states that the Comos database provides a framework that fully satisfies the company’s collaboration needs in the EI&C, automation, and process design teams, and that Comos supports an efficient and consistent exchange of data. The flexible interface will make it easy for SWEPDI to roll out the solution to other locations and regions. The new software will also help compile the documentation for projects, supporting a smooth handover to plant owners and operators.

The SWEPDI teams are quite confident that with Comos they have found the right solution for a uniform engineering database that will effectively support collaboration and improve efficiency. Moreover, the system can be tailored and expanded to meet new requirements, so the software is also future-proof. But most importantly, the new tool helps the engineering teams do their job even better, says Jinbin Zhang, chief design engineer at SWEPDI: “The Comos data management platform meets all our requirements. The working layers guarantee planning reliability, and we can work on different projects across all technical areas at the same time.”

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Blasting a yearly output of 6.5 million t of steel products, Kunming Iron & Steel Co. Ltd. (KISCO) is the largest iron and steel production facility in Yunnan province and has been recognized for its excellence by the Chinese government. Using the latest technology, the company produces a broad variety of iron and steel products including iron, billet, high-speed wire rod, hot-rolled rebar, hot-rolled slab, cold-rolled sheets, and much more.

In 2008 the company built a 2,500-m³ blast furnace with a yearly production capacity of 2 million t of pig iron. In mid-2012 it went into operation in the Caopu New Area plant, 30 km southwest of Kunming.

Massive power needed with a soft start

A blast furnace is a large-scale, highly technical facility in which liquid pig iron is produced from prepared iron ore in a continuous melting and reduction process. To ensure that a blast furnace never cools down, giant axial...
and radial blowers are needed. These blowers supply the blast furnace with combustion air, which is heated upstream in the hot-blast stoves. The blowers are driven by synchronous motors with a capacity of several megawatts.

On blast furnace No. 1 at KISCO, a four-pole Simotics synchronous motor with a power rating of 40,000 kW and a speed of 1,500 rpm drives the blower. To directly start such a high-powered motor, a soft starter with a frequency converter is used to avoid dangerous electrical and mechanical peak loads when the synchronous motor is started.

An integrated drive solution

The new motor is part of the Integrated Drive Systems (IDS) portfolio. A core element of IDS is triple integration of the drivetrain: horizontally as one mechatronic unit following the flow of energy from the couplings and gear units up to the motor and converter, vertically within the automation pyramid and embedded into the system architecture, and timewise in regard to the product lifecycle. Horizontal integration improves plant availability. Vertical integration ensures plant productivity and flexibility, and with added functions it provides safety, maintainability, and environmental protection.

In the IDS drivetrain, all components are coordinated in terms of functionality, mechanics, and energy efficiency. The optimal operating point is reached without overstraining a machine’s mechanics, and implementation time is reduced. This means less work for project management.

High dependability after installation

The main challenge was designing a drive system that was not only stable and reliable but also cost-efficient. A Sinamics GL150 MV was used for variable-speed operation and for start-up operation of large synchronous motors. The jolt-free transfer does not burden the grid and is easy on drivetrain mechanics. This means less wear and tear and longer component lifespans. On the electrical side, the redundantly designed Simatic S7-400H control system ensures dependability. With the control system’s help, important variables in the vacuum chamber can be controlled, such as blast pressure and blast flow.

With the integration of the entire blast furnace from automation to drive system, KISCO engineers and technicians had an easy time familiarizing themselves with the system. The need for spare parts was also greatly reduced, decreasing inventory costs. The entire system was commissioned in only 25 days, and since the drive control uses Siemens products throughout, the 24-hour service hotline addresses all problems. “The Integrated Drive System delivered by Siemens for our blower on blast furnace No. 1 runs perfectly,” says Shi Yiwei, automation department manager at Kunming Iron & Steel Caopu New Area.

Reliable and efficient

Since the official start-up of the blast furnace in June 2012, perfect horizontal integration of the Siemens drive system has been achieved. System reliability and availability are higher than 99%, and not a single problem has occurred. This guarantees extremely reliable operation of the blower and maximizes economic efficiency.

“The Integrated Drive System delivered by Siemens for our blower on blast furnace No. 1 runs perfectly.”

Shi Yiwei, Automation Department Manager, Kunming Iron & Steel Caopu New Area

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Reducing load

With a booming building sector, China is currently consuming large amounts of cement – and the cement industry is often cited as one of the major consumers of energy and a large contributor to pollution. Consequently, the industry is implementing measures to both save energy and reduce emissions – and automation technology and industry software are proving essential instruments for this purpose.

With business widely spread in Guangdong, Guangxi, Fujian, Hainan, Shanxi, Yunnan, Guizhou, Inner Mongolia, Hong Kong, and Macau, China Resources Cement is one of the large cement businesses that receive concentrated support from the national government. The company is also the largest cement and commercial concrete supplier in the south of China and holds an important position in China’s cement industry.

In recent years, in collaboration with Siemens, China Resources Cement has implemented Siemens integrated energy-saving technology and systems into its cement production facilities and has adopted energy management systems, distributed control systems, high-voltage/low-voltage frequency converters, motors, and geared motors as well as Siemens operational solutions to achieve energy savings for large equipment such as vertical mill circulating blowers, kiln head and kiln end exhaust blowers, and high-temperature blowers.

The company has been continuously reducing energy consumption in the cement production process and making the environmental goal of energy savings and emission reductions in the cement industry a reality. Specifically, three projects in Fengkai, Pingnan, and Guigang demonstrate how to achieve more energy-efficient and cleaner cement production.

Building a bridge for raw material

About 80% of cement raw material is limestone, which is found in mountains rich in limestone ore. In Fengkai, the limestone quarry is located in the mountains 63 km away from the cement works. Until recently, the limestone was transported in trucks. To save fuel and reduce emissions from vehicle transport, the company undertook an ambitious project: building a conveyor bridge from the quarry

Operators in the control room use Simatic PCS 7 to monitor energy consumption and equipment efficiency in the Fengkai cement works.
to the production site. The bridge is designed to be 52 km long when complete, and the first 40 km are already in operation. The belt has enough capacity to satisfy the demands of six production lines producing a total of 5,000 t per day and is equipped with synchronized motors controlled by a Simatic PCS 7 system using information provided by tension sensors installed on the belt. Based on the belt tension, the control system adjusts the motor speed in each section through frequency converters, and the belts can then be started quickly, in less than 15 minutes. When the belt runs steadily, the maximum speed can be as fast as 4.95 m/s, and in only two hours the limestone can be transported from the quarry to the production factory. Compared with truck transportation, the annual cost can be reduced by RMB 179 million, fuel savings can be as much as 14,000 t, and carbon dioxide (CO₂) emissions can be reduced by 42,000 t.

**Automation and drive technology help cut energy losses**

Another area where using state-of-the-art drive technology can help save energy is the blowers in the mills and kilns. In Fengkai, the plant operator has recently equipped the 20 blower motors with Sinamics frequency converters for speed-controlled operation to adjust air volume, replacing the throttles previously used for this task. Liuyang Lan, director of the electrical department at China Resources Cement Ltd. in Fengkai, has witnessed the renovation of the automation system: “The frequency converter makes the blowers run more steadily, causes less impact to the motors and power grids, and allows the factory to benefit significantly from enhanced energy efficiency. The frequency converters implemented in four blower units in 2012 have resulted in energy savings of 22%, reducing electricity costs by more than 10 million yuan.”

Coal burned as fuel is a large cost factor in cement production, and typically much of the heat energy generated is dissipated. In 2007, China Resources Cement implemented a system for recovering this waste heat in the company’s Pingnan cement works based on Simatic PCS 7. The result: one-third of the total power consumption in the cement clinker production line is now generated from waste heat, saving more than 30,000 t of coal per year, and CO₂ emissions were reduced by more than 50,000 t. This project has since served as a model for other sites as well.

**Managing efficiency**

On a higher level, China Resources Cement has also improved its energy monitoring, shifting from manual reading of consumption data to an integrated approach. The company is now using Simatic B.Data to automatically collect and evaluate the energy consumption in the different units and processes. The first plant to use B.Data was the Guigang cement works. “Simatic B.Data enables us to have an intuitive understanding of energy consumption conditions and support the optimization of processes and technologies. It is a powerful tool for achieving energy savings,” says Tang Ditian, assistant general manager of the Guigang cement works.

In addition to implementing systems for energy efficiency, China Resources Cement encourages energy awareness among its staff to further improve operations. All these measures together help the company in its efforts to move the cement production industry toward a greener and cleaner future.

“Simatic B.Data enables us to support the optimization of processes. It is a powerful tool for achieving energy savings.”

Tang Ditian, Assistant General Manager, Guigang Cement Works

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Focusing on soybean and maize processing, Shandong Scents Holding Group is a leading national enterprise in the area of agriculture industrialization. Soybeans are an excellent, safe, and economical source of plant protein for food and nutritional products. Soybeans are rich in valuable nutrients, especially fiber and protein, and because soybean products are cholesterol-free they are particularly beneficial for people at risk for cardiovascular disease. One of the holding group’s more than 10 subsidiaries, Shandong Yuxin is a large enterprise specializing in intensive soybean processing. As the market demand keeps growing, Shandong Yuxin has built two new production lines for soybean protein isolation and soybean dietary fiber production.

**Precision control for quality and efficiency**

Product safety is a critical aspect of food processing. Choosing the right process control technology helps maintain the process within the specified limits, contributing to both product quality and production efficiency. This is especially true for a complex process such as the extraction of protein and fiber from soybeans. The soybean protein isolation technique comprises extraction, isolation, acid addition, water scrubbing, isolation, neutralization, sterilization, drying, screening, and superfine grinding. The dietary fiber production process features pretreatment, processing, function improvement, isolation, drying, smashing, and refining. Additionally, the food processing industry has set strict requirements for the processing environment, production technology, and site equipment. The process design must not only meet the demands of production; there is also a requirement that the production information be traceable.

The second important factor in the food processing industry is efficiency – efficient operation to avoid any unnecessary losses of materials and re-

In the food processing industry, product quality and quantity are critical factors. To meet the demand for a larger quantity, Shandong Yuxin Biotechnology Co. Ltd. constructed two new production lines – one for soybean protein isolation and the other for dietary fiber production. In both lines, Simatic PCS 7 helps enhance food safety and production efficiency.

**Safe yield**

The Shandong Yuxin production facility processes soy into various products for both the domestic and international markets.
**Soybeans are an excellent source of protein and dietary fiber and produce significantly more protein per acre than most other uses of land.**

sources, but also efficiency in design and engineering to be able to bring products to market faster. In the two Shandong Yuxin lines, system programming requires a great deal of expertise and attention to detail due to the complex production process and large number of I/O points (nearly 5,000).

**High-performance solution**

For its new production lines, Shandong Yuxin opted for an integrated process automation and drive solution from Siemens. Two Simatic PCS 7 systems, one for each line, as well as four A-compact motors and four 10-kV Robicon HV frequency converters, were adopted to enhance food safety and production efficiency. The solution has since paid off in many respects. The team worked with the latest version of Simatic PCS 7, V8.0, which increases engineering efficiency through advanced programming methods.

To master the complex control requirements, the automation integrator Beijing Sciample Technology Co. Ltd. used fuzzy control to develop an acid-adding algorithm model in PCS 7 for the soybean protein isolation. The required acidity is precisely calculated with fuzzy control and proportional-integral-derivative (PID) control, eliminating the need for manual intervention. The adjustments are quicker and more accurate, and the product quality is more stable. The model has since been successfully applied in several other processes as well. Similar projects usually require about a month of system programming, but thanks to the skilled team from Sciample and advanced system features, the programming was completed in just one week. To ensure optimum availability, the process control solution also used the latest automation system available for PCS 7: the new 410 and 410 SMART redundancy controllers. The systems offer a high processing capacity and internal storage capacity. Both systems can be engineered using identical tools, enabling a high degree of standardization between the two lines. By standardizing on Siemens motors and drives, Shandong Yuxin benefits from added savings in terms of spare parts inventory and maintenance costs. The four A-compact motors are installed on the drying blowers, and the four 10-kV Robicon HV frequency converters enable speed-controlled operation of motors, contributing to improved energy efficiency in the production process.

**A healthy future**

The Shandong Yuxin project is currently being commissioned and is expected to be fully operational by the end of 2014. The use of Siemens products not only helps Shandong Yuxin enhance the automation level of the production lines, but it also helps improve the production process and product quality. This will put the company in an excellent competitive position, ensuring healthy and sustainable growth. And as the new control system will provide a perfectly controlled production environment, consumers can trust the safety and quality of the soybean products from Shandong Yuxin – for a healthier future for everyone.
Foshan Nanhai Lvdian Regeneration Energy Co. Ltd. is an enterprise focusing on solid waste treatment, mainly household garbage incineration and power generation, urban-rural integrated household garbage compaction, and transshipment and treatment of sludge and kitchen waste. At present, Nanhai Lvdian has two 15-MW plants to treat 1,500 t of domestic waste per day. Facing a growing volume of waste, Nanhai Lvdian decided in 2014 to build another plant with a similar capacity.

**Proven solution**

The company had already equipped the existing plants with Siemens control technology, and based on the good experience with those systems, Nanhai Lvdian contacted Siemens about the expansion project as well. The plant is controlled with a Simatic PCS 7 system comprising eight sets of redundant controllers, one for each of the three incinerators and two generators, two for shared units, and one for flue gas treatment. The control system designed for the plant uses the latest generation of Simatic PCS 7 automation systems with the CPU 410-5H. This powerful, rugged, and durable controller was specially developed for the process industry. It offers high computing speed; is capable of performing reliably even in harsh process conditions with extreme temperatures, vibration, and shocks; and satisfies even the most stringent electromagnetic compatibility (EMC) requirements.

Siemens also supplied additional systems such as process instruments, the power supply, switchboards, communication cards, high-voltage/low-voltage (HV/LV) distribution, motors, HV/LV frequency converters, soft starters, and smart motor control cabinets as well as a comprehensive lifecycle service package. Siemens supported Nanhai Lvdian during the planning and design of the system and was responsible for on-site delivery, installation, and commissioning. The Siemens team also performed the factory and site acceptance tests.

In addition to the controller, the plant also uses state-of-the-art fieldbus technology for networking the distributed devices and process signals. The process instruments are connected to each other via Profinet PA and to the process control level via Profinet DP. The con-
Controllers are connected to the server through a dual-ring Industrial Ethernet network. Industrial Ethernet is also used for connecting the server and the client on the control level. Twenty-five AFDs made of stainless steel with IP65 degree of protection have been deployed near to the Profibus PA instruments in order to reduce wiring effort and expense. Real-time monitoring of the process devices is performed through the Simatic PDM software, supporting predictive and preventive maintenance.

Perfect control for perfect conditions

A critical process aspect of waste incineration is maintaining the process temperatures and flow conditions within specific limits to prevent the formation of toxic combustion products such as dioxins. In the Nanhai Lvodian incineration plant, the upper part of the incinerator is usually kept at a temperature of around 950°C; the temperature of the burning zone at the bottom of the incinerator is kept above 1,000°C to ensure that the burning temperature is higher than the standard temperature. The garbage usually stays in the incinerator for at least 40 minutes; continuous turbulence and airflow ensures that the burning is sufficient.

Using Robicon frequency converters, the air volume of the internal blower and exhauster is adjusted to save energy, and the internal environment of the incinerator is maintained at negative pressure to prevent the flue gas from escaping. A totally enclosed automatic production process is then realized in the entire plant: first, the garbage is transported to the transit station; after being compacted into standard sealed boxes at the transit station, the garbage is then delivered to the incineration plant; and after sufficient fermentation in the dump pit, the garbage is transferred to the incinerator for burning. This way, dioxin levels can be reliably kept below the safety limits.

The fly ash is processed into cement blocks, and wastewater and flue gas are also purified. After multilayer treatments, only compound cement blocks and purified gas remain, at one-tenth the original size.

Safe waste disposal for the entire district

Nanhai Lvodian’s first-phase garbage incineration power plant has been in efficient operation for three years. The second phase of this project is just entering commissioning and is on schedule for completion by 2015. After this project is completed and operation is started, the daily garbage treatment capacity of Nanhai Lvodian will reach 3,000 t, which means it will be capable of processing all the 2,800 t of domestic waste currently generated every day in the Nanhai district.
A new standard for coal

For Shaanxi Xianyang Chemical Industry Co. Ltd., Siemens has addressed several process control challenges with a solution based on Simatic PCS 7. The new system meets the requirements for process safety and was engineered and implemented within a tight time frame.

A long with the continuous development of China’s industry in the 21st century, petroleum products, which are raw materials for energy and the chemical industry, are increasingly in demand for industrial production. Producing light olefins from coal instead of oil can help significantly reduce energy costs and support enterprises in achieving steady development. In the coal-to-methanol project of Shaanxi Xianyang Chemical Industry Co. Ltd., the company designed a plant for an annual output of 600,000 t, comprising processes for coal gasification, synthesis gas purification, and methanol synthesis. Many process areas in the plant are classified as hazardous, so the plant required a reliable and powerful process control solution to ensure plant safety. Moreover, the project schedule was very tight, with only one year available for the design and implementation of the process control and safety system.

Production safety is the top priority

The plant generates synthesis gas through the gasification of coal. The synthesis gas is then purified and used to produce methanol. Coal water slurry and pure oxygen flow concurrently into the gasification furnace, in which a series of physical and chemical processes – including heating, water evaporation,
cracking, burning, and conversion – are completed quickly and methanol is produced. During coal gasification, pure oxygen is used to prevent new impurities from being introduced into the process. The process is very complex and requires the monitoring of volatile, flammable, and explosion-hazardous substances.

The process is not operating in a steady state, so the process control system must provide the required fast and precise control features to ensure safe and continuous operation. With a comprehensive package including Simatic PCS 7 as a high-performance control system and in-depth engineering expertise, Siemens was able to meet all these requirements. The engineering team designed and integrated a solution for the distributed control system (DCS) and the safety instrumented system (SIS).

The entire system comprises more than 5,000 I/O devices and uses a redundant hot-standby configuration. The two CPUs are linked to each other by a special high-speed synchronous fiber-optic cable, enabling a transparent, fault-tolerant structure. The controller can process, program, and design, just like the standard PCS 7 system.

When a failure occurs, the event redundancy mechanism will prevent data loss and the redundant connection will be automatically activated. This configuration also allows firmware updates to be performed during operation. In addition, the operating system synchronizes events in the two controllers so that they are always in the same state and operations will deliver the same results. To fully exploit the capabilities of the new PCS 7 system, the engineering team also needed to have the right expertise – and in this case, the team excelled at its task, completing a project that would usually take two years in half the time.

This outstanding performance is a result of the in-depth knowledge of the chemical and petrochemical industry that Siemens had already demonstrated in several large projects in recent years, such as the Shenhua Inner Mongolia 5-million-t coking project, the Shandong Haihua Group’s 1-million-t sodium carbonate project, the Shengli Oil Field Chengdao offshore project, and the Qingdao Refinery’s 10-million-t oil refinery project. Meticulous site work, thorough follow-up, and high-level responsibility from the Siemens engineering team helped ensure that the project was successfully completed on schedule.

A new start

Coal chemistry has become a hot new focus in China’s chemical industry. It also offers a potential solution to the present scarcity of energy resources in China. With the project in Xianyang, PCS 7 has proven itself as a powerful and reliable process control solution in this industrial sector. Not only was the project completed on schedule, the plant has been delivering an annual methanol output of 600,000 t as planned, with record-breaking fault-free operation of five straight years.

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In the Yuanba Gas Field, stable and reliable Scalance X switches create a high-redundancy Industrial Ethernet network with a four-layer structure to ensure reliable communications, data acquisition, parameter adjustment, and equipment control process.

Yuanba Gas Field, located in eastern Sichuan province, has the potential to become the largest natural gas field in China. Discovered in 2011 and developed by China Petroleum & Chemical Corporation (SINOPEC), Yuanba is the deepest gas field in marine strata ever found in China, with deposits reaching as deep as 6,950 m. The gas-water ratio, climate, and geological conditions of the gas field are complex, and the exploitation and transmission of the gas is extremely difficult. The gas is intended to contribute to the energy supply for almost 14 million people in the region.

A logistics challenge

In addition to the challenges of developing the field, the natural gas must also be transported to consumers. This involves a close monitoring system for the pipelines to ensure the safety of the supply network and to detect leaks. The sensors installed along the lines need to be connected with the central monitoring system via a high-performance and reliable network that can bridge long distances.

For the Yuanba project, Siemens proposed a redundant solution using Industrial Ethernet networked by Scalance X switches. The Scalance X series of network switches is especially suited for applications with elevated safety and reliability requirements. The devices have a mean time between failure of more than 20 years, are fully compliant with the EN61000-6-2 and EN61000-6-4 standards for electromagnetic compatibility (EMC), and are certified in accordance with UL508. In addition to the switches, Siemens also supplied customized redundant power supplies for the network switches to ensure communications availability in the case of a power failure.

The communications network is designed as a completely redundant Industrial Ethernet system with fiber-optic cables with a virtual private network (VPN) link. The individual networks are linked to the central control system via a fiber-optic 1,000-Mbit/s Industrial Ethernet backbone. In addition to the main network, there are several dedicated systems for remote units such as valve hubs. To ensure maximum communications reliability, there are two independent networks in redundant configuration. This results in a fourfold redundant architecture.

Reliable and flexible

A four-layer network is especially resilient against network failures. When a point failure is detected in the network, the Scalance switches use the High-availability Seamless Redundancy (HSR) protocol to reroute the communication through the intact segment of the ring in less than 300 ms. In the event of a switch failure, the affected network is isolated and the communication between units is switched to another system in less than 3 s. In a multipoint fail-
ure event in which several remote units are cut off from the wired backbone, the communication with the control center is switched to the wireless transmission link. This task is performed via the OSPF (Open Shortest Path First) dynamic routing protocol within 1–3 s. The other units still use a wired communications link, and the communication will not be affected or jitter. Because the two network structures in the dual-network system are identical, each system can compensate for a point or switch failure, allowing the network as a whole to compensate for up to five faults in the system, which would be a most uncommon event, likely involving a large-scale natural disaster.

Another key requirement for communication in industrial applications is that control information be transmitted in real time, that is, the signal must be transferred reliably and within a set transmission time. For this purpose, the communication in the backbone uses 1,000-Mbit/s full-duplex switched Industrial Ethernet, a technology that helps avoid collisions and channel conflicts. The switch forwards data packets with a delay of only 5 µs, and the delay in a series of 10 switches is 60 µs, so the system can transfer data with an event resolution of well below 1 ms.

As the Scalance technology is fully compliant with international guidance and standards such as the IEEE 802.3 protocol for Ethernet communication, the system can be flexibly networked with other Ethernet networks. Additionally, the fault tolerance of the ring architecture also allows the system to be extended or modified without interrupting communications. The Scalance switches offer various diagnostic features to facilitate the rapid identification of a fault or failure, supporting maintenance and system repair, further improving system availability.

A network for the energy future

The Yuanba Gas Field will be constructed in two phases. The first-phase project, completed at the end of 2013, has reached a production capacity of 1.7 billion m³ of purified gas per year; the second-phase project, which will be completed at the end of 2015, will also have a capacity of 1.7 billion m³ of purified gas per year. Together, the two projects will have a production capacity of 3.4 billion m³ of purified gas per year. When the project is completed, it will become an important part of China’s greener and cleaner energy future, helping pave the way for sustainable growth and resource preservation. The reliable and flexible network solution will ensure that this energy future is also safe and efficient by monitoring the pipelines’ integrity and safety.

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The pharmaceutical industry directly affects human health, and the industry’s production environment is key to guaranteeing quality. For this reason, the Good Manufacturing Practice (GMP) 2010 revision strengthens requirements for pharmaceutical production environments and requires enterprises to establish pharmaceutical quality management systems. GMP implementation assures the quality and safety of pharmaceutical products and also helps enterprises enter international markets.

Precise control ensures a sterile environment

To meet GMP pharmaceutical requirements, Shandong Luye Pharmaceutical Co. Ltd. (Luye Pharma) in the Yantai Pharmaceutical Industrial Park invested RMB 1 billion to construct the Shandong Yantai Pharmaceutical Industrial Park. The project was implemented in three phases and included a microsphere plant, an antibody pilot test plant, a pilot test base plant, a warehouse, and four injection production lines. Siemens was responsible for the air-conditioning control system throughout the entire factory.

In the pharmaceutical industry, the greatest challenge is to create a sterile environment. To ensure high quality, the updated GMP absorbs the latest A, B, C, and D grading standards stipulated by the World Health Organization and European Union. The standards raise the requirements for each step of production and operation and require real-time online monitoring of aerosols, floating bacteria, and sediment bacteria as well as surface microbes. The air-conditioning control system is key to ensuring a sterile production environment. To meet Luye Pharma’s requirements, Siemens designed software modules and provided detailed documentation for the engineers to assist with verification. The documents will continue to support system maintenance and future expansion.

The air-conditioning system purifies the air with primary, middle, and advanced levels of filters to meet environment requirements in different areas. To avoid cross-contamination between different production areas, a constant differential air pressure must be maintained in each room. In Siemens’ air-conditioning control system, the indoor pressure difference is detected by an area pressure difference...
transducer and then compared with the required specified pressure difference. Using proportional-integral-derivative (PID) calculation, the return valve is adjusted to keep the air pressure difference constant. There are also stringent requirements for temperature and humidity in production facilities. To meet these, temperature and humidity sensors are placed in the return and supply ducts of the air-conditioning control system. Signals from these sensors are connected to a PID controller to achieve precise control of room humidity. For production convenience, the air-conditioning unit was configured for four modes: filling mode, cap-rolling mode, sterilization mode, and cleaning. The control system can easily and smoothly switch between modes.

Smooth GMP certification

Without GMP certification, medicine cannot be listed for sale, so achieving this certification is the greatest challenge confronted by a pharmaceutical factory. The latest GMP set stricter requirements for process design, installation, and factory operation, as well as for production performance. As the supplier of the air-conditioning control system, which is closely linked with the production environment, Siemens provided project hardware, addressed all customer concerns, and enabled the customer to pass the automated system certification process.

Following the V-model for acquiring GMP certification, Siemens engineers executed every step in strict accordance with the certification requirements in the latest GMP. After completing a task, the project partners must review it before taking the next step, which avoids poor project results and losses stemming from product modification. This approach reduces investment costs for enterprises. Siemens engineers also created detailed documentation of process features, which can be used for GMP certification.

Efficient certification means faster to market

With in-depth technical expertise and a well-defined workflow, Siemens helped Luye Pharma complete the automation system verification successfully. All the production lines were put into operation promptly. Currently, Phase 3 of the project is in full swing, and after that, all heating, ventilation, and air-conditioning (HVAC) systems in the entire industrial park will be integrated into Simatic PCS 7.

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Clean water for sustainable growth

Water is the lifeblood of every city. Erdos, in Inner Mongolia, needed 20,000 additional tons of water per day to satisfy its growing population and industries. The water supply also had to meet new water quality standards, and, with winter approaching, the clock was ticking to find the right solution.

Erdos is an emerging Inner Mongolian city undergoing rapid population growth and economic development. Its expansion was putting a great deal of pressure on the city’s water supply. In addition, the water pumped from deep wells was vulnerable to seasonal changes and suffered from water quality issues such as algae, toxins, turbidity, and disinfection by-products. Not only did water production need to be dramatically increased but the water purity also had to meet new domestic drinking water standards.

A new water treatment plant was to be built in Dalad Banner, a municipality of Erdos, and Siemens played an instrumental role in ensuring both that the water supply could be increased and that the water purity improved.

Dual-membrane water purification system

Siemens partnered with Tri-Tech Holdings, a leading provider of water treatment solutions, to construct an automated water treatment system for the city of Erdos. Tri-Tech Holdings proposed the use of dual-membrane technology for purifying the water, consisting of three or more processes. This was to be the largest dual-membrane water purification system ever engineered, with an output capacity of 200,000 t per day, exceeding the Paris Mery-sur-Oise water purification plant by 60,000 t. Creating a membrane of this size would require extensive interlock control technology, consisting of 10,000 control points and 12 substations. Such a network needed to comply with stringent requirements for reliability, automation, and control. Any risk of system problems causing water shortages was not an option.

Erdos water plant: key facts

- Daily output increased to 200,000 t
- Dual-membrane purification system is the largest in the world
- Simatic PCS 7 ensures stable and reliable operation
- Industry Library vastly reduced the time and cost of implementation
- Managers gain real-time monitoring and control
- Reliable water supply improves the living standards and economic development of Erdos
Multiple levels of redundancy

Drawing on its advanced expertise in system redundancy and experience in water treatment technology, Siemens devised a highly redundant and automated configuration for ensuring the dual-membrane system’s safety and reliability. Siemens provided a distributed control system (DCS) based on Simatic PCS 7 comprising 14 sets of automation systems: 6 AS417, 6 AS414, and 2 S7-315 systems. In particular, the AS417 had an adapted S7-417H redundant controller integrated with a redundant Profibus fieldbus network for enhanced configurability and availability. An additional set of redundant ring networks was used as a control solution for processing activated carbon.

In the unlikely event of a communication failure, the DCS solution will take emergency measures via an interlock control and seamlessly switch over to ensure that there is no impact on daily water supply. The extensive redundancy of the Siemens configuration and countermeasures ensures that any failures can be overcome and the supply of water to Erdos is safeguarded around the clock.

The Simatic PCS 7 Industry Library was used to design the control system. Specially developed for automation procedures, the library features functional blocks for water treatment technology along with complementary standard modules. These helped vastly reduce the project’s commissioning time and cost. Another advantage of PCS 7 is that it is easy to operate, with an intuitive graphical interface, and offers integrated web launching and OPC communication functions. Siemens deployed 10 web clients across the plant so that managers can carry out real-time remote monitoring and management of water treatment operations.

As the systems integrator, Tri-Tech Holdings used the PCS 7 programming tools to develop a process as a series of 3-D flow diagrams. Compared to 2-D images, the 3-D charts are more representative of real objects, allowing the operator to judge the location of failure more accurately and carry out prompt maintenance.

A landmark project

The seamless integration of Tri-Tech Holdings’ dual-membrane technology and Siemens’ automation control system has been praised throughout the water treatment industry. Engineers from around the world have visited the water plant to see how they can use this sophisticated technology in their own water treatment projects.

For the city of Erdos, Siemens and Tri-Tech Holdings delivered the perfect water production system. Its high output capacity and powerful automation control continue to assure a clean and reliable water supply for the city. It has helped raise living standards and will support Erdos’ population growth and economic development into the future.
**Sitrans VP160 positioner**

A specialist for basic applications

The Sitrans VP160 is a low-end device with top control performance thanks to Siemens positioner technology. It is especially suitable for the water/wastewater, pulp and paper, food, and beverage industries. Besides, the new positioner is applicable for basic industries suitable in all other industries, and is simple to operate by using just three push buttons and a user-friendly two-line display. Designed especially for hostile environments the positioner has a robust aluminum housing and a modular design for easy maintenance. The Sitrans VP160 can be easily mounted on a wide range of different standardized actuators: on rotary actuators according to VDI/VDE 3845 or linear actuators according to IEC 60 534-6 (NAMUR) as well as on non-standardized proprietary actuators. Over 400 mounting kits are available for this purpose. This reduces the effort required for mounting and simplifies the entire initialization process.

[siemens.com/sitrans](#)

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**Sitrans P310 pressure transmitter**

Reliable and easy to install

The Sitrans P310 universal pressure transmitter for gauge, differential, and flow measurement features a broad range of measuring cells for measuring ranges of 10 mbar – 400 bar gauge pressure and 1 mbar – 30 bar differential pressure.

The new transmitter offers simple start-up as well as smart functions for diagnostic simulation and measuring. Sitrans P310 is perfectly suited for installation in harsh conditions and has NEPSI approvals for use in explosive areas. To simplify maintenance, the device can be sealed off from the process with shutoff valves for gauge and differential pressure.

The pressure transmitter Sitrans P310 is available in two diaphragm materials such as stainless steel and Hastelloy.

[siemens.com/sitransp](#)

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**DSM Nutritional Products, Xinhua**

Complete package

For an expansion project at DSM Nutritional Products in Xinhua, Siemens will provide a comprehensive package of distributed control and safety systems based on Simatic PCS 7. The order also comprises devices for temperature measurement as well as services for basic and detail engineering and on-site commissioning.

This project continues the successful history of DSM and Siemens in China. Through its engineering company SIAS, Siemens also equipped the existing vitamin B6 plant in Xinhua with a Simatic PCS 7 system. The new plant adds more capacity to the site. DSM Nutritional Products is one of the world’s leading suppliers of vitamins, carotenoids, and other ingredients to the feed, food, pharmaceutical, and personal care industries. It is part of DSM, a global science-based company active in health, nutrition, and materials.

[siemens.com/pharma](#)
Siemens AG, founded in 1847, is a global leader in electronics and electrical engineering, operating in the fields of industry, energy, and infrastructure and cities as well as healthcare. For more than 140 years, since entering China in 1872, Siemens has pioneered cooperation with the country, offering cutting-edge solutions, technologies, and products. Siemens has become known in the country for quality and reliability, technological excellence, and innovation. In fiscal year 2013 (October 1, 2012 – September 30, 2013), Siemens generated revenue of €6.14 billion in China, with nearly 32,000 employees, 20 R&D hubs, and 76 operating companies across China.

From large drives to controllers to process instruments, Siemens is able to manufacture and supply a broad range of products and systems from its own facilities and has a strong workforce of skilled technology and industry experts to provide local support to its Chinese customers. In the Chinese process industry, Siemens has successfully completed a series of projects that serve as benchmarks in both the domestic and global markets, for example, acting as the main automation vendor for one of the world’s largest refineries for CNPC and providing the integrated automation system for the SINOPEC Qingdao refinery and petrochemical complex.

Siemens has become an integral part of the Chinese economy and society and will continue to make a contribution toward sustainable development and growth in China.

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* The figure is based on Siemens’ continuing operation in China.
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