



INDIAN STEELWORKS

CURRENT DEVELOPMENTS AND TRENDS

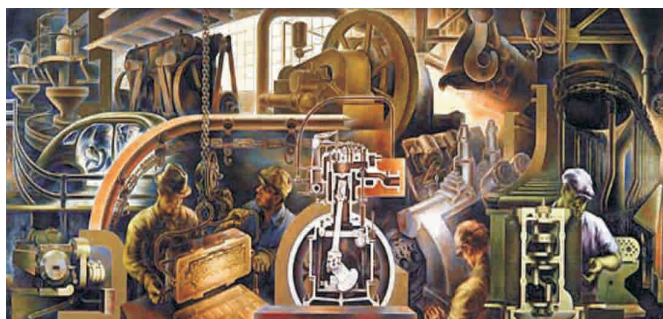
The Indian economy is characterized by an environment of confidence, positive business expectations, a renewal of rule-based fiscal consolidation, stable and orderly financial markets and institutions, and positive integration within the global economy. After making headlines as the "software smithy of the world" in recent years, India now possesses a Steel industry that is the focus of international attention. However, global concerns such as environmental protection will have to be taken into consideration in any future investments.

The Steel industry throughout the world is still growing steadily. This year, for example, the global demand for Steel will grow by seven per cent and, next year, the International Iron and Steel Institute (IISI) is expecting a further six per cent rise. More than half of the finished Steel products are bought and used in Asia and this, of course, has consequences for the Indian Steel industry. Foreign Steel corporations as well as domestic investors are planning large-scale projects in India - not least with a view to the rich deposits of raw materials, a factor which favors local processing and smelting. At the same time, the existing plants, some of which have been operating since the 1970s, need to be brought up to date with the latest state of the art. Improvements in the individual production stages, enhancement of process flows, cut-backs in the total energy requirement as well as the reduction, recovery and utilization of recyclable materials, not to mention environmental protection, all require special attention.

Equipped for the markets of the future: Steel for the automotive industry

At the moment, a large proportion of the products are needed on the buyer side in order to improve India's infrastructure. This step-by-step improvement in India's infrastructure will then

give a boost to the automobile industry. India is regarded as the fifth largest market for motor vehicles and all large automotive manufacturers already have branches in the country. Although automotive applications only account for around nine per cent of total worldwide steel consumption, this segment is seen as the motor of innovation. In addition to the preconditions that have to be provided for these needs in steelworks and hot rolling mills, further investment in the production chain will be a consequence: cold rolling mills must process ever larger quantities while maintaining the high quality of the product. In the last few years, Siemens VAI has equipped cold rolling greenfield plants - mostly pickle line tandem cold mills (PLTCM) - for important producers in Europe (ThyssenKrupp Steel, SSAB, Arcelor, voestalpine Stahl, and others) and China (Wuhan, Baosteel, Angang) and has also been involved in



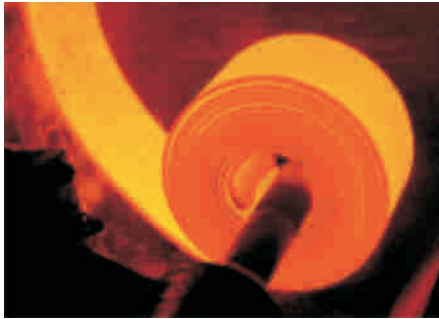
modernization projects of varying sizes. Strip processing lines, especially hot-dip galvanizing lines, also need to be aligned to the requirements of modern car body construction or need to develop the corresponding production capacity. Here, a key role is played by the combination of process automation and modern IT as productivity today can no longer be raised solely by improving individual items of machinery but also requires

comprehensive integration of communication, automation and technologies into factory processes.

Latest technologies in the hot rolling sector

An interesting development is that two "newcomers" have been the first to take the risk of establishing new hot-strip rolling mills.

Bhushan Ltd. in Rengali Jharsuguda, for example, is building a new compact hot strip mill. For the electrical and automation equipment, the operator is placing



its trust in the experience of Siemens, which has equipped 21 of such plants up to now. The same applies to a new conventional hot rolling mill, which Bhushan Steel and Strip Company Ltd. is building in Meramandali. Here, the latest process models and control systems, such as those needed for the production of modern high-strength steel grades, will be supplied by Siemens, as will the microstructure monitor, which has been developed for determining the microstructure of the steel product. Technological process models and control systems also create the basis for ensuring minimum tolerances in respect of thickness, width and strip temperature. Moreover, they guarantee safe and fully automatic plant operation combined with high plant availability.

Examples of modernization projects worth mentioning include the hot strip mill of Jindal South West Steel (JSW) in Toranagallu, where the finishing train was subjected to a complete overhaul. In addition to improvements in the mechanical equipment, the plant was fitted out with six new AC motors, increasing the power output to 31 MW, and a new automation system. The plant started production again in spring 2006.

The development of the Indian infrastructure is leading to a great demand for steel for bridge structures, pipelines, ships and industrial tools. Companies, however, need to have their own rolling facilities in order to produce the heavy plate needed for this purpose. This is why corporations such as Jindal Steel & Power Limited (JSPL), Essar and Welspun invested in new plate rolling mills and ordered all their equipment from Siemens VAI.

In focus: Continuous casting plants

Many continuous casting projects are focused on improving quality and increasing throughput. Tata Iron & Steel Company (TISCO) wants to increase its annual production of low and

medium carbon Steels in its LD factory No.1 in Jamshedpur to one million metric tons. The company is also modernizing its continuous billet caster No. 2. The aim of the conversion is to enable the production of larger formats of 130 mm and 150 mm while speeding up the casting process and producing better quality. To help to achieve this, Siemens VAI is supplying a machine head with Dynaflex oscillators, Diamold fast-casting molds, an electromagnetic stirrer, a mold level control system, the secondary cooling, the strand containment and also the electrical equipment and plant automation system. The CC1, CC2 and CC3 continuous slab casters of the same mill were modernized by Siemens VAI one year ago. Whereas CC1, which was equipped with a curved mold at the time, was converted to a caster with a straight mold by means of a complete re-design of the casting

bow in order to reduce the degree of inclusion of foreign matter in the steel and thus to improve the quality of the slabs, the main focus of the conversion for the two other casters (CC2 and CC3) was on an increase in the casting speed and a resulting growth in productivity.



Environmental protection begins in Ironmaking

Over the long term, Indian steelworks too cannot ignore the need for environmental protection. The fact that environmental protection can be accompanied by cost-effective production is shown by Siemens VAI with the Corex technique. Corex allows low-cost production of high-quality crude Iron without the use of coke and with less effect on the environment. The procedure saves energy because some stages in the process such as coal coking and ore sintering are simply dispensed with. Corex also produces an export gas with a medium calorific value of approx. 7,500 kJ/m³. The purified gas can be used for



power generation in a combined-cycle power plant or elsewhere in the steelworks. At the

moment, there are four Corex facilities in use at various locations around the world, at Jindal South West Steel (JSW) in India, at Posco Pohang Works in South Korea and at Saldanha Steel in South Africa. Start-up of the world's largest Corex installation to date at Baosteel Pudong Iron & Steel Co. Ltd. in Luojing, Shanghai, with an annual capacity of 1.5 million metric tons, is scheduled for 2007. In a further stage of expansion for the steelworks, the installation of a second Corex module of the same size is planned.

In collaboration with voestalpine Stahl, Siemens VAI developed the closed-loop expert system, VAIron. It enables resource-sparing and energy-saving blast-furnace operation and is the world's first system to allow a "look inside" the blast furnace process during operation. From the charge, the chemical composition, the gas flow, the movement of solids and the temperature distribution, VAIron determines what process conditions can be expected and corrects the amount of coke, burden basicity or steam addition, doing so fully automatically without manual intervention. This reduces pollutant emission, the energy required and coke consumption. In a medium sized steelworks, VAIron results in savings of around 30,000 metric tons of coke per year and thus significantly reduces production costs. VAIron is now being used in more than 60 blast furnaces worldwide.

Further efforts being made by Siemens VAI concern the recycling of all Steelworks waste such as dross, dust, sludge, scale, ash and gases. One goal is the efficient recovery of the metal component through oxide reduction and another is the manufacture of better ingoing material (clinker substitute) for the cement industry. In a pilot installation at Vitkovice Steelworks in the Czech Republic, the technical and economic viability of the Zero Waste (ZEWA) process for carbon steel and stainless steel production has been demonstrated successfully.

In a series of sequential treatment stages, Meros (Maximized Emission Reduction of Sintering) removes fine dust and health-damaging metal and organic components from sinter waste gases. In the demonstration plant, the dust content in the waste gas is below 5 mg/Nm³, up to 95 per cent of heavy metals are removed and up to 98 per cent of the dioxines and furanes is eliminated. The degree of desulphurization when slaked lime is used may reach 80 per cent and, with sodium bicarbonate, is even over 90 per cent.

Siemens VAI - Completely Integrated Solutions for tomorrow's plants

As the world's largest supplier of solutions in this field, Siemens VAI enjoys technological leadership through its innovations in all stages of Iron and Steel production. This is made possible by the experience that flows back from

worldwide projects and by Siemens VAI's high expenditure on research and development. A driving force is also Siemens VAI's own personnel as well as a network of universities and operators which ensures practical viability. In addition to all this, the corporate research department of Siemens provides a constant supply of ideas from the cutting edge of research. Worthy of mention in this connection are the excellent strip-cooling model based on Gibbs free enthalpy, the Siflat flatness control system and the microstructure monitor. When creating practical solutions from ideas, Siemens VAI proceeds according to an internal standardization process as well as the concept of Completely Integrated Solutions (CIS), based on the idea of lifecycles. The resulting platform strategy ensures the required flow-back of experience and forms the basis for superior technological solutions which shorten project completion times, reduce project costs and enable plants to be built in the shortest possible time. In this way, Siemens VAI guarantees rapid start-up of the installations and minimum stoppages during conversions.

Siemens VAI is continuing its 160-year tradition in the area of Iron and Steel. One of the largest technology-oriented turnkey solutions suppliers in the world has been created as a result of the link-up between the Siemens Industrial Solutions and Services (I&S) Group, with its platforms for electrical and automation solutions, and Voest-Alpine Industrieanlagenbau of Austria, with its competence in metallurgical plant construction and its strengths in iron and steel making. A glance at recently started projects reflects this. For example, Siemens VAI is supplying a new turnkey high-output hot strip mill for Mittal Steel in Cracow, Poland. Recent orders from voestalpine Stahl, Corus, Dragon Steel and Evrazholding underline the confidence that the industry has in the combined company.



Forthcoming Events

- ▶ **Metalex 2007**
15-18 November,
Bangkok, Thailand.
- ▶ **7th Asian Steel Conference**
7-8 December, 2007
The Leela, Mumbai
- ▶ **2nd Gulf Iron & Steel Conference**
21-22 January, 2008
Expo Centre, Sharjah, UAE