

metals & mining

The magazine for the metals and mining industries

Issue 2 | 2009

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**Cost-Saving Solutions
In Difficult Economic Times**



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Werner Auer

Dear Readers,

At the start of 2008, the continued development of the steel industry appeared to be certain, not to mention even blessed, with above-average growth. However, beginning in the second half of the year, a worldwide economic malaise set in, which made all forecasts redundant. World steel production collapsed nearly one third by the end of the year. The impact was so severe that our economic bearings came out of kilter, making reliable mid- to short-term business planning virtually impossible. Slab yards and coil-storage bays are bursting at the seams, and manufacturers are forced to cut back production. No one knows where this roller-coaster journey will end, and most steel companies have had second thoughts about new construction projects. Instead, efforts are being increasingly concentrated on enhancing the productivity and efficiency of existing facilities.

In our opinion, now is the right time to invest in cost-saving solutions. These include mechanical, electrical and automation improvements, in addition to technological and mechatronical packages complimented by advanced sensor technology. Steps such as these are decisive for assuring a company's ability to compete, and for enabling business returns to be maximized when the economy improves. A host of new opportunities are opened up for producers to design production processes more efficiently and flexibly; to reduce raw-material and energy costs, to enhance product quality; to allow the manufacture of new materials; and to improve overall plant and personnel safety.

It is clear that in the current economic environment any investments made at this time will have to pay off quickly, otherwise there is no chance for their implementation. In this issue of metals&mining, numerous cost-saving solutions from Siemens VAI are outlined for every step of the iron and steel production route. These have the objective of supporting producers in their efforts to slash costs and to ensure sustainable, competitive and profitable production.

The importance of steel in terms of economic growth and as a catalyst for technological innovation remains as ever and is not to be underestimated. Let us learn from the current crisis together and put into practice those steps that will make us even stronger to meet the challenges of today and those that lie ahead.

A handwritten signature in blue ink, appearing to read 'W. Auer', written in a cursive style.

Werner Auer

CEO of Siemens VAI Metals Technologies

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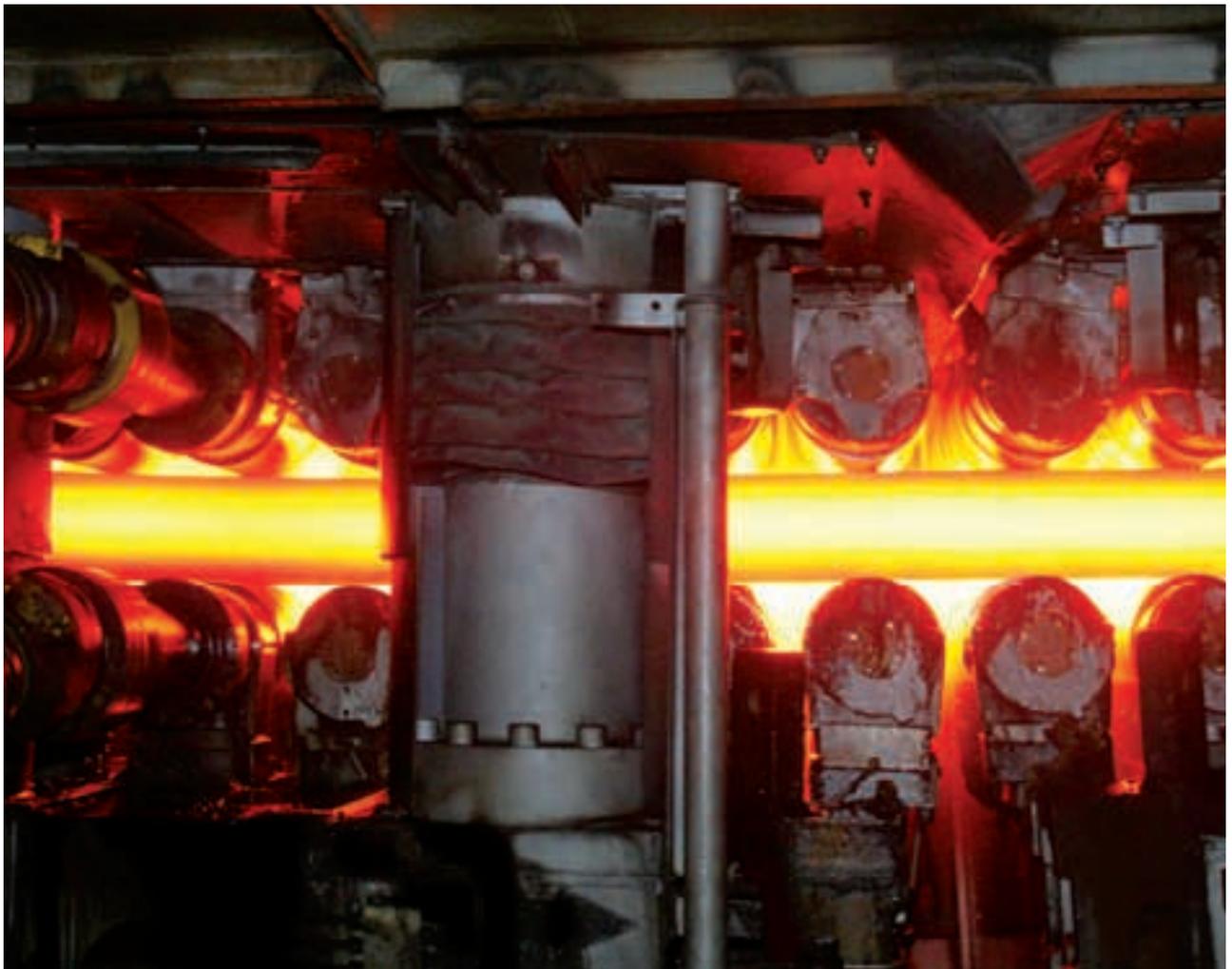
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A Smart Solution for JSW Steel, India

To improve the quality of their slabs for the production of special steel grades and to more quickly and efficiently carry out slab-thickness changes, a total of 20 existing segments of a slab caster originally installed by Siemens VAI at JSW Steel Ltd. were upgraded to Smart Segments and equipped with DynaGap Soft Reduction. With this solution, automatic strand-taper/thickness control can be carried out as the basis for achieving best slab-centerline quality, as required for the production of pipeline grades used in the petroleum industry. Furthermore, adaption of the roller-gap settings to cast slabs in thicknesses between 220 and 260 mm can now be remotely carried

out at JSW Steel, keeping caster downtime to a minimum. The caster is capable of producing approximately 1.5 million tons of steel per year.

Following the successful fulfillment of the required guarantee tests, the Final Acceptance Certificate was received at the end of February 2009, within only three weeks after the start-up of the upgraded caster. In the words of Abhijit Sarkar, Deputy General Manager of the steel plant, "The caster with the Smart Segments is progressing well and the quality, especially for API X70 grades, is excellent. We are proud to operate the first caster with Smart Segments in India and to be associated with Siemens VAI." ■



Plant Start-ups and FACs (Jan. 1 to April 30, 2009)

Company	Country	Project
Ahmsa	Mexico	FAC received for Level 2 automation system, including Dynacon Lomas, installed in two LD (BOF) converters
Alchevsk Iron & Steel Works	Ukraine	Start-up of Converter No. 1 and receipt of PAC
Arcelor Mittal Temirtau	Kazakhstan	PAC received for 400,000 t/a bar & section mill
Badische Stahlwerke	Germany	Start-up of upgraded 5-strand billet caster
Baoshan Iron & Steel Ltd.	China	FAC received for plate mill expansion (E/A supply); FAC received for new PLTCM (E/A supply)
Baosteel (Special Steel Branch)	China	Start-up of new 1-strand slab caster
Caparo Merchant Bar	U.K.	FAC received for revamped 350,000 t/a section mill with universal stands
Corus	Netherlands	Start-up of Galvanizing Line DVL3 and receipt of PAC; FAC received for new PLTCM (mechanical and E/A supply) PAC
Egang (Wuhan)	China	Start-up of new plate mill (mechanical and E/A supply)
Gerdau Acominas	Brazil	Start-up of 230-ton RH-T-COB vacuum-degassing plant
Ilva s.p.a Taranto	Italy	Start-up of replaced 2-strand slab caster
JSW Steel Ltd.	India	Start-up of Blast Furnace No. 3, upgraded slab caster equipped with Smart Segments and DynaGap Soft Reduction, and 1,000,000-t/a bar mill with high-speed entry system
Laiwu Steel Group	China	Start-up of plate mill
Lianzhong Stainless Steel Corporation (LISCO)	China	FAC received for stainless steelmaking plant comprising EAF, AOD, ladle furnace, VOD plant and slab caster
Pangang Group Chengdu ISCO	China	FAC received for 900,000 t/a bar & coil mill for special bar quality (SBQ) steels
Posco (Pohang Works)	Korea	FAC received for engineering and delivery of static coolers and power-control system for secondary dedusting system of Steelmaking Plant No. 2
Qinhuangdao Shouqin Metals Materials	China	FAC received for Level 2 automation system for two twin-ladle furnaces
Salzgitter Flachstahl	Germany	Start-up of 240-ton ladle furnace, including automation system. FAC received for process optimization systems supplied for two twin-ladle furnaces and three VD plants.
Siderúrgica de Guatemala SA (Sidegua)	Guatemala	Start-up of wire-rod line
Sigosa	Mexico	Start-up of revamped section mill with universal stands
SSAB Tunplåt	Sweden	FAC received for Level 2 automation system for converter and RH plant
Talleres y Aceros	Mexico	Start-up of 350,000 t/a bar mill
Tangshan Guofeng Iron & Steel Co., Ltd.	China	Start-up of new 2-strand slab caster
ThyssenKrupp Nirosta	Germany	Start-up of AOD Converters No. 1 and No. 2, including upgraded automation systems
Tianjin Iron & Steel Co. Ltd.	China	Start-up of 800,000 t/a high-speed wire-rod mill
Tianjin Rockcheck Metalwork Co., Ltd.	China	FAC received for 700,000 t/a high-speed wire rod mill
Union Iron & Steel	U.A.E.	FAC received for multi-slitting rolling mill
voestalpine Stahl	Austria	Start-up of replaced Converter No. 8 with nominal tapping weight of 180 tons; PAC received for new cold-rolling mill (mechanical and E/A supply)
Xiantan Iron & Steel Co., Ltd.	China	FAC received for 3.8-m-wide plate mill (E/A supply)
Welspun	India	First plate rolled on plate-Steckel mill
Wuyang Iron and Steel Co. Ltd	China	First plate rolled on roughing mill

FAC = Final Acceptance Certificate, PAC = Provisional Acceptance Certificate, PLTCM = Pickling Line and Tandem Cold Mill, E/A = Electrics & Automation

Investment planning in the metals industry during turbulent times

Grab the Bull By the Horns

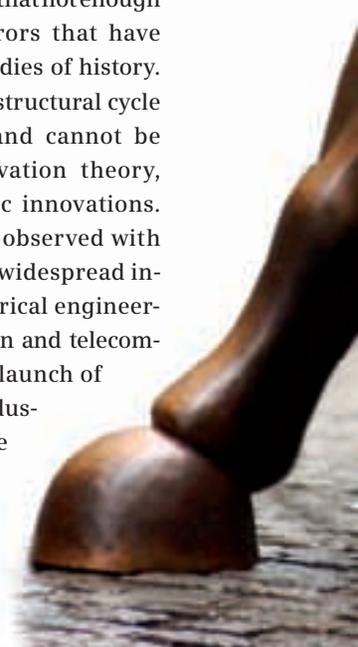
What should producers do in turbulent economic times such as these? Should they take a “wait and see” attitude, or should they proactively “grab the bull by the horns” and invest now to be ready for the inevitable market upswing – as predicted by most experts. What type of investments should be made during the undulating economic cycles? In the following, a general overview and various aspects of long- and short-term economic trends are presented to help producers in their quest to make the right investment decisions at the right time.

COVER STORY >

The present economic and financial downturn is heavily influencing the industrial and banking sectors, national economies and individuals on a worldwide scale. The landscape of the metals industry looks completely different now compared with mid-2008. Lower steel consumption and the sharp drop of steel prices not only cast a shadow on the current situation, but also demand a revised strategy by producers. But how can the economic up- and downturns be explained? Research on this topic beginning three-quarters of a century ago provides a possible answer and helps to put things into perspective. Already in the year 1925, the Russian economist Nikolai Kondratieff described that our economy fluctuates in major cycles of 40 to 60 years. He even predicted the Great Depression, which became reality only four years later with the crash on the Wall Street Stock Exchange in 1929. He described the long economic cycles as consisting of four distinct “seasons,” i.e., spring (beneficial inflation), summer (prosperity or stagflation), fall (recession or beneficial deflation) and winter (depression). A few years later, the Austrian economist

Joseph Schumpeter named these business cycles the “Kondratieff wave.”

However, many scholars dispute the validity of Kondratieff’s theory. Some believe that not enough is attributed to actual human errors that have created some of the economic maladies of history. Others believe that every wave is a structural cycle that has unique characteristics and cannot be repeated. According to the innovation theory, these long waves accompany basic innovations. For example, a rise and fall can be observed with the invention of the steam engine, widespread installation and use of railways, electrical engineering, the automobile, and information and telecommunication technologies. With the launch of these technological revolutions, industrial and commercial sectors are created. Between the long economic waves, several shorter cycles occur. Nonetheless, to answer the question of where we are now in the metals industry, we need to take a closer look.



Recent crude-steel production trends

On the basis of crude-steel production, three main long-term periods can be identified after the Second World War (Figure 1). A period of expansion up until the mid-1970s was followed by only moderate production increases for the next 25 years. What then came was a period of high growth that peaked during the middle of 2008 with an all-time high in monthly crude-steel production. Thanks to the strong parallel increase in the price for steel products, in addition to the costs for raw materials and energy, turnover in the iron and steel industry grew to an all-time remarkably high figure.

Triggered by the financial crisis, total crude-steel production plummeted within only six months. As seen in Figure 2, the monthly crude-steel production figures in late 2008 were down by 26.4 percent com-

pared to the year before, which was at a level similar to that in 2004. (All data from the World Steel Association). The respective monthly figures in the European Union, the Commonwealth of Independent States (C.I.S.), North America, South America and Asia, excluding China, fell by between 40 percent and 50 percent. The production levels during the first quarter of 2009 have not been this low for decades, which dramatically illustrates the current exceptional economical situation for the industry in these regions. Consequently, investments increasingly focus on maintaining >>



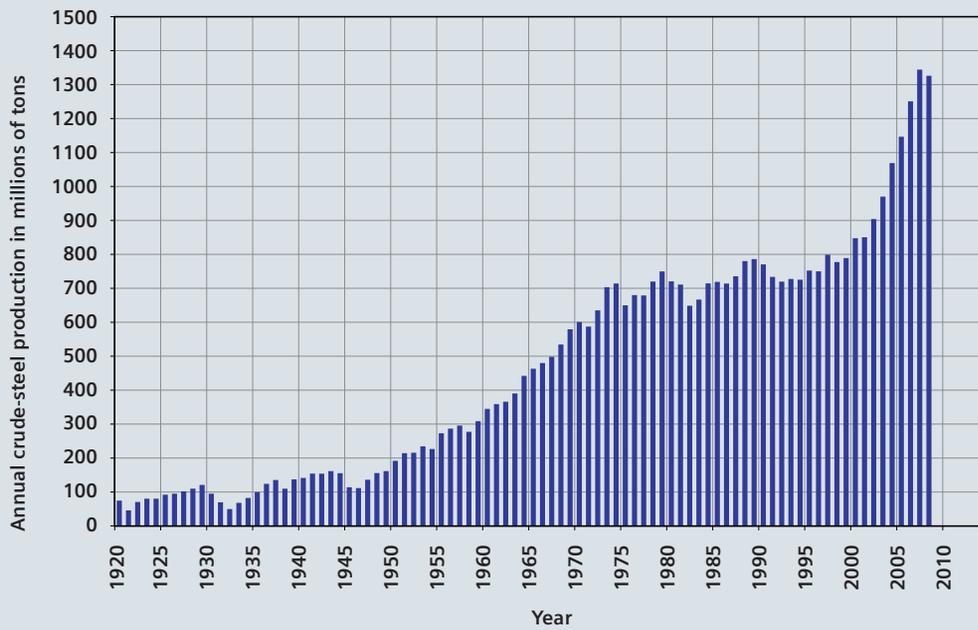


Fig. 1: Annual crude-steel production showed strong growth during the last decade.

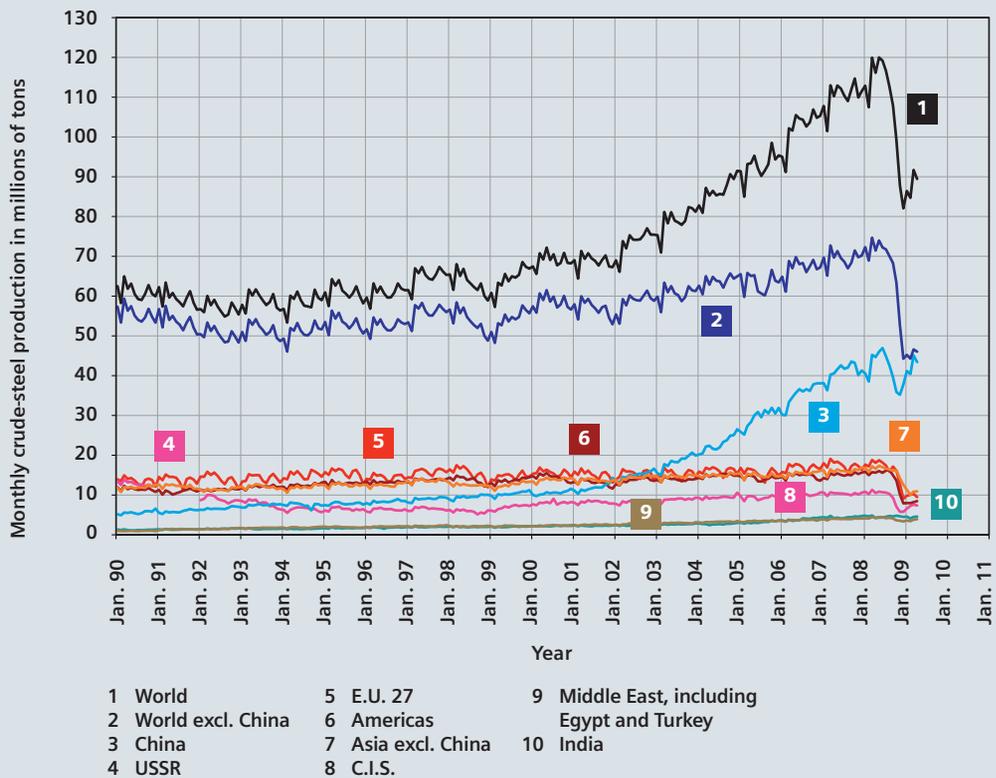


Fig. 2: Monthly crude-steel production figures for the world and selected markets. The exceptional reduction in steel production in late 2008 occurred in most markets worldwide.



>> existing facilities and equipment, and not on installing additional production capacity.

In China, the figures depict a different picture. The country has increased its monthly crude-steel production almost fivefold since 1998, from 9.5 to 46.9 million tons. For the first time ever, China is presently producing about as much crude steel as the rest of the world combined. In India and the Middle East, where crude-steel production doubled during the last decade, the production level only slightly changed as a result of the current economic crisis. These regions made an above-average contribution to the world's monthly crude-steel production that rose from 58.4 million tons in March 1998 to 74.7 million tons in March 2008. The figure slumped to 46.0 million tons in April 2009.

In most regions and countries of the world, the monthly production figures slightly increased in the last months compared to the low figures of late 2008. The World Steel Association expects the apparent steel consumption to decline 14.9 percent by the end of 2009, and noted that the improvement in steel consumption for the second half of 2009 will depend on the effects of government stimulation packages, the continued stabilization of financial systems and a return of consumer confidence. Other steel-market analyses say crude-steel production will decline for

the remainder of 2009, but expect production to reach 2008 levels again in 2011/12 (CRU assessment in addition to other sources).

Investment considerations

In a short-term view, the ups and downs in production and consumption show cycles lasting five to seven years, with a high peak in 2008. Parallel to the strong growth of crude-steel production, the order intake of companies organized in the section referred to as "large industrial-plant manufacturing" of the German Engineering Federation (VDMA), which also includes >>





>> the iron and steel industry, grew by 115 percent since 2003. This represents an all-time high of €32.8 billion in 2008.

It would have been better, yet riskier, if the original investment decision had been made earlier.

Accordingly, the level of investment activities was extraordinarily high, and directly related to the operating margin level of producers. This tendency to make major investment decisions in times with high operating-margins means that a producer can only benefit from an investment once the new plant facilities have started up – which often implies a time lag of several years. At that time, the economical conditions will most likely be less favorable. It would have been better, yet riskier, if the original investment decision had been made earlier, allowing producers to maximize their operating margin in the “good times.” From this perspective, it would therefore be more logical to invest independently of the short-term business cycle, however, always in line with a company’s long-term business strategy.

Another indicator for investment activity is a positive gross domestic product (GDP) that should be at a minimum of approximately 2 percent per year. Oxford Economics, a leading economic forecasting consultancy, forecasts a worldwide GDP growth of 2.2 percent in 2010 and 4.7 percent in 2012. These figures are subject to regional conditions, with countries such as China and India showing higher growth rates. The present government stimulation packages, such as the efforts to jumpstart the economy with investments in infrastructure combined with decisive measures to support the private bank sector, are important preconditions for investments also in the iron and steel industry. These programs must, of course, take into account ecological considerations in order to ensure a “win-win” situation for both the industrial sector and the environment.

Clear and realistic forecasts serve as the basis for decisions related to growth-based investments. The industry has to adapt to the current market situation, yet would be well advised to initiate a fitness program to be ready on time for the inevitable market recovery and continued growth. Strategies need to aim at making production more efficient, reducing specific material and energy consumption, improving product quality, increasing capacity base, meeting environmental regulations along with ensuring profitability and liquidity. In this issue of metals&mining,



a number of practical solutions are outlined that allow producers to meet many of these targets with only smaller investment expenditures.

The right time for investments

In general, three forthcoming economic phases affecting investments can be identified beginning mid-2009 (Figure 3). They can be defined as “rebound,” “growth” and “harvesting.” The key features of these phases are described as follows:

Phase 1 – Rebound

- Operation with existing capacities
- Investments in improved cost efficiency related to materials and energy
- Investments in modernizations
- Forward-looking strategies for phases two and three
- Planning of investments that are to become operational within a maximum time period of two to three years

Phase 2 – Growth

- Continued investments in cost efficiency
- Operation with existing capacities
- Execution of projects for phases two and three

Phase 3 – Harvesting

- Expansion of capacities
- Operation of new and modernized facilities
- Product-quality improvements
- Value-added production

For all phases, a continued benchmarking system for the price-cost ratio has to be monitored, accompanied by investments to maintain and improve current operations. Intensive and ongoing personnel training, regardless of the prevailing economic cycle, should be a cornerstone of company philosophy in the pursuit of business excellence. The introduction of >>

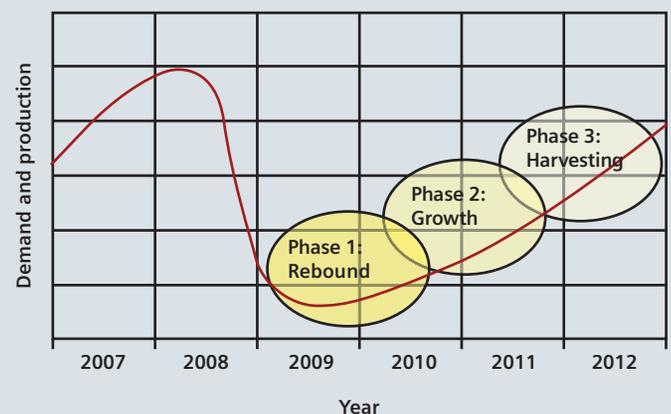


Fig. 3: Rebound, growth and harvesting phases for investments beginning in 2009

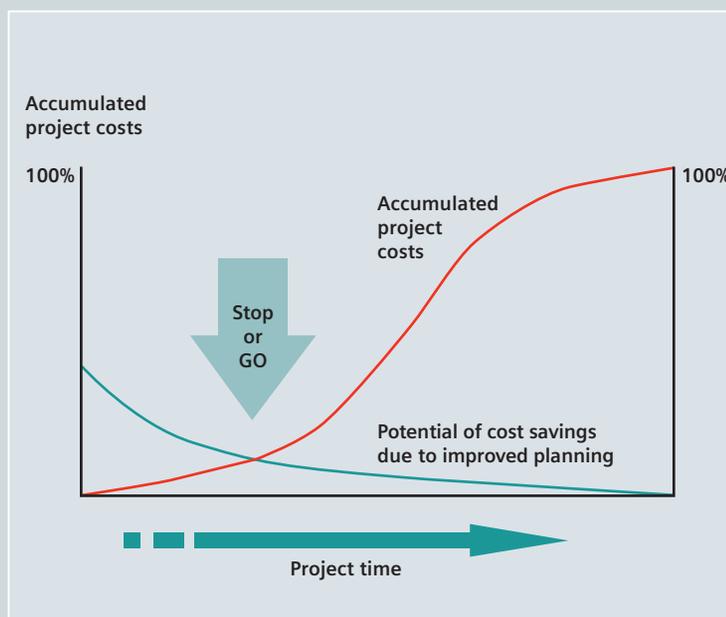


Fig. 4: Detailed initial studies offer the greatest potential to minimize overall project costs and project time.

>> innovative business models and financial schemes should be taken into consideration for mid- and long-term operations, including service contracts, outsourcing models and leasing models.

Figure 4 illustrates that with competent and thorough planning during the early stages of a project, there exists the greatest potential to minimize overall costs during a project. Subsequent operational expenditures can also be optimized for the entire lifetime of a plant. If a plant is not designed properly, it may no longer be possible at a later stage to rectify problems that may arise.

In the construction phase, every month of accelerated construction reduces pre-operating expenses and the total cash outflow, in addition to interest savings during construction. For the start-up and operating phase, a fast ramp-up curve together with safe and easy-to-learn technology and intensive personnel training are decisive factors to quickly reach the cash-flow break-even point. Therefore, the early involvement of a highly experienced engineering partner at every stage of a plant project is the basis for ensuring long-term project, plant and business success.

Profit from experience

As outlined above, operators need to invest also in turbulent times such as these in order to benefit during the current economic climate as well as to derive the most from the projected upswing in the economy.

Early involvement of an experienced engineering partner is the basis for long-term project, plant and business success.

The path from the project idea to the investment decision is often long and complex and involves considerable outlays of both time and money. Studies, which are the basis for early decision making, followed by the preparation of detailed technical and commercial specifications, should therefore start as early as possible. As a competent, comprehensive and experienced plant builder, Siemens VAI supports producers at every project phase to implement their investment targets with the best existing technology, in the shortest possible time and with the goal of achieving a high return on investment. ■

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Optimized and plant-wide energy management in integrated steelworks

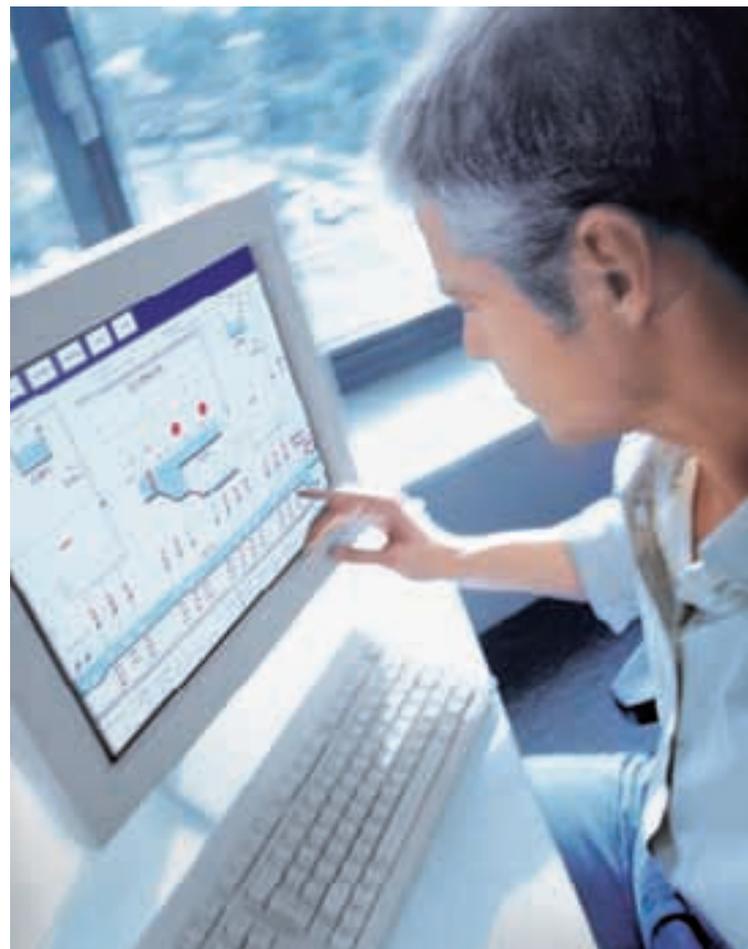
Efficient Energy Use Pays Off

In the steel industry, energy-related costs to convert raw materials to final steel products typically account for approximately one quarter of total production costs. For most producers, however, there is normally an enormous potential to reduce the energy consumption and thus the related costs by applying innovative plant-wide energy-management systems. Siemens VAI helps producers to optimize their energy efficiency with the additional advantages of improved environmental compatibility and a fast payback on investment.

The Siemens VAI Energy Management System is characterized by flexibly combinable energy-management modules in different automation levels to meet individual customer requirements (Figure 1). It can be easily integrated into existing automation environments such as basic automation, process automation, production planning and enterprise resource planning (ERP). All areas related to energy management are part of this solution package, including the entire energy topology (media, energy suppliers, energy-storage facilities, consumers and supply contracts, etc.) and the respective production facilities from raw-material processing up to finished-product manufacturing. The system provides increased transparency of the overall cost structure, and ensures an optimized utilization and distribution of energy throughout a steelworks. Reduced load peaks, minimized flaring losses and maximum utilization of periods with low tariff rates are key factors for major cost savings.

Supervisory control and data-acquisition level (SCADA)

Centralized control is provided for all media (e.g., fuels, technical gases, water, steam, electrical power) at this automation level. Specific functions for data collection, recording, alarming, trending, logging and the control of the energy consumption of all relevant loads or load groups are available. A main objective >>



Optimized and individually tailored energy-management modules ideally meet the requirements of producers to improve energy efficiency and reduce costs.

>> is to reduce and avoid load peaks which, of course, reduces costs. “Load shedding” is implemented on the basis of sophisticated load-switching strategies.

Energy Data Management Level

This module acquires and stores data from the relevant computing and measuring (or SCADA) systems through flexible communication interfaces. It creates

the basis for transparency in energy management by making visible both the energy input and related expenditures. Energy cost control, energy cost allocation to cost centers as well as steps to reduce the CO₂ load and environmental impact are facilitated and become traceable through continuous documentation. The system is based on a modern client-server configuration. Oracle servers can be used for the data-

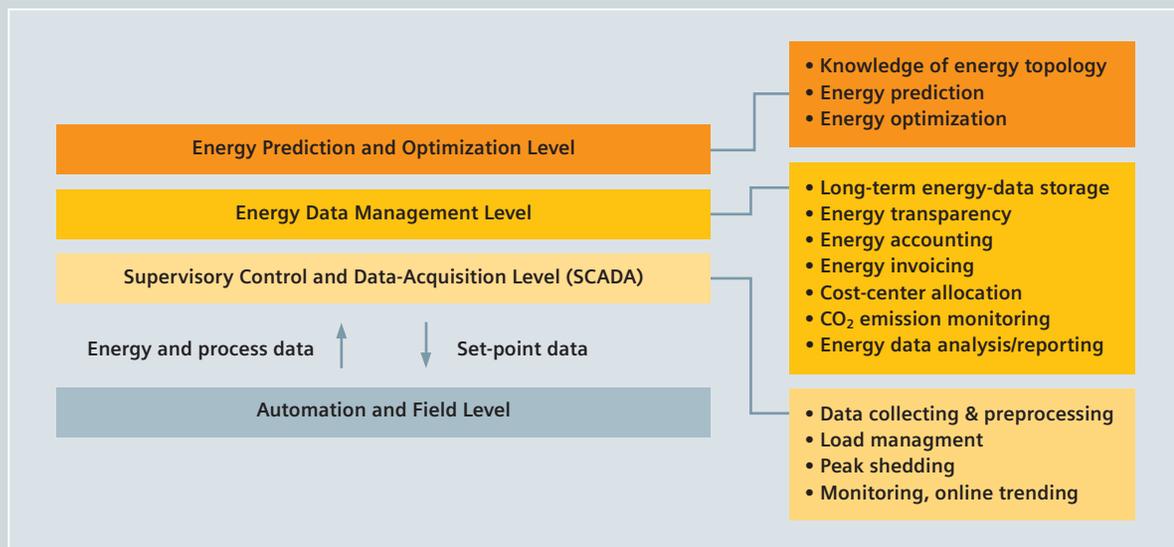


Fig. 1: Hierarchical structure of the Siemens VAI energy-management system

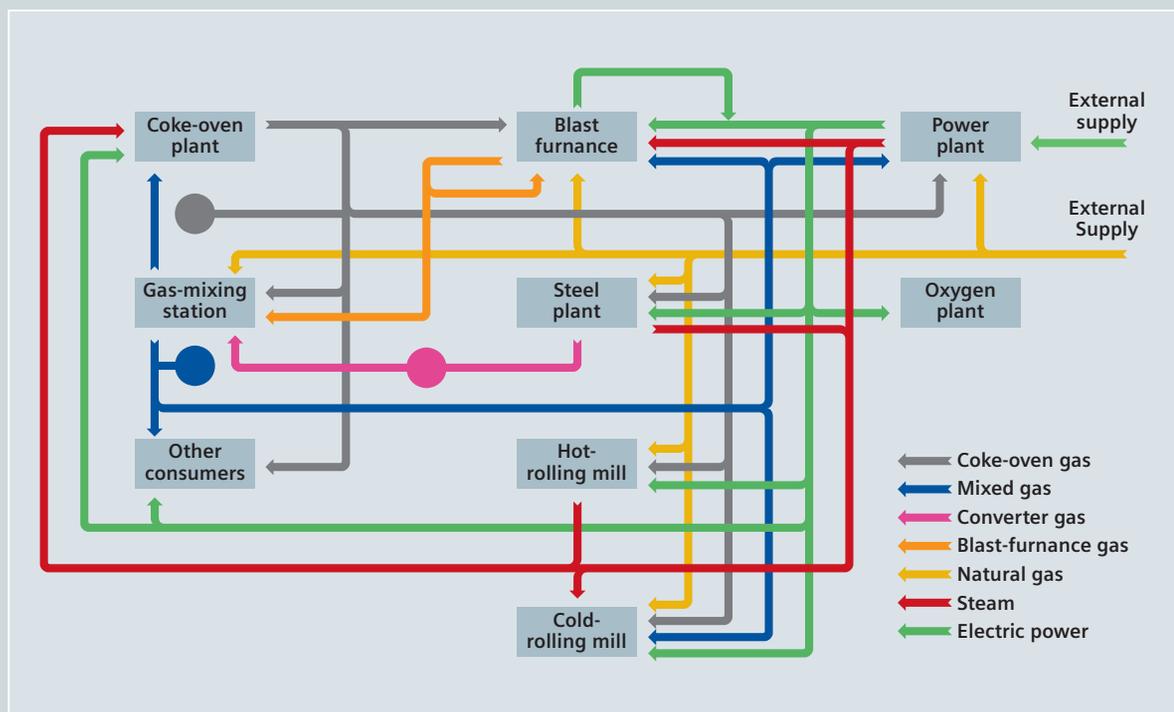


Fig. 2: Typical energy network within an iron and steel works

base. State-of-the-art and freely configurable user- and WEB interfaces ensure a high degree of flexibility to adapt the system to customer requirements. All necessary plant components (equipment units, cost centers, data points, energy prices, calculation formula, reports, key performance indicators (KPIs)) are defined through the user interface by means of drag-and-drop functionality analogous to a Windows Explorer function. In this way, new plant components relevant for the energy-management system can be easily created in the system and adapted accordingly. A high level of configurability, flexibility and extensibility are key features with respect to practicability and a long life cycle. All recorded and/or compiled energy data can be processed on the HMI (e.g., in the form of Sankey diagrams). Prepared templates are available and user-defined templates can also be created for the reports. Distribution by e-mail is possible. Thus, the system can be easily fit into a growing und developing energy network.

Energy prediction and optimization level

The energy used for production and the entire energy-supply network represent a complex system with considerable room for improvement (Figure 2). Energy optimization considers the interdependencies between the entire media complex (electricity, fuel gases, steam, water, bulk materials), the facilities related to the energy supply, storage and consumption as well as demand-side management concepts. The integrated prediction and optimization function makes it possible to forecast the energy requirements well in advance of the actual need. This provides the basis for the ideal scheduling of energy producers and the energy transport to consumers in the necessary quantities. Energy-supply contracts, maximum output, high tariff rates, fuel quantities, energy limits and even time-dependent differences in fuel prices are taken into consideration. Various models are used for energy prediction and optimization, including discrete event, empirical model and neural network models.

A tailored energy-management system

Depending on the plant setup and the energy-related boundary conditions, different sets of tailored energy-management systems can be supplied that take into consideration a wide range of plant/energy conditions and factors. These include the overall plant configuration and anticipated modifications, the typical and maximum energy demands of the various consumers, bottlenecks, degrees of freedom for energy substitution in the various plants, capacity and operational limits of the power plant, and environmental restrictions and taxes (such as for CO₂ emissions). The

external energy-supply situation and the related costs are accounted for, which include energy costs in general (e.g., for natural gas, electrical power and steam) and costs for “peak-work” and “peak-load” periods. The internal energy situation is carefully evaluated, including the quantity of residual gases, the average energy demand for various media, assurance of energy supply for various media, stability of pressure in the gas networks, sensitivity of thermal plants towards pressure drops and changes in the calorific value of process gases. Furthermore, energy-storage capacities (e.g., gas holders or for steam), the flexibility of the production plan, possibilities for load shedding in the various production plants, characteristic figures of the gas-mixing stations and the hierarchical positioning of energy-saving measures are also assessed by the energy-management system.

Concluding remarks

On the basis of the “Completely Integrated Solution” (CIS) philosophy of Siemens VAI, advanced and individually tailored energy-management solutions are available for producers that fulfill all functions as required for monitoring, controlling and optimizing the entire energy flow topology within industrial plants. The energy-management functions include transparent and consumer-dependent energy balancing, CO₂ emission monitoring, load management, energy-consumption planning and energy optimization, which are all performed reliably and at optimized cost. ■

Main benefits

- Reduction of load peaks and flaring losses (also gas-leakage detection)
- Intelligent linking of decentralized energy-production units
- Optimum utilization of existing energy network
- Forecasting and budgeting of energy consumption
- Reliable fulfillment of energy-supply contracts
- Clear representation of all events, statuses and measured values in connection with energy distribution
- Transparent energy and material balance as the basis for the enhancement of energy efficiency
- All resulting in a major reduction of plant energy costs

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The world's first ore-grinding mill with frozen charge shaker starts in Brazil

New Standards For Productivity

In December 2008, Siemens started up the world's first ore-grinding mill with the frozen charge shaker function at the Rio Paracatu gold mine. With the help of this solution, which is integrated in the Simine^{CIS} Mill GD gearless mill drive, charge that has become "frozen" to the mill's inside shell can be removed quickly and efficiently. This reduces maintenance times and costs considerably.

MINING ^

Rio Paracatu Mineração's Morro do Ouro mine is an open-cast operation owned by the Kinross Gold Corporation. The mining site is near the historical gold-digger city of Paracatu, around 220 km to the southeast of the capital, Brasília. Rio Paracatu Mineração is the largest active single gold mine in the world in terms of ROM (run-of-mine) processing and uses modern technology to increase its production. As part of the expansion project, Siemens supplied a Simine^{CIS} Mill GD gearless drive system with 20,000 kilowatts of rated power. With a diameter of approximately 12 m and a length of around 7 m, the new SAG (Semi-Autogenous Grinding) mill is one of the largest mills in the world.

First step: Detect the frozen charge and avoid damages

When maintenance has to be carried out, grinding mills used in mining installations have to be shut down for several hours or even days. In this time, the remaining mill charge can easily solidify, firmly attaching itself to the shell of the mill. This is called "frozen" (i.e., hardened) charge. When the mill is restarted, there is a danger that the frozen charge will not detach itself from the mill shell immediately, but will initially be lifted up by the mill and then dropped from a great height. The resulting damage to the mill can be severe. To detect firmly attached charge in good time and switch off the mill, Siemens developed a frozen charge protection function for gearless mill drives of the type Simine^{CIS} Mill GD. In normal operation the charge starts sliding after the mill reaches an angle of between 40° and 70° and the load torque decreases. This decrease in torque is monitored and used by the frozen charge protection to stop the mill



before falling frozen charge damages it. This prevents damage but does not automatically eliminate the frozen charge. Frequently, the material does not break up and remains stuck to the mill's shell. Only with labor-intensive mechanical means such as jackhammers or pressurized jets of water can the firmly attached charge be removed. This is time-consuming work, which causes loss of production.

Second step: Remove the solidified charge and increase productivity

With the help of the "frozen charge shaker" function integrated in the Simine^{CIS} Mill GD system, deposits can be loosened by causing the mill to move systematically. To do this, the operating personnel initiates the mill drive's frozen charge shaker mode from the local control desk. Defined forward and reverse movements of the mill lift the charge to a less critical angle



Simple control of the inching and creeping modes lets the operator quickly set up mill maintenance procedures.

and move the mill in a harmless range with varying speed and acceleration. The angle and movement are designed to break the frozen charge and remove it from the mill body. The motor is the same one that is used for grinding. The frozen charge shaker avoids production from being interrupted for the removal of a solidified charge attached to the mill shell. This prevents the mill from being damaged as a result of charge falling down in an uncontrolled manner and simultaneously reduces maintenance times considerably. Given that production is worth thousands of dollars per hour, maintenance cycles costing several million dollars can be avoided.

Next steps: New projects in Zambia and Chile

At the Equinox Copper Ventures Ltd. of Zambia, Siemens equipped two ore-grinding mills for the Lumwana copper project with gearless Simine^{CIS} Mill GD drive systems. The frozen charge shaker function will also be used there. The Lumwana copper mining district is around 220 km west of the Copperbelt in Zambia's North-Western Province. A SAG mill and a ball mill will be used to grind the ore.

At Los Bronces, part of the Anglo American Chile company, Siemens supplies a 22 MW gearless drive for a 40-foot SAG mill and two 16.4 MW gearless drives for two 26-foot ball mills. Thanks to this development project, Los Bronces will be one of the biggest copper and molybdenum mines worldwide. The gearless drives are designed to provide mill drives with the lowest possible power consumption and are equipped with the frozen charge shaker function. ■



The first gearless mill drive with a frozen charge shaker

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Quality management and machine automation in material-handling plants

Achieving the Right Quality Mix

MINING >

Customers in the mining and metals industry have ever-increasing expectations for the punctual delivery of material in the required quantity and defined quality. In order to meet these demands, material-handling operations require a system capable of capturing all process, quality and grade information – and one that can correlate the data to the physical position of the product as it passes through the plant.

The answer from Siemens is Simine^{CIS} MAQ, a comprehensive material-monitoring system that allows for straightforward quality planning and material blending. The solution covers the entire process chain, from incoming material, e.g., via a mine or train, to the storage area, and delivers precise 3-D visualization of the stockpile and its composition. The operator is kept informed of the current flow of material and the current material qualities/grades in the stockyard at all times. User-friendly HMI design based on graphical screens and 2-D and 3-D stockpile models greatly simplifies material-dispatch operation. Together with Simine^{CIS} MOM (the fully-automatic machine-operation module for stockyard machines) contractual requirements are guaranteed to be met. Furthermore, this combination increases the efficiency of the entire materials-handling plant.

The modular structure of Simine^{CIS} MAQ means that it can be flexibly adapted to plant conditions and the conveying process. Depending on the specific plant configuration, different standard modules can be installed, such as:

- Data Import Interface (e.g., for material received from a mine, barge or train)
- Configurable Material Tracking with an online link to the control system
- 3-D stockpile management
- Data Export Interface (e.g., for material going to the power plant, barge or train)

The Material Tracking module, which is the core module in Simine^{CIS} MAQ, maps out the entire material flow from material input to delivery. All other modules also have interfaces for transfer of material data (e.g., train unloading, reclaiming from pile and train

loading). Depending on process requirements, the material data held in the system are adapted to meet the specific requirements. All relevant data are listed in a configurable material-data record. In addition to the quality data, a material-data record also contains quantity information and a time stamp.

The right quality each time

The stockpile-management module integrates data from the stockpiles and bins into the material flow. Its central function is to represent the stockpile's contour and quality based on online process values. The derived stockpile structure is stored in the database with information for each cubic meter in regard to quantity and quality. It is updated online each time the stockpile is changed.

The latest stockpile contour and material data stored in the database can be visualized in different forms. Along with a 3-D model of the stockpile (see Figure 1), a compressed 2-D stockpile model is also available. In addition to mapping the surface contour, different material classes or material types are displayed in different colors.

A central function of quality-planning support is the early planning of blend qualities. Using the virtual grid, it is possible to select zones for which the system then directly calculates the resulting blend quality. This enables the resulting quality parameters to be established for the material before it is actually removed from the stockpile.

To define a blending job, the relevant zone has to be selected in each bin. The calculated resulting quality and the total quantity of both zones are immediately displayed in the lower area of the display in tabular >>



The bucket wheel stacker/reclaimer can be automated on the basis of a high resolution computer model.

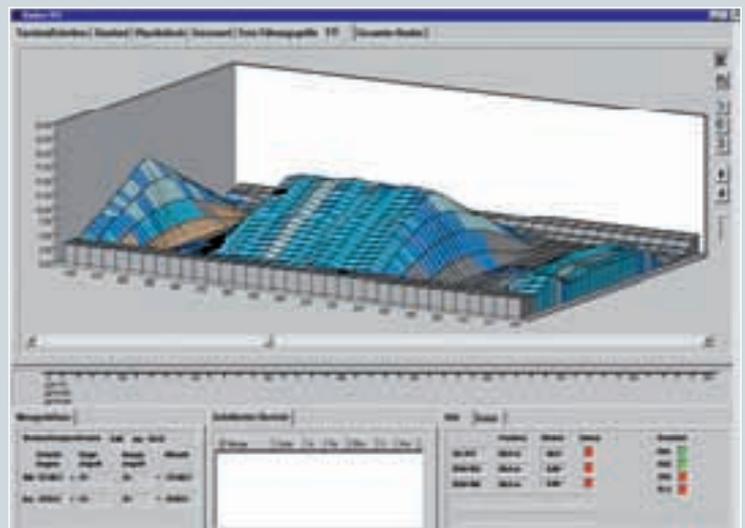


Fig. 1: 3-D stockpile image; different colors signify different materials



Simine^{CIS} MAQ monitors the material flow from excavation to transportation and further processing.

>> form. The required blend result for quantity and quality can be optimized by moving the relevant virtual grids.

Fully automatic blending process

The blending process is precisely where fully automatic operation of Simine^{CIS} MAQ comes in. This package ensures simplified material quality and quantity management in bulk-handling facilities. All quality parameters and the calculated material classification from the blending module are directly transformed into job orders for the reclaimers. The material-transport process can then be executed with the highest efficiency and accuracy.

An updated 3-D model of the stockpile enables the safe operation of driverless bucket-wheel machinery by knowing the exact position of the bucket wheel in relation to the stockpile. This helps avoid potential damage to the bucket wheel and its support structure through uncontrolled contact with the stockpile. The 3-D model also achieves the optimal flow of bulk material through exact positioning of the bucket wheel during excavation.

A fast and precise semiconductor laser scanner acts as a sensor, which is mounted on the boom arm for positioning over the bulk material. Exact determination of the scanner position, described through locations and angles, is done by absolute rotary-position encoders with a high resolution. The encoders are

connected to the PLC in the electrical cabinet of the machine. Within the PLC, the angular degrees of the boom and the lifting equipment, as well as the distance covered by the machine chassis, are calculated and sent, together with the scanned values, to the PLC for further processing.

Advanced software in the PLC provides both open-loop and closed-loop control of the bucket-wheel machine. For unmanned operations in particular, a software package was developed that handles communication with the quality-management system Simine^{CIS} MAQ in order to get the exact contour for the reclaiming process and to keep the shape model of the stockpile updated during stacking and reclaiming.

Easy integration into other systems

The system's modular setup allows the design of tailor-made solutions to meet the needs of the customers, enabling seamless integration from operations all the way up to management. All solutions are based on ISA 95, which allows them to be scaled up to a Manufacturing Execution System (MES). Below are some examples of available standard functions:

- Production Order Management integrates the planning and scheduling functions. Both optimize interactively the transport and storage of raw materials and maximize the effectiveness of operations.
- Data Integration Service links all relevant Enterprise Resource Planning (ERP) data to the operating units and gives feedback about the status of the production back to the ERP system.
- Product Tracking & Tracing follows up orders during storage and transport and traces the origin of raw materials up to the finished product (product genealogy).
- Process Information Management System consolidates all process and production data on a real-time basis, over periods of years.

Benefits

The quality-management system combined with the automatic machine-operation module is a well-proven system that can be adapted for various types of bulk-material-handling plants (e.g., stockyard systems for power plants, harbors and mines). It makes production planning straightforward and offers maximum transparency. The investment cost for the system is kept low due to the extensive use of standard components. ■

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Trolley-assist trucks with new AC drive system

Higher Speed and Lower Emissions

The Siemens Mobile Mining Equipment team has developed a new IGBT AC drive system for heavy haul trucks with a trolley-assist option. This latest-generation electrical-drive system for trucks with payloads of 260 tons and larger boasts improved fuel efficiency, so it is gentler on the environment and saves on operating costs. When using the trolley-assist capability, ROI can be achieved in one to three years.

New Siemens IGBT drive systems are currently being used to power the recently announced Komatsu 860E-1K truck, with other development projects planned for the future. After successfully testing the prototype systems in the harsh mining environments of Arizona and South Africa, Siemens and Komatsu have introduced the 860E-1K, an electric-drive rigid-frame truck.

Specifically developed for the rugged demands of the mining industry, the new drive system has been designed to withstand higher vibrations and a wider range of altitudes with a temperature spectrum of -40°C to $+60^{\circ}\text{C}$. The truck's low-emission engine qualifies for EPA Tier 2 certification. EPA Tier 2 regulations for engines above 751 hp (560 kW) encompass the most stringent emissions standards in the world for large surface-mining equipment.

By offering the option for a factory-installed trolley-capable system, mining operators can save fuel and prolong the life of the truck's diesel engine. The Siemens trolley-assist system can be used on either 1,600 or 1,800 volt lines and enables trucks to draw the electricity required for the AC wheel motors in much the same way as conventional railway systems. Loaded travel on uphill grades typically accounts for 70 percent to 80 percent of a truck's total fuel consumption. Speed on an uphill grade is normally limited by the diesel engine's horsepower. However, a truck can climb faster if it can get additional power by connecting to an overhead electric line. The engine simply idles, thereby reducing fuel consumption by an astonishing 95 percent. In addition to saving fuel, noise and emissions are reduced to almost zero and very little heat is emitted.

The drive system can travel at a maximum speed of 64.5 km/h with a 35.52:1 final gear ratio and is powered by the latest Siemens control package. The unique liquid-cooled IGBT AC drive system from



The new Siemens drive system will power the recently announced Komatsu 860E-1K truck

Siemens provides advanced features and a smooth application of torque and traction. In contrast to conventional DC systems, the AC wheel motors have no brushes or commutators subject to maintenance and wear. This significantly reduces costs and has the added side effect of increased availability due to less scheduled maintenance.

With engine operating and maintenance costs tied directly to fuel consumption, trolley assist lowers the cost per ton because the time between engine overhauls may double or more. ■

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It pays to invest in cokemaking process-control systems from Siemens VAI

Small Investments, Big Returns

Now is the right time to focus on smaller investments that offer quick and sizeable returns. One such example is the latest control technology for cokemaking plants. The project value fits well within a tight budget and execution is relatively fast so that producers can be ready on time for increased productivity demands combined with substantial cost savings.

The main targets in cokemaking are to keep the process stable and fault-free and to produce coke of the highest quality. These objectives all have to be met while taking particular care to minimize energy costs, ensure a high level of productivity, a maximum battery service life and low environmental emissions. This can be achieved by applying Simetal^{CIS} Coke products from Siemens VAI, which are state-of-the-art Level 2 control systems designed for the demanding conditions of a cokemaking environment.

Advanced process-control systems

Dynamic scheduling of coke-oven machine operations and optimized heating control of the coke-oven battery are decisive factors for producing coke of excellent quality and meeting the productivity demands of blast furnaces. Reliable positioning and interlocking of coke-oven machines by means of the well-proven RaDiPoSi tool from Siemens VAI is an important part of the integrated control system.

Various process-related calculations are performed

by the Coking Process Management System (CPMS) developed by Siemens VAI. After each coke-pushing procedure, the dynamic scheduling model of the system calculates and sends the next pushing time to the coke-oven machines, taking into consideration the respective oven number in the pushing sequence. The heat-energy input into the battery is optimized by means of the heating-control model. The control system aims for a uniform end temperature of the coke within the entire battery. Required heat adjustments are calculated after each gas-reversing sequence in the battery.

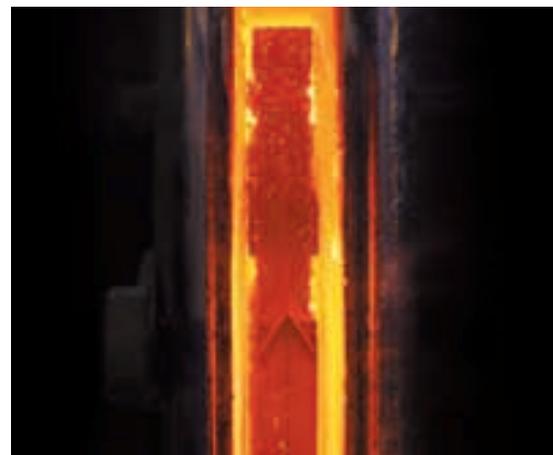
At the steel producer Rautaruukki Oyj, Finland, proper heating control has reduced variations in the coke end temperature and, partly as a consequence, considerably decreased the required energy input over the same time period (see graphs).

Payback considerations

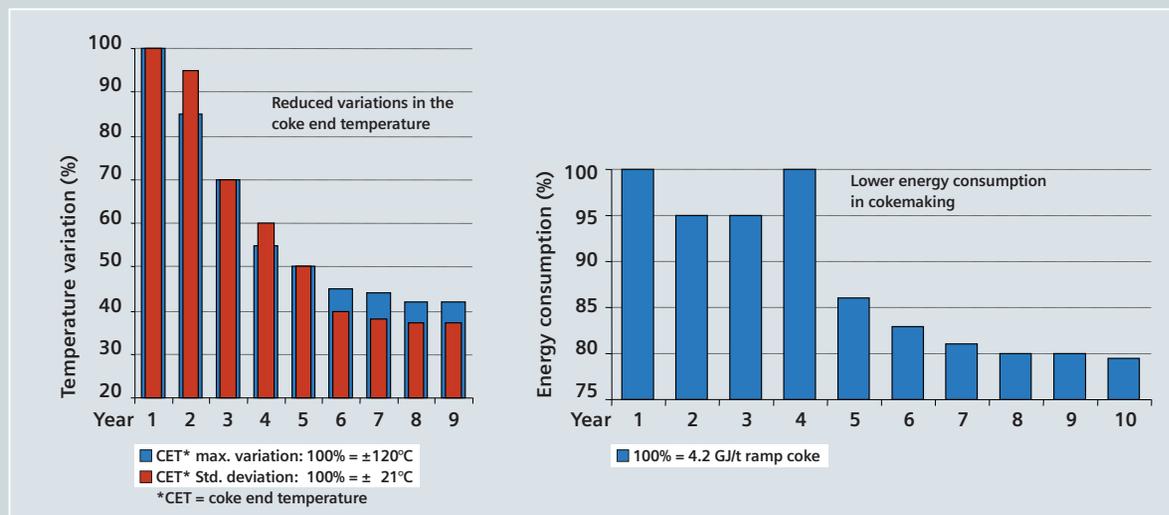
The payback time for an automation investment can be estimated by taking into account the cost savings from reduced external energy requirements, increased



State-of-the-art cokemaking facilities at Rautaruukki Oyj, Finland



Pushing of coke from a coke-oven battery



Improved cokemaking at Rautaruukki Oyj, Finland, with the application of advanced process control systems

productivity and the benefits of postponed battery maintenance and upgrading. Consider the following: Within an integrated iron and steelworks, coke-oven gas (COG) is typically used in reheating furnaces, coke-oven batteries, the power plant and in lime kilns. The value of COG may be considered to be the same as the purchase price of the respective fuels for these consumers, including natural gas, light oil and heavy oil. With the application of an advanced process-control system in cokemaking, approximately 5 percent less energy is required for battery heating. For the production of one million tons of coke, this means an extra 6.5 million Nm³ of COG that is available for other heating applications, as proven under actual plant operations. About 16 MJ of energy is available per standard cubic meter of COG. Assuming an energy price in the range of €8 to €15 per GJ, this is equivalent to a payback of €750,000 to €1,500,000 per year!

The benefit of additional coke production lies in the compensation rate for converting coal to coke – which is typically €20 per ton for the amortization of the battery investment – or the sales margin of the coke-oven plant (COP), which may be multiple of €20 per ton of coke. Considering a realistic 2 percent to 3 percent productivity increase and the above compensation figure of €20, the payback for each one million tons of produced coke is €400,000 to €600,000 yearly. When the sales margin is used as the basis for a calculation, the figure even increases to €3 million in the market situation of 2008.

Smooth cokemaking operations are undoubtedly a factor for a prolonged battery service life. For example, the cokemaking batteries at Rautaruukki Oyj were controlled by an automation system from the start of their operations. Experts from the Japanese steel producer Nippon Steel Corporation evaluated these facilities seven years after their start-up. The result was that the batteries appeared to be two years

younger than their actual age. Delaying the rebuilding of a battery by three years after 20 years of service life pays back an additional €600,000 per year at a 5 percent interest rate.

Experience and references

With references in more than 30 countries worldwide, Siemens VAI Finland has a wealth of experience at its disposal for the expert engineering and supply of automation and process technologies for the iron and steel industries.

Rautaruukki Oyj, for example, has fully utilized the advantages of the Siemens VAI Simetal^{CIS} Coke solutions, in particular CPMS for its coke-oven batteries for more than 20 years with outstanding results. Thanks to the excellent quality of the produced coke, the blast furnaces of the company rank among the best blast furnaces in operation worldwide.

Since 1989, Siemens VAI has successfully commissioned complete CPMS systems for various coke-battery sizes and designs worldwide. Six new installations are currently underway in India and these are scheduled for start-up between 2010 and 2012. ■

Main benefits of Simetal^{CIS} Coke solutions

- Reduced heating-energy costs
- Increased production rate
- Uniform final coke temperature resulting in improved coke quality
- Increased coke-oven battery service life
- Optimized process control of coke-oven battery
- Highly user-friendly for process operators

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Cost-saving sinter-plant solutions offer a host of benefits for producers

Agglomeration Of Benefits

Can sinter-plant performance be improved without major investments? Yes it can. A number of easy-to-install, stand-alone and practical solutions are available from Siemens VAI at relatively low costs to help producers optimize operations. All of the described equipment units and systems are installed in existing plants and well proven. Your best bet is to let Siemens VAI inspect your sinter facilities and to show you what improvement potential lies in store. All in all, the benefits add up!

Intensive mixing and granulation system

High homogeneity and permeability of the sinter raw mix are key factors for achieving maximum sinter productivity and quality at low energy consumption. With conventional mixing drums, however, the homogeneity of the sinter raw mix is less than ideal. Siemens VAI has therefore developed an intensive mixing and granulation system to improve previous design solutions. The new system basically consists of a high-speed intensive mixer and horizontal granulation drum. The sinter raw materials (coarse and fine iron ores, ultra-fine ores/pellet feed, additives, dusts, solid fuels, return fines and recycled materials from the steel plant, etc.) are continuously fed to the mixer where macro- and micro-mixing of the sinter raw mix takes place. The material is then transported to the granulation drum. Thanks to the extremely high homogeneity of the resulting sinter raw mix, overall sinter quality is improved, which contributes to better blast-furnace performance.

Main benefits

- Lower investment costs compared to conventional systems
- Mixing of higher ratio of fine iron ore possible, e.g., pellet-feed concentrates
- Reduced solid-fuel consumption during sintering by up to 5%
- Increased sinter productivity by up to 2%

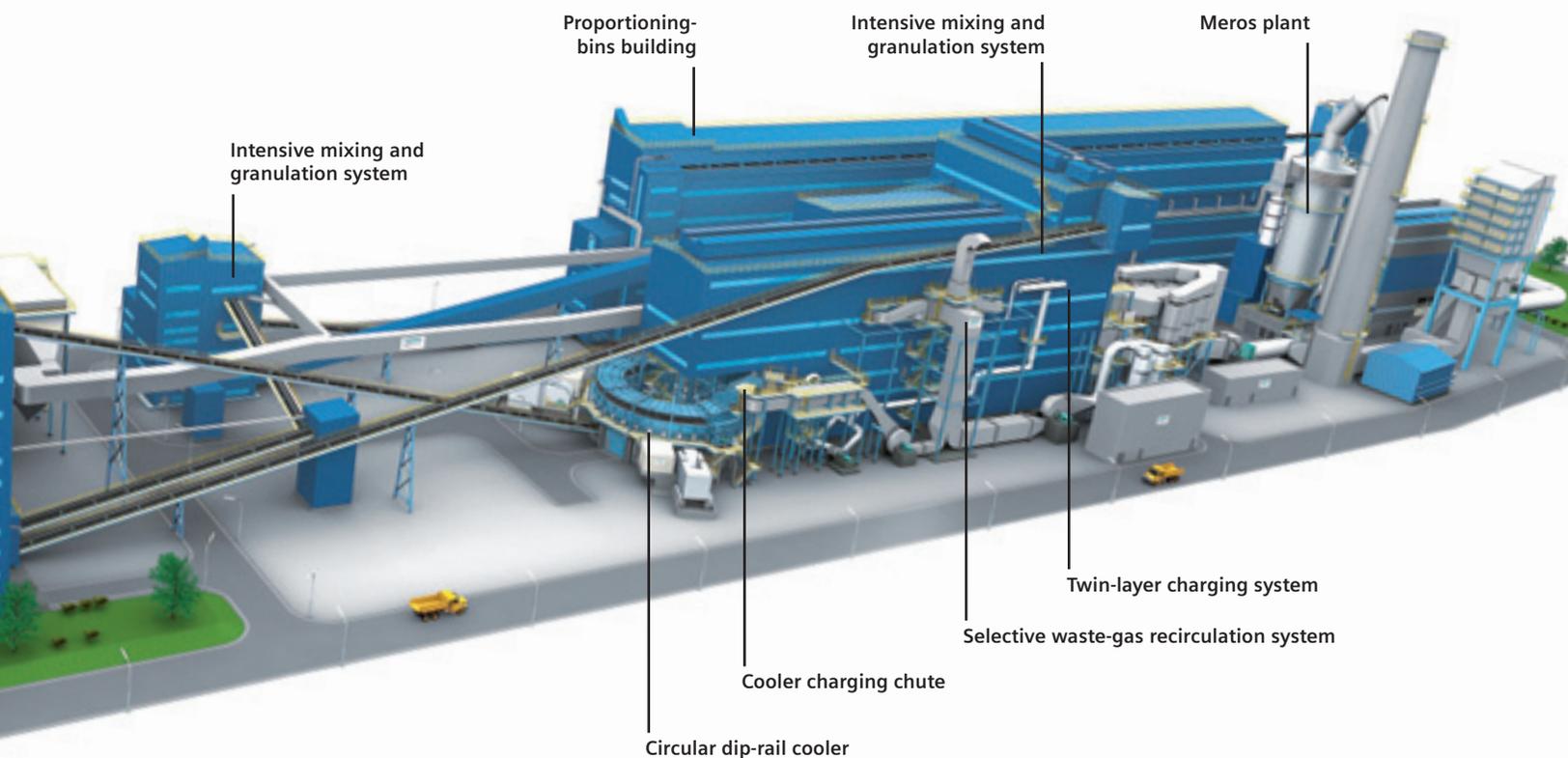
Schematic overview of sinter-plant design



Twin-layer charging system

The twin-layer charging system from Siemens VAI is a simple and practical solution to achieve a more uniform sinter-feed segregation and improved permeability of the sinter bed with respect to the material grain size and solid-fuel content. The initial layer deposited onto the bottom of the sinter bed is comprised of a coarser sinter raw mix with a lower solid-fuel content. The second layer is charged onto the top of the first layer and is comprised of smaller grain sizes and a higher solid-fuel content. These

With an experience background based on the implementation of numerous sinter-plant projects during the past five decades, Siemens VAI is one of the leading suppliers of sinter-plant technology and all related automation, media and environmental facilities. A full range of design, technological and system-improvement packages are also offered that enable producers to enhance performance, product quality, lower environmental emissions and, above all, reduce costs.



measures improve the permeability of the sinter raw-mix layer, contribute to a more efficient use of fuel and ensure excellent ignition behavior.

Main benefits

- Reduced specific solid-fuel consumption
- Increased plant productivity, even with bed heights of up to 800 mm
- Lower specific electrical energy consumption estimated at 2 percent

Special pallet-car design

Sinter machines from Siemens VAI feature the use of so-called Grate Wings Pallet Cars. Gas-tight rim-zone covers are installed in the side-wall areas of the pallet cars, which significantly reduce the false air volume compared with conventional designs. This leads to a large reduction of the waste-gas volume and improved sintering of the raw mix at the side-wall areas. The result is a reduced quantity of return fines, contributing to enhanced productivity of the sinter plant. >>

>> The sintering suction area can be easily increased at relatively low costs by increasing the width of the pallet car. This solution can be applied without the need to modify the supporting structure of the sinter machine, thus minimizing operational downtime for modification work. The sinter output can be increased by up to 12 percent in this way. Further capacity increases are possible by extending the length of the sinter strand. These steps represent highly economical solutions to expand the capacity in existing sinter plants.

Main benefits

- Reduced false air intake and waste-gas volume
- Therefore, lower electrical energy consumption by up to 12 percent
- Proven sinter output increase by more than 12 percent

Selective waste-gas recirculation system

Siemens VAI has developed and implemented new technologies that improve sintering operations and keep environmental emissions in check. One such example is a selective waste-gas recirculation system, jointly developed with the steel producer voestalpine Stahl GmbH (Linz, Austria). The offgas from selected zones of the sinter machine is mixed with cooler off-air and/or ambient air and recirculated to the sinter strand.* A key reason behind the development of this process was to enable increased sintering capacity without an increase in the offgas volume and emissions. Specific investment and operating costs for gas-cleaning facilities can therefore be kept relatively low. Specific emissions for each ton of produced sinter are also much lower than in conventional systems because recirculated dust is trapped in the sinter bed and organic compounds destroyed as they pass through the flame front. The selective waste-gas recirculation system from Siemens VAI is ideal for installation in both new and existing plants. Furthermore, in combination with the Meros* Process, this represents the best-available technology for the treatment of sinter offgas.

*See metals&mining 2|2008 for more details.

Main benefits

- Full productivity using same raw mix
- Decreased waste-gas volume by up to 40%
- Proven reduction in the solid-fuel consumption by up to 10%
- Lower specific CO₂ emissions by up to 10%
- Lower specific emissions of SO_x, NO_x, organic compounds and heavy metals

Sinter cooler charging chute

The efficiency of cooling air can be enhanced using a specially designed cooler charging chute. With this solution, an improved segregation of the sinter deposited onto the cooler is achieved in that large particles collect at the bottom and small- to middle-sized particles accumulate at the top of the cooling bed across the entire cooler width. This contributes to a more homogenous permeability of the sinter bed, better cooling efficiency and thus lower electrical energy consumption of the cooler fans. The described solution step can be implemented in existing coolers where the sinter-cooling efficiency is inadequate. Siemens VAI is capable of performing 3-D computer modeling and specific lab tests to determine the ideal improvement solution for the requirements of each producer.

Main benefits

- Increased cooling-bed permeability and cooling efficiency
- Therefore, reduced electrical energy for suction fans by up to 3 percent
- Less spillage in the charging area

Advanced sinter-cooler design

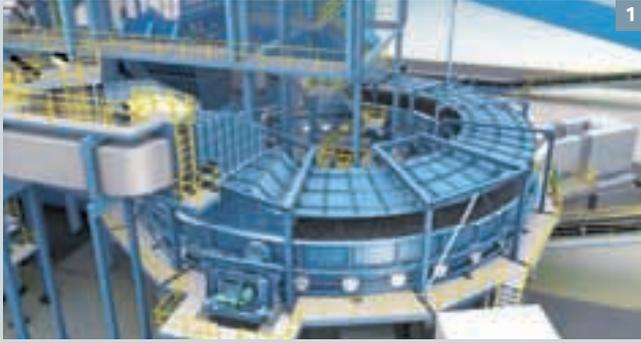
The sinter cooler is designed according to the patented Grate Wings Cooler Trough technology of Siemens VAI to meet the requirements for higher efficiency and lower electrical energy consumption. By means of special rubber sealings installed between the moving cooler troughs and the air-channel system, a more efficient utilization of the cooling air is possible. Spillage pans located below the lower plates of the cooler troughs protect the air channel from spillage and dust. Applying the new design in an existing conventional circular sinter cooler with a trough width of, for example, four meters, the cooling capacity can be increased by approximately 15 percent without increasing the cooling-air volume.

Main benefits

- Decrease of specific electrical energy consumption by up to 3 percent
- Higher cooling efficiency resulting in decreased specific cooling-air volume
- Effective utilization of heat-recovery system in combination with offgas recycling

Sinter VAiron

Installation of the Simetal^{CIS} Sinter VAiron automation/expert system in new or existing sinter plants is



- 1 Schematic representation of advanced sinter cooler
- 2 "Grate Wings" pallet-car extension
- 3 Principle of segregation with sinter-charging chute design
- 4 Eirich intensive mixer
- 5 Horizontal granulation drum
- 6 Selective waste-gas recirculation hood

the basis for reliable process control and optimized raw-material handling – from stacking and dosing up to sintering and material analyses. Key functionalities for the sinter process were developed to improve product quality and reduce overall production costs. Examples of control modules related to the raw-material composition include sinter-mix moisture and feed control, ignition control, burn-through-point prediction and deviation control, as well as basicity and harmonic diameter calculation. These lead to an increase in productivity with a simultaneous decrease in the coke rate.

Main benefits

- Proven coke-rate reductions by 2.5 percent
- Increased productivity by 3–5 percent
- Improved sinter-size uniformity

To improve sinter quality even further, the Level 2 Sinter Expert System for feedstock up to plant-specific

fine-tuning represents an ideal analysis and optimization tool for plant technologists. (For more details, please refer to *metals&mining* 1|2008.)

Concluding remarks

In order for sinter producers to derive the most from the available improvement and optimization potentials, an in-depth analysis of the raw materials and process parameters is necessary first. A quick assessment of the existing plant conditions can be made during on-site investigations by expert personnel from Siemens VAI. This is then followed by recommendations for improvement solutions that are implemented on a cost-effective basis. ■

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Start-up of the No. 3 Blast Furnace of JSW Steel Ltd.

India's Largest Blast Furnace



IRON & STEEL >

JSW Steel is the fastest-growing private-sector steel company in India. In order to increase steel production from four to seven million tons of steel per year, the company launched its so-called Cheetah project. Major investments were made in new hot-metal-production and steelmaking facilities. For the new blast furnace, Siemens VAI received the order for the design and supply of all primary blast-furnace equipment and technical services for construction and commissioning. This included the copper stave coolers, the pulverized-coal injection system and a high-efficiency hot-blast stove plant. A complete automation package was also installed, highlighted by the VAiron expert system for hot-metal production and quality control. Site construction was provided by JSW Steel.

The blast furnace has a hearth diameter of 13.2 m and an inner volume of over 4,000 m³. It was designed as a free-standing, stave-cooled shell inside a splayed-leg tower and is equipped with 36 tuyeres and 4 tapholes. The furnace operates with a high top

pressure (2.5 bar g) and high hot-blast temperature (1,250°C). This allows a coal-injection rate of up to 200 kg/t of hot metal to be employed, reducing operating costs. The furnace is also provided with modern environmental-protection systems, including a de-dusting cyclone and venturi scrubber for gas cleaning, cast-house and stock-house de-dusting systems and a slag-granulation plant. The energy of the furnace top gas is recovered by a 11-MW top-gas-recovery turbine.

In order to use the top gas for heating purposes in other parts of the integrated steelworks, the gas is cleaned in a two-stage plant. In the first stage, a specially developed cyclone from Siemens VAI removes iron-laden dust, which is re-used in iron production. Up to ten metric tons can be recovered per hour. The new cyclone allows highly flexible control of the dedusting process, optimizing iron recovery while simultaneously preventing concentrations of heavy metals such as zinc to accumulate, which can reduce the useful life of the furnace's refractory lining.

On February 18, 2009, in the presence of Managing Director Sajan Jindal, Blast Furnace No. 3 of JSW Steel Ltd. was successfully started up at the company's integrated iron and steel works at Toranagallu, in the southern Indian state of Karnataka. With a nominal annual capacity of 2.8 million metric tons of liquid iron, it is the largest blast furnace in India today. Siemens VAI was the technology provider for this plant.



State-of-the-art automation system



First tap of hot metal on February 19, 2009

Closed-loop control with VAiron expert system

The furnace is equipped with a wide array of sensors to monitor the gas flow and temperatures within the furnace. The data is collected and evaluated by the sophisticated automation system, which is comprised of a number of Level 2 control models to regulate furnace burdening and material distribution. The suite of software applications is completed by the closed-loop Simetal BF VAiron expert system, which is able to control the furnace heat level and production rates, ensuring optimized furnace operation and low fuel rates. Simetal BF VAiron has been installed in more than 70 blast furnaces worldwide.

First tapping of hot metal

The start-up of the blast furnace was carried out by JSW Steel with the support of a multi-discipline team of specialists from India, the U.K. and Austria. The first tapping of hot metal took place 23 hours after the furnace was lit. Close interaction between all members of the start-up teams ensured that the production tar-

gets were quickly and safely met without incident. The build-up in production coincided with the hot-commissioning schedule of the new steelmaking plant and continuous-casting machines. After one month of operation, the furnace was producing 7,000 tons of hot metal per day, which is 90 percent of its rated output.

Concluding remarks

The successful completion of this blast-furnace project underlines the experience and expertise of Siemens VAI in the design and construction of large-scale blast furnaces. The outstanding cooperation between the teams of JSW Steel, Siemens VAI and other suppliers, as well as the highly professional project execution, were decisive factors for the rapid plant start-up and fulfillment of JSW Steel's production targets. ■

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The Simetal^{CIS} VAiron Expert System for fully optimized blast-furnace performance

It Runs by Itself (Nearly)

Hot-metal production is the dominant cost factor in any integrated steel plant. From both a cost perspective and a production point of view, optimized operation is necessary to reach peak performance in the blast furnace. This affects not only a steel company's bottom line, but helps to generate a reasonable return on investment in the current challenging business environment. The Simetal VAiron Blast Furnace Optimization package from Siemens VAI provides the automated and optimized blast-furnace operation needed to achieve all these goals. The authors explain why.



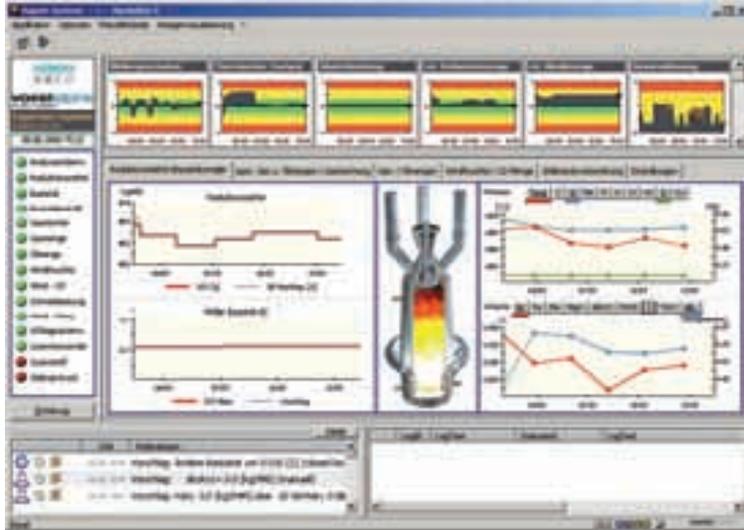
The decisive advantages of the well-proven VAiron expert system have been confirmed in more 70 blast furnaces worldwide.

Solidly based on advanced process models, artificial intelligence, a closed-loop expert system as well as enhanced software applications and operational expertise, Simetal VAiron continuously performs a complete diagnosis of all process conditions to be expected during blast-furnace operations while the built-in closed-loop control system executes corrective action, as the need arises. Detailed descriptions of the decision-making process ensure transparent operating conditions. This enables fully automatic and stable blast-furnace operations with

consistent hot-metal quality at significantly lower production costs.

Robust data management, comprehensive process models, innovative expert system

Simetal VAiron comprises three parts: The first involves Process Data Management. This component is arranged around a database used to store all process data as well as operator inputs or model parameters. Data is retrieved from the Level 1 system, laboratory, Level 3 system, and elsewhere and stored or presented to



Clear and informative Simetal VAiron user interface

the operator or engineer via graphical user interfaces. Internet-based visualization is also supported. Production and other reports are included in this part of VAiron.

The second part comprises a broad collection of process models, including:

- **Burden Control Model**
The operator uses this model to calculate the burden composition based on raw-material chemistry, the targeted reducing-agents rate and the targeted slag basicity. During standard operation, the input parameters are controlled by the expert system in closed-loop control without operator interaction.
- **Burden Distribution Model**
Major burden distribution changes are visualized by this model. Under normal conditions, the model adjusts the burden distribution automatically in closed-loop operation.
- **Stove Control Model**
The model automatically controls the fuel-gas set-points during each gas cycle in a closed-loop process so that the desired blast temperature is achieved with a minimum amount of fuel.
- **Hearth Wear Model**
Based on a finite element method, this model calculates the wear line in the hearth.

The expert system is the third and final part of Simetal VAiron. In fact, this is the very first blast-furnace expert system to control the furnace without any operator intervention. This technology employs a number of process models to perform additional calculations, observes the blast furnace on a continuous basis and changes various operational parameters.

This includes modification of the fuel rate, changes in the burden composition and distribution, and changes in steam additions.

Recent references

As a testament to its advanced capabilities, Simetal VAiron is now in operation at more than 70 blast furnaces worldwide, currently supporting over 10 percent of the world's hot-metal production. Recent examples of successful installations include BF No. 4 and BF No. 5 of Ahmsa, Mexico; Severstal North America, U.S.; Nanjing Iron & Steel, China; BF No. 3 of JSW Steel, India; Ilva/Riva Group, Italy; and Isdemir, Turkey.

Impressive cost and energy savings

In blast-furnace installations equipped with Simetal VAiron, producers benefit from reduced fuel consumption (typically 10 kg/t hot-metal savings); enhanced productivity; stable product quality; elimination of heavy control actions; and avoidance of critical process situations.

Taking into account a medium-sized blast furnace with an annual output of 2,000,000 tons of hot metal, a fuel-rate savings of 10 kg/t hot metal and an estimated coke price of €180/ton, a yearly reduction of some €3.6 million can be achieved in operating costs. These cost savings are truly significant, enabling Simetal VAiron to pay for itself in six months or less of operation. ■

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Engineering studies for hot-blast stoves

For a Better Blast

Interested in saving money in your blast-furnace operations? As a full-line supplier of all blast-furnace equipment and solutions, Siemens VAI can help you to optimize production by assessing plant parameters and performance, followed by expert modernization advice. In this article, the focus is on improvements for hot-blast stoves.

The blast-furnace process is the largest consumer of energy within an integrated steelworks and the hot-blast stoves are one of the main equipment sections that needs to be working efficiently for optimized blast-furnace performance. These are major consumers of energy, so they must be in top condition to keep fuel requirements down and CO₂ emissions at a low level. Siemens VAI offers a variety of stove studies and health-check investigations to enhance stove performance, leading to better ironmaking operations and production.

Get the most from hot-blast stoves

The application of computational fluid dynamics (CFD) investigations allows existing designs to be evaluated and new ideas to be tested prior to implementation. Using the in-house stove design model from Siemens VAI, actual operational data and stove performance can be reviewed against model-predicted data. Stove improvements for planned rebuilds or repairs can also be forecast with this model, and completely detailed stove-sizing investigations carried out. It is even possible to evaluate the increased fuel consumption dur-

ing the rebuild period when one stove is under repair, or the feasibility of installing an additional stove to ensure continuous hot-metal production.

Physical inspections can include external checks of the shell, an internal examination with an endoscope, assessment of field measurements (e.g., chequer-chamber pressure drop) and a review of the control-system configuration. Additional equipment-feasibility reviews with respect to the installation of new equipment, such as waste-heat recovery, can also be performed.

Fuel optimization for the operation of a new stove design can be calculated, including the potential cost savings and return on investment. Furthermore, the net blast-furnace performance, hot-metal costs and capital requirements can also be determined in the course of the engineering studies with consideration to variable stove-enrichment gas quantities, coke rates and coal-injection rates and productivity, etc.

Recent industrial examples

Stove studies were recently carried out at four U.S. production sites. The objectives included increasing the hot-blast temperature and capacity as well as improving energy efficiency. At one site, a process and economic analysis of hot-blast stove rebuild options was carried out in preparation for a planned blast-furnace modernization. At a second steel mill, a new stove design was proposed. At a third location, Siemens VAI will provide two new stove designs for two blast furnaces expected to be rebuilt by 2011. Inspection of stoves by Siemens VAI at a fourth site showed that they were in poor condition. A repair plan was proposed that included defining refractory supply requirements and an accelerated installation schedule. ■



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Application of advanced CFD and simulation tools allows equipment design to be optimized in a cost-efficient and effective manner

The Numbers Say It All

Over the last decade, computational power and software simulation technology have dramatically advanced. This has allowed computational fluid dynamics (CFD) to be practically applied as a powerful design and analysis tool in the iron and steel industry. A brief overview of several application examples is presented in the following.

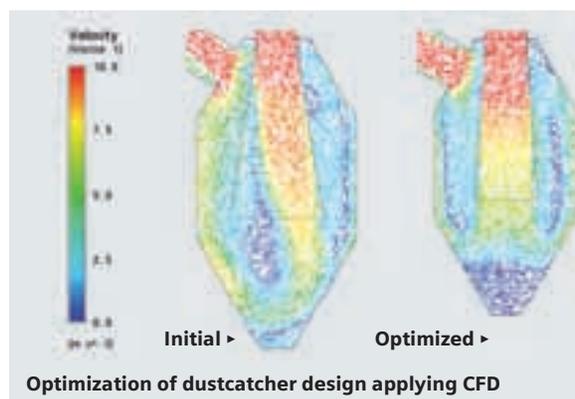
CFD is a numerical analysis technique in which the flow of a gas or liquid is simulated by solving a large system of governing equations. Practical applications can range from simulations of gas flow through a ducting system up to combustion in a stove burner where chemical reactions, heat and mass transfer as well as gas flow are involved. Not only can performance be compared between different designs, but detailed visualization is possible, allowing a level of understanding not possible with a physical model.

In the course of hundreds of engineering projects implemented worldwide, specialists at Siemens VAI have acquired extensive in-house CFD analysis capabilities and are able to quickly and effectively evaluate new technologies, as well as diagnose and solve problems with existing equipment. For the blast-furnace area, recent examples include the optimization of dustcatcher internals, an assessment of convective cooling of an iron trough, and an investigation of the gas-flow distribution exiting a hot-blast bustle main.

Application examples

An efficient dustcatcher is critical in meeting emissions regulations for gas exiting a blast furnace in a cost-effective manner. Gas flow and collection performance for two designs were compared (see Figure). It can be clearly seen that the initial design produces an undesirable flow pattern where high-velocity gas sweeps the dust-collection area. A CFD analysis shows that by modifying the design of the dustcatcher, the poor flow pattern can be eliminated, collection performance increased, and equipment size decreased.

Convective cooling of an iron trough is another example of where CFD analysis can be applied to assess heat-transfer conditions. An investigation was performed on a new trough design to ensure that its thermal convection pattern and maximum metal temperature were close to that predicted for a proven existing



design. This could be confirmed, showing that the new trough design was acceptable and safe for use.

Uniform distribution of hot blast exiting the bustle main is critical for maintaining stable blast-furnace operation. Gas-flow distribution predicted by CFD analysis and also by a one-dimensional mathematical model was compared with actual plant data. The effect of gas-flow redirection near the connection between the hot-blast main and the ring bustle was accounted for by the CFD analysis, but missed by the mathematical model. There was a local increase in pressure, resulting in more gas being passed through the first tuyere. After this was recognized, rectification measures could be undertaken. Although both design tools closely agree with each other, added insight was gained by performing a CFD analysis.

The examples above are by no means the extent of what is possible with CFD analyses. Siemens VAI is continually finding new applications and is keen to provide analysis services for new and existing plant equipment to optimize design criteria and performance. ■

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Examples of cost-saving and improvement solutions in oxygen steelmaking

Small Steps, Major Improvements\$

In addition to its well-known reputation as a complete supplier of LD (BOF) steelmaking plants, Siemens VAI also offers a wide range of systems, solutions and technological packages that help steelmakers optimize production and save costs. A few examples are outlined in the following.

With relatively simple measures and steps typically involving only smaller investments, it is possible for steelmakers to optimize production operations, increase operational reliability and enhance personnel safety. This is achieved with new design solutions, mechanical improvements and process-control enhancements. On the basis of its formidable experience in the supply of oxygen steelmaking plants, Siemens VAI helps producers achieve the full potential of their plant. As the saying goes, "There's always room for improvement."

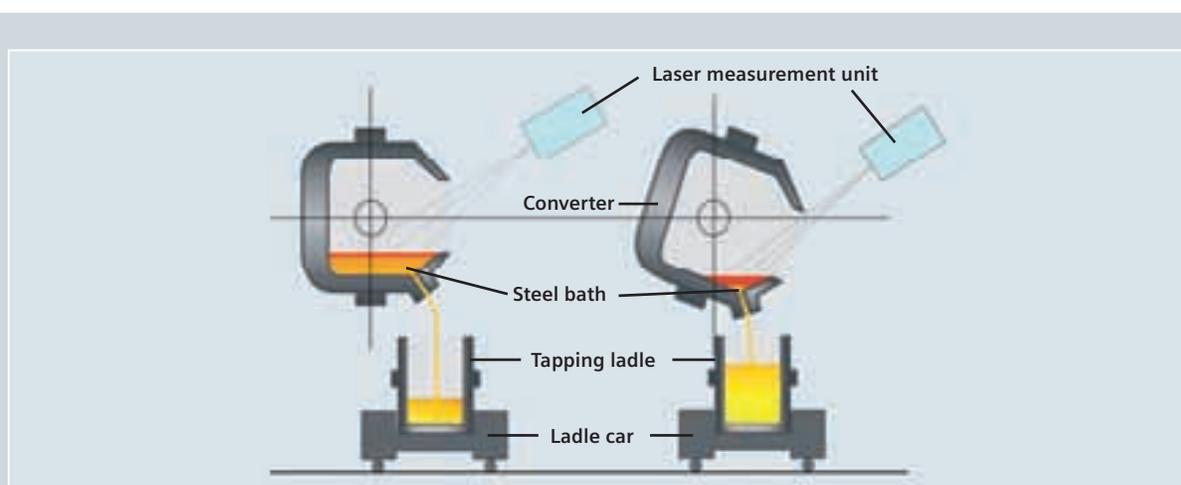
Converter replacements to increase production

As an example of a steelmaking project to expand output, the LD Steelmaking Plant No. 3 at voestalpine Stahl in Linz is being revamped to enable more than six million tons of steel to be produced per year, compared with the previous figure of 5.5 million t/a. All replacement and modification work has to be carried out during ongoing production, within an extremely tight time sched-

ule and under especially cramped conditions. The three 160-ton LD vessels were replaced with 180-ton vessels, and new trunnion rings with tilting drives were installed. A highly compact suspension system was designed on the basis of the well-known Vaicon Link suspension system to provide optimum converter support despite tight space conditions. New moveable skirts and offgas cooling-stack hoods will be supplied, in addition to new doghouses and alloy-charging systems for tapping. Unique was the work involving the cutting of the upper part of the three converter foundations by means of diamond-rope saws, followed by rebuilding according to the new load and anchoring requirements. The start-up of the third replaced vessel is currently scheduled for November 2009, which will also mark the successful conclusion of this project.

Charge-mix optimization

State-of-the-art automation solutions for oxygen steelmaking are offered by Siemens VAI under the name of



Laser-based monitoring of automatic tapping sequence

Simetal^{CIS} BOF Optimization to maximize plant performance and product quality throughout the entire steel plant. The SteelExpert system, for example, is a group of advanced Level 2 process models that monitor and control all process steps starting with the scrap order up until alloying during tapping. The purpose of this model package is to calculate the quantity of charging materials and the required volume of oxygen to be blown in order to produce a heat according to the production schedule and required steel grade.

The SteelExpert FCC (first charge calculation) determines an optimized mix of charging materials and performs a complete precalculation of the heat. Different raw-material strategies related to the hot-metal/scrap ratio can be defined by these Level 2 system models. An optimized scrap mix of different scrap classes can be calculated on the basis of the hot-metal data and the target analysis of the heat. Depending on the actual hot metal or scrap availability and with consideration to fluctuating scrap prices, the model is also able to calculate an optimized charge mix that meets production requirements while saving costs.

Recent implementation of the SteelExpert FCC at the steel plant of Salzgitter Flachstahl GmbH in Germany demonstrated the cost-saving potential of this automation system within only a short time.

Automatic tapping control

The basic set-up of an automatic tapping system consists of a tilting-drive position-detection and -control system, a slag-carry-over detection system and a tapping-ladle-car position-control system. For safety reasons, an infrared camera is usually installed to monitor the converter mouth area. If steel spills out of the converter mouth, the automatic tapping sequence is immediately interrupted and the converter is tilted back several degrees to prevent further steel overflow.

With the automatic tapping system from Siemens VAI, the converter is tilted to the initial tapping angle to start the procedure. The tilting-drive angle is automatically changed by the PLC-based automation system applying three different approaches: The time-based method uses a predetermined start-of-tapping angle and changes the tilting angle as a function of time. If the tapped steel weight is measured by a weighing system on the tapping car, the tilting angle can be automatically changed on the basis of this parameter. These methods do have disadvantages, however, such as the influence of the actual geometry of the tapping hole on the tapping duration and the availability of the weighing system. Siemens VAI is currently investigating a totally new method that will employ a laser-based bath-level detection system (see Figure). The steel bath level is adjusted so that it is



Fully optimized tapping control of LD (BOF) converters

close to the converter mouth with a predefined safety level to avoid possible spillage. It automatically and (nearly) continuously modifies the converter tilting angle to assure a smooth and safe tapping procedure.

Automatic media-coupling systems

A number of quick-exchange solutions have been developed for various mechanical components, including couplings for blowing lances, sublances, and the complete media supply of exchange converters and ladles. These systems are designed to avoid any manual work for the opening or connecting of the piping with the media supply. With little modification, the quick-exchange mechanisms can be quickly installed within existing equipment facilities. For example, the Vaicon Quick Lance is a self-coupling and self-centering system. Exchange times can be reduced to approximately 15 minutes and with a minimum of manual work. Furthermore, coupling of the media piping of an exchangeable converter with the trunnion ring, or the ladle with the ladle car, is done quickly and automatically carried out with the Vaicon Joint system. This is especially important when the ladle is to be connected and disconnected often. These are important aspects for increased personnel safety and operational efficiency. ■

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Accurate prediction of the blowing endpoint in oxygen steelmaking with the Simetal^{CS} Dynacon process-optimization system

No More Crystal Ball

Extensive cost savings in oxygen steelmaking can be achieved through the exact determination of the blowing endpoint. This is made possible by the application of the Simetal^{CS} Dynacon automation solution and the integrated Lomas system. This allows the consumption of oxygen and deoxidation agents to be reduced with a simultaneous increase in productivity and personnel safety

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On the basis of the experience acquired from the implementation of more than 100 converter automation projects worldwide, Siemens VAI provides solutions that meet the tough demands for optimized performance, quality steelmaking and competitive production in oxygen steelmaking. One such solution is the Dynacon process-optimization system. Installed worldwide in both new plants as part of a turnkey project, or embedded within the automation environment of existing plants, it allows producers to improve their temperature and carbon-hitting rates, reduce the oxygen reblow rates, and lower operating and maintenance expenses accordingly.

The key to process optimization in LD (BOF) steelmaking is the exact determination of the blowing endpoint. In a conventional approach, the steel temperature and composition is measured towards the end of a production cycle on the basis of samples taken from the converter. Predictions are made with respect to the final temperature and carbon content, enabling the required oxygen quantities and the duration of the end blow phase to be approximately calculated. However, this means an interruption in the steelmaking process and, in most cases, necessitates corrective oxygen reblowing. The result is longer heat cycles, lower productivity, possible disruptions in production scheduling and even higher production costs.

System description

Dynacon is a unique Level 2 process-optimization system that Siemens VAI introduced to the market in 1997. It works in conjunction with Lomas (Low Maintenance Analyzing System), which continuously analyses the converter offgas to provide real-time dynamic control of the entire converter process. This extends from the ordering of hot metal and scrap up to alloying during



tapping. By means of the Steel Expert Prediction model, belonging to a suite of advanced metallurgical models from Siemens VAI, the steelmaking process can be imaged and fully optimized. Complete precalculations are performed covering the entire blowing procedure, including the required quantities of input materials such as hot metal, scrap, ore, alloying compounds, additives, the volume of stirring gas and blowing oxygen as well as any other additions to the converter and tapping ladle. The metallurgical and thermal processes are monitored by the Steel Expert Supervision model. The result is highly accurate blow-end control to achieve the targeted temperature and carbon content of the steel. With this highly advanced system solution, valuable minutes are saved in the steelmaking process, leading to a higher production output.

Project example

In November 2007, Qinhuangdao ShouQin Metals Material Co., located 270 km east of Beijing, awarded Siemens VAI a contract for the supply and installation of Dynacon, including the Lomas off-gas analysis system, for their converter steelmaking plant equipped with three 100-ton LD converters. Within only 13 months after the kick-off meeting, Siemens VAI received the Final Acceptance Certificate (FAC) for the Dynacon system, demonstrating successful fulfillment of the performance-guarantee figures. The test was carried out on the one hand with intermediate blowing interruption and intermediate partial deslagging, and on the other hand with straightforward blowing without any interruptions. In both cases, the hitting rate for the steel bath temperature and the carbon content was over 85 percent. The application of Dynacon allowed the quantities of blowing oxygen and aluminum for deoxidation to be significantly reduced with a simultaneous improvement in productivity. ■

References

To date, more than 30 Dynacon systems and 130 Lomas units have been installed or are currently being supplied to producers worldwide. Dynacon customers since the year 2005 include:

- SAIL Bhilai, India; start-up: 2011
- Shougang Qiangang, China; start-up: 2010
- NLMK, Steel Plant No. 2, Russia; start-up: 2010
- NLMK, Steel Plant No. 1, Russia; start-up: 2009
- CSA, Brazil; start-up: 2009
- AHMSA, Mexico; start-up: 2008
- Qinhuangdao Shouqin Metals Material Co. Ltd., China; start-up: 2008
- Tangshan Iron & Steel Co., China; start-up: 2008
- Salzgitter Flachstahl, Germany; start-up: 2007
- Lian Yuan Iron and Steel Co., China; start-up: 2007
- Panzihua Iron & Steel Co., China; start-up: 2006
- Maanshan Iron & Steel, China; start-up: 2005

Main Benefits

- Automatic blow-end control and avoidance of overblowing
- Improved hitting ratio of targeted carbon and temperature values
- Continuous online calculation of steel and slag properties
- Fewer reblows required
- Reduced Fe content in slag
- Reduced Al consumption for deoxidation
- Elimination of manual sampling of steel bath, increasing personnel safety

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The electric arc furnace of the future

Setting the Pace for the Future of Technology

Based on 40 years of experience in electric steelmaking, Siemens VAI focuses on the main areas for continual improvement, including optimizing consumption parameters, reducing tap-to-tap times and fulfilling the requirements of maximum automation. This results in following developments with respect to maximum operator safety, minimum manual operations, increased process flexibility, and lower offgas and electrical emissions.

High efficiency with advanced injection technologies

The use of advanced Siemens VAI Refining Combined Burner (Simetal^{CIS} RCB) technology and the application of post-combustion practice promote high bath turbulence and, consequently, a high heat transfer and scrap-melting rate. Since 1995, up to 100 furnaces – conventional EAFs and shaft furnaces, both AC and DC EAFs, for the production of carbon steel, stainless steel or specialty steels – were equipped with RCB technology. Excellent results have been achieved with this technology worldwide.

Designed for low maintenance, the RCB itself is made of two parts – a water-cooled copper front part and a rear part supporting the injection nozzles and quick media connections – which can be easily dismounted by removing a coupling strap. The oxygen mixing chamber is built inside the burner mouth to improve flame stability, and supported by central oxygen injection that leads to a more



250 t Ultimate EAF

powerful flame compared to a conventional burner.

Multipoint supersonic oxygen injection results in strong bath stirring and compositional and temperature homogeneity. Due to the angle and length of the laminar stream, oxygen injection is far more efficient than in other systems, which enables very low carbon content to be achieved quickly with favorable oxygen consumption rates. In addition to the shorter power-on time, the bath and slag oxidization levels can be carefully controlled.

Until now, RCB technology was available using natural gas, LPG and even coke oven gas as an energy source. With our latest development – the Simetal^{CIS} RCB Oil – now even light diesel oil can be used if no natural gas is available. A specially designed spray nozzle combines oil and oxygen to provide efficient heating. In addition, a special molded burner flame optimizes the heat transfer. Special safety aspects have been integrated in the injector, including easy-to-operate control, for the highest level of on-the-job safety.



Modular Injection Panel

In day-to-day operations, especially when using heavy scrap, oxygen flashbacks can occur with the result of severe damage. Due to their monolithic construction, conventional nose panels must then be completely replaced or repaired. Therefore, Siemens VAI has developed a new, easy-to-maintain design in a modular structure that combines side pieces with a front and cover plate, and each sensitive part can be replaced. The front plate in particular can be removed quickly using an exchange device attached to a crane. This allows it to be lifted quickly and easily towards the center of the furnace so that a new front plate can then be inserted and connected. Furthermore, there is no need to cool down the furnace before initiating the procedure. Additionally, a temperature sensor can be installed directly into the front plate for better thermal control and safety. The newly designed front plate has optimized water circulation, which allows safe and efficient cooling and ensures optimal heat discharge.

Holistic process transparency

The environmental-control system Simetal^{CIS} Offgas Analyzing System introduces a new holistic process model and reacts faster to the current process conditions. To gain close to real-time data from the furnace, the system uses two independent modules: Lomas (low-maintenance gas-analyzing system) and SAM (single air measurement of velocity and flow).

An automatic probe takes samples from the furnace atmosphere and measures the content of carbon monoxide, carbon dioxide, hydrogen and oxygen. With the proven analyzing technology and extremely short response time, Lomas provides highest reliability and availability and fast and easy detection of dangerous situations, e.g., increased concentration of carbon monoxide and hydrogen that can lead to explosions. SAM uses triboelectric cross-correlation technology to provide reliable gas-flow data within an extremely short response time. It measures the transport velocity of dust particles from the air pre-heater and determines the gas volumetric flow.

The analyzed data are used in a holistic process model to control the injection of gas, oxygen and carbon and to provide an optimized use of ingredients at a given point in time and in the required quantity. The main difference between the Siemens VAI model and most existing systems is the reaction corresponding to the actual process conditions – in other words, the actual furnace behavior. This is a significant step forward, especially when compared to the usual rigid control diagrams.

In this way, the Offgas Analyzing System saves electric and fossil energy, reduces the tap-to-tap time and makes the process even more transparent.

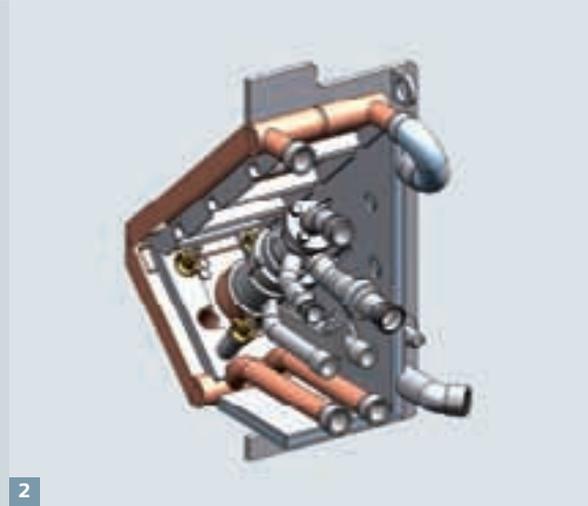
Special robotic solutions ensure safety

In a steelworks environment, particularly where hot liquid metal is produced or processed, operators are exposed to dangerous working conditions. Siemens VAI has developed different robotic solutions to ensure the highest level of on-the-job safety and minimized power-off times.

The most flexible system – the LiquiRob – is based on an industrial six-axis robot with different tools to take care of a number of tasks. A possible working area is the tapping zone for automatic removal of the crown on the taphole after tapping using a special cutter. Taphole observation by means of a camera system is also possible. Thanks to its six-axis configuration, the system is flexible enough to implement further tools for taphole cleaning, such as oxygen lances or ramming scrap in the case of a taphole being blocked by scrap. Another working area for LiquiRob is right in front of the slag door. The system can handle different tools >>

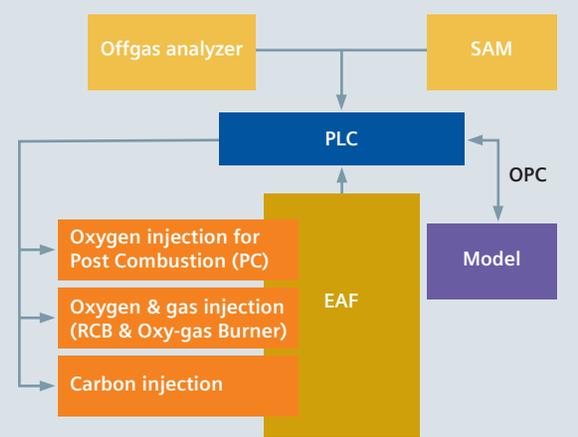


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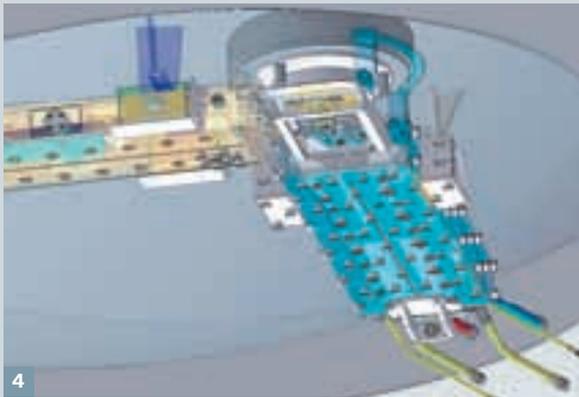


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- 1 RCB – oil application
- 2 Modular injection panel – the new radical design concept
- 3 Simetal^{CIS} Offgas Analyzing System – layout principle
- 4 Taphole Scraper – position on the lower shell of the EAF
- 5 Slag Door Pusher – application for slag-door cleaning
- 6 Sampler – application through hole for taphole refilling



3



4



5



6

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>> to take temperature measurements or extract probes for sampling. With the included protection suit, cartridge magazine and motion controller, the system provides maximum operator safety and reduces manual operations to a minimum. In combination with a cartridge test, the hitting rate during sampling increases. Using this system provides maximum process flexibility and lowered cycle time based on optimized power-off time.

Scraper, Pusher and Sampler are further special solutions for taphole cleaning, slag-door cleaning and temperature and probe sampling. The Scraper is a device designed to automatically remove the crown on the taphole with a special cutter, and it uses a camera system for taphole observation. The steel-maker gets knowledge about whether or not the taphole is blocked by slag or scrap from remote pulpit

and about taphole wear and prediction for next taphole sleeve exchange or safe sand filling. The Pusher, either fully integrated into the working platform or as rail-based solution, provides semi-automatic slag-door cleaning and repeatable results for sill management and deslagging operation. The Sampler provides trouble-free temperature measuring and sampling under power-on in less than one minute. Based on proven, simple and flexible technology and a maximum range of 5.8 m, the system can be installed in any kind of furnace area. ■

Authors

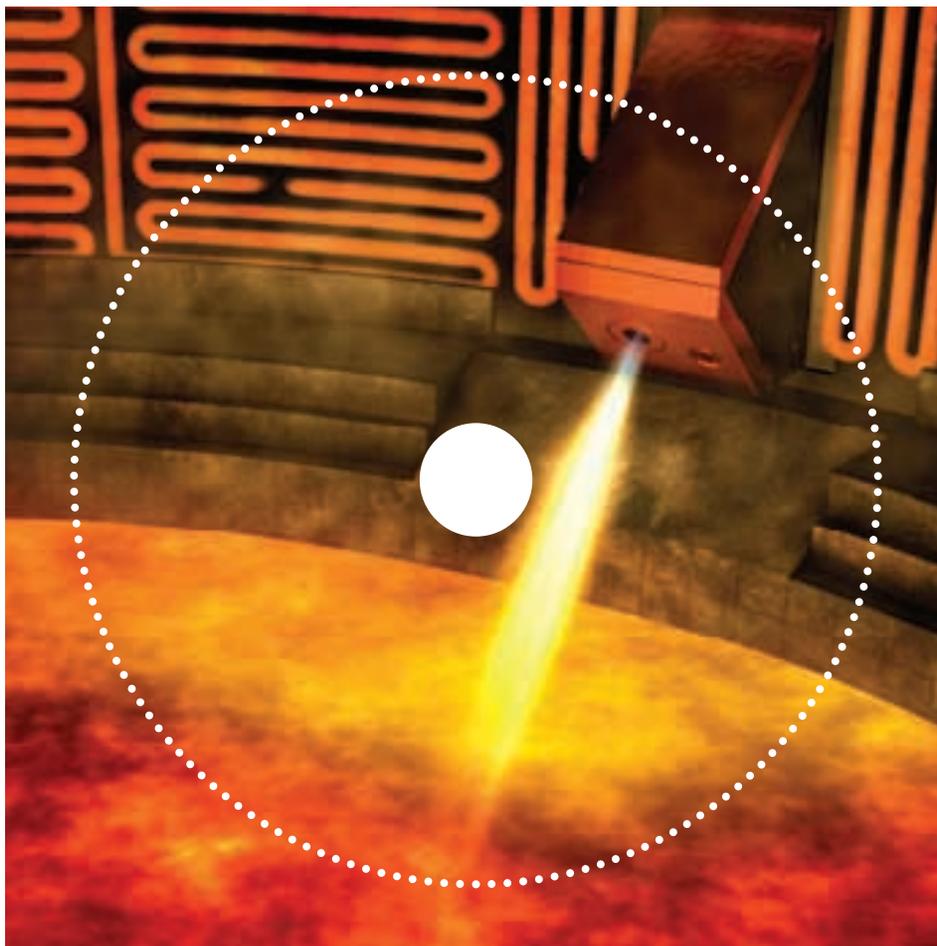
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Have a look –

The innovative approach that saves time and money:
Simetal^{CIS} RCB Modular Injection Panel video



Siemens VAI helps producers maintain highest casting standards despite changing market demands.

In Pursuit of Excellence

To remain competitive in continuous casting, producers must respond quickly to changing market conditions, increasing quality demands and greater cost pressures. This calls for highly flexible, reliable and well-engineered plants designed on the basis of experience and using the latest simulation and CAD tools.

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Casting excellence as the product of experience, in-depth know-how and optimized machine design

Casting operations with older machines and continually changing output requirements may result in quality problems, leading to downgraded and even rejected products and additional costs. The objective is to ensure permanent production excellence on a cost-effective basis. This is where Siemens VAI can help. Thanks to our broad company experience from the implementation of more than 440 caster projects worldwide, specialists at Siemens have acquired vast technological know-how related to the pillars of simulation, component design and product quality.

Simulations to “see” inside the strand

Numerical-simulation techniques were already developed by Siemens VAI in the late 1970s to quickly optimize the engineering of the casting process and to ensure a high level of product quality. Thanks to the enormously expanded computer capacity and improved software algorithms, company experts can analyze complex processes and conditions even in real time. Using advanced simulation techniques, it is now possible to acquire even deeper insight into the steel-solidification process as the basis for ensuring fully optimized equipment design and casting operations. The applied tools include thermomechanical investigations (mainly finite-element methods) for component design, computational fluid dynamics analyses for simulating steel flow in the tundish and mold, and thermodynamic models to replicate phase transformations.

“Excellence is the gradual result of always striving to do better.”

Pat Riley, well-known American basketball coach

Longer lifetimes and reduced maintenance

The highest machine performance, flexibility and reliability can only be ensured when the installed equipment, components and systems are thoroughly designed, fully integrated with each other, and dynamically adjustable to the process requirements. While this is the case with new casters, it might not apply to older machines that have been in use for years or even decades. Special components and packages are available to enhance machine availability and to meet the greater demands with respect to new steel grades, tighter product dimensions and higher product quality. With the installation of advanced equipment, maintenance expenditures are also drastically



Simulation of strand behavior applying finite-element methods (FEM)

reduced. Intelligent component designs that help caster operators to earn money include dynamically adjustable molds, installation of the latest generation of rollers for longer lifetimes and reduced wear, and dynamically adjustable nozzles for optimized spray-water distribution.

Quality – the basis for business success

Investigations of quality-related improvements in continuous casting begin with a comprehensive evaluation of all factors that can have a potential effect on product quality. This commences already with steel-making operations. Statistical evaluations of process and quality data combined with detailed metallographic analyses help to identify potential deficiencies and ensure a top condition of the cast product. Improvement recommendations are provided with respect to, for example, optimization of the casting process, use of alternative consumables (e.g., casting powder, refractories), modification of the automation system, and necessary training services for operators and metallurgists.

Experience – the tutor of success

Expert technological support is a decisive factor for the successful start-up of new caster equipment and for the casting of top-quality products. To maintain casting excellence over the life cycle of a caster, Siemens VAI also provides professional engineering and after-sales services for any casting machine, regardless of the make. A vast wealth of experience is available to help producers maintain the highest production standards, despite continually changing market conditions. ■

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EcoStar – A new cost-saving, long-life roller for ideal strand support

Slabs Never Had It So Good!

The EcoStar roller is a recent development by Siemens VAI in continuous casting for ideal strand support and reduced roller investment and life-cycle costs. Design solutions are also offered for dry roller cooling, ideal for the casting of crack-sensitive steel grades or ultra-thick slabs.



Designed to perfection

Each roller unit typically consist of three or more roller bodies and the associated bearings blocks mounted on rigid prefabricated roller stubs. The design of the intermediate support structures represents an optimum of load-carrying capacity and roller-body spacing. Particularly high-strength and ductile rollers are produced in a special manufacturing process. The roller bodies are overlay welded, which increases their wear resistance. Thermal protection is provided by means of internal cooling through the center bore and bearing housings. The bearing internals are sealed against water and dirt. The driven and non-driven rollers are, in principle, of identical design. They differ from each other only by the shaft with coupling flange.

Modular and flexible

The patented EcoStar rollers are highly modular, which reduces costs. This also allows individual adaptations for nearly any application in the strand-guide system, also for competitor-supplied machines. By applying a shrink-fit technique, the roller bodies and the axle stubs are seamlessly joined together, which prevents backlash. Depending on requirements, steel producers can choose from a wide selection of bearings, including spherical, toroidal, self-aligning cylindrical (three-ring type) and Eich spring roller bearings.

When external roller cooling is not necessary

Peripheral cooling of the roller bodies is also offered to enable “dry casting” in all sections of the caster where secondary cooling of the slab is no longer required. The internal water circuit requires no elastomeric seals and welds for sealing. This contributes further to a reliable and most sturdy design. Dry roller-cooling solutions are particularly ideal when casting crack-sensitive steel grades or ultra-thick slabs requiring super-soft cooling conditions.

Easy maintenance

Following the completion of the first roller campaign, the surface of the EcoStar roller can be skimmed without dismantling the unit. After a functionality check, it is then reinstalled in the caster. After the second roller campaign, the roller is then refurbished. Components that are in good condition are reused and worn parts are replaced by OEM (original equipment manufacturer) components. Following reassembly, the virtually new roller can be used for the next campaigns. Considerable maintenance-cost savings result from the high reusability of all components.

Benefits

- Robust and highly reliable rollers as proven under the harshest of casting conditions



Assembly of an EcoStar roller

- Low roller deformation – and therefore minimum strand bulging – thanks to the intermediately supported roller design
- Internal cooling for longer bearing lifetime and increased safety in case of external cooling failure
- Dry-casting design solutions also available
- Reduced life-cycle costs due to “skimable” roller surface and high reusability of all components
- Short delivery times with prefabricated, standardized components

EcoStar installations

To date, EcoStar rollers have been installed at Acciaieria Arvedi (Cremona, Italy), voestalpine Stahl (Linz, Austria), Essar Steel Algoma (Sault Ste. Marie, Canada), Rautaruukki Oyj (Raahe, Finland), NLMK (Lipetz, Russia), North American Stainless (East Ghent, Kentucky, U.S.) and ThyssenKrupp Steel AG (Duisburg-Beeckerwerth, Germany).

With the proven EcoStar roller design, the strand is ideally supported along its width, preventing or minimizing strand bulging for the production of highest-quality slabs. ■

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Medium-thick-slab casting and rolling offers a host of benefits for producers

Best of Both Worlds

Continuous casters producing an intermediate slab thickness between conventional and genuinely thin slabs is a highly attractive technical and economical option for the production of hot strip or plate. Especially during difficult times with unpredictable market developments, this caster solution offers a unique combination of operational flexibility, excellent product quality and high plant productivity with moderate investment costs.

In the past decade, Siemens VAI introduced medium-thick-slab casters with typical slab thicknesses between 100 mm and 170 mm to meet the requirements for a wide range of product applications. The first casters of this type were supplied to special and stainless steel producers, beginning with a caster upgrade to cast 100-mm-thick slabs at Avesta (now Outokumpu Avesta) and followed by the installation of a new caster to AK Steel Mansfield (Ohio, U.S.) capable of casting 130-mm-thick slabs. Here, the entire stainless steel product mix is produced in a directly linked casting-rolling line without intermediate slab inspection or grinding.

This casting-rolling process, of course, is also ideally suited for the production of carbon steels. When former Nova Hut (now AM Ostrava) modernized its flats production, a medium-thick-slab caster was linked with a twin-stand Steckel mill in an extremely compact plant arrangement. This configuration represents a highly economical solution for hot-strip production of up to 1.5 million tons per year. If productivity or gauge requirements exceed those attainable with a Steckel mill, slabs cast in a thickness range between 130 mm and 170 mm can be directly fed to a compact hot-strip mill consisting of a reversing rougher and, typically, six finishing stands. A key advantage of slab thicknesses in this range is that the number of required roughing passes can be reduced. This leads to a higher and more uniform transfer-bar temperature, facilitating the production of thin gauges down to 1.2 mm. Furthermore, this caster type can be backwards integrated into existing hot-strip mills.

Medium-thick-slab casters supplied to China

The first medium-thick-slab caster in China was commissioned at Anshan Iron & Steel Co. (Angang) in 2001. The monthly production of the single-strand machine soon reached 120,000 tons. On the basis of the excellent results, a second machine was installed in 2003. Roughly 50 percent of the hot-rolled strips

have a thickness below 2.5 mm. It could be shown that practically all steel grades can be cast as medium-thickness slabs, including high-value products such as API (American Petroleum Institute) and IF (interstitial-free) grades. Angang therefore decided to further extend its strip production applying this solution. A plant configuration was implemented with two



- 1 2-strand medium-thick-slab caster, Angang, China
- 2 Single-strand, ultra-wide, medium-thick-slab caster, SSAB Swedish Steel (formerly IPSCO Steel), Alabama, U.S.



Single-strand, ultra-wide, medium-thick-slab caster, Nanjing Iron & Steel Co., China

2-strand casters that directly feed the cast slabs into a high-capacity hot-strip mill. This is indeed the most compact plant worldwide capable of producing more than five million tons of high-quality hot band per year. With this economy of scale, conversion costs from steel to strip are much lower than in conventional plants. The impressive production benefits achieved at Angang convinced other Chinese steel producers to base their hot-strip production on the medium-thick-slab casting process, including Jinan Iron & Steel Co., Tangshan Guofeng Iron & Steel Co. and Lingyuan Iron & Steel Co. In all of China, Siemens VAI-supplied medium-thick-slab casters with a total of 13 strands are capable today of casting 16.5 million tons of steel per year.

Ultra-wide-slab casting

Another feature of the medium-thick-slab concept is that the slabs can also be cast in ultra-wide-slab casters followed by rolling in a plate mill. Such plant configurations can produce plates with widths of more than 3 m at thicknesses of up to 50 mm. Siemens VAI installed ultra-wide-slab casters at Ipsco Steel, Alabama, U.S. (now SSAB Swedish Steel), at Nanjing Iron & Steel Co., China, as well as at Tokyo Steel, Japan. This again underlines the high degree of flexibility of the described solution.

According to Andreas Flick, Senior Vice President

of Siemens VAI Continuous Casting Technology, “Our customers are convinced by the benefits offered with medium-thick-slab casters, especially the ideal balance between product quality, caster output, capability to roll thinner-gauge strip and also the overall production flexibility of this line concept. We see a promising outlook for this casting solution for both machine upgrades and backwards-integration projects as well as for new plants.”

Concluding remarks

Medium-thick-slab-casting technology fills the gap between conventional hot-strip production and the latest generation of thin-slab casting and rolling plants. Whether flat or long, ultra-wide or narrow, thick, thin or medium, Siemens VAI offers superior casting solutions to help producers meet their needs for the economical production of all steel grades in the required capacities and product dimensions. ■

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Siemens VAI Media Summit in Moscow highlights improvement solutions for steel producers

Driving Forces for New Iron and Steel Production

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The horizontal and vertical integration of electrical systems and automation solutions is opening up new potential for cost savings, flexibility and transparency in the production of steel and iron. "Electrical engineering, sensors and automation are becoming the drivers of change in the industry and, in the future, will have more impact on company competitiveness than location factors alone," explained Guenther Winter, head of Technology & Innovation at Siemens VAI, on the occasion of the 3rd international "Media Summit Metals and Mining Technologies" in Moscow, Russia. "Crucial in this connection is the close intermeshing of mechatronics, horizontal and vertical integration of the automation system and the creation of integrated process routes," he stressed.

The current drop in demand for iron and steel products and the metal industry's weakness when it comes to making necessary investments will intensify competition in the coming two years as well as accelerate consolidation. "In the years to come, the competitiveness of steel producers will be determined not only by the cost of energy and raw materials, but also by stricter environmental and safety regulations as well as the flexibility and quality of production, which will have to satisfy new market requirements," explained Winter.

Siemens offers customers added value by integrating technological processes into an automation system and using optimally matching automation and software solutions to create the prerequisites for better performance and more flexibility. The efficiency, quality and flexibility of production can be enhanced even further through the integration of solutions such as sensors, automation systems and drive technology in an overall system, and through the integration of individual steps in an improved overall process. Additional added value is created by means of new automation functions. Above all, the seamless interaction of both horizontal and vertical integration and mechatronics plays a decisive role in this context. Such integration solutions give not only new plants but also existing production chains a chance to improve productivity, efficiency and industrial safety, making these integration solutions ideal modernization packages.

For example, Siemens has developed the LiquiRob robot system for the operation of electric arc furnaces, converters and continuous casters. Tasks such as sampling, temperature measurement or powder charging

no longer have to be performed by the plant personnel directly but are carried out automatically by robots. This mechatronic system improves industrial safety by a vertical integration and, thanks to reproducible process sequences, increases productivity as well.

The Simelt FSM system – based on structure-borne noise sensors for electric arc furnaces – is unique throughout the world. The structure-borne noise is measured at the furnace and a process model is then used to exactly determine the way in which the melting process and foamed slag formation occur. This new software-sensor combined with suitable control algorithms, brings about a reduction in operating costs in the vertical integration. With regard to carbon injection, the amount of injected carbon can be reduced by 20 percent to 30 percent. These savings automatically lead to lower CO₂ emissions, while the shortened process-sequence times result in a reduction in energy consumption.

Another very successful example of a horizontal technological integration is the process automation used for heavy plate lines. Siemens is thus setting new standards for the efficient integrated production of thermo-mechanically rolled, high-quality steel sheeting. This material is used, for example, in the shipbuilding industry and for pipelines. Productivity is increased by the fact that several metal sheets are alternately rolled automatically and are then optimized in the Mulpic cooling section in such a way that the properties of the resulting material ensure a high level of quality. The most recent commissioning of such a system took place two weeks ago for a Chinese steel producer. ■



Automated thermo-mechanical rolling in "batch mode" increases mill utilization

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- 1 Tandem cold mill at voestalpine Stahl, Austria
- 2 Roughing mill entry at the Arcelor Mittal Poland hot-strip mill
- 3 Hot rolled coils at the hot-strip mill Hadeed, Saudi Arabia
- 4 Downcoiler pulpit at a hot-strip mill

High performance with new technological packages

Fountain of Youth For Strip Rolling

The slump in sales at iron and steel producers calls more than ever for solutions to modernize facilities or individual production steps with a short payback period of up to two years. Technological packages are perfectly suited for upgrading hot-rolling and cold-rolling mills; they improve the competitive situation of steel producers, which in turn influences their product mix as well as their ability to reduce operation and maintenance costs.

More than ever, the payback period and the long-term positive effect on competitiveness are decisive factors for modernization projects for strip-rolling mills. The evaluation of the most effective measures requires continuous and detailed reporting and data logging in regard to costs, consumption figures, maintenance, process data and product-quality data – and detailed knowledge about the interdependencies of all these aspects. Consolidation steps in companies may even lead during times of big overcapacities to mill extensions, which require debottlenecking studies. If the most effective cost-reduction measures are not obvious, Siemens VAI rolling-mill experts are ready to provide studies when, for example, production planning for smaller order lots, yield improvement or product-mix extension to new grades are under investigation. Examples for such steps are the production of X80 to X100 on a hot-strip mill (HSM), which can call for additional requirements in the coiler area. Or the extension of harder materials in a reversing cold mill or tandem cold mill, which possibly needs higher rolling forces and torques.

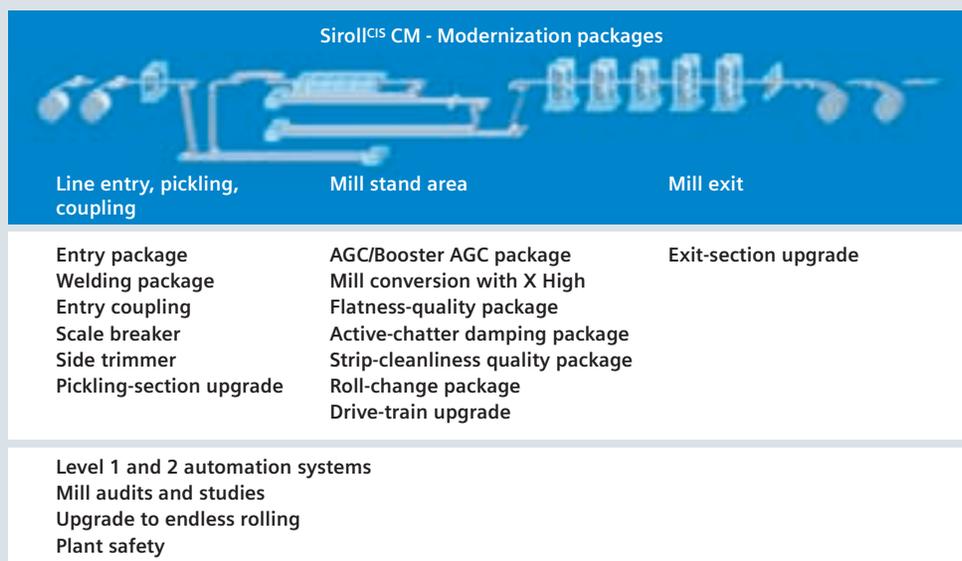
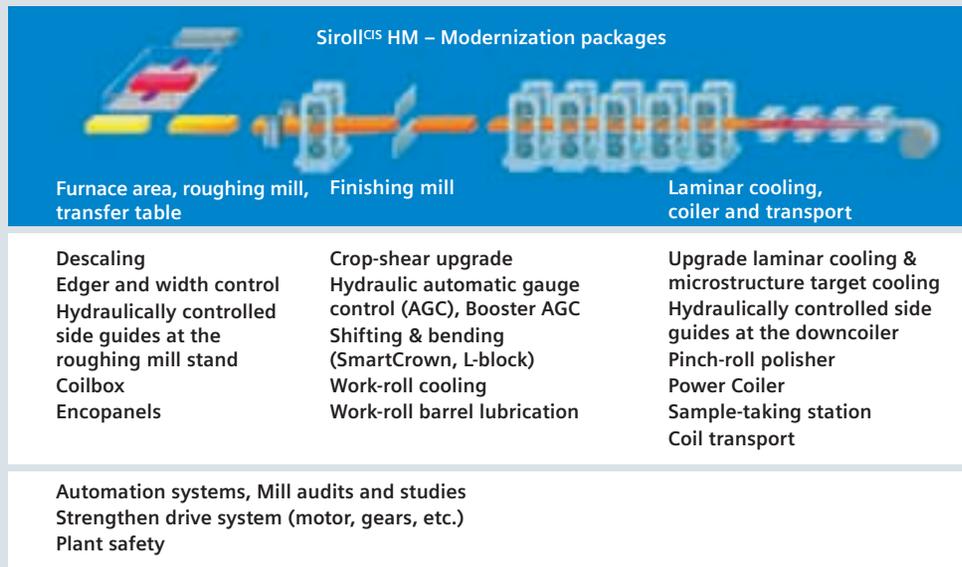
Strengthening competitiveness with technology packages

Siemens VAI has developed several technology packages especially dedicated to the modernization of existing mills. Here it is essential to shorten the standstill times of the mill when installing the new equipment. This can be realized by offline assembly and pre-testing of the components in the workshops. The components and line concepts for hot-rolling and cold-rolling mills follow standardized modules that are optimized in terms of delivery time, functionality

and complexity. The packages comprise know-how and expertise in process technology, layout competence, mechanical equipment, electronics, hydraulics, drives and automation systems as well as turnkey competence from Siemens VAI's in-house resources. They have been proven in several modernization projects with specific improvements according to the needs of the customers. Many of these achievements, now combined, were developed or introduced together with leading steel producers around the world. Today, Siroll^{CIS} HM and Siroll^{CIS} CM are the most comprehensive collection of technological and control components for hot rolling, pickling and cold rolling.

- The roll-gap lubrication package is applied to improve the strip surface quality by reduced roll cracks and roll peeling. Roll-gap lubrication also has an impact on the rolling force. The significant reductions of the roll-force level can lead to decreased work-roll wear and reduced energy consumption. Roll-gap lubrication is based on the application of water-oil dispersion to the upper work roll of the finishing mill stands. Wiper modifications ensure that the system works effectively. Process-parameters adjustments and the influence of lubrication are carried out and monitored by a fast data-monitoring system. Typically the roll-gap lubrication system is applied in mill stands No. 2 and 3 and the modular design of the system allows a later extension for other mill stands.

- Cooling package: The successes of new materials are accompanied by an increase in the requirements that are placed on steel. Precise and highly flexible control of the cooling process in the cooling section is therefore extremely important. The Siemens VAI strip-cooling package was developed >>



- >> for the production of advanced steel grades such as HSLA, IF, DP, TRIP or pipe grades on hot-strip mills. This package is based on laminar cooling/turbo laminar cooling, quick switch headers, intensive cooling or microstructure target cooling. While the laminar cooling with turbo cooling headers achieves a higher throughput and the quick switch cooling headers take care of higher accuracy in the coiling temperature, the intensive cooling is specially designed for the requirements of advanced steel grades.
- The flatness package includes all required mechanical actuators, control and measurement systems to ensure highest flatness performance. Depending

on mill type and product mix, the mill stands are equipped with work-roll bending and shifting, SmartCrown® work-roll contour and multi-zone cooling. The flatness control system features self-learning parameter optimization for adaptation to the rolling conditions and material properties. To complete the package, Siemens VAI can either use the contactless Siflat system or the Planicim® flatness measurement roll depending on technical and ambient conditions.

- Third octave chatter is a self-excited vibration phenomenon common to practically all tandem cold mills. With the use of the new Siemens VAI anti chatter damping, system no speed reductions are

required, which usually leads to a reduced mill throughput or chatter marks that worsen the strip surface quality. Additionally, overall vibration of mechanical components is reduced, which leads to a longer lifetime for some mill components. If a customer is interested in operating a chatter-free mill, third octave vibrations can actively be damped by a specially designed high-speed servo valve, which has a unique dynamic behavior and was developed in a cooperation involving MOOG and Siemens VAI. This specific high-speed servo valve and acceleration sensors are directly mounted and integrated in the AGC cylinder.

- The drive package comprises all mechanical, electrical and automation components of the whole drive train for mill stands or coilers. It consists of a medium-voltage power supply and harmonic filters, the drive transformer, the drive system (Sinamics) and contactors, motor, sensors and brakes, reducer or pinion gear, couplings, spindles and torque limiters (e.g., shear pins). Siemens VAI can act as a supplier for mechanical, electrical and automation systems for the drive train, putting us in the position to avoid risks in project execution and to reduce project execution time. Depending on the targets of the project, the scope of the package will be adjusted.
- The safety studies and safety package is a standardized methodology to design and implement safety solutions as required according to local regulations. This approach is divided into three steps: The first step is a safety study for which Siemens VAI conducts a risk analysis in cooperation with the customer. A concept study has to be prepared by an expert team consisting of electric and automation, hydraulics, mechanics and safety specialists with the support of an external institute. This concept is then approved by the legal authority in cooperation with the customer and builds the foundation for the second step, which concerns the actual offer for equipment and installation based on the concept study. Step three is implementation and it includes supply and installation of equipment and automation systems according to the contract, validation of control-based safety solution for automation and hydraulic, and the whole documentation including safety instructions.

Typical modernization projects

Although business in recent years was strongly focused on new mills, Siemens VAI has an interesting record of modernization projects. These include a very big extension for a relocated HSM from Europe



New PLTCM linked to an existing pickling line at Corus, Netherlands

to China, new downcoilers in a HSM for high-strength steel grades, the installation of new tandem cold mills behind existing pickling lines as well as smaller packages like the connection of pickling lines and tandem mills, coiler modernizations, and AGC and flatness packages. Recent modernization projects include:

- Major upgrade of a relocated hot-strip mill at Jiangshu Shagang Group Co. Ltd., in China
- Installation of the new Siemens VAI Power Coiler for improved coiling of thick-gauge and high-strength steels at the ArcelorMittal hot-strip mill at Fos-sur-Mer, France
- Major expansion of hot-strip mill capacity and mill features at Hadeed, Saudi Arabia
- New bending blocks and finishing mill upgrade at the Sail Bokaro hot-strip mill, India
- New tandem cold mill for a linked pickling line and tandem cold mill (PLTCM) with existing pickling line for Corus, IJmuiden, Netherlands
- Flatness package for the reversing cold mill at Duferco Coating, Beautor, France
- Coiler packages for ArcelorMittal, Saint Chely, France
- New downcoilers for the HSM at voestalpine Stahl, Austria
- Cooling-section upgrades to microstructure target cooling at several plants, such as TKS Hoesch Hohenlimburg, TKS Beeckerwerth and ArcelorMittal Iscor
- Plant upgrades to Siroll^{CIS} automation solution in TISCO HSM1, Corus IJmuiden and Baosteel HSM1, among others
- Crop shear for voestalpine Stahl, Austria
- Roughing mill and Power Coiler for Severstal, Russia
- Hot-coil transport system for Dunaferr, Hungary ■

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Start-up of new reversing hot-rolling mill at Plansee Metall, Austria

An Exceptional Rolling Mill

ROLLING & PROCESSING >

Why did Plansee decide to invest in a new rolling-mill line?

Plansee: The rolling mill is the centerpiece of a major investment program in one of our core business areas to optimize our production chain for flat products and create the basis for future growth. The project was motivated by the desire to increase capacity and productivity, and to improve our competitiveness with higher-quality and lower-cost products by investing in modern technology. Another aspect was to be able to produce larger product formats. We wanted to enhance our production flexibility to better satisfy customer demands under changing market conditions. Also, production times would be shorter and stocks lower, meaning less bound capital. These were the main factors. The vision of Plansee is “A step ahead in technology.” And this rolling mill, which is certainly the only one of its type in the world, reinforces our position as the technology and market leader in this field.

The project had a relatively short tendering time and your company decided rather quickly to choose Siemens VAI as the project partner. Why?

Plansee: This project was preceded by a lot of internal preparation work. And a private company, such as we are, can make decisions fast. Other related projects were going on at the same time, which meant that we had to accelerate the preproject phase. We chose Siemens VAI because of your experience and references. We looked at plants that you built, such as the rolling stand supplied to Böhler, and we saw a high degree of technical competence

and a very customer-oriented approach. This was especially important for us, because we needed a tailor-made rolling-mill solution. And then, of course, the commercial conditions were competitive. We – as a supplier to various Siemens businesses – also had good business relationships for decades. For this rolling-mill project, everything was from a single source – control, technology, equipment and A&D. Because this was a truly unique mill installation, an “off-the-shelf” solution could not apply, except for standardized parts. Therefore, partnership played a key role.

Following your initial planning, did the project parameters change after discussions with potential suppliers?

Plansee: The basic mill concept was established during the bidding phase. We needed high rolling forces, high-temperature operation and an extremely compact line with short distances and an optimized material flow. In the detail planning there were some changes, and that took some time.

What were the tasks and responsibilities of Plansee in this project?

Plansee: We were responsible for the complete construction of the building, the infrastructure, media supply and furnace technology, all of which we fully engineered by ourselves. That was the hardware side. Also in the project planning, we were heavily involved in process technology, especially with our know-how about the properties and behavior of our special materials.



Newly installed hot-rolling mill at Plansee Metall GmbH, Reutte, Austria. Dr. Wolfgang Köck (far left), Kurt Rotert (3rd from left), Heinrich Pühringer, Siemens VAI Project Manager (far right)

In December 2008, a new Siemens VAI-supplied, 4-high, reversing hot-rolling mill was started up at Plansee Metall GmbH, located in Reutte, Austria. The rolling stand is capable of exerting more than 50,000 kN of force – the strongest in the world applied for the rolling of refractory metals that include molybdenum, tungsten, tantalum, niobium and chromium. The mill configuration is also unique worldwide for its ability to roll such materials. It is comprised of a reversing rolling stand, leveler, dividing shear, slitting machine and coiler, all fully automated from the heating furnaces to the downcoiler. Dr. Wolfgang Köck, Managing Director of Plansee Metall GmbH, and Siemens VAI Senior Vice President Kurt Rotert (Business Segment Strip Rolling) discussed the project background and the benefits of this investment in this interview conducted on April 22, 2009.

Were you satisfied with the start-up of the new rolling line?

Plansee: The project time plan was strictly adhered to. Mill start-up took place on the very day that had been planned. The start-up phase went well and we are now producing saleable products.

How would you describe the working relationship with Siemens VAI?

Plansee: This project was characterized by the close cooperation, an open exchange of ideas and information, and detailed discussions among the team members. The right persons were on the project team and the teamwork was excellent. It is ultimately the qualified personnel upon which the success of a project is based.

What are the future plans and outlook of the Plansee Group?

Plansee: We are an international and growth-oriented company, especially in the Asian and North American markets. We want to further improve our value-added chain, beginning with semi-finished products up to ready-to-use components and parts. Besides having a strong presence as volume supplier in our markets, we want to keep our ability to tailor specialized products and components for particular customer needs. Even in this time of economic crisis, we want to emphasize that we are a reliable partner offering the complete value-added chain to better support and supply our customers. ■

Profile of the Plansee Group

Powder-metallurgically manufactured semi-finished products, tools and ready-to-install components from high-performance materials of Plansee are thermally, mechanically and chemically resistant to an extraordinary degree. They are used in many high-tech products of everyday life and usually play a decisive role in the functionality of the final product. The products of Plansee are further processed in numerous industries. In metal forming, components are used in extrusion press processes (die plates), in foundry technique (forming) or for the manufacture of control elements (semiconductor base plates). On the basis of the technical demands placed by customers on material properties, including high thermal conductivity, high density, electrical conductivity, high melting point and extreme hardness, companies of the Plansee Group develop high-performance and composite materials made from tungsten, molybdenum, chromium, tantalum and niobium as well as their alloys.

The Plansee Group comprises the divisions: Plansee High Performance Materials (HPM); Ceratizit, the hard metal expert specializing in solutions for cutting tools and wear-resistant surfaces; the powder manufacturer Global Tungsten & Powders; and PMG, which focuses on powder-metallurgical components for the automotive industry. With 73 sales and production sites located in 23 countries, the Plansee Group is always in close proximity to its customers. In the fiscal year 2007/08, a turnover of approximately €1.1 billion was achieved.

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Sophisticated models supply control with microstructure information.



Laminar cooling headers give the maximum cooling power on short distances with a wide range of cooling capacity.



Microstructure target-cooling model saves costs in hot-strip mills

Hitchless Switch-Over and High Revamp Efficiency

Siemens VAI successfully implemented microstructure target cooling in the framework of hot-strip-mill revamps for facilities in Germany belonging to TKS Hoesch Hohenlimburg and ThyssenKrupp Steel (TKS), and for the ArcelorMittal Vanderbijlpark Works in South Africa. The advantage of minimized switch-over losses could already be realized in the mills that have implemented the shadow-mode strategy.

Requirements on steel, especially for very thin high-strength steel, are still increasing, both from the automotive and other industrial sectors. In addition to the alloying elements, the cooling section is decisive for the properties of these steels. Siemens VAI developed a new cooling-section control system that uses the so-called Gibbs' free enthalpy to calculate the steel transformation very precisely on the basis of a thermodynamic model. The new developments in the physical modeling of the steel transformation allow computation of temperature and phase fractions along the entire cooling section in real time.

By means of a model-predictive control function, the stipulated time curve of cooling in the cooling section is optimally adhered to for the whole strip within the limits of the plant. This not only ensures constant quality along the whole strip, but also enables efficient and reliable manufacture of multiphase steels. Specific properties of the material, for example in the case of deep-drawing steel grades, can also be specified precisely. Moreover, the strip-cooling model increases the flexibility of the rolling mill: it is possible to switch over production between different types of steel whenever the situation demands and new steel grades can be included in production without altering software or model parameters. This

makes the new cooling models from Siemens VAI the best choice either for the revamp of an old plant or as a must-have for each new plant.

Revamp strategy using shadow mode with parallel observer

Siemens VAI applied the shadow mode with switch-over concepts that proved successful in previous revamps. In the shadow mode it is possible to establish a new automation in parallel to the old one, supplied with all necessary data. A stand-alone Simatic S7 for the basic automation control (valve actuation, measured value sampling and communication) is prepared in advance and the interfaces are installed during normal scheduled maintenance shutdowns. After that, the real-time observer of the new automation and model calculates what happens on the plant based on the data measured by the old automation that is still in control. The operator can now check, whether:

- the model computations are accurate enough, i.e., that the observer computations show similar deviations from the desired temperature in comparison to the real temperature measurement;
- the monitor computation shows that the new automation system is able to improve the coiling temperature; and

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- >> • the new system is able to handle the entire product mix.

When this is the case, it is the time to switch over to the new system.

Direct control of the phase transformation during cooling high-carbon steel at TKS Hoesch Hohenlimburg

The first plant to implement the new microstructure target cooling was the hot-strip mill at TKS Hoesch Hohenlimburg in Germany. At this plant, Hoesch produces a wide range of products with many challenging steel grades in regard to cooling. A significant percentage of the production shows steel grades with more than 0.3 percent carbon and more than 50 percent of the production is single-coil orders. Hence, there are many material changes during production. Since there have always been difficulties to handle the high carbon grades, Hoesch decided to be the first to adopt the new cooling system. Furthermore, the operators are very familiar with the metallurgical needs of the material. Thanks to the new cooling approach, they gain a display of the calculated phase fractions at the coiler as well as online measurement of the coiler temperature.

After establishing the shadow mode, the first tests with the new cooling section took place in 2007. Over a period lasting several months, the models and cooling strategies were optimized, and microstructure target cooling was introduced and applied for all high-carbon steel grades, so that the full product spectrum could be run through and checked. Final acceptance was in May 2008.

Since the operators had the tools available to control the cooling section not only in regards to water amount and temperature, but also phase transformation and transformation degree, the amount of high carbon steel that doesn't meet specification has been significantly reduced. The possibility to switch back and forward between the new and the old automation also led to a high acceptance and confidence of the operators, which resulted in a smooth switch-over with low production losses (see Figure 1).

Minimum switch-over time and losses in a high capacity mill at TKS Duisburg

With the experience of the first plant's ability to deal with a very wide range of the product spectrum, the next plant was a very big challenge in respect to the production throughput and hence required minimum switch-over losses. The Hot Strip Mill 2 of TKS at Duisburg-Beeckerwerth in Germany is a two-meter-wide hot strip mill with six furnaces and a yearly production of up to 5.8 million metric tons.

A special revamp strategy with duplicated mode computation (observer computing with valve feedback from plant, monitor computing with desired valve states from the new automation system) and full adaptation during listener mode was developed for this plant. Here the switch-over concept proved its advantages regarding cost and time savings with fast availability of the new automation after the shadow mode had been established, and a quick phaseout of the old automation.

After communication had been established and the shadow mode started in July 2007, the first test strips could already be produced in August 2007 with the new automation, and a first quality evaluation showed some tighter tolerances compared to a similar campaign made with the existing automation system. Until October 2007 the whole product spectrum was rolled, typically during the day. During the other hours the old automation was running the system. Then the ramp-up phase started and by December 2007 the whole range of steel grades had been run with the new system, without using any extra downtime and thus without any production loss. By June 2008, only results of very rarely rolled thick material (between 16 mm and 25 mm) had been improved. Figure 2 provides an overview of the production times with the different systems and the according usage and switch-over times. Due to the pre-optimized model, the quality was inside the range or even better than with the old automation, right from the start. With the excellent results in quality, the final acceptance was issued in August 2008. The achieved quality parameters exceeded expectations and performance was improved regarding cooling quality in all aspects. The savings that materialized in this plant due to the new cooling section include fewer rejected coils due to missed or inconsistent material properties because a cooling course was missed, and fewer coiling problems due to sagging coils. The latter is a problem when the phase transformation happens on the coiler. Due to the different expansion coefficients of austenite steel and ferrite steel, the windings of the tightly coiled austenite coils loosen after the phase transformation due to the leap in the expansion coefficients. If the phase transformation can be calculated and therefore the location of it can be controlled, this can be avoided as long as there is enough cooling capacity left. This also leads to savings in recoiling costs due to the reduction of such coils.

Revamp without additional switch-over time and production losses at ArcelorMittal Vanderbijlpark Works

After this success, the third customer – ArcelorMittal



Vanderbijlpark Works – was looking for better cooling results and decided to go with the low-loss switch-over method. The ArcelorMittal Vanderbijlpark Works plant is a 2.05-meter-wide hot-strip mill with a production of approximately 3.5 million metric tons per year. The former automation from General Electric was quite old and unable to provide the flexibility that a modern plant needs for more complex steel grades and more demanding customers. In order to improve the cooling quality, reduce the number of out-of-tolerance coils, avoid egged coils and be more flexible to produce enhanced steel grades, ArcelorMittal decided to revamp the cooling section's automation. The listening mode was implemented during a maintenance shutdown. The communication, including also the old GE system, was implemented in cooperation with the customer in a very short time frame. After restart, the cooling section could be easily switched back and forth and the data supply for the shadow mode started in September 2008. To save

costs, a shadow mode with an offline optimization was established again to ensure that the quality after the switch was as good as possible.

The first switch-over was made on October 22. Just a few months later, at the end of January 2009, the acceptance certificate was issued. The first strip was already within the required tolerances and the performance from the start was better than before. The number of out-of-tolerance strips could be significantly reduced, especially for thick material up to 25 mm and for thin material with deep finishing-temperature skid marks. In addition, the cooling system is now able to observe the cooling quality also for higher mill speeds – a big advantage in regard to the mill's potential throughput. ■

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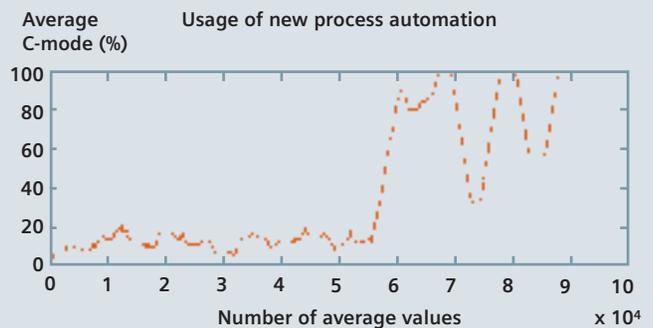


Fig. 1: Usage of new and old automation during commissioning at TKS Hoesch Hohenlimburg

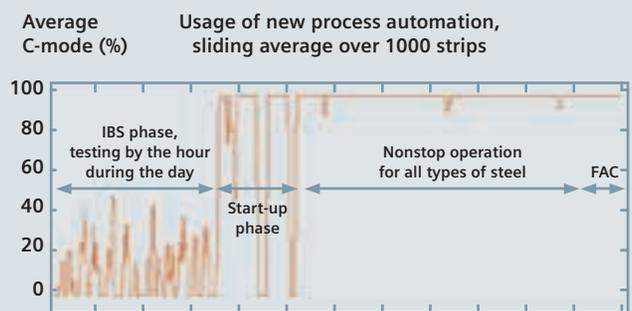


Fig. 2: Switch-over sequence at the WBW2 (HSM2) plant of TKS in Duisburg-Beeckerwerth

Money-saving solutions for plate mills

Cost-Saving Measures Keep with the Times

Only a year ago, worldwide steel consumption was at an unprecedented peak, and the installed production capacity was just able to meet this demand. As a consequence of this situation and in combination with other factors – such as the dramatic increase in the iron ore, coke, scrap, alloy, energy and freight costs – steel prices reflected this demand. Now with the dramatic reduction in steel consumption, producers are looking to cut costs, and they are focusing on four areas: raw materials, energy, consumables and manpower.



A platemill back-up roll being shipped

Plate mills are no exception to this rule, and neither are they immune to the need to cut costs during a market downturn for rolled steel products. It's no coincidence, therefore, that several recently developed plate-mill solutions from Siemens VAI target operating-cost reduction for the mill owner.

Reduced raw-material costs: MULPIC® technology

For a wide range of plate products, accelerated cooling systems allow a given set of properties to be achieved using less alloying, leading to raw-material

cost savings and often also enhanced product weldability. As a general rule, the higher the rate of cooling that can be sustained, the leaner the steel can be. In practice, the most severe limitation on high-rate inline cooling is the avoidance of thermal buckling. For this reason, system designs are delineated more by the features incorporated to ensure cooling uniformity than by considerations of efficiency, and the MULPIC® technology, exclusively licensed to Siemens VAI, has a dominant market position because of its proven design for high-intensity cooling uniformity.



Mill operators pulpit at Shagang, PR China

The metallurgical control capability further described in the fourth section of this article is further enhancing its use in precision alloy design.

Reduced energy costs: Plate Steckel Mills

The Plate Steckel Mill solution from Siemens VAI, pioneered at NISCO in China, has set new benchmarks in near netshape rolling for HSLA products including line pipe. In fact, 20 mm thick X70 steel at -15°C has been established as a commercial product, and thicker, stronger and lower-temperature variants are actively being developed. The same process is a focus for hot charging development. By exploiting both, the plate-steckel route can demonstrate 40 percent energy savings over the conventional thick-slab practice for some products. Meanwhile, research is being conducted with the assistance of the Institute for Microstructural & Mechanical Process Engineering (IMMPETUS) at the University of Sheffield to optimize cast thickness and reheating practice with a view to lower energy consumption in plate making.

Reduced consumable costs: large back-up rolls

A major concern for operators of wide-plate mills in recent times has been the severe shortage of large back-up roll casting and forging capacity, leading to prohibitive lead times and prices. Siemens VAI has developed a number of technical concepts both to reduce back-up roll weight (as a temporary solution to reduce manufacturing lead times), and to allow fabricated construction of the roll. These have been complemented by joint development activities in the supply chain aimed at increasing foundry capacity to

enable full-weight back-up rolls to be manufactured. The increase in ingot size has been successfully seen through to a finished roll weight increase of 30 tons.

Reduced manpower costs: new automation concepts

This is an area in which Siemens VAI seems to be ahead of customer needs. Our plate-mill partners consistently tell us that they don't want a mill without operators, because of the critical role that diligent mill staff fulfill in process supervision. Nonetheless, Siemens VAI process-control capability is now ready to provide a completely hands-free rolling process as soon as the market demands it.

Traditionally difficult areas such as squaring and turning can now match the best operators by using vision-system-based techniques. Alignment in the shearline is another area ready for the exploitation of similar principles, and a cross-company development project based at the Siemens Roke Manor Research facility in the UK is investigating the application of vision systems to process control in multiple fields of metals manufacturing.

The Microstructure Monitor, a metallurgical model that predicts steel properties accurately enough to replace the test house mills for some time. It is now available for a significant range of plate grades. Since plate certification safeguards so many safety-critical applications, the development once more leads the market needs (see *metals & mining* 2|2009, p. 58).

Siemens drive systems combine dynamic performance and low energy consumption. For main drives, the most powerful and demanding drives in all rolling processes, the extended vector control with Rotos (Reduced Optimized Task Oriented Switching) is incorporated in the Sinamics SM 150 medium-voltage source converter. It benefits both, making the most out of the drive system and optimized pulse pattern in each mode for a motor-saving operation. Cost savings over the long haul are possible in the entire range of drive solutions, not last by choosing speed-controlled drives instead of constant speed drives for auxiliary applications (see *metals&mining* 1|2009, p. 52). Plate-mill technology development at Siemens VAI continues apace, bringing new processing capability as well as cost reductions for our customers. ■

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Mechatronics packages for processing lines

Expand Capacity, Enhance Quality

Maintaining a competitive edge is a continuous process that wins particular importance in a demanding market. This article provides an overview of available options in the area of mechatronics.

Staying on top in industry requires quality and throughput improvements at tightly controlled operational costs. What options are available to meet these growing demands?

Companies today ask for higher-quality products at competitive prices. At the same time, the present situation holds opportunities for those who prepare for the next upward cycle. Trends in the industry call for production with less impact on the environment and higher efficiency, creating demand for new advanced high-strength steel grades with perfect strip surfaces, tight tolerances, uniform mechanical properties and excellent flatness.

Requirements for a typical line

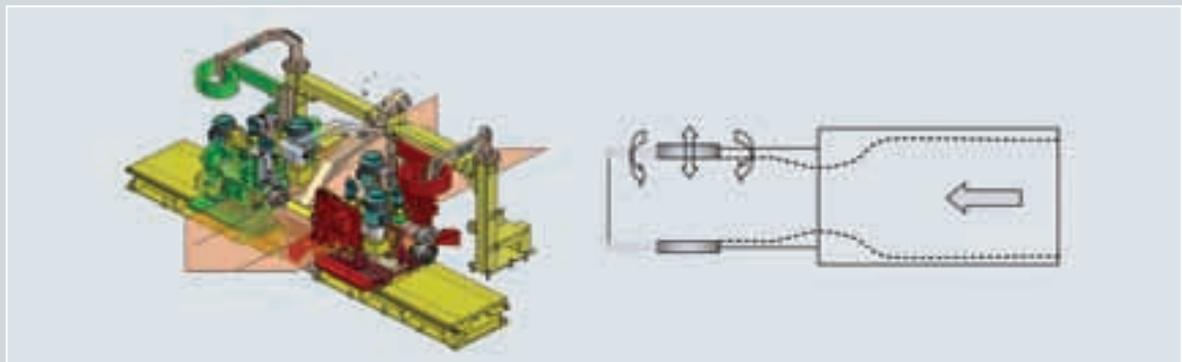
Highest processing-line availability is the key to economical viability. Also, the line has to adapt flexibly to any condition, ensuring consistent production even if challenging materials are used or a wide variety of

end products is made. Plus, technical-processing equipment and automation must be highly reliable, day after day. The next requirement is high production throughput and yield, with reduced strip-to-strip transition times and minimal scrap losses. Also essential are safe operation and maintenance procedures. Low operating costs ensure highly competitive and profitable operation. This means minimizing the use of coating materials and other consumables, reducing the need for maintenance, and lowering energy consumption and automating processes.

A host of solutions

A number of mechatronics packages for various stages of processing lines and a rolling mill can help meet new requirements:

- **Welders** are a prerequisite for continuous processes in any line. Siemens VAI delivers welders of all types, whereas laser welding offers particular per-



Side trimmer with a new dynamic width adjustment



The DAK® dynamik air knife controls both longitudinal and transversal coating thickness in Galvanisation Line.



A laser welder joins steel strips for continuous processing.

formance, productivity and cost-efficiency benefits. Better control of over thickness also improves the performance and service life of downstream equipment such as scale breakers, skin-pass mills, etc. The laser's flexibility to cut and weld high-strength and carbon-quality steel in homogeneous as well as heterogeneous combinations imposes fewer constraints on production management. And since there is no contact between the welding head and strip, coated and uncoated strip surfaces can be joined without any cutting and welding-tool wear.

- **Coating machines** contribute to important raw-material savings in painting, chemical treatment or zinc-coating processes. The DAK® (dynamic air knife) system not only controls longitudinal but also transversal coating thickness. In zinc coating processes, a DAK system can reduce zinc consumption by approximately 5 percent for a target coating quality of 60g/m² per face.
- **Controlled elongation systems** improve line flexibility and productivity and permit a top-level quality product. A skin-pass mill with high response time of temper-mill roll force minimizes the non-skin-pass strip length during weld passage. Also high-pressure work-roll cleaning system increases the work roll life time-reducing maintenance costs. Elongation remains constant for a given operation and is insensitive to variations of strip gauge and width, metallurgical strip properties and strip velocity. In pickling lines, the Siemens VAI scale breakers reduce acid consumption and increase line speed, enabling faster roll changes as well as increased service life of wringer and looper rolls.

- **Side trimmers** are available for all kinds of lines and strip thicknesses. The Siemens VAI side-trimmer design uses servo-motor-powered turrets that enable fast knife replacement without line stoppage. Unlike conventional systems that stop the line for width changes, the new dynamic width-change mechatronics (DWA) design only lowers the speed as the weld arrives in the side-trimmer area. Then, the side-trimmer mechatronics move the knife in a double curve to perform the width change, effectively increasing line productivity.
- **Automatic surface inspection** using the SIAS system ensures perfect, defect-free steel-strip surfaces. The system quickly detects surface defects such as roll marks and acts as production watchdog, drastically reducing the need for manual inspection. Since the system can, for example, detect edge cracks on a pickling line, it can help to avoid damages and loss of productivity in downstream processes.

Holistic approach to plant modernization

Building on engineering and process competence, Siemens VAI delivers proven mechanical solutions to optimize actuator systems, control systems, sensors and measurement with a focus on improving overall line performance, reducing maintenance costs and offering top-level service and support. ■

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The world's largest push-pull pickling line at voestalpine Stahl

Push-Pull Technology For New Advanced Steels

In 2008, Siemens VAI commissioned a new pickling line of the push-pull type with an inline skin-pass mill at voestalpine Stahl in Linz, Austria. The new line offers a capacity of approximately one million tons per year for strips thickness ranging between 2 mm and 12 mm. Some 40 percent of its capacity serves for the production of feedstock for subsequent cold rolling in a continuous tandem cold mill in the gauge range from 3 mm to 5.5 mm. The remaining portion of the product mix is dedicated to pickled and oiled hot strip. The maximum tensile strength of the feed material can reach up to 1,150 MPa.

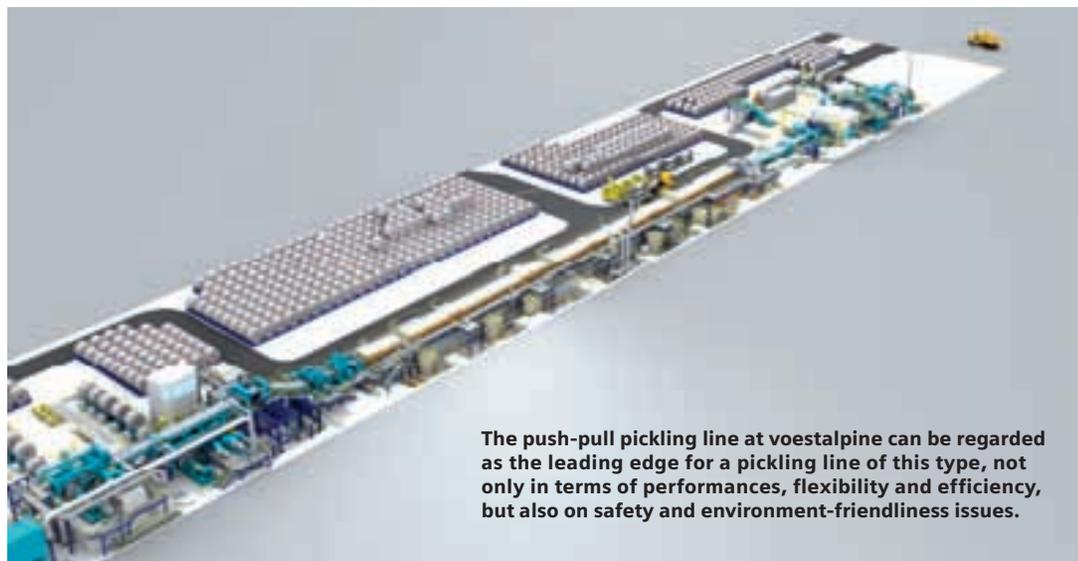
The trend to pickle particularly advanced high-strength steels (AHSS) is leading to higher-order equipment requirements in all kinds of pickling lines. Especially hard-to-weld steel grades raise the demand for (discontinuous) push-pull pickling lines. Besides, lines of continuous designs are usually limited to 6.5 mm. For thicker products, there is no way around push-pull pickling lines to cover a growing range of applications. For the pickling of up to approximately one million tons of strip per year, push-pull pickling lines offer significant advantages in regard to investment costs and operational flexibility, especially in the case of frequently changing strip dimensions and steel grades.

As a result of rigorously developed design and

automation concepts, Siemens VAI made it possible for voestalpine to substantially increase capacity and offer an extremely varied product mix. voestalpine's requirements for this line exceeded the standard industry demands by far, but as today's results show, it proved to be a smart concept to combine the production of highest-quality cold-mill-substrate hot band with the niche of special pickled-and-oiled, heavy-gauge coils into one line. In the past, it was only possible to accommodate such a product mix by separate pickling lines. Today, though, a single line can accomplish both tasks. This provides a substantial benefit to this major steel producer in terms of capital investment and quality yield.

1 View to the entry section and the pickling tanks

2 Process section of the PPPL



The push-pull pickling line at voestalpine can be regarded as the leading edge for a pickling line of this type, not only in terms of performances, flexibility and efficiency, but also on safety and environment-friendliness issues.

Top-grade pickling and rinsing process

The five pickling tanks, as well as the subsequent five-cell rinsing tank, feature a highly efficient counter-stream cascade process. The continuous combination of these pickling and rinsing sections leads to a fully pickled, washed strip. Each pickling (or rinsing) section features a pair of wringer rolls to minimize unwanted acid (or water) drag out, opposite to the cascade process.

The uniquely designed V-shaped flat pickling tank increases strip stiffness during its passage through the tank. This eliminates strip buckling and flattening, and assures reliable threading. To prevent strip staining in the rinsing section, Siemens VAI developed a special anti-stain system that does not require chemical additives. The energy-efficient design of the fume extraction and sealing system significantly reduces energy costs and acid losses.

Advanced automation for optimized conversion cost

The acid temperature and the strip speed is calculated and selected with the aid of a reference model in order to ensure a proper pickling process. The Siemens VAI Automatic Pickle Liquor Analyzing and Control System (Faplac®) automatically controls the main parameters of the process (concentrations, flows, temperature) and optimizes them in real time using data derived during the running process about the chemical formula and other parameters. This minimizes fluid and heat consumption, adjusts the iron content of the waste acid for optimum regeneration, and optimizes the reuse of waste rinse water and steam condensate.

Reducing maintenance and operating costs

Wringer rolls always prove to be the major source of maintenance costs. To improve their life expectancy, the pickling line features a taper shear ahead of the process section. By cutting the edges of the strip's head ends, a safe threading of the strip through the pickling tanks and onto the wringer rolls' chambers can be ensured.

To minimize the operating downtimes, the entry section features two pass lines: the upper one is dedicated to thin strips (up to 6 mm) while the lower one, equipped with two inline flatteners, can handle both thin and thick strips. After pickling and rinsing, and contrary to the common push-pull pickling line standard, the material is passed through a turret-type side trimmer whose dual rotating heads allow worn knives to be changed safely while the active ones continue cutting the strip edges.

To improve the surface quality and saleability of the finished product, the voestalpine pickling line features an in-line skin-pass mill. The 4-high dry-type mill can operate with two work-roll diameters to adapt for the hardness of the grades rolled and to allow a suitable control of roughness transfer versus elongation properties of the strip. Work and back-up rolls are equipped with cleaning devices to avoid dust pick-up on their barrels and to achieve the best surface conditions on the strip. ■

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Handan Iron & Steel turns to Siemens VAI

Three New Processing Lines

Siemens VAI has received an order from the Chinese company Handan Iron & Steel Corporation to supply the automation and electrical equipment for a new annealing line and two hot-dip galvanizing lines. This includes all the drives plus the basic and process automation systems. The strip processing lines are part of cold-rolling mill No. 2, which is currently being constructed and is scheduled to start production at the end of 2010.

Handan plant view: the company boosted its production up to 10 million tons by 2008.





Stone-laying ceremony for the new cold-rolling mill No. 2



Established in 1958 in Handan, a city in the Hebei Province, Handan Iron & Steel Corporation has an annual production of around nine million metric tons of steel. Since the middle of 2008, the company has been part of the Hebei Iron & Steel Group, the leading steel producer in China. The company boosted its production to 10 million tons last year, and will improve its value chain with an additional cold-rolling plant scheduled to go on line in 2010.

For the three processing lines of the new cold-rolling mill, Siemens is supplying all the drive technology and the basic automation, which includes technological control systems for the built-in skin-pass mills and stretch levelers as well as measuring and control equipment for strip cleaning and post-treatment. The project also encompasses process automation, control desks and HMI equipment with user-friendly process and plant diagnostic functions. Automation will be completely based on Simatic S7 programmable logic controllers, whereby standardized application modules will be used for the actual programming to facilitate commissioning and maintenance. The process-automation system and the HMI system for the almost fully automated production plants will contain standard server components with a partially redundant design to enhance plant availability. All the main and auxiliary drives are based on three-phase technology.

In order to ensure a uniformly high product quality, the annealing line is to be fitted with a fully automatic strip-surface inspection system (SIAS). Systems from third-party companies will be integrated in the two hot galvanizing lines. Siemens is also responsible for supervision of the installation work as well as for commissioning, acceptance-test support and customer training. Siemens VAI was awarded the contract primarily due to numerous reference projects for processing lines and the local Siemens presence, which will ensure speedy and efficient after-sales services. ■

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The new cold-rolling complex at Shougang Shunyi

A Reliable Partner For the Entire Production Chain

In May of last year, Beijing Shougang Co. Ltd. started operations in a new production complex northeast of Beijing. The Shougang Shunyi cold-rolling project is one of Shougang's key projects involving relocation, structural adjustment and environmental protection. Siemens VAI equipped the production systems of the whole process chain – from cold rolling to strip processing – with automation and drive systems.

China's megacities are facing a dilemma: On the one hand, they need millions of tons of steel every year in order to build car bodies, office towers and shopping centers, power plants and bridges, and metro lines and housing. On the other hand, steel production places a big burden on the environment. As a result, the newly industrialized country is locating production facilities in less heavily polluted areas and equipping them with environmentally friendly technology.

Shougang, headquartered in Beijing, is one of the the largest steel producers in China. The company operates production facilities in and around Beijing. Within the framework of measures to improve air quality in Beijing, Shougang moved production facilities to new locations in the Hebei Province. In addition, all production capacity for the supply of raw materials and parts for the automotive companies in greater Beijing have been relocated from the city center to a new location, Shunyi district, northeast of China's capital city.

The new production complex – comprised of a continuous pickling line tandem cold mill (PLTCM) with a capacity of 1.8 million tons per year, one continuous annealing line (CAL) with a capacity of 950,000 tons per year, and two hot-dip galvanizing lines (CGL), CGL 1, designed to produce 475,000 tons and CGL 2 for 370,000 tons of cold strip per year – will be used

for processing low-alloyed, cold-rolled carbon steels for high-quality car-body parts.

All these plants are automated on the basis of the product Siroll^{CIS} from Siemens VAI comprising the technological control system, the entire process automation and the whole drive system. Siemens VAI was also responsible for supervision of installation work, commissioning and customer training.

The challenge: Highest productivity at high plant availability and environmental protection.

What were the main decision criteria from Shougang to select Siemens VAI as single source supplier?

According to Mr. Ma Jia Ji, the general manager of the Shunyi plant, Shougang cold-rolling group, a lot of criteria lead to the decision placing the order with Siemens VAI as single-source supplier. Below the most important factors:

- Competence in Process technology
- Competence in Electrical and Automation systems
- Excellent reference situation especially in China
- Involvement of local resources during engineering and commissioning





Example of Siemens VAI coupled pickling line



High-capacity quality products

Quality Report Shougang PLTCM

Coil-ID.:	0830385411030_1
Alloy code:	SPHC
Entry thickness:	3,14 mm
Exit thickness:	0,72 mm
Strip width:	1285 mm
Start time:	14:08:24 11.07.2008
End time:	14:14:10 11.07.2008
Valid length:	3436 m
Evaluation:	
• Tolerance limit (thickness deviation):	95.40 %
• Percentage inside tolerance limit:	99.52 %

Continuous Pickling Line / Tandem Cold Mill

Annual capacity:	1.8 million tons
Material:	Hot-rolled strip, low-carbon steels and high strength
Strip thickness:	
• Entry:	1.60 – 6.00 mm
• Exit:	0.20 – 2.50 mm
Strip width:	800 – 1900 mm
Coil weight entry:	38 tons max
Running speeds:	
• Entry:	700 m/min
• Pickling section:	230 m/min
• Trimming section:	260 m/min
• Tandem entry section:	260 m/min
• Tandem exit section:	1470 m/min
• Cutting speed:	300 m/min

- >> • Strong local after-sales service
- Reducing of spare parts due to harmonized equipment over all plants
- Availability of spare parts of China

Continuous Pickling Line/Tandem Cold Mill (PLTCM)

The facility consists of two uncoilers, a tension leveler, a turbulence process section, side trimmers and three loopers as well as a 5-stand tandem mill featuring a 6-high design with intermediate roll shifting, roll eccentricity compensation on stands 1 to 4 and flatness measurement and control on stand 5. The finished strip is fully automatically wound up onto a carousel reel. Further components include the fully automatic coil conveyers at the entry and exit site. The automation system is linked to the superordinate production-plan system (level 3).

The plant is automated on the basis of Siroll^{CIS} CM comprising the technological control systems and the entire process automation. A central component for the plant is the thickness-control system based on an advanced mass-flow concept. This guarantees compliance with very fine tolerances such as those demanded by customers in the automotive industry. The online rolling-process control function of the process automation system calculates set points for the operating parameters of the rolling plant on the basis of analytical, mathematical models during ongoing production. Self-learning neuronal networks carry out the adaptation of the models to the respective production conditions, thus enabling flexible production planning. Due to the optimized interaction of exact process models and fast closed-loop control systems, it is also possible to roll critical sections of strip at the weld-seam sections in fully automatic mode with minimum losses in terms of time and material.

Technological controls and process models are the core of the sophisticated automation concept.

Continuous Annealing Line (CAL) and Continuous Galvanizing Lines (CGL1 and CGL2)

The processing lines consist of two uncoilers each. Before the annealing furnace, the band is freed of impurities and mill residues in a cleaning area. The recrystallization annealing is realized with the help of vertical annealing furnaces outfitted with modern fast-cooling facilities. In both galvanizing facilities,



Continuous Annealing Line

Annual capacity:	950,000 tons
Material:	Cold-rolled strip, soft steel and high-strength steel products
Strip thickness:	0.30 – 2.50 mm
Strip width:	800 – 1870 mm
Coil weight entry:	38 tons max
Running speeds:	
• Entry:	700 m/min
• Furnace:	420 m/min
• SPM:	820 m/min
• Side Trimmer:	820 m/min
• Exit:	820 m/min

Continuous Galvanizing Line 1

Annual capacity:	475,000 tons
Material:	Cold-rolled hard coil of CQ, DQ, DDQ, EDDQ, SEDDQ & HSS
Strip thickness:	0.40 – 2.50 mm
Strip width:	800 – 1870 mm
Coil weight entry:	38 tons max
Running speeds:	
• Entry:	240 m/min
• Furnace:	180 m/min
• SPM:	210 m/min
• Exit:	240 m/min

Continuous Galvanizing Line 2

Annual capacity:	370,000 tons
Material:	CQ, DQ, DDQ, EDDQ & HSS
Strip thickness:	0.20 – 1.60 mm
Strip width:	800 – 1520 mm
Coil weight entry:	35 tons max
Running speeds:	
• Entry:	240 m/min
• Furnace:	180 m/min
• SPM:	210 m/min
• Exit:	240 m/min

with the aid of a coating weight gauge and an air knife, the thickness of the galvanization is fully automatically regulated. In order to reach the necessary deep drawability, flatness and finish quality, the continuous annealing line is equipped with a 6-high stand, and the galvanizing facility with a quarto stand and a tension leveler. The finished product is fully automatically coiled onto two coilers. The entry and exit coil



Mechatronic knowledge for optimized performance with Siroll^{CIS} Siflat flatness measurement and control



Shougang PLTCM – TCM entry section

transport and coil tracking is fully automated and linked to the superordinated production-planning system (level 3).

For the new lines, Siemens VAI supplied all the drive systems as well as the basic and process automation, including the technological control systems for the built-in skin-pass mill stand and the tension leveler. All main and auxiliary drives are based on AC technology. They feature among others a compact design, low noise emission, uniform parameterization over the entire product line and ease of maintenance. In addition, the projects include HMI equipment with user-friendly process and plant diagnostic functions.

Automation will be provided in the form of the Siroll^{CIS} PL automation concept for strip processing lines on the basis of Simatic S7 programmable controllers.

Standard application modules will be widely used for programming. This will facilitate commissioning and maintenance. As a special technological highlight, Siemens VAI is equipping the skin-pass mill stand of the annealing line with the Siroll^{CIS} Siflat contactless flatness-measurement system. This system reliably ensures that narrow tolerances – especially demanded by customers in the automotive industry – are not exceeded, thus ensuring quality and that no damage is done to the surface of the strip, for example scratching.

Excellent leadership during commissioning and final acceptance test

There is a long history between Shougang and Siemens VAI. Presently Siemens automation and drive equipment is installed and operated in most of the plants at Shougang. To ensure direct, fast and single-point communication with the customer, Siemens China appointed a single contact person for Shougang.

Thanks to the commitment, the experience and know-how of Siemens VAI – and despite difficult conditions – the project goals could be met to the customer's complete satisfaction. The basis was bundling know-how in the product family Siroll^{CIS}, the dedication of experienced commissioning personnel, and project management on location taking over during commissioning and acceptance tests. According to the general manager of Shougang Shunyi Cold-rolling, Mr. Ma Jia Ji, these aspects guaranteed a successful closing to the project. In particular, he stressed the technological competence of Siemens VAI as well as local presence in Beijing. Together, this assured customer-oriented processing of the project as well as efficient after-sales service of the facility after commissioning.

Siemens personnel based in Beijing and Shanghai accomplished around a third of the commissioning work for the facility. For Shougang this has the advantage that the entire Siemens know-how is quickly available close by well into the future. By using Siroll^{CIS} modules, fewer spare parts need to be kept on hand, and when spare parts are needed, they can be sourced locally.

As a basis for later life-cycle service, a remote-access system was already installed at the beginning of commissioning. This remote-access system allows a connection to be established between the plant network and the Siemens VAI worldwide engineering and service/maintenance specialists, who are ready to provide quick help 24 hours per day. ■

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With FCF technology, a wide range of product-size changes in profile mills is possible using the same set of tools

No More Tooling Around

The flexible production of a wide range of longitudinally welded square and rectangular profiles is possible using the same set of tool rolls with the world-unique FCF system. Not only can plant productivity be increased, but less steel strip is required to produce the required products. FCF technology from Siemens VAI has been installed in profile mills in Spain and Austria.

The downtime of tube mills for roll-tool changes and other operational interruptions means lost production time. This inflexibility increases costs and reduces profit. In order to sharpen their competitiveness, producers must be able to supply a wide range of products on a just-in-time basis and reduce their product stock.

As an answer to these demands, VAI Seuthe, the specialist company within Siemens VAI for tube, pipe and section mills, has successfully introduced FCF (Flexible Cold Forming) technology to the market. This is a highly flexible forming, welding and sizing system for the production of cold-rolled and longitudinally welded square and rectangular profiles. This technology is distinguished by the use of the same set of tools for the production of a complete product-size range without the need for forming- and sizing-tool changes. FCF fulfills all of the standard requirements of tolerance, corner radii and product-surface quality. Because no tool changes are necessary, the standstill times for product-dimensional changes are greatly reduced and overall productivity is substantially increased.

Equipment features

FCF is the most flexible and productive solution on the market for the manufacture of longitudinally

welded products with square and rectangular cross sections. During forming and sizing operations, no tool change is required for the entire range of product dimensions. Product-size changes are automatically performed by means of central adjustment drives that are activated by computer control. Adjustments in the forming and sizing section are carried out within minutes, and tool settings as well as other key operational parameters are visualized by digital displays.

FCF forming, welding and sizing sections

The essential difference between FCF forming and conventional forming systems with single forming stands is the arrangement of the tool rolls. Contrary to conventional forming stands, which are characterized by the opposite arrangement of the tools on a common shaft, the tool rolls in the FCF system are alternately mounted on the left and right cantilever shafts of the forming blocks. The left and the right strip edges are subsequently bent as they pass the individual tool rolls. Final bending and adjustment of a C profile to a profile ready for longitudinal welding is carried out by the top rolls.

Welding operations can be performed using high-frequency (HF), tungsten-inert-gas (TIG) welding or laser-welding systems. The strip edges to be welded

are squeezed with the use of two side rolls and two inclined top rolls, universally applicable for several product dimensions. Welding in the FCF line is performed centrally along the mill centerline.

Following welding of the profiles, final calibration of the square and rectangular sections is carried out in the FCF sizing section. The same set of universal tool rolls is used for the calibration of the final section dimensions and corner radii as well as for product-size changes.

FCF benefits

By applying universal tools for the production of the complete range of line products, time-consuming tool changes are effectively eliminated. With the application of hard-metal tools, considerably reduced wear and thus longer tool lifetimes were achieved. This has led to an impressive 80 percent line availability for actual production work at the line of a producer, compared with a typical 40 percent production availability in conventional lines.

The direct forming concept employed in the FCF system allows the required steel-strip width to be reduced by between 2 percent and 6 percent, compared with the conventional production of squares starting with a round mother tube. This is explained by a thickening of the steel at the corners during shaping from round to square.

As a direct consequence of its high availability, the FCF production line is distinguished by its exceptional productivity, especially for the production of small order lots. All quality requirements with respect to tolerances, corner radii and product-surface quality are fully satisfied. This is the key not only for satisfying niche-product markets, but also for penetrating and succeeding in new market segments and regions.

The accumulative result of all benefits outlined above is enormous cost savings in production, maintenance, spare-parts management and time expenditures. Far less capital is bound in tool inventory and product storage. Depending on the local conditions, the return on investment (ROI) for a new FCF line is estimated to be at two-and-a-half to three years!

Not only can manufacturers of tubes and profiles profit from the above advantages offered by the highly innovative FCF solution, they also have a decisive competitive edge to succeed even in a difficult market environment. ■

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FCF line showing strip entry and FCF forming sections



View of a typical roll configuration of an FCF line

Example of increased productivity and profitability with FCF technology

Conventional line		
Two-shift operation	48 weeks/year	
Partial roll change	5x/week, 2 hours each	= 480 hours/year
Complete roll change	2x/week, 4 hours each	= 384 hours/year
Line downtime per year		= 864 hours
FCF line		
Partial roll adjustments (no change necessary!)	5x/week, 0.2 hours each	= 48 hours/year
Complete roll adjustments	2x/week, 0.5 hours each	= 48 hours/year
Line downtime per year		= 96 hours
Additional production time	(864 minus 96 hours)	= 768 hours/year
Productivity		
Medium dimension	40 x 30 x 2.5 mm	
Weight of section	2.51 kg/m	
Line speed	50 m/minute	
Additional productivity	7.5 t/h x 768 hours/year	= 5,780 t/year
1) Example product price	€670/t	
2) Example raw material costs	€600/t	

Additional possible profit with FCF Line 1) minus 2) = **€400,000/year**

Maximizing cost savings with system analyses and simulation tools

Leaner but Stronger

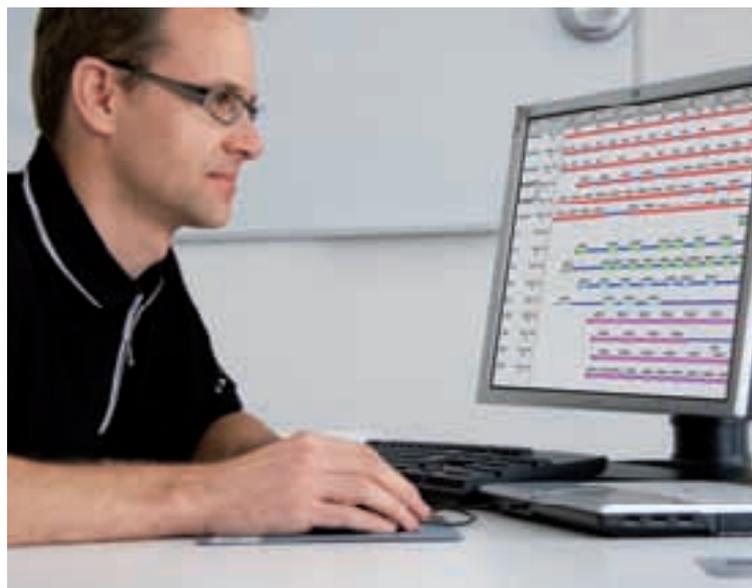
This is not the first time that the steel industry has been in a recession. And steel markets will certainly rebound as the economic climate improves. Those companies that are able to optimize their cost structure systematically in the lean times will be stronger and better able to reap higher profits in the good times. This article describes how.

Experts in the steel arena are generally unanimous in their forecasts that the current steel crises can be managed and overcome during the next years. This is because in the mid- to long-term outlook, steel demand will continue to grow in most market segments and for most products. The key issue for producers now is to maintain a sufficient cash flow despite shrinking sales, and to get ready for the inevitable upswing in the steel market. Steps to exploit all cost-saving potential to improve cash flow from ongoing operations are therefore decisive. During the recent economic euphoria up until the end of 2008, reduced competitive pressure may have allowed some steel manufacturers to “slack off” in their continuous efforts to improve performance. Now is the right time to get back into shape for the next market recovery.

Analyses and simulation tools

A number of steps can be undertaken along the entire manufacturing process to maintain cash flow at an acceptable level. However, “across-the-board” cost-cutting programs may endanger the strategic position of a company as a consequence of diminished service and performance capability. What is needed is a systematic approach applying specific tools to identify savings potential in addition to strict management and adherence to recognized improvements. This is the basis for a flexible and short-term adjustment of costs to fluctuating order volumes, but without losing core competence needed when demand resumes.

The complexity of interlinked operative processes within the total business cycle requires the use of spe-



cial tools to analyze and better define the best cost-optimization approach under prevailing conditions (Figure 1). Improvement recommendations, which may involve both technological and organizational processes, take into consideration the business environment of a particular steel manufacturer. Implementation assistance is also offered by Siemens VAI to help producers overcome the typical “resistance-to-change” mentality that generally increases in an unfavorable business climate.

Measures and improvements

As shown on the basis of project experience, the application of advanced analysis and simulation tools allows areas to be identified where the cash flow from oper-

ations can be improved and the operating costs and working capital decreased. This begins with the proper definition of the requirements placed on finished products at every step of the production route. Measures to streamline production logistics are identified, which shorten order-to-delivery times, allow smaller order lots to be accepted, and more frequent product changes to be carried out at lower product prices.

Variable/direct costs can be reduced by, for example, improving material yields and product quality, i.e., minimizing rejects. Residual fixed costs can be lowered, for example, by introducing suitable measures to enable an efficient and flexible production characterized by the lowest possible machine-preparation times.

Cost-effective production, especially at lower production levels, is vital for reaching the break-even point to assure continued profitable business (Figure 2). A systematic analysis of production processes must be ongoing to reveal additional savings potential with respect to consumables and stock keeping. Low stock levels of intermediate and finished products will help to downsize working-capital requirements and financial obligations.

Maintenance costs should be adapted to fluctuating production orders – which amount to about 40 percent – on the basis of a maintenance review. This prioritizes production facilities, classifies faults, shortens repair times, and allows the quantity of spare and wear parts to be optimized. Identified cost-saving potential that can be achieved in maintenance work is seen in Figure 3.

Concluding remarks

With optimized production logistics, the residual (fixed) costs are adjusted to the capacity utilization. This enables producers to reach the break-even point even at reduced output, which fluctuates according to changing demands. In this way, a sufficient cash flow can be maintained even during a market recession. Reduced pressure for production also provides manufacturers with a golden opportunity to enhance operational processes to allow new and higher-value steel products to be introduced in a company's product portfolio.

The improvements described above have been demonstrated in services projects implemented by Siemens VAI. Benefits for producers could be achieved within a short period of time. ■

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Fig. 1:
Evaluation of plant layout and material flow using simulation tools

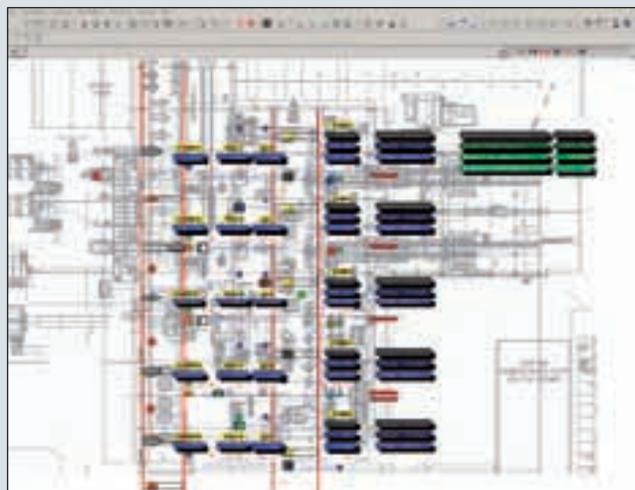


Fig. 2:
Break-even point achieved at lower capacity utilization

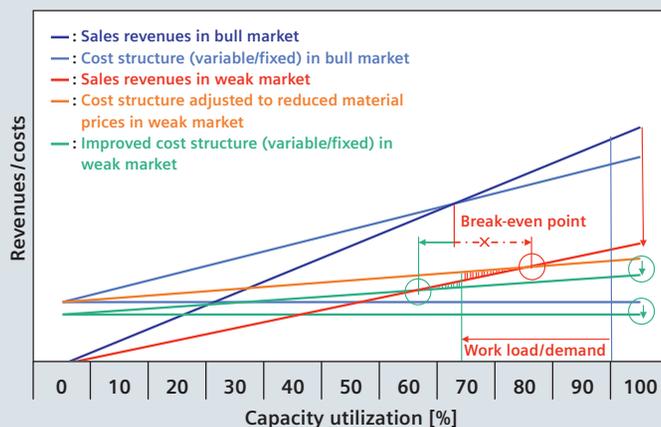
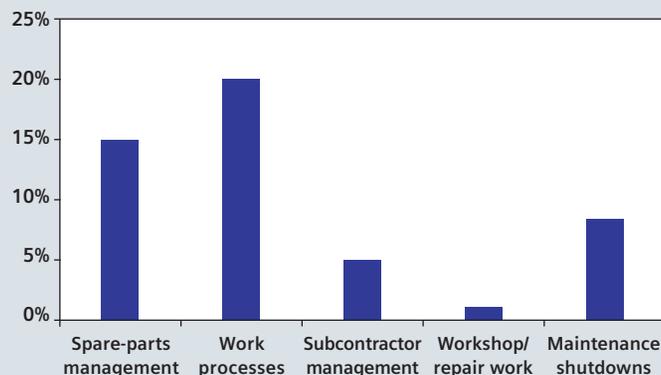


Fig. 3:
Identified cost-saving potential in various maintenance areas



First cRSP remote-access connection to India in the Metals Industry –
HSM Bhushan Steel

Remote Support – A Good Idea is Making its Way

SERVICES >

The worldwide availability of Internet services made possible the creation of a remote-access platform that meets customers' requirements with respect to security, availability, data bandwidth and a wide range of remote-service functionalities. This article describes the criteria for and the introduction of a remote-access service platform for Bhushan Steel's Hot Strip Mill in Orissa, India.

The cRSP service router establishes the link between a customer's factory network and the Siemens VAI remote service center.



Remote access to customers' computers and automation systems has been an issue for a long time. The advantages of an immediate response by specialists for troubleshooting as well as for a preventive diagnosis of upcoming problems are obvious. Years back, first teleservice attempts suffered from severe limitations due to point-to-point connections on isolated systems, narrow data bandwidth and access to only a limited number of applications. However, customers themselves imposed the most important

restrictions. Only very few were ready to open their systems for remote access, since most of them feared that unauthorized users could enter their systems with all thinkable consequences. Today's Internet with high data bandwidths and reliable security precautions has opened new possibilities for viable remote-service access.

cRSP – a dedicated platform for remote services

Building on this situation, Siemens developed its cRSP

(common Remote Service Platform), which the company also uses for its Metals and Mining Service & Support Center (MSC). cRSP is an access platform that meets all needs and customer expectations for secure access with high availability and performance. An installed base of almost 90,000 systems in various industrial sectors proves that users have accepted this method today.

The architecture of a cRSP connection (see Figure 1) contains several safety features that give the customer full control over the extent of remote-service communication. A dedicated service portal handles all communication between the customer and the Siemens service team (and other business partners) and the customer's local network. This portal is implemented as a "demilitarized zone" (DMZ) with specific access and data servers. Customers with a re-



ote-access service contract can only access the data server area that contains their own data. The DMZ's access server controls customer authorization and verification. The portal uses state-of-the-art encryption technologies for secure data exchange.

There are two ways to establish Internet access: In Customer Owned Access (COA), the client provides the infrastructure pursuant to Siemens recommendations. In Siemens Owned Access (SOA), the customer receives a preinstalled system that only needs to be com-

pleted by entering the Internet provider's access data.

Remote support sessions can only be initiated by the customer using a service router at the customer's premises that is specifically configured to only connect to the Siemens VAI service portal. This service router ensures that only the MSC Web portal can be reached, precluding any risk of unauthorized access to the Internet by customer personnel. Exclusive routing to specific computers guarantees that MSC can only reach computers and systems that have been released for access, thus protecting confidential data in the customer's systems. In addition to these functions, the architecture also keeps logs of all activities between Siemens VAI and the customer, ensuring full traceability.

On top of this, classical data transfer is also available for the collection of log files from the customer's installation or for provision of appropriate software updates, field reports or spare-parts-supply analyses on the part of the MSC.

The MSC offers a clearly defined customer access with 24/7 availability, providing expert support for a wide range of customer requirements.

Remote access – An integral part of the MSC concept

The MSC of Siemens VAI relies on cRSP as an integral part of its service concept. The MSC offers a clearly defined customer access with 24/7 availability, providing expert support for a wide range of customer requirements in plant operation and servicing.

The first contact for Siemens customers is a central e-mail address. Customers with service contracts can also use the telephone hotline, which is answered by service experts who follow a predefined escalation strategy to solve the problem. This also includes involvement of commissioning engineers and product or solution-related experts. Depending on the problem, support can also be provided via remote access to the plant.

The best time to consider remote access for new installations or modernizations is during system design. That way, remote access can already be used to support commissioning. However, remote access may also be integrated in running systems.

This concept offers important benefits: Siemens VAI experts can link to the customer's installation from their workstation systems, which contain all necessary development and analytical tools. At the same >>

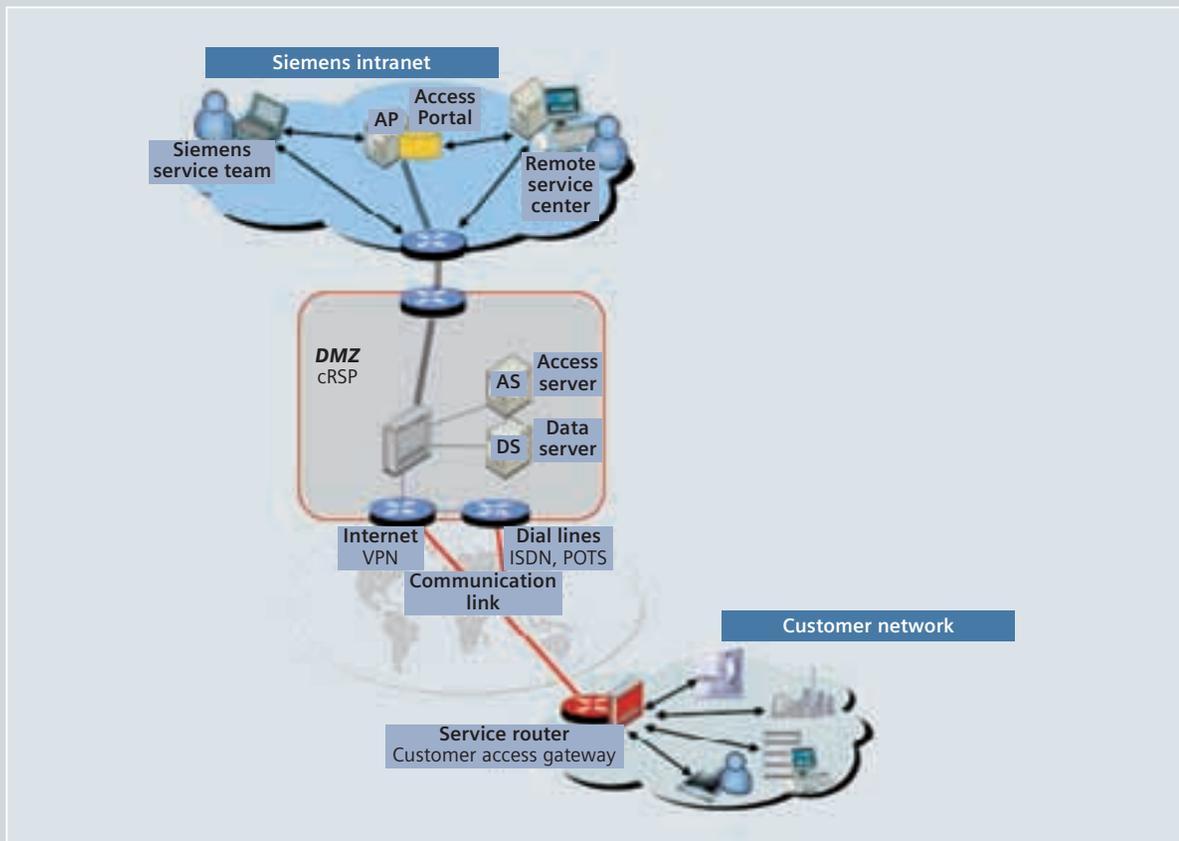


Fig. 1: cRSP remote access ensures data security in the Siemens VAI Metals and Mining Service and Support center.

>> time, Siemens VAI can meet all security-policy requirements. Consequently, a team of experts composed of customer personnel and Siemens VAI specialists on- and off-site can collaborate irrespective of their physical location until the problem is solved.

Conversely, remote access can also be used as a diagnostic tool for a regular analysis of system log files. This helps to ensure proper system operation and to avoid any upcoming problems that could cause production loss.

cRSP deployment at Bhushan Steel

Bhushan Steel's Hot Strip Mill System (HSM) in Orissa, India, has been in operation since fall 2008. Convinced of the advantages of remote access, the customer successfully installed a COA in March 2009. As in all previous instances, the finalization of technical details and the installation with all necessary tests were completed in less than one day.

To ensure cRSP visibility into the HSM's automation infrastructure, nine computers of the Level 1, Level 2, HMI, Drive Systems and Production Data Acquisition (PDA) systems were configured for access to the MSC. Using this installation, Bushan Steel's maintenance

personnel can request and receive online service and troubleshooting support whenever needed.

Siemens VAI experts can link directly to the customer's installation with all their development and analytical tools.

In the case of an equipment problem, Bhushan Steel can now contact the MSC and open their computer systems for a cRSP remote connection. Relevant system-status data are retrieved and analyzed by MSC experts. Subsequently, the experts narrow down their error search, eventually locate the cause of the problem, and then suggest possible solutions in dialogue with the customer.

In the past, when a common problem arose, a technician was sent to the site, and it took on average 48 hours for things to be back up and running (due to the time needed to book travel, arrange visas and travel

time itself). Remote cRSP access dramatically accelerates this process: support is provided directly and immediately – no long phone calls or trips to the site are required. Typical mean time to repair (MTTR) values dropped to just three hours, minimizing plant downtime and maximizing productivity.

Remote cRSP access dramatically accelerates the maintenance process, reducing the typical MTTR to just three hours.

But this is not the end ...

Future remote-service advances promise to turn maintenance from a retroactive to a proactive process. Using sophisticated program scripts, system status data can be acquired and sent to the MSC on a regular basis. The online service team could analyze these data, so that even problems that occur infrequently can be pinpointed, such as issues with certain product qualities that are not produced continuously.

If certain plant parameters exhibit unusual values, or if the frequency of specific system events is shifting away from a typical distribution, then the online service team could suggest acquiring a wider set of parameters in order to monitor plant behavior. Consider a motion-axis stop monitored by a sensor. If sensor data state that the stop is reached less frequently, this could indicate mechanical wear on the axis and point to an impending problem. Consequently, maintenance of that axis could be scheduled for the next regular maintenance break instead of risking a machine stop that would need to be fixed outside the normal schedule.

Software maintenance can also be streamlined with automated data-collection processes. If the version states that all the plant's software programs are automatically logged in a database, then the online service team can issue lists of recommended software updates to optimize system performance.

Siemens VAI cRSP-based remote-access plant services help to decrease delays in troubleshooting and repairing plant problems, and support on-site maintenance personnel as well as process engineers to achieve their objectives of higher efficiency. ■

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cRSP remote connections contribute to a quick analysis of problems so that the customer's maintenance engineers receive clear guidance for troubleshooting.



The MSC concept even integrates the transmission of media files (e.g., images) that were acquired under Siemens VAI instructions.

Interview with Dr. Erhard Reichel – Outsourcing leads to decisive cost and machine-availability benefits

A Win-Win Option

Dr. Erhard Reichel has been with the Metallurgical Services Department of Siemens VAI since 1984. He is responsible for the global development of maintenance-services projects and has negotiated many projects of this type with customers worldwide. In the following interview he describes the advantages for producers to outsource their caster maintenance and also outlines a performance-based payment model.

SERVICES >



Dr. Erhard Reichel in a caster workshop

For nearly 25 years now, Siemens VAI has served as a reliable outsourcing partner for producers with respect to the refurbishing of molds and slab-caster segments. Is outsourcing still a reasonable option for producers in times of economic downturn?

Dr. Reichel: The slab caster is the single most maintenance-cost-intensive machine in the entire steel-making and rolling process. Maintenance costs account for approximately 50 percent to 60 percent of the total expenditures necessary for steel-plant maintenance. However, during times of low-capacity plant utilization, two matters are very important: low costs in general and low fixed costs in particular. Both criteria can be ideally fulfilled by Siemens VAI as an outsourcing partner.

If this is so, why doesn't everybody decide to outsource slab-caster maintenance work? What are the main objections from potential customers?

Dr. Reichel: Their arguments are both rational and emotional. For example, we sometimes hear, "If we outsource offline caster maintenance to Siemens VAI, they may take away our bread-and-butter business and leave me with the 'crumbs.'" Or, "Siemens VAI wants to make a profit, so how are they be able to provide the required services at lower costs than we can as an internal service provider?" And you also may hear, "If Siemens VAI provides the services that we are responsible for, we could get blamed if something goes wrong, or we may even be accused of incompetence!"

What do your customers mean by “bread-and-butter business”?

Dr. Reichel: The repair work of caster molds and segments is an ongoing and continuous activity. A number of maintenance craftsmen are always busy with the same repetitive repairs. Most of the other repairs within a steel plant occur at a far lower frequency. Such repairs cannot be regularly scheduled and are therefore not part of a normal mid-term maintenance program. For a plant maintenance manager who has to “sell” his services to operations, it’s understandable that he prefers an assured capacity utilization.

I see your point, but are the managers right or wrong from an economic viewpoint?

Dr. Reichel: Generally, and especially in times of an economic downturn when production rates are down to between 50 percent and 80 percent of capacity, producers have to minimize fixed costs and convert as many costs as possible to variable costs. To keep a high utilization of personnel capacity would be an outdated approach.

O.K., that sounds logical, but how can Siemens VAI provide services at lower costs being that Siemens VAI needs to make a profit as well?

Dr. Reichel: The more often one does a job, the more efficient one gets at it. Sixteen Siemens VAI offline-maintenance workshops look after slab casters, which together cast a total of around 60 million tons of steel per year. This means that in a typical year we partially or completely refurbish around 600 caster molds and 120 benders – or “segment zeros” as our competitors call them – and so on. This know-how allows us to identify the ideal solution even where the smallest improvement potential exists. Our business objective is to provide services at a lower cost per ton of cast steel than our customers can achieve themselves.

How are you able to do this?

Dr. Reichel: You get your cost-per-ton figure by dividing the offline maintenance costs by the tons cast on a slab caster. How can you improve this calculation? By reducing the numerator. This means that the most efficient way to reduce maintenance costs is to reduce the number of mold and segment repairs required. We achieve this by applying special repair technologies and by using spare parts and materials with an increased service life.

But doesn’t this mean that these components are much more expensive? How can you reduce costs this way?

Dr. Reichel: Every mold or segment includes a particular component or part with the shortest service life.

This then defines the service life of the entire mold or segment. We therefore focus on finding solutions that extend the lifetime of that part. This can include, for example, choosing a different part or redesigning the part, or by applying wear-resistance coatings that can extend the service life of the unit. These solutions are then tested several times before being applied on a standard basis by our workshops. And of course, each solution must ultimately withstand the test of whether it reduces the cost per ton or not.

Isn’t this type of continuous improvement done by the maintenance department of every producer?

Dr. Reichel: If every maintenance department had the same resources that we deploy for developing solutions, they could theoretically do this. But in actual practice, it is a question of costs and the availability of qualified internal and external personnel resources, which is usually problematic for steel producers. Furthermore, time-consuming approval procedures are necessary in large enterprises, which hinder maintenance engineers from pursuing all interesting improvement possibilities. Siemens VAI has structured its maintenance services as a network of small- and middle-sized enterprises, which regularly exchange experience and know-how, and which closely work together with the design offices of our caster competence center.

The logic of the outsourcing concept is quite clear, but how do you convince the responsible personnel when emotional reasons are involved?

Dr. Reichel: Well, we present our win-win business model and then we invite the customer to talk to other customers of ours who have outsourced. This normally removes any remaining doubts. The win-win model is based on a compensation scheme for our services, where payment is almost entirely based on the actual tons cast by their slab caster. If the customer produces more, then he pays more. If fewer tons are cast, he pays less. A fixed amount is paid for each ton of cast product. So our payment and success is fully dependent on the results. In this way, our customers are assured that we do everything possible service-wise to assure maximum caster performance.

Interview with Dr. L. Gould on March 25, 2009. ■

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Morgoil bearing upgrades increase mill utilization

Get Your Bearings Right

Since the 1930s, the tapered-neck Morgoil bearing has been the premier load-carrying bearing used in the metals industry. These have been installed in more than 1,500 mills on six continents. Improved design solutions provide even greater benefits for operators.

The Morgoil bearing is a hydrodynamic oil-film unit with an integrated design. It consists of load-carrying elements that provide precise vertical, horizontal and axial positioning, and is characterized by its unique sealing and mounting designs. These features have all proven to function well with high rolling loads and speeds. Its high capacity, long life, easy maintenance and low cost have made it ideally adapted to all rolling-mill applications, both for ferrous and non-ferrous metals as well as for hot and cold rolling.

“Rolling mills have long lives, but their technology becomes outdated,” notes Gabriel Royo, Vice President, Morgoil and Long Rolling Services. Advances in newer mills with contemporary bearing technology make it difficult for older mills to match their costs, quality and production levels. The Morgoil Group of Siemens VAI works with mill operators to economically upgrade these older mills with the latest Morgoil bearing technology, bringing mills up to date to compete more effectively. In the 1990s, Morgan purchased the trade name and designs for Mesta oil-film bearings, further expanding the Morgoil product line.

“We continue to refine the Morgoil bearing to meet the demanding conditions of today’s market,” says Royo. Engineers have introduced advancements in strength, durability, accuracy, seal design and lubrication to ensure they are the most reliable in the industry, and easy to quickly mount and dismount. For

example, the latest KLX design, an advanced keyless-bearing technology, improves strip quality, reduces mill capital-investment and operational costs and absorbs 25 percent to 29 percent more load in the same space. It allows mills to roll with higher loads to produce harder materials. With appropriate back-up roll-bearing upgrades, mills can increase load capacity and produce materials that could not be produced with outdated bearings.

Advancements in Morgoil bearing strength, durability, accuracy, seal design and lubrication ensure the greatest reliability.

“Upgrades allow mills to roll products and obtain cost efficiencies unimaginable decades ago,” continues Royo. “Every solution is customized to the customer’s equipment and goals. Our job is to clearly articulate to our customers the potential opportunities for their particular situation. Typical questions are ‘Can I improve strip quality?’, ‘Can I roll tougher materials?’, ‘How do we connect an existing mill to a slower-running processing line?’ and ‘How do we reduce operating costs of bearing and lube systems?’, among others.”



Proven reliability of Morgoil bearings since the 1930s in more than 1,500 mill installations worldwide

Both older oil-film bearings and roller-bearing mills have been successfully upgraded while reusing existing chocks. To extend roll life, mill owners can upgrade back-up roll seals. Upgrades to back-up roll-bearing locking ensure more consistent and safer

operation. In many cases, mills have paid for the upgrade within a year through increased productivity and more efficient equipment utilization. Many factors drive the decision to upgrade bearings, including:

- equipment that has just become too old and worn to produce a quality product;
- the desire to produce tougher grades requiring higher stand capacities;
- demand for increased rolling speed and production capacity; and
- accommodation for an additional processing line.



Morgoil bearings in a continuous hot-strip mill

Upgrade examples and benefits

Sleeve upgrades: The original Morgoil 1960s-vintage bearing can be converted to a so-called KTRT (key-type, thrust roller thrust) bearing with a short-key design. This common conversion significantly reduces the size of the keyway effect along with allowing an 18 percent increase in the load rating of the bearing and a significant improvement of strip-gauge quality (Figure 1).

Bushing upgrades: Bearing loads can be upgraded significantly by means of a short key-sleeve conversion combined with the use of High-Strength Babbitt (HSB) bushings. Upgrading an old TRT bearing to special short-key sleeves and HSB bushings can increase the rating by 33 percent. The ratings of relatively modern KL (key-less) bearings can be increased by 12.5 percent with the use of HSB bushings.



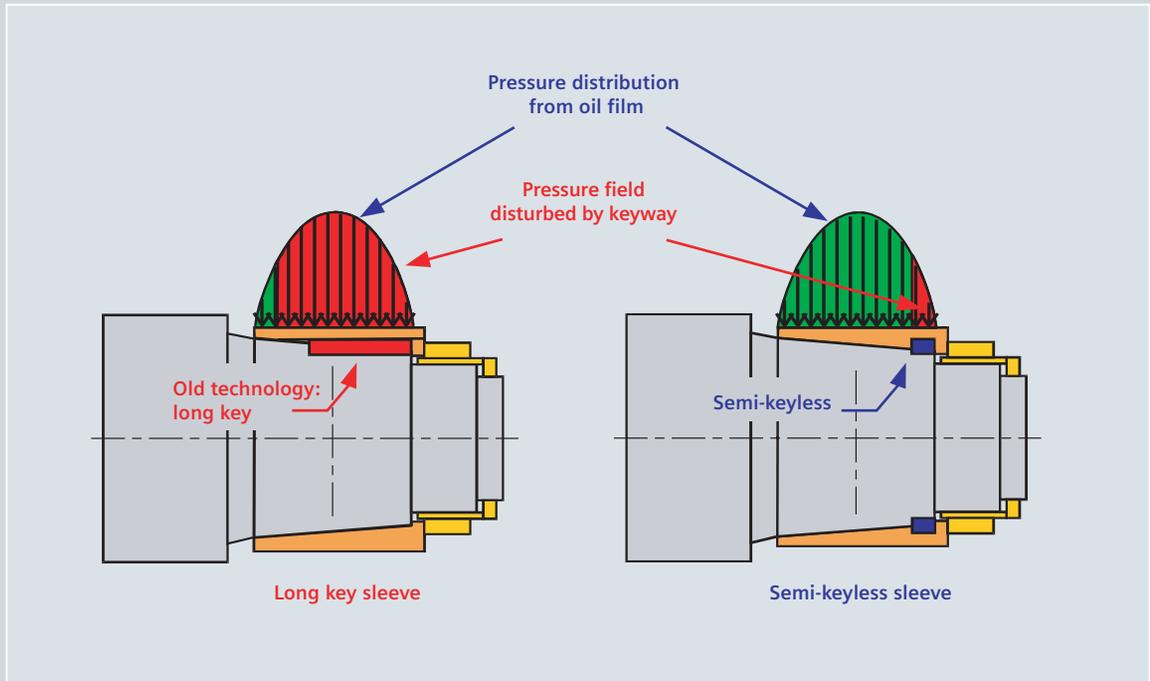


Fig. 1: Conversion of keyed technology to semi-keyless technology for strip-gauge improvements

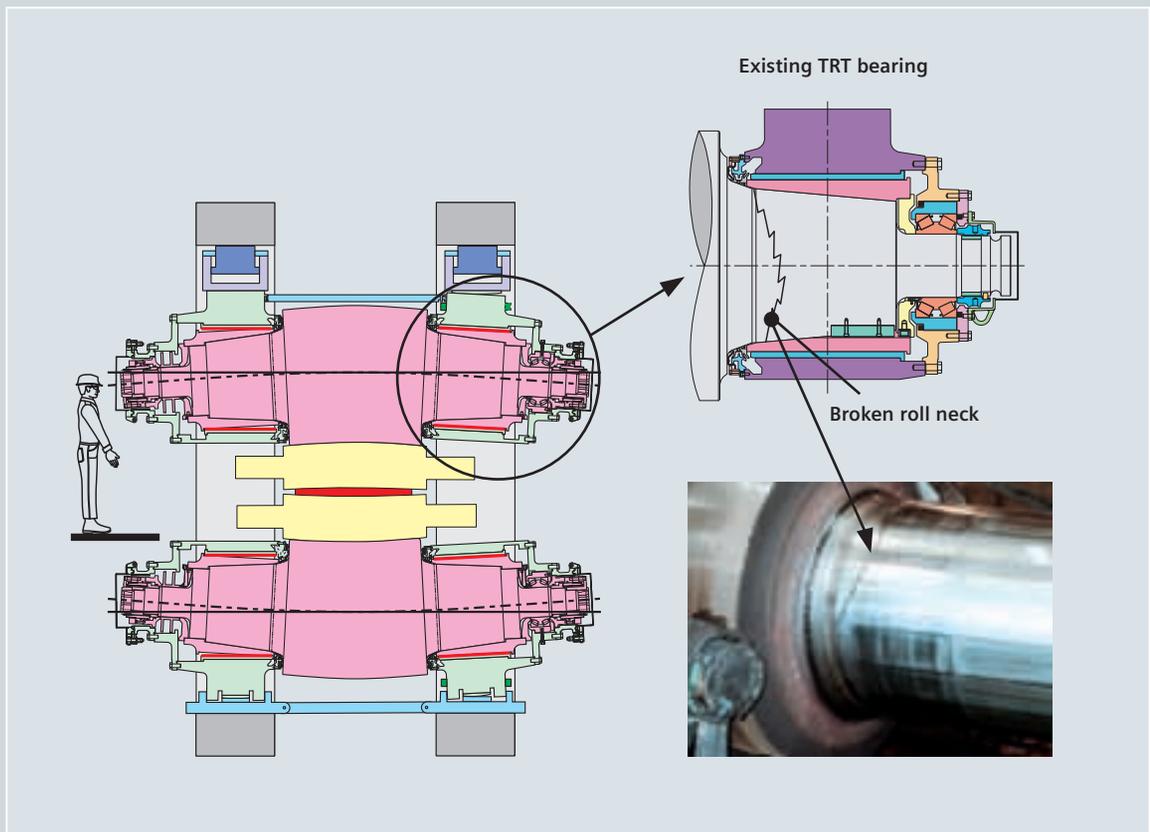


Fig. 2: Hot-strip-mill case study shows need to replace bearing



Morgoil KLX bearing at Shagang 5 m Plate Mill, China

>> **Seal upgrades:** Morgoil and Mesta bearings can have their sealing systems converted to more modern designs to reduce maintenance time and increase effectiveness. These conversions can be done individually or during complete bearing upgrades. For a certain type of Mesta plate-mill bearings, the existing sealing system limits the diameter that a roll can grind down to before it must be discarded. Changing to a more modern neck-seal design allows smaller diameters to be reached, thus extending the life of these million-dollar plate-mill back-up rolls. In the case of one 5 m plate mill, this seal conversion resulted in operational savings in the range of millions of euros.

Locking upgrades: Bearing locks have advanced significantly over the evolution of the Morgoil bearing. The original mechanical threaded-ring design and later quick-change design have been replaced by more modern hydraulic concepts. On new mills, one of three types is now standard: hydraulic bayonet, removable mount or compact bayonet. Older mills with mechanical locks can often be converted to hydraulic mount and LD Locks, increasing the repeatability and safety of the mounting process and eliminating the need to use an overhead crane to tighten the locks.

Case study: Hot-strip mill (HSM) upgrade

An HSM with older-style Morgoil 42"-90 TRT bearings began experiencing bearing failures and serious roll neck-breakage problems (Figure 2). Analysis found that modern material requirements had driven the total separating force well above the rating of the bearing. After

close study, Morgoil recommended a complete bearing replacement based on a load analysis. It was clear that the failures were occurring because the bearing loads had exceeded original bearing rating. With very few modifications, a 42"-86 KLX bearing could be fit into the existing chocks. The updated bearing would have a higher load capacity and larger roll neck, reducing the stress in the neck at the new, higher loads.

Many mills pay for upgrades within a year through increased productivity and more efficient equipment utilization.

Concluding remarks

Through the constant development of new technology, which can be applied to older mills, Morgoil remains a market innovator. The KLX developments increase bearing capacity with smaller bearings. Continuing improvements in sealing, locking and lube-system components are other examples of Morgoil market leadership. ■

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New 3100 m² Foil mill assembly bay, SVMC Taicang

Siemens VAI manufacturing and assembly facility for aluminum-foil mills now in China

Combining the Best Of East and West

A golden rule in a global economy calls for locating production value chains close to major markets whenever possible. Consequently, Siemens VAI moved its manufacturing and assembly facility for its high-performance foil mills to Siemens VAI Manufacturing Company (SVMC) located in Taicang, China.

Siemens VAI continuously develops and optimizes its high-speed wide-foil mills for key markets. Particularly focusing on the Chinese market, the company opened a local manufacturing facility, and therefore needed to assess which system components could be sourced locally and which had to be imported from overseas for the best cost-performance ratio.

Value-chain analysis

In preparation for the move, the company identified

a number of items and features critical to mill performance that would continue to be sourced from Western Europe to ensure optimum, consistent quality of the finished rolled product. This mainly concerned key items to control gauge, flatness and quality of the finished rolled product, including passline rolls, roll-load cylinders, work and back-up roll balance and bend cylinders, work and back-up roll-spray bars, hot edge sprays, shaperoll and roll-coolant filter. These and other high-tech items

will still be imported into China to complete the mill assembly.

In principle, low-tech items, large fabrications and simple structures are cost-effectively sourced locally through Siemens-owned workshops or approved fabrication and machine-shop facilities.

Stringent quality requirements

To gain approval from Siemens, all facilities must adopt stringent Siemens quality requirements as a minimum practice. Furthermore, local manufacturers have to follow a Siemens VAI quality plan to ensure the integrity of each part, which is monitored and checked by SVMC engineers. In economic, logistic and environmental terms, it does not make sense for customers within China to ship 30 tons of simple and large low-tech structures halfway around the world if the capability and experience at the required quality is available locally.

Originally, the Taicang factory had been established in 2004 to produce and assemble high-quality equipment for aluminium mills, bar mills, billet casters, cooling beds, gear reducers, mill guides and tube mills. In 2008, with growing business, Siemens added new facilities with 3,100 m² of additional floor space, giving a total of 4,500 m². The new building has an extensive area dedicated to precision assembly of items like rolling-mill stands. It features two 50-ton overhead cranes and a modern office space over five stories.

Extended capabilities

The facility is ideal for aluminum-foil mill assembly. Thus, Siemens VAI is now capable of building mills in its own workshop, using its own skilled work force that adheres to strict Siemens procedural and quality control.

For the standard foil-mill project, the mill housings are set down onto their bedplates and aligned to within 0.05 mm in three planes. All housing attachments including passline height-adjustment equipment, roll latches, roll-load cylinders and all balance and bend cylinders are assembled into and onto the mill stands. To ensure mill-stand interface integrity, the mill-entry bridle and exit table are assembled and fitted to the mill housings, together with the mill drive and operator-side fume-exhaust enclosures. Mill-stand piping is then assembled to the housings and enclosures. This reduces the installation time at the customer's site and ensures conformance with the Siemens VAI requirements for high quality. Subsequently, a set of work-roll and back-up-roll assemblies is prepared and inserted into the housings, completing the trial mill build. All these activities are per-



Foil-mill assembly trial

formed under continuous supervision by experienced engineers directly from Siemens VAI in the UK.

High-quality technical and commercial support

Strong emphasis is placed on technical and commercial support from Europe to ensure the best quality and timely delivery. Detailed engineering for all disciplines such as mechanical, hydraulic and automation equipment are part of the overall product, and continues to be based in Europe. This ensures that the highest technical standards are maintained and that the latest technological advances can be introduced rapidly.

New cost-performance standards

The new Siemens VAI Taicang facility is producing both for the local Chinese and for the global foil-mill market. It sets new standards for foil-mill manufacture and assembly in terms of high-tech product performance, high-quality manufacturing and cost efficiency. ■

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Experience in maintenance services

Increased Customer Proximity

Siemens VAI is creating new manufacturing and service centers to support its move to become a local supplier of plants and process solutions for iron and steel production. The newest facility within Siemens VAI Services is in Columbus, Mississippi, where a mechanical maintenance facility is embedded within the Severstal Columbus plant.



Siemens VAI employs around 3,000 specialists in over 50 different countries. They have unique experience in the maintenance and modernization of mechanical and electrical installations as well as in all aspects of process automation. Thanks to service solutions that are tailored to the customer's plants, Siemens VAI upholds its customers' competitiveness and increases the productivity of their installations. This regionalization of the business is one response to ongoing consolidation among steel manufacturers and to the need for a change in production conditions due to the ever-rising costs in steel production.

Since 1984, Siemens VAI Services has been providing maintenance services to metals customers in North America. Currently, Siemens VAI holds 12 maintenance and manufacturing facilities strategically located in key metal-producing locations throughout the U.S. to enable optimal customer focus.

The newest facility within Siemens VAI Services is

in Columbus, Mississippi, where a mechanical maintenance facility is embedded within the Severstal Columbus plant. The 40,000-square-foot facility (3,700 m²), designed to be self-sufficient, can also expand with Severstal's future growth in production and mill-equipment maintenance needs. Severstal Columbus – America's newest steel company – will produce 1.5 million tons of high-quality steel a year for use in the automotive, building, agricultural, pipe & tube, and appliance industries. A unique feature of the company is its 1400-acre megasite, which has been designed to accommodate production partners and related manufacturers onsite.

Maintenance services

The embedded location at Severstal Columbus allows the facility to eliminate nearly all of the material-handling costs and transit time that are common with many offline maintenance approaches. It also allows



- 1 Siemens VAI offers an entire spectrum of services, perfectly coordinated for the optimization of the plant.
- 2 Five-strand bloom caster: Siemens VAI is equipped to maintain each of the major units of the casting machine.
- 3 Out of a global network of 250 Siemens locations in more than 190 countries over 40 are at disposal for metallurgical services.

for rapid response to operating needs, a higher frequency of preventive maintenance, and an immediate and effective exchange of critical information that drives maintenance-related production planning, troubleshooting and overall maintenance optimization.

The Siemens VAI facility in Columbus is primarily focused on the maintenance of the continuous-casting machine. The facility is equipped to maintain each of the major units of the casting machine, molds and strand-guide segments, as well as other components such as individual roll assemblies. The facility's machining and fabrication capabilities enable Siemens VAI to refurbish even individual components such as roll shells, copper mold liners, bearings and spray headers.

Spare-parts management and supply

The continuous-casting facility at Severstal Columbus operates 24/7, requiring a fast turnaround of

many of the major units under any operating circumstance. In order to support the turnaround times, it is necessary to have on hand an optimal quantity of critical spare parts.

Siemens VAI inventories a blend of refurbished and new critical spares to support Severstal's operating needs. Most of the spare-part components in this type of application can be refurbished multiple times before having to be replaced. Once the major unit is disassembled to the individual component level, the components are refurbished in the Siemens VAI Services Columbus facility, or in one of the 12 facilities in the U.S. that specialize in specific technological repairs.

When a spare component does require replacement, Siemens VAI Services uses its global sourcing capabilities and OEM purchasing status for critical spares. This approach ensures that purchases are timely and efficient and allows Siemens flexibility to meet the cost needs of our customers. Frame contracts that combine global quantities for similar spare-part products also aid in further cost control and fast delivery for items with a long lead time.

Machine alignment

Being at the customer's site allows rapid analysis, modification and application of machine-alignment standards tailored to the operating and unique product-quality requirements of each casting machine. A very high level of strand and equipment integration is crucial in high-speed casting applications. Maintenance of existing tolerances while exploring ways to further improve quality are clear customer expectations.

Maintenance contracts structured to work

With the Siemens VAI maintenance-support model combining facilities specializing in specific component refurbishment, strategically located site-specific facilities, and global procurement resources, structuring a contract that addresses customer needs is simplified. The robust business model allows implementation of most any conceivable contract structure, whether the customer desires a contract based purely on production output, unit-menu pricing, investment or any combination thereof. ■

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Prestigious Award Goes to Siemens VAI Employee

Each year the Institute of Materials, Minerals and Mining (IOM3) awards numerous medals and prizes to those in the profession for their achievement and published work. Among the winners this year is Jim Hogg, Technical Manager, Long Products for Siemens VAI, who is being honored with the Dowding Medal. First awarded in 1980, the Dowding Medal recognizes a major contribution to the invention, development or design of a metallurgical plant, particularly rolling and finishing, leading to improved economy, yield or quality in metal production.

Jim was named as this year's recipient for his work in rolling-mill designs and project engineering, mainly related to long products. "This is a great accolade for Jim and thoroughly deserved," says Jon Stewart, Director of the Siemens VAI Sheffield site where Jim works. "He personifies professionalism in the rolling-mill engineering field and in a career of nearly forty years he has demonstrated an exemplary blend of creativity and practicality in both design and project execution."

Jim started his career in 1970 at British Steel after graduating with honors in Mechanical Engineering

from the University of Leeds. It was during a graduate apprenticeship there that he was first exposed to rolling-mill engineering. He went on to gather further experience with different employers in mill-equipment design, development and commissioning, working on projects in his native UK as well as in Australia, France and Korea, among others.

In 1995, Jim led a project to build a rod mill at Tokyo Steel, which at the time was the fastest hot mill in the world. He then went on to lead the design and supply of Europe's first endless mill at Fundia Dalsbruk, Finland. In the late 1990s, focus shifted to China, where Jim supervised the supply of five high-speed rod mills to the Xingtai company.

In the last five years, Jim has been working on a number of projects in the UK for Corus, a Siemens VAI customer. His first and one of his more challenging projects was the primary mill conversion for Corus Engineering Steels at Aldwarke. The Medium Section Mill conversion to roll rail for Corus C+I at Scunthorpe is the most recent and notable engineering success.

Colleagues and customers alike hold Jim's dedication and professionalism in the highest regard. ■

Jim Hogg, Technical Manager for Long Products at Siemens VAI, is this year's winner of the IOM3 Dowding Medal and Prize.



More information

You can find further information and company press releases at our online portal www.siemens-vai.com.

Events: Upcoming Conferences and Fairs

- JUN/JUL 30 – 02** ALUMINIUM CHINA 2009, Shanghai, China
- JUN/JUL 30 – 03** 7th IFAC International Symposium on Fault Detection, Supervision and Safety of Technical Processes, Barcelona, Spain
- JUL 06** 15th IFAC Symposium on System Identification, SYSID 2009, Saint-Malo, France
- JUL 13 – 17** 64th ABM Congress, Belo Horizonte, Brazil, Expominas; www.abmbrasil.com.br/seminarios
- JUL 16 – 19** 7th MachinExpo Bangladesh 2009 International Expo, Dhaka, Bangladesh
www.machinexpoonline.org
- JUL 22 – 24** ENGINEERING SOLUTIONS FOR SUSTAINABILITY: MATERIALS & RESOURCES, Lausanne, Switzerland; www.spe.org/events/aime
- AUG 13 – 15** 6th China (Beijing) International Metallurgy Expo 2009 (CIME2009), Beijing, China
www.bcime.com/en
- AUG/SEP 31 – 02** 8th INTERNATIONAL STAINLESS & SPECIAL STEEL SUMMIT, Düsseldorf, Germany
www.metalbulletin.com/events
- SEP 01 – 03** The 6th Int'l Stainless Steel Expo (STEXPO), Shanghai, China
- SEP 06 – 08** INT. SYMPOSIUM ON AUTOMOBILE STYLE (ISAS'09), Dalian, China; <http://hy.csm.org.cn/isas09/en>
- SEP 08 – 10** 3rd STEELSIM: Int. Conference Simulation & Modelling of Metallurgical Processing in Steel-making, Leoben, Austria
- SEP 08 – 11** METALLURGY UKRAINE 2009, Donetsk, Ukraine
www.metallurgy-ukraine.com
- SEP 13 – 16** HOT FORMING OF STEELS, Grado, Italy
www.aimnet.it/hfs2009.htm
- SEP 14 – 18** 29th PERUMIN MINING CONVENTION (incl. EXTEMIN), Peru, Arequipa
www.convencionminera.com/eng/per_int.html
- SEP 15 – 17** ISIJ MEETING, Tokyo, Japan
www.isij.or.jp/Event/kokusai.htm
- SEP 16 – 18** MINING WORLD CENTRAL ASIA, Almaty, Kazakhstan, Atakent Exhibition Centre
www.miningworld-events.com
- SEP 17 – 18** 24 Aachener Stahlkolloquium "Metallurgie," Aachen, Germany; www.eurogress-aachen.de
- SEP 17 – 19** ISCS'08 – INT. SYMPOSIUM ON CLEAN STEEL, Anshan, China; www.csm.org.cn/iscs08/en
- SEP 17 – 19** 3rd INT. SPECIALIZED EXHIBITION "HEAT TREATMENT – 2009," Moscow, Russia, Expocentre Fairground, Pav. 6YZYZYZY
- SEP/OCT 28 – 02** IAS2008 – 1st INT. CONF. ON INTERSTITIALLY ALLOYED STEEL, Pohang, Korea
www.ias2008.Org
- SEP/OCT 30 – 02** ENVIROMINE 2009, Santiago de Chile, Chile
- OCT 04 – 10** CONAC 2009, Monterrey, Mexico, Convex Center
www.aistmexico.org.mx
- OCT 05 – 10** EMO MILANO 2009, Milano, Italy
www.emo-milan.com/eng/home.cfm
- OCT 07 – 10** INSTITUTE OF ROLL DESIGN CONFERENCE, Cleveland, USA; www.ird.net
- OCT 12 – 14** NORTH AMERICAN STEEL CONFERENCE, Chicago, USA, The Fairmon Hotel; www.cruevents.com
- OCT 13 – 15** CONTINUOUS CASTING – A PRACTICAL TRAINING SEMINAR, Charleston, USA; www.aist.org
- OCT 14 – 16** IFAC Workshop on Automation in Mining, Mineral and Metal Industry – IFACMMM2009, Viña del Mar, Chile, Sheraton Miramar Hotel
www.ifacmmm2009.com/evento_2009
- OCT 14 – 17** MINING INDONESIA 2009, Jakarta, Indonesia
- OCT 19 – 22** SMRP 17th ANNUAL CONFERENCE, St. Louis, USA
www.smrp.org
- OCT 19 – 23** The 5th International Congress on the Science and Technology of Ironmaking (ICSTI'09), Shanghai, China; www.csm.org.cn/icsti09/en
- OCT 20 – 22** STAINLESS STEELMAKING & CASTING SPECIALTY TRAINING CONFERENCE, Pittsburgh, USA
www.aist.org
- OCT 20 – 22** CHINA MINING Congress and Expo: Global Mining Gathering to Discuss the Big Concerns, Tianjin, China; www.china-mining.com
- OCT 21 – 23** 2009 INT. SYMPOSIUM ON LIQUID METAL PROCESSING & CASTING, Santa Fe, USA
www.tms.org/meetings/meetings.asp
- OCT 25 – 27** ILAFA 50, Quito, Ecuador, Swissotel; www.ilafa.org
- OCT 26 – 29** AIST'S STEEL PROPERTIES & APPLICATIONS CONFERENCE + MS&T'09 – The Materials Science & Technology Conference & Exhibition, Pittsburgh, USA, David L. Lawrence Convention Centre
www.aist.org
- OCT 27 – 30** 46th ABM ROLLING AND PROCESSING SEMINAR, Santos, SP, Brazil, Mendes Convention Center
www.abmbrasil.com.br/seminarios
- OCT 07 – 09** 13th ABM AUTOMATION SEMINAR, Minas Gerais, Brazil; www.abmbrasil.com.br/seminarios
- NOV 03 – 06** China Coal & Mining Expo 2009, Beijing, China
www.chinaminexpo.com
- NOV 09 – 12** FLOTATION 2009, Cape Town, South Africa
- NOV 09 – 12** 17th IAS STEELMAKING CONFERENCE & 7th IAS IRONMAKING CONFERENCE, Rosario, Argentina
www.siderurgia.org.ar
- NOV 10 – 12** STAINLESS STEEL WORLD CONFERENCE, Maastricht, Netherlands; www.stainless-steel-world.net
- NOV 10 – 13** 15th INT. INDUSTRIAL METAL-EXPO 2009, Moscow, Russia, Crocus Expo Int. Exhibition Center



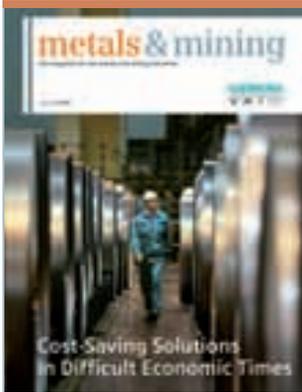
The next issue of metals & mining ...

Focus on Plant Modernizations and Long Products

Now is the right time to get your plant into shape to be ready for the next market upswing. With targeted modernizations of mechanical and electrical components, combined with the installation of new automation and technology packages, metals producers can maximize the performance potential of existing facilities at relatively low costs along the entire iron and steel production chain.

Roughly half of all steel produced is used in the long-product sector in the form of steel bars, wire, profiles, structures, supporting beams, tubes, pipes and sections, etc. Major investments in infrastructural facilities by governments worldwide are anticipated to jumpstart the economy and to get business “back to usual.” Greater demands will therefore be placed on all plant facilities related to the manufacture of long products, including electric arc furnaces, secondary metallurgical facilities, billet and bloom casters, the subsequent rolling mills, tube, pipe and section mills in addition to optimized production logistics within complete minimill complexes. There will be the need to improve production scheduling, operational flexibility, product quality, plant reliability and just-in-time delivery.

The next issue of metals & mining focuses on the above topics and presents the latest solutions and plant examples from Siemens VAI in these fields.



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To keep you informed about the latest developments, innovations, start-ups, events and other newsworthy items from the world of Siemens VAI, a new e-mail-based company newsletter will appear shortly. The announcements will complement the articles and topics appearing in metals & mining and will include links to enable readers to access additional information. If you would like to receive this newsletter (currently planned for several times a year), you are most welcome to sign up at the following link:

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