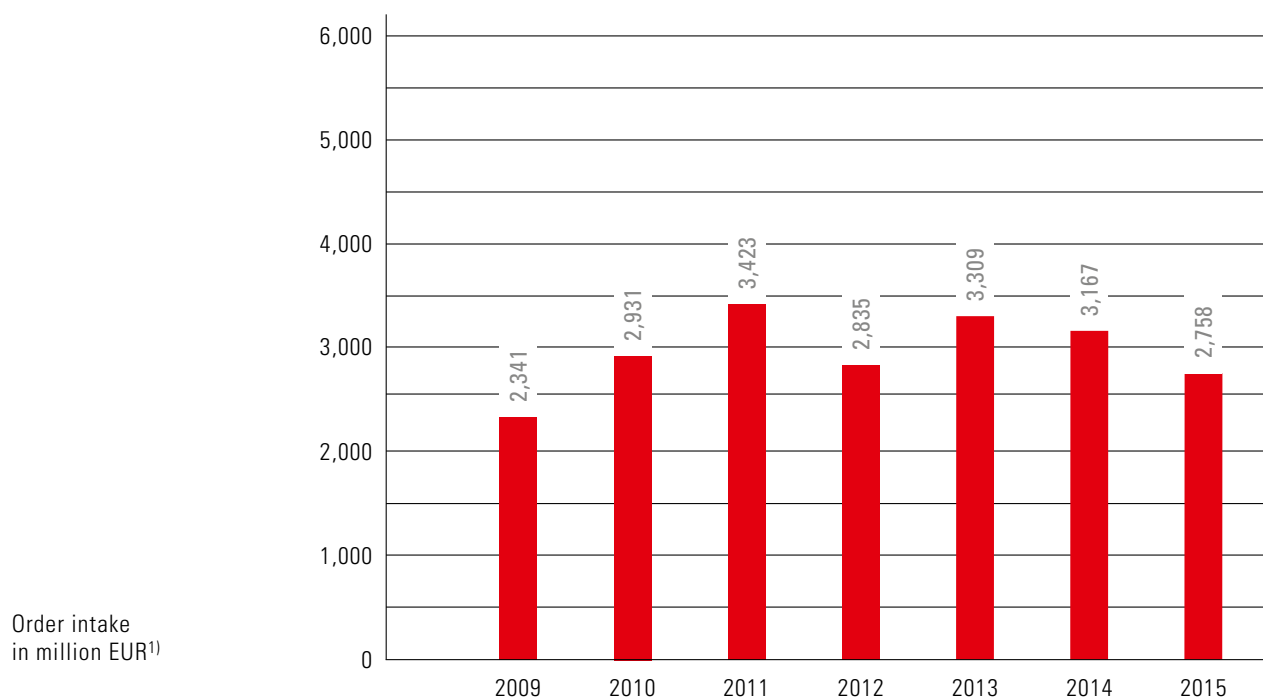




## FIGURES of the SMS group



<b>SMS group in million EUR<sup>1)</sup></b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
Order intake	2,341	2,931	3,423	2,835	3,309	3,167	2,758
Sales	3,891	3,036	3,070	3,237	3,495	3,406	3,310
Order backlog	4,641	4,460	4,862	5,377	4,997	4,613	4,018
Employees <sup>2)</sup>	9,001	9,209	10,477	11,822	13,856	14,003	14,342

Figures in accordance with International Financial Standards (IFRS)

<sup>1)</sup>Including Other/Consolidation.

<sup>2)</sup>Year average with apprentices/other.

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# EXECUTIVE SUMMARY

## GLOBAL ECONOMY

The development of the global economy in 2015 fell short of expectations. Supported by the quantitative easing policies of most central banks, global growth reached just 3.1%, slightly below the previous year's level.

## THE STEEL AND ALUMINUM MARKET

Global overcapacities and stagnating demand impacted negatively on global raw steel production (1.62 billion t; -2.8% compared to 2014). China – by far the world's largest steel producer – saw a slight downturn (-2.3%). Due to stagnating domestic demand, China increased its steel exports to 112 million tons (+20% compared to 2014).

Production slumped in the USA (-10.5%). India expanded production by 2.6% to 89.6 million t, while production in Russia declined by 0.5%.

Production within Europe dropped by 3.2%. Inevitably, the rapidly increasing imports of cheap steel from China combined with a further price drop also depressed the profits of European steel producers. That has led to more calls for trade protection measures in the EU.

Global primary aluminum production increased by 9% to 57.9 million tons. This included over-proportional growth in China of +15% and in the other Asian countries of +24%. In Western Europe, there was moderate growth of 4%.

## MARKET SITUATION IN PLANT CONSTRUCTION

The market situation for metallurgical machine and plant construction proved even more difficult in 2015. Average capacity utilization of steel producers dropped to below 70%. Worldwide overcapacities and reduced margins not only mean that willingness to invest is low among steel producers, but they are also driving price competition between plant manufacturers. Furthermore, the crisis in Eastern Europe as well as low oil and gas prices are dampening willingness to embark on major projects.

However, there remains high potential for modernizations of existing plants that offer customers a rapid return on investment. That also applies to green technology solutions, which are becoming increasingly important. Cooperating with partners has helped us focus ever more on developing and building plants for nonferrous metals. To fulfill our role as a leading supplier and respond quickly and flexibly to our customers' requirements in the field of digitization, we established our own start-up company. This is dedicated to developing digital products and business models in a direct dialog with our customers.



Eckhard Schulte,  
Vice Chairman

Burkhard Dahmen,  
Chairman and CEO

The number of projects for new plants continues to decline. However, the political and economic opening up of Iran will lead to a number of shelved projects being realized there in the coming years. Just one year after signing a licensing contract with Kobe Steel Ltd., Japan, for the construction of Midrex® direct reduction plants, Paul Wurth landed its first order for a reference plant in Algeria. We expect further major projects for direct reduction plants in this region.

Our two logistics subsidiaries CTI Systems S. A., Lentzweiler/Luxembourg, and SMS Logistiksysteme GmbH, Netphen, will merge to form one larger business unit. It's a move designed to expand our business on the growing market for logistics applications in the aviation industry (e. g., airfreight and aircraft maintenance).

## **ADJUSTMENT TO ALTERED MARKET CONDITIONS**

Going beyond our already resolved cost-reduction and efficiency-boosting program, we will also adjust our capacities in new plant business globally to the much lower market volume. This gives us the opportunity to more rapidly expand our capacities in the lucrative service sector.

Our ongoing cost-saving program is on schedule.

## **FUTURE PROSPECTS 2016/FORECAST**

Our main markets remain China, India, Southeast Asia, the MENA region, the US, and Europe. Considering high overcapacities and weak growth in demand, we do not anticipate a noticeable recovery in new plant business before 2018.

Global geopolitical risks are additionally unsettling steel companies and holding back investments.

So, under these conditions, the group's success rests essentially on its flexibility. The backbone of our corporate strategy remains the development of market-leading technological solutions that offer our customers the maximum benefits. The current market situation and capacity utilization status demand even more flexible adjustments within the group. Simultaneously, we are increasingly diverting our capacities to the attractive markets for new nonferrous metals plants as well as technical services for customers.

That's why our strategic targets this year include continuing and intensifying our cost-cutting and efficiency-boosting program as well as adjusting our capacities to the changed market situation. Simultaneously, we will continue to vigorously expand service business.

We expect order intake to remain at the previous year's level. Due to a dwindling order backlog, the level of sales will be lower.

Yet we anticipate a moderately improved pretax profit due to implementation of our restructuring activities.

## ORDER INTAKE

Order intake by the group in the last business year amounted to EUR 2,758 million. This was EUR 409 million below the previous year's figure (2014: EUR 3,167 million).

In metallurgical plant construction, we attracted orders worth EUR 2,476 million (2014: EUR 2,921 million), or EUR 445 million below the previous year. Whereas plant business decreased to EUR 1,882 million (2014: EUR 2,406 million), our service business grew to EUR 594 million (2014: EUR 515 million).

elexis/Elotherm reported a slight increase to EUR 295 million (2014: EUR 260 million).

## SALES

Sales totaled EUR 3,310 million, roughly the same level as the previous year (2014: EUR 3,406 million). That means we almost achieved our forecast of matching the previous year's sales.

This is how SMS group sales broke down according to global regions:

- Europe including Russia: 36% (2014: 32%)
- Asia: 33% (2014: 45%)
- America: 29% (2014: 22%)
- Africa: 2% (2014: 1%)

## ORDER BACKLOG

Due to the lower order intake, our order backlog fell short of the previous year's level, reaching EUR 4,018 million (2014: EUR 4,613 million).

## EMPLOYEES

The average number of employees<sup>1)</sup> increased by 339 to 14,342 (2014: 14,003).

The continuous expansion of our service business resulted in increased capacities in this area from 1,774 to 2,385 employees, especially in our foreign service companies.

## RESULT

In business year 2015, SMS group attained a net result of EUR 7 million (2014: EUR 31 million). The net operating margin was 0.2% (2014: 0.9%).

The equity ratio in 2015 amounted to 18.4% (2014: 19.1%).

## LIQUIDITY

Compared to the previous year, liquid assets were up by EUR 40 million to EUR 972 million (2014: EUR 932 million).

In addition to liquid assets totaling EUR 972 million, we also hold securities from current assets to a market value of EUR 551 million. After deduction of financial liabilities of EUR 168 million, this results in net liquidity of EUR 1,355 million (2014: EUR 1,492 million).

## INVESTMENTS

Expenditure for investments in business year 2015 totaled EUR 65 million (2014: EUR 77 million). This investment volume mainly went into expanding our workshops worldwide as well as expanding and modernizing existing IT systems and workshops in Germany.

According to our plans, the investment volume in 2016 will match the previous year's level. Our focus here is on modernizing IT as well as investing in replacement machines. More individual investments will go into further expansion of our global service workshops.



Burkhard Dahmen



Eckhard Schulte

<sup>1)</sup> Average for the year, including apprentices.



## **DEAR BUSINESS PARTNERS AND FRIENDS,**

We still find ourselves in the headlock of a crisis in the steel industry that has lasted for years. Overcapacities on the global market, estimated at some 30%, result in a surplus of steel products, leading to declining prices. As a result, our customers' profits are shrinking and many steel companies are making substantial losses.

All this means investment in new plants has almost stopped, so that our business is mainly confined to modernizations, above all in the field of electrics and automation. Even though we are expanding our range of services, this is not enough to fully utilize our engineering and workshop capacities.

There is also weak demand on our markets outside the steel industry, in aluminum production, and general mechanical engineering.

We have pursued a strict cost-cutting and efficiency-boosting program for several years. Included here was streamlining our organization by merging the formerly independent business units SMS Siemag and SMS Meer to create SMS group. Nevertheless, our divisions and product units remain decentralized and responsible for their own markets and products.

We are further increasing our efforts in research and development to defend or expand our technological leadership in many fields.

Order intake has been too low for years. Inevitably, that results in fewer orders in hand. This is forcing us, for the first time in fifteen years, to significantly reduce our workforce. We are mitigating the social hardship this causes by offering early retirement, redundancy payments,




and social plans. Essential for us here is that employee expertise built up over decades is systematically transferred to younger colleagues.

The group's financial structure remains solid. Both equity and net liquidity are adequate. Due to our cost-cutting efforts and reduction of overcapacities, we expect improving results for the next years.

We would like to thank our longstanding employees for their loyalty to the company. As family shareholders, we are committed to making our own contribution as well. That's why we transferred all the shares in our family holding to a family foundation at the beginning of the year. This move is designed to ensure the independence and cohesion of our group – now and in future as well.

We will continue to make every effort to earn the trust of our business partners. That's the foundation of our business. Our mission – as always – is to remain the preferred partner for plant and machinery construction in the steel and aluminum industry.

A handwritten signature in black ink, appearing to read 'Heinrich Weiss', written in a cursive style.

Heinrich Weiss  
Chairman of the Shareholders' Committee

# STRUCTURE OF THE **SMS GROUP**

The SMS group GmbH is a group of global players in machinery and plant construction for steel and nonferrous metals processing.

## IRONMAKING AND DIRECT REDUCTION PLANTS

## METALLURGICAL PLANTS AND ENVIRONMENTAL TECHNOLOGY

### COKE OVEN AND SINTERING PLANTS

- Coke oven plants
- Coke oven batteries
- Coke oven auxiliary plants
- Coke oven automation and control
- Coke handling machines
- Sintering plants
- Sinter cooling
- Sinter off-gas cleaning (EFA™)
- Environmental protection technologies for the metals industry
- Steelmaking by-product recycling plants

### BLAST FURNACE PLANTS

- Blast furnace construction and modernization
- Stockhouse and charging systems
- Blast furnace top charging systems
- Blast furnace proper design
- Blast furnace lining and cooling
- Hot blast stoves and energy recovery
- Blast furnace gas cleaning systems
- Furnace automation and control systems
- Coal grinding, drying, and pulverized coal injection plants
- Tapping and measuring technology
- Slag granulation
- Pig casting machines

### METALLURGICAL AND STEEL MAKING TECHNOLOGY

- Reduction furnaces
- Converters
- Electric steelworks
- CONARC® furnaces
- Ladle furnaces
- Pretreatment
- Secondary metallurgy
- Tertiary metallurgy

### CONTINUOUS CASTERS

- Continuous casting technology for slabs
- Continuous casting technology for blooms, billets and beam blanks
- CSP® technology/USP® technology
- BCT® plants

### ENVIRONMENTAL TECHNOLOGY

- Dedusting plants
- Filter and environment protection plants
- Energy recovery technology

### DIRECT REDUCTION TECHNOLOGY

- Midrex® direct reduction plants
- Rotary hearth furnaces

## FLAT ROLLING PLANTS

## LONG PRODUCTS PLANTS

### HOT ROLLING MILLS

- Steckel rolling mills
- Heavy plate mills
- CSP® technology/USP® technology
- Filter and environment protection plants
- Water supply systems
- Logistics systems

### ALUMINUM PLANTS

- Hot strip rolling mills
- Tandem cold rolling mills
- Individual stands
- Thin strip stands
- Shear and slitting equipment
- Filter and environment protection plants
- Logistics systems

### TUBE AND PIPE PLANTS

- Seamless tube plants
- Welded tube plants
- Large-diameter pipe plants (LSAW)
- Spiral pipe plants (SSAW)
- Finishing lines
- Technologies

### SECTION AND BILLET MILLS

- Heavy section mills
- Medium section mills
- Blooming mills
- Billet mills
- Large bar mills
- Rail mills

### BAR AND WIRE ROD MILLS

- Combined bar and wire rod mills
- Rebar mills
- Wire rod mills
- Merchant bar mills
- SBQ bar mills
- VCC® lines
- Coil handling systems

### BRIGHT STEEL LINES

- Drawing machines
- Peeling machines
- Straightening machines
- Grinding and polishing machines

### COLD ROLLING MILLS

- Tandem cold rolling mills
- Reversing rolling mills
- Skin-pass mills
- Multi-roll mills
- Filter and environment protection plants
- Logistics systems

## PROCESSING LINES AND FURNACE TECHNOLOGY

## FORGING PLANTS

## ELECTRICAL AND AUTOMATION SYSTEMS

### STRIP PROCESSING LINES

- Pickling lines
- Hot-dip galvanizing lines
- Annealing lines
- Anodizing lines
- Coating lines
- Annealing and pickling lines for stainless steel
- Shear and slitting equipment
- Regeneration, filter, and environment protection plants

### FURNACE TECHNOLOGY

- Furnaces for heat treatment of steel and NF metals
- Cooling systems for heat treatment of steel and NF metals
- Furnaces for heat treatment CSP® technology/ USP® technology
- Heating furnaces

### FORGING PLANTS AND PRESSES

- Open-die forging presses
- Closed-die forging presses
- Powder presses
- Radial forging machines
- Wheel rolling machines
- Forging rolls
- Ring rolling machines
- Forging manipulators
- Extrusion presses
- Special presses

### ALUMINUM PLANTS

- Smelting and casting furnaces
- Casters – Vertical – Horizontal
- Continuous homogenization plants
- Chamber homogenization plants
- Ingot scalpers
- Band saws
- Brazing machines
- Plate stretchers

### COPPER PLANTS

- Anode casting wheels
- CONTIROD® plants
- directube® plants
- VERTICAST® plants
- Straighteners
- Drawing plants
- Inner grooving lines

### GENERAL SOLUTIONS

- Production planning systems (PPS)
- Energy advisor
- Plant condition advisor
- New plant operation concept
- Holistic solution for the operating areas
- Web based reporting
- Wireless LAN operation
- Upgrade package
- Virtualization

### Complete Solutions for

- Blast furnaces
- Steel plants and submerged arc furnace
- Continuous casting plants
- Hot rolling mills
- Cold rolling mills
- Aluminum hot and cold rolling mills
- Strip processing lines

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## PRODUCTION

## TECHNICAL SERVICE

## PARTICIPATIONS

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### WORLDWIDE PRODUCTION FACILITIES

- Germany
  - Hilchenbach
  - Mönchengladbach
- China
  - Shanghai
- India
  - Bhubaneswar

### SPARE PARTS AND LOGISTICS

- OEM spare parts
- Spare parts management
- eService
- Warehousing

### UPGRADES AND MODERNIZATION

- Value added components
- Mechanical, hydraulic and electrical systems
- Automation equipment

### ELEXIS

- Strip and web-guiding systems
- Quality assurance systems
- Drive technology
- Automated handling systems plastic

### MAINTENANCE AND REPAIRS

- Trouble shooting
- Maintenance service
- Condition monitoring
- Equipment checks

### CONSULTING AND TRAINING

- TECademy
- Fact finding
- Maintenance audits

### ELOTHERM

- Hardening machines
- Inductive heating plants
- Laser exposure systems
- Inductive tube welding
- Inductive seam annealing
- Quench and temper lines



## TECHNOLOGIES FOR IRONMAKING

- Repair and revamp strategies for improved energy efficiency and environmental protection
- Efficient solutions for coke oven gas treatment help comply with stricter emission regulations
- Order for world's largest direct reduction plant in Algeria
- Further expansion of our service business







## ECONOMIC CLIMATE AND KEY FIGURES

As before, the steel industry is still struggling with overcapacities and cheap imports from China. The continuing price pressure on the global market is stifling steel producers' willingness to invest. Despite this extremely gloomy and volatile business climate, 2015 was a satisfactory year for the Paul Wurth group.

## PIG IRON PRODUCTION

Considering this difficult market situation, hardly any new production plants will be built now or in the near future. That means steel producers are mainly investing in the repair and modernization of existing plants. Their aim is to either reduce overheads or meet ever-stricter environmental protection requirements. Very often, these two goals go together. The blast furnace revamp programs developed by Paul Wurth respond to today's needs and offer integrated solutions for better energy efficiency, increased environmental protection, and improved process control.

Especially on the European market, the Paul Wurth group landed a series of projects in 2015. This was largely due to the company's own technologies and outstanding know-how. Leading customers were Ilva Taranto in Italy, HKM, Salzgitter, and Rogesa in Germany, Tata Steel in the Netherlands, and ArcelorMittal in Dunkirk, France, and Ostrava, in the Czech Republic.

Although the crisis in Ukraine and corresponding sanctions against Russia continue to impact negatively on trade relations with both countries, the Paul Wurth group succeeded in booking commercial successes in both regions in 2015. Similar to coking plant business, the market in Japan also developed very positively in 2015. This success is in particular attributable to the efforts of the joint venture Paul Wurth IHI Co., Ltd. The company acquired two



Dr.-Ing. Guido Kleinschmidt,  
Member of the Managing Board,  
SMS group GmbH

### Paul Wurth Managing Board

Georges Rassel, CEO  
Dr.-Ing. Thomas Hansmann, COO & CTO  
Frank Wagner, CFO

projects for coal dust injection plants in Japan for the first time.

Included in the major project category, Ilva's Blast Furnace No. 1 in Taranto (Italy) was successfully run up in August 2015 after a complete modernization. We also successfully completed many other modernization orders for equipment and plants in the reporting year (bell-less top charging systems, slag granulation plants, and gas cleaning plants).

Especially worth mentioning is that the Paul Wurth group attracted an order from Turkish steel producer Tosyali Holding for the engineering and construction of the world's largest combined direct reduction plant in Algeria. This came just under one year after signing a license agreement with Midrex® Technologies for the construction of Midrex® direct reduction plants.

## COKING PLANT TECHNOLOGY

Paul Wurth booked further success with coking plants, which consolidated its market position in 2015, especially on the difficult-to-crack Japanese market. Both NSSMC in Kashima and JFE in Kurashiki contracted Paul Wurth with the design, supply of core components, and commissioning supervision for two coke oven batteries each.

Also in the newly added area of coke oven machines, the group achieved commercial successes in Japan and Brazil last year.

**Late in 2015, Paul Wurth also set a first milestone in coking plant technology in China.**

Shandong Province Metallurgical Equipment awarded the group a contract for the engineering construction supervision of four large-volume batteries. Each battery consists of 58 ovens with a height of 7.3 meters. They are destined for the new coking facility at the Rizhao location.

As a complete supplier of coking plant technology, the group offers a portfolio that also features efficient solutions for coking oven gas treatment. One example is the successful start-up of the new coking-oven gas decarburization system smoothly commissioned in July 2015 at ArcelorMittal Méditerranée's plant in Fos-sur-Mer, France. Now our customer can meet the strict environmental requirements for sulfur emissions as well as improving the overall eco-balance of its coking facility.

## **AGGLOMERATION AND GREEN TECHNOLOGY**

Ever since 2014, when Paul Wurth attracted the order to build a new sinter plant for Bhushan Power & Steel in Rengali, India, the project has been progressing steadily. Paul Wurth is responsible for engineering, supply of core components, and assembly/commissioning supervision of a complete plant including material preparation, exhaust heat utilization, and automation. The facility is designed for an annual production of 4.8 million tons of sinter. Once finished, this plant will stand as a perfect reference for cutting-edge sintering technology that meets high standards of eco-friendliness and energy efficiency.

Thanks to the expertise of an extended team of experts plus in-house development work, the Paul Wurth group will not only consolidate its position

as a technology supplier to sinter plant operators. It will also expand its activities in agglomeration technology to cover pelleting processes and the relevant plants.

## **SERVICE**

There was a very positive expansion of service business in 2015. This segment contributed some EUR 90 million to the total volume of new orders. Especially impressive here is that customers can access a range of innovative designs and ingenious solutions. Included here are comprehensive repair packages in case of stoppages, hot repairs of coking oven batteries or recuperators, plus special repairs to blast furnace frame refractory linings.

The foundation of Paul Wurth do Brasil Montagens e Manutencao Ltda provides our customers in Brazil with a competent team of experts for preventive repairs and maintenance of blast furnaces, coking plants, sinter plants, and all auxiliary equipment.

## **INNOVATION AND GROWTH INITIATIVES**

Innovation is essential for a technology company that wants to maintain its competitive edge and meet market demands as well as customer expectations. Ongoing R&D projects are tackling issues such as feeding hot coking gas into the blast furnace shaft, developing a new burner system for recuperators, and various applications using microwave heating. The reporting year also saw a continuation of lab experiments on the hydro-metallurgical treatment of furnace sludge using Ciroval™ technology.

To reduce Paul Wurth's dependence on the steel industry, the company is keen to apply its expertise in other industries. That is why it launched a new division in early 2016. This offers the oil and gas industry modern solutions for special fittings used in refinery technology.



Furthermore, Paul Wurth aims to sign cooperation agreements that will give it access to the field of locally generated energy. Finally, the “Paul Wurth InCub” program is designed to support young, innovative start-ups in implementing and developing projects.

## **FUTURE PROSPECTS**

Considering the current weak economic situation, our group’s success rests essentially on its flexibility and talent for adjusting to changing framework conditions. The management took steps in good time to establish our group as a leading, global player

capable of providing even better and more efficient services to our customers. There is a permanent focus on developing market-leading technology solutions that meet customer expectations. They form the backbone of the corporate strategy. Equally significant is implementing better allocation of available resources within the group as well as assigning capacity to attractive markets and industries. Our group is confident it can continue to create added value for its customers and shareholders.

## MAJOR ORDERS

### TECHNOLOGY FOR PIG IRON PRODUCTION

- Tosyali, Algeria; engineering, supply, and construction site supervision for construction of a Midrex® direct reduction plant
- ILVA, Italy; engineering, supply of core components, and construction site services for the revamp of blast furnace No. 5
- Rogesa, Germany; core components for the relining of blast furnace No. 4
- HKM, Germany; turnkey gas cleaning plant on blast furnace B
- ArcelorMittal Kryviy Rih, Ukraine; construction of a new recuperator on blast furnace No. 9
- Evraz ZSMK, Russia; recuperator on blast furnace No. 2
- NSSMC, Japan; turnkey general overhaul of coal dust injectors in two plants
- NSSMC, Japan; engineering, supply, and construction site supervision for construction of coke oven battery 2E
- JFE, Japan; engineering, supply, and construction site services for the modernization of coke oven battery 2A-B, including coke oven machines
- Shandong Rizhao, China; engineering and supervision services for construction of the new coke oven battery 3.2

### CTI SYSTEMS S. A.

- Middle East; construction plant for small and large-volume aircraft including all crane and docking systems as well as warehouse and materials management systems, and software
- STTS, France; 12 telescopic platforms for aircraft coating hall
- Polimeks Construction, Turkmenistan; fully automated logistics center for airfreight terminal
- Premium Aerotech, Germany; salt bath plant for thermal processing of aircraft parts

### URBAN DEVELOPMENT, CONSTRUCTION, AND INFRASTRUCTURE PROJECTS (PAUL WURTH GEPROLUX)

- Luxtram, Luxembourg; general coordination and planning for a new tramway (consortium)
- DB International, Germany; technical engineering for the construction of an ICE maintenance hall (follow-up order)
- Tuntingen municipality, Luxembourg; building technology for construction of a new firefighting station
- Sanem municipality, Luxembourg; project management for construction of a special-needs school
- Trilogie, Luxembourg; building technology and construction site supervision for multifunctional building

## COMMISSIONING PROJECTS

### TECHNOLOGY FOR PIG IRON PRODUCTION

- ILVA, Italy; relining of blast furnace No. 1
- ArcelorMittal Atlantique et Lorraine, France; bell-less top charging system and gas cleaning on blast furnace No. 2
- Voestalpine, Austria; revamped recuperator A2 on blast furnace A
- Salzgitter Flachstahl, Germany; coal grinding, drying, and injection plants on blast furnaces A & B
- Tata Steel, India; coal dust injection plant on blast furnace H
- Bhushan, India; coal dust injection plant on blast furnace No. 2
- RINL Vizag, India; coal dust injection plant on blast furnace No. 3
- ArcelorMittal Ostrava, Czech Republic; sinter plant and casting shop dust extraction
- Tata Steel, Netherlands; three condenser towers for slag granulation plant on blast furnace No. 7
- ArcelorMittal Mediterranee, France; coking gas desulfurization plant

### CTI SYSTEMS S. A.

- KUMZ, Russia; high-rack store including cooling strategy for aluminum coils
- Avery Dennison, Luxembourg; expansion of a high-rack store for foil coils

### URBAN DEVELOPMENT, CONSTRUCTION, AND INFRASTRUCTURE PROJECTS (PAUL WURTH GEPROLUX)

- Luxembourg railroad company CFL; new maintenance hall in Luxembourg-Howald (technical planning services)
- Luxembourg railroad company CFL; two new control centers in Luxembourg and Bettemburg (project management and technical building planning)
- Niederaanven municipality, Luxembourg; "Maison Relais" child daycare center (project management)
- Fonds Kirchberg, Luxembourg; Brigade Kirchberg – offices for road construction administration (project management)



## PERFECT MONITORING

**Implementing BFXpert® from Paul Wurth, operators increase reliability and cut costs. The automation package monitors all processes.**

Process models and expert systems are crucial for reducing overheads from blast furnace operation. Applying a suitable model to control the process data and an expert system to evaluate it sustainably supports production.

### Modular automation package

This is where our modular BFXpert® automation package proves its worth. It combines models from various areas of blast furnace operation with an expert system and a rule-based automation interface. What users can expect is better process control based on additional information about the blast furnace process. Equally welcome, plant owners save money due to optimized operation. Furthermore, the automation of routine tasks such as adjusting the charging or controlling the recuperator saves time and standardizes procedures. We have developed special blast furnace thermal regulation models to save fuel. The modular BFXpert® automation package improves blast furnace process control. Automation optimizes blast furnace procedures.



The modular BFXpert® automation system enhances the process control in blast furnace plants.

Moreover, BFXpert® offers extensive interaction options and interconnection of the individual models on a modifiable platform. During development, our experts ensured users can customize their system by modifying existing functions and adding new ones as required.

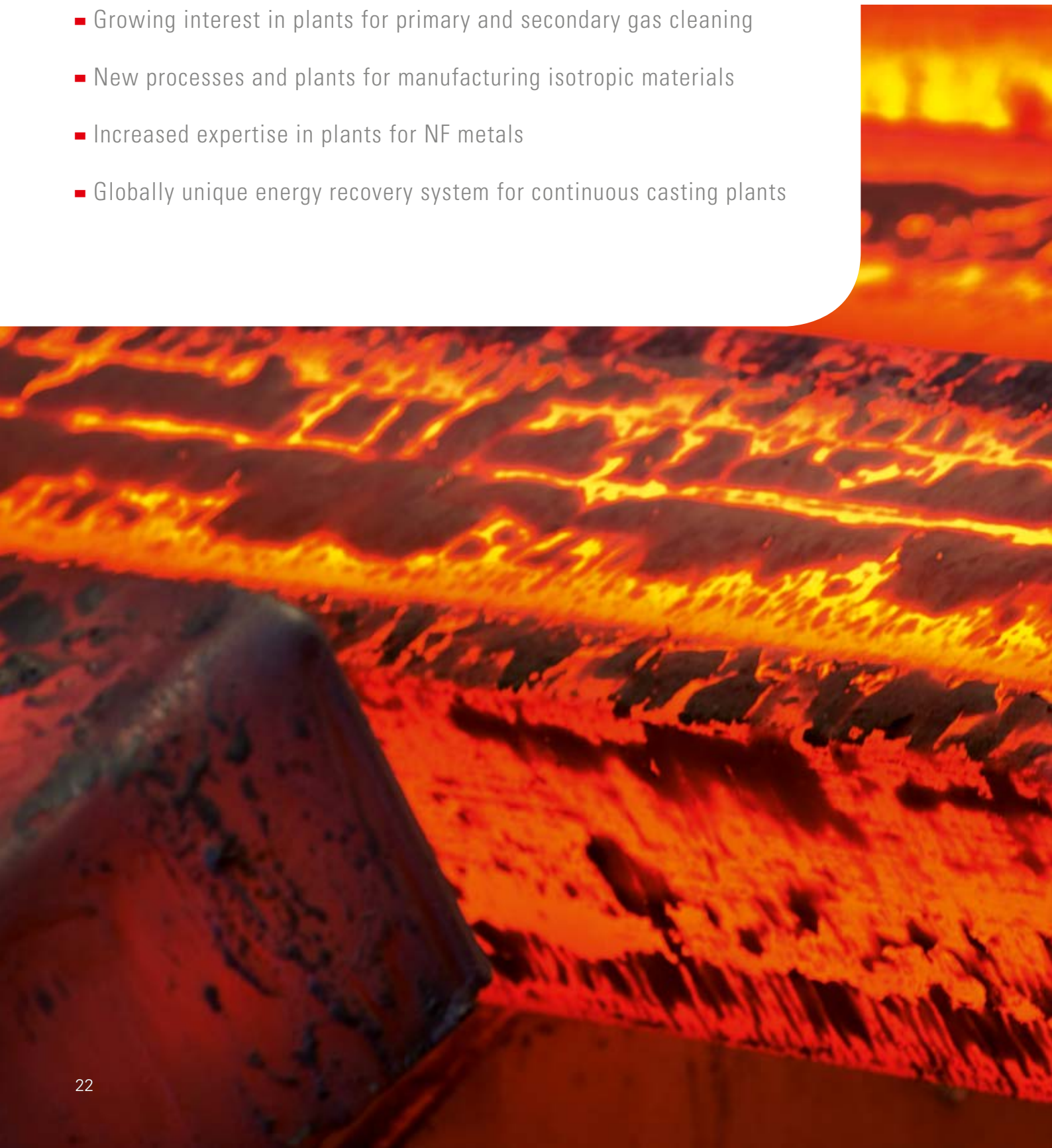
BFXpert® can substantially cut pig iron production costs, paying for itself in approximately six months.

Automation solutions can improve blast furnace operations.



## METALLURGICAL PLANTS AND ENVIRONMENTAL TECHNOLOGY

- Growing interest in plants for primary and secondary gas cleaning
- New processes and plants for manufacturing isotropic materials
- Increased expertise in plants for NF metals
- Globally unique energy recovery system for continuous casting plants





## GENERAL MARKET DEVELOPMENT

Although order intake by the division declined sharply compared to 2014, sales dropped only slightly. The worldwide overcapacity of steel production facilities and the associated price pressure continue to exacerbate the already tense situation of the steel industry.

Projects in 2015 covered all products relating to our division and often required custom, special solutions.

This is illustrated, for example, by an order from Iceland for a turnkey silicon metal plant. Silicon metal is used in a wide range of applications, from the aluminum to the electrical and the solar power industries.

Many customers place a premium on green technology and are also interested in energy efficiency and resource saving. A Chinese customer installed our hydro-hybrid filter systems for dust cleaning in its converter process.

Today as in the past, our customers rely on our expertise in revamps and new plants for converter steelworks. One example is IISCO (Indian Iron & Steel Company), the oldest member of the SAIL Group. Its new converter steelworks will replace outdated production plants in the medium term.

We were able to implement special solutions, in particular in continuous casters for flat products. With our expanded product portfolio and know-how above all relating to special dimensions, we achieved good results once again in 2015. We also presented new plant assistance solutions that create a good basis for generating modernization orders.

Even on today's difficult market, there is strong global demand for continuous casters from SMS Concast. This was proved by successful commissioning projects in countries such as Canada, New Zealand, India, China, Brazil, Mexico, and Turkey.

Whatever products they require, our customers always ask for details of operating expenses (OPEX). There is a growing focus here on equipment reliability.



Dr.-Ing. Guido Kleinschmidt,  
Member of the Managing Board,  
SMS group GmbH

**Heads of the Division**  
Dr.-Ing. Thomas Germershausen  
Michael Rzepczyk

## MARKET POTENTIALS AND STRATEGIES

We expect only a few brand-new investments in 2016. The order volume available on the market is set to shrink further. There will probably be a number of modernization projects, some of a larger magnitude. Overall, we anticipate only a few major projects.

### SUBMERGED-ARC AND SMELTING FURNACES

Recent market development indicates that there is a constant demand for submerged-arc furnaces for the production of silicon/silicon metal. That remains the case despite the current decline in prices for nonferrous metals. Nevertheless, no projects for greenfield plants are in sight.

### ENVIRONMENTAL TECHNOLOGY - ECOPLANTS

Green technology remains a major component of our product portfolio. Our customers' demand for energy-optimized overall plant designs remains consistently high. This means we anticipate strong project activities here in 2016.

The international tightening of emission limits has raised many customers' interest in green technology available for retrofitting – for instance hydro-hybrid systems for primary and secondary gas cleaning plants. The major markets here are China, India, and Europe.

We broadened our development work in 2015. Today's technology level means even small mechatronic modifications can result in better steel quality. Already familiar methods such as ultrasonic solutions are being expanded to new fields, opening up fresh opportunities to evaluate steel quality.

Looking at vacuum and tertiary metallurgy, we are receiving more and more inquiries about innovative products and manufacturing methods for special steels. Another trend is the use of mechanical degassing pumps instead of steam jet vacuum pumps. Modernizations will remain the standard option in vacuum metallurgy. Target markets here are Europe, India, and Iran.

### COMPETENCE IN NF METALS – DIVERSIFICATION OF THE PRODUCT PORTFOLIO

It takes just small adjustments to make steel production technologies suitable for NF metals. That means our products provide an ideal starting point for tapping into this new business field.

Just like steel, NF metals are under high price pressure worldwide. Therefore, producers are not focusing on complete plants. However, we expect an increase in project activities, above all for modernizations and process optimizations.

A newcomer on the scene, our joint venture POLY-METAL solutions GmbH (50% SMS group, 50% Mettop, Austria) covers the entire process chain for copper. Now, it plans to extend its portfolio to other NF metals. The aim here is to optimize or newly develop existing process routes and plants in the field of nonferrous metals.

### PRODUCING ISOTROPIC MATERIALS

The focus of SMS Mevac in tertiary metallurgy is on improving our electric slag remelting (ESR) and vacuum arc remelting (VAR) processes. Tertiary metallurgy is all about producing isotropic materials for highly sophisticated applications. These materials are vital, especially in areas such as the aviation and aerospace, energy, automotive, and oil and gas industries.

### MANUFACTURING HIGH-QUALITY METAL POWDERS

Today, methods such as additive manufacturing and in particular 3-D metal printing are evolving rapidly. They are set to permanently change major sections of industrial and medium-scale production processes. We expect not only volume-based benefits, but also the option of producing much higher qualities and specific metallurgical properties.

Ready for future challenges, SMS Mevac has already developed essential technologies such as vacuum and induction furnace solutions for high-quality metal powders.

### ROBOTS IN STEELWORKS

It is too dangerous for humans to work in some areas of steelmaking shops due to the extreme heat of the molten steel, toxic substances, and the risk of explosions. That applies in particular to the direct surroundings of production units such as electric-arc furnaces, ladle furnaces, or VD plants.

This is why SMS group uses robots to take samples in steelworks. The advantages of robots:

- Samples always taken at the right time – irrespective of unexpected events.
- Faster sampling integrated more smoothly into the process. Much shorter power-off times.

**In 2016, SMS group will combine robotics, data mining, and digitization to present the first integrated solutions to industry.**





### **CONSTIR - MODULATED WAVE STIRRING**

SMS Concast has improved its electromagnetic stirring technology. Now, frequency and current modulation intensifies stirring. To achieve this result, SMS Concast developed a simulation model that calculates the modulation parameters. The system provides positive metallurgical effects yet simultaneously cuts electricity consumption by 25 to 40%. As stirrers are the highest energy consumers in an ingot plant, this offers great money-saving potential. The system is ideal for retrofitting into existing plants.

### **DIRECT DRIVE FOR OSCILLATION - NEW ELECTRIC OSCILLATION DRIVE**

In the past, online electrical adjustment of the frequency and stroke of oscillators for continuous caster molds was not possible. Usually, operators could only control the frequency.

Yet SMS Concast has developed an innovative electric oscillation drive based on a torque motor. It regulates both stroke and frequency. Engineered as a direct drive, the unit does not require gears. Also no longer necessary is a separate hydraulic station for hydraulic oscillation. This cuts costs considerably. The new drive is ideal for implementation in existing plants as well as for upgrading continuous casting plants for rebars into plants for special steels.

### **NEW ADDITIONS TO THE HD FAMILY - HD SPRAY AND HD SCAN**

HD (high definition) plant components ensure more precise processes and better products while also saving money. Taking these aspects into account, SMS group has developed a flexible secondary cooling solution for slab continuous casters.

Crucial parameters to be considered here are not only the range of steel grades and the casting rate, but

also the casting width. Many conventional systems do not have the flexibility to react effectively to an altered width. That affects slab quality.

This is where HD spray comes in. It is a new secondary cooling method that adapts to the slab width and can also be used in existing plants. Alternatively, producers can apply the system only in the strand guiding sections to boost quality and productivity. Equipped with HD spray, our customers can achieve a broader product range, increase production quantities, and rely on consistent quality.

**HD scan is an ultrasonic technology developed by SMS group. It enables manufacturers to inspect the internal quality of cast products. The new method is much faster to set up than the macro-etching procedure commonly used today.**

It delivers a 3-D view inside the sample for much more information.

The result is precise quality evaluation of cast products. A number of producers viewed a pilot plant in 2015. Now we have built an industrial-scale version.

## **DESIGN OF A BCT® BELT CASTING TECHNOLOGY INLINE PLANT**

During belt casting, the steel solidifies horizontally without bending and straightening, also without casting powder or oscillation and under an inert atmosphere. That forms a thin strip. Typical product dimensions are 14 to 20 millimeters thick, at casting speeds of up to 30 meters per minute.

Our micromills are designed to realize the full benefits of belt casting technology. That goes especially for energy efficiency and CO<sub>2</sub> reduction. BCT® is an inline process performed in a single line simultaneously to hot rolling.

What distinguishes this groundbreaking innovation are its compact dimensions and great energy savings. It is suitable for both conventional and high-tech steel grades, which are often difficult to produce in normal continuous casters.



## MAJOR ORDERS

### ELECTRIC SUBMERGED-ARC FURNACES

- PCC BakkiSilicon hf, Iceland;  
turnkey submerged-arc furnace plant for the production of 32,000 t/year of silicon metal
- Sakura Ferroalloys, Malaysia;  
drying plant for added substances

### BOF

- JSPL Angul, India;  
engineering of a complete system plus supply of core components for 250-t converter including lance, gas cleaning, and recovery systems
- Tata Steel Ijmuiden B. V., Netherlands;  
modernization of two 350-t BOF converters
- Shougang Qian'An Iron and Steel Co., Ltd., China;  
retrofitting a converter steelworks with three hydro-hybrid filter systems
- ArcelorMittal Annaba, Algeria;  
eight transfer cars for the BOF converter steelworks

### EAF

- US Steel Fairfield, USA;  
electric-arc furnace with gas cleaning plant
- Azar Foolad Amin Co. (AFA Steel), Tabriz, Iran;  
60-t electric-arc furnace
- Qatar Steel, Qatar;  
gas-cleaning plant with quenching tower for an 80-t electric-arc furnace
- Uddeholm, Sweden;  
gas cleaning plant for a 60-t electric-arc furnace
- Hyundai Steel, Pohang, South Korea;  
155-t electric-arc furnace
- Tenaris Tamsa, Mexico; alloying station

### SECONDARY AND VACUUM METALLURGY

- JSPL Angul, India; 250-t ladle furnace
- US Steel Fairfield, USA;  
vacuum tank degassing plant
- Ilva Taranto, Italy;  
290-t hot metal desulfurization plant (HMD), alteration of an existing HMD, and modernization of the dedusting plant
- Azar Foolad Amin Co. (AFA Steel), Tabriz, Iran;  
60-t ladle furnace
- Hyundai Steel, Pohang, South Korea;  
155-t ladle furnace

### CONTINUOUS CASTING OF LONG PRODUCTS

- Azar Foolad Amin Co. (AFA Steel), Tabriz, Iran;  
billet continuous caster with three strands
- Tosyali, Algeria;  
billet continuous caster with eight strands
- Hyundai Steel, South Korea;  
alteration of the billet continuous caster with six strands
- Tenaris Tamsa, Mexico;  
alteration of the bloom continuous caster with five strands

### CONTINUOUS CASTING OF FLAT PRODUCTS

- Tata Ijmuiden, Netherlands;  
modernization of the CSP® continuous caster
- EZDK Egypt;  
modernization of the CSP® continuous caster, mechanical adjustments for Liquid Core Reduction (LCR)

## COMMISSIONING PROJECTS

### ELECTRIC SUBMERGED-ARC FURNACES

- Kansanshi Mining PLC, Zambia;  
24 MVA copper matte settling furnace
- Mississippi Silicon, USA;  
submerged-arc furnace #1 and #2 for silicon as well as gas cleaning plants

### BOF

- SSAB Lulea, Sweden;  
modernization of two BOF converters as well as the primary gas cooling system including energy recovery
- IISCO Steel Plant (ISP), India;  
converter steelworks with two 150-t converters, two purging systems, two ladle furnaces, and gas cleaning systems including electrostatic precipitators (ESP)

### EAF

- Hyundai Steel, South Korea; 155-t electric-arc furnace
- GV do Brasil, Brazil; 65-t electric-arc furnace
- Tenaris Tamsa, Mexico; alloying station

### SECONDARY METALLURGY

- Tata Stocksbridge, UK;  
8/18-t VIM vacuum induction melting furnace
- Fuxin Special Steel Co. Ltd., Taiwan;  
150-t Duplex-VOD plant
- Metal Ravne, Slovenia;  
60-t ladle furnace, 60-t VD-VOD plant, skimming stand, and filter plant
- Hyundai, South Korea;  
ladle furnace, 155-t RH plant
- New Zealand Steel, New Zealand;  
80-t ladle furnace
- GV do Brasil, Brazil; 65-t ladle furnace
- Taiyuan Iron & Steel Co., Ltd., China;  
two ladle furnaces

### CONTINUOUS CASTING OF LONG PRODUCTS

- GV do Brasil, Brazil;  
billet continuous caster with three/four strands
- New Zealand Steel, New Zealand;  
four-strand billet caster
- Taiyuan Iron & Steel Co., Ltd., China;  
bloom continuous caster with three strands
- Asil Celik Sanayi ve Ticaret, Turkey;  
bloom continuous caster with three strands
- Zhangjiagang Renzhong Wire Rod Co. Ltd., China;  
billet continuous caster with six strands
- Tenaris Tamsa, Mexico;  
alteration of the bloom continuous caster with five strands
- Jindal Steel and Power Limited (JSPL), Angul, India;  
high-speed billet caster with eight strands

### CONTINUOUS CASTING OF FLAT PRODUCTS

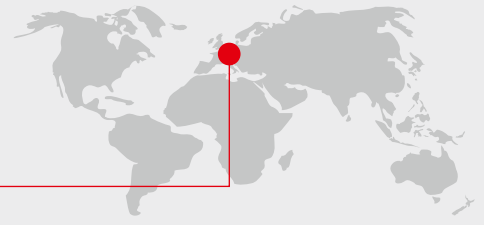
- Dillinger Hütte, Germany;  
two-strand thick slab caster
- thyssenkrupp Steel Europe, Germany;  
final approval of modernization of the two-strand slab caster
- Hebei Puyang Iron and Steel Co., Ltd. (Puyang Steel), China; single-strand slab caster for medium slabs
- US Steel Gary Works, USA;  
modernization and alteration of a slab continuous caster
- Jindal Steel & Power Limited, India;  
modernization of a slab continuous caster

### CSP®

- Nucor Steel, USA;  
modernization of the CSP® continuous caster as part of modernization of the entire CSP® plant

SALZGITTER FLACHSTAHL GMBH

Location: Salzgitter, Germany

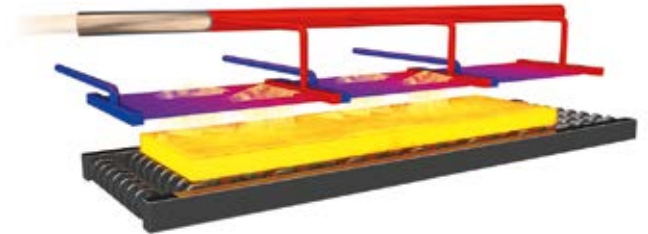


## E-CO ENERGY COLLECTOR PILOT PLANT AT SALZGITTER FLACHSTAHL

Brand new from SMS group is our E-CO energy collector. It is the only plant of its type in the world. To absorb radiated heat, the energy collector (E-CO) requires free access to glowing material that reaches temperatures of over 600°C.

Installed on a continuous caster at Salzgitter Flachstahl, the pilot plant successfully went into operation in May 2015. It achieved a very rapid run-up curve. The plant delivers one ton of saturated steam per hour.

The glowing slabs are transported on the roller table underneath the heat exchanger. Each slab remains there until the next one arrives. Then, the automated roller table control system releases the slab lying under the heat exchanger for discharging. Now, the next slab remains below the heat exchanger. According to their surface temperature, the slabs radiate between 30 and 45 kW per square meter. The heat exchangers absorb the radiation energy and convert it into steam.



The principle of the E-CO energy collector.

Salzgitter Flachstahl already fully utilizes the SMS group pilot plant.



## FLAT ROLLING PLANTS

- Newly developed quality assurance system with operating know-how for hot rolling mills
- Even more Ecoplants technologies for cost-effective and eco-friendly hot and cold strip production
- Success with expansion design for reversing cold rolling mills
- Key supplier of plant technology for aluminum rolling mills





Overcapacities and a weak profit situation in the steel and aluminum industries mean our customers are unwilling to invest. We see little prospect of a sustained market upturn. There is fierce price competition for individual projects, for example for conventional hot rolling mills.

However, demand remains strong for challenging revamps with high project planning and engineering costs, as well as for individual machines. Energy-efficient solutions for broader product ranges are becoming ever more important. In the cold rolling segment, we expect increasing demand for smaller rolling capacities that can be expanded later, as well as for special quality and niche product plants. We have also identified a growing market in threshold/developing countries for our reversing cold mill extension strategy.

## HOT ROLLING MILLS

### **Shandong Iron & Steel Rizhao, China: Flat steel complex for challenging steel qualities**

Shandong Iron and Steel Rizhao, China, contracted SMS group to supply a complete flat steel complex to Shandong Province on the east coast of China. The project includes a newly developed quality assurance system and special operating know-how. This expertise, covering the entire process, enables simultaneous monitoring, documentation, and assurance of the product properties.

The complex consists of a hot strip mill, a pickling/tandem mill, a hot-dip galvanizing line, and two annealing lines. SMS group is supplying core parts of the electrical and automation systems. After this investment in top plant technology combined with extensive know-how and innovative quality monitoring, Shandong will boast one of the world's most modern facilities. Its focus will be on producing pipe grades and cold strip for the construction and household appliances industries, as well as high-end steel grades for the automotive industry. Operations will start in 2017. Then, the plant will be capable of producing just under 5 million tons of hot strip and 2 million tons of processed cold strip per year.



Dieter Rosenthal,  
Member of the Managing Board,  
SMS group GmbH

### **Heads of the Division**

Frank-Günter Benner  
Stephan Krämer

### **Tata Steel Ltd., India: Mandrel-less coil box**

Tata Steel Ltd. placed an order with SMS group to alter the coil box in its hot strip mill in Jamshedpur, India. This will convert the unit into a mandrel-less coil box. Modifying the coil box installed in 1993 to a design that does without a mandrel will reduce wear and maintenance costs. Our supply scope includes X-Pact® automation. We will install and test the equipment in advance during ongoing operations. This will enable us to make the system changeover in a standstill period of just two weeks.

### **VDM Metals: Cold plate straightener**

As early as April 2015 – four days before the deadline – the new 11-roll cold plate leveler we supplied to the VDM facility in Altena, Germany, went into operation. VDM Metals is a leading producer of nickel and titanium alloys as well as high-alloy special stainless steels. The company operates a plant in Siegen, where it rolls plates on a 2.7 meters, four-high stand supplied by SMS group in 2013. Downstream of that, the quality plates are heat-treated, cut, and straightened in the Altena workshop.

## COLD ROLLING MILLS

### **Gunung Raja Paksi, Indonesia: Reversing cold rolling mill**

Indonesian steel producer Gunung Raja Paksi (GRP) awarded SMS group an order to supply a complete reversing cold rolling mill (RCM) in CVC® plus six-high design with skin-passing function.

What GRP appreciates particularly is supply from one source as well as production plants designed to mesh perfectly. The combined reversing and skin pass mill will start up in early 2017.

Headquartered in Bekasi, West Java, GRP was founded in 2001. It belongs to the Gunung Steel Group. GRP has been operating a Steckel rolling mill from SMS group since 1996. The company produces a broad range of hot-rolled flat products with an annual capacity of 1.2 million tons.

The new reversing cold rolling mill is dedicated to cold strip mainly used in the construction industry for façades and roof cladding. The overall supply package covers the entire reversing cold rolling plant including mechanical equipment, electrics and automation, and ancillaries.

**North American Stainless, USA:  
20-roll cold rolling mill for stainless steel  
and bright annealing line**

North American Stainless (NAS), USA, a subsidiary of the Spanish Acerinox Group, contracted SMS group to supply a 20-roll cold rolling mill as well as a bright annealing line. In Ghent, Kentucky, NAS is erecting the country's most modern and high-performance production plants for bright-annealed stainless steel strip. What makes the state-of-the-art equipment stand out is its high efficiency, flexibility, and product quality. The plants' production capacity is 95,000 tons per year. Commissioning is scheduled for the beginning of 2017.

**Compact cold mills (CCM®) for  
burgeoning companies in Asia**

We have generated major success in the Asian region with our flexible method of upgrading reversing cold mills (RCM) into CCM®. This solution enables up-and-coming companies to react rapidly to fresh market opportunities. These can arise, for example, in Bangladesh, with its continually expanding economy and steadily developing industrial sector. Not only the generally well-known textile and shipwrecking businesses are booming, but also the steel industry is on an upward trajectory. A good example is the young company KYCR Coil Industries Limited. Furthermore, companies in Vietnam or Pakistan rely on our consulting and implementation expertise.

■ **Nam Kim Steel Joint Stock Company, Vietnam**

Nam Kim Steel started successful production with its new reversing cold mill in April 2015. Soon afterward, the Vietnamese steel producer contracted SMS group to supply a complete compact cold mill (CCM®). What the six-high CCM® means for Nam Kim Steel is a boost to its annual capacity for high-quality cold strip by 435,000 tons and an even stronger position on the regional market. According to plans, Nam Kim Steel will be able to go on stream with the new CCM® in late 2016.

■ **Abul Khair Strip Processing Ltd., Bangladesh**

Abul Khair Strip Processing Ltd. started production on its new compact cold mill (CCM®) on April 23, 2015. SMS group engineered the CCM® specifically for rolling very thin strip.

**The new CCM® from SMS group is a central unit in the cold strip plant of Abul Khair Strip Processing Ltd. in Chittagong.**

■ **International Steel Limited (ISL), Pakistan**

As early as July 26, 2015, the first coil successfully rolled off the compact cold mill (CCM®) of International Steel Limited (ISL). Now, with the successful commissioning of the CCM® at International Steel Limited (ISL) in Karachi, Pakistan, the cold-strip producer's expansion project is nearing completion. Central to the production expansion is the reversing cold mill (RCM) supplied and commissioned by SMS group in 2011. Right from the start, the RCM was engineered for a possible future expansion.

■ **KYCR Coil Industries, Bangladesh**

The new compact cold mill (CCM®) owned by KYCR Coil Industries Limited started production in Bangladesh on August 16, 2015. This cold rolling plant is based on an existing reversing cold rolling mill upgraded by SMS group according to our flexible expansion method.

Just a few years after starting up, ISL was so successful with its cold strip products on the regional markets that increasing its capacity was essential. That was why, in 2014, ISL awarded SMS group an order to expand the CCM® so it could boost production to 450,000 tons per year.





The plant produces very thin strip for the regional market in widths of 600 to 1,050 millimeters and final thicknesses of down to 0.09 millimeters. Now, the annual production capacity is 170,000 tons.

It was vital to keep the costs low and the necessary stoppage period as short as possible. To do this, SMS group originally planned the foundations of the RCM so that the second mill stand could be installed easily.

## ALUMINUM ROLLING MILLS

### **AMAG rolling GmbH, Austria: Cold rolling mill with thermal treatment line and high-rack store**

AMAG rolling GmbH of Austria placed an order with SMS group for a cold rolling mill, a thermal treatment line with downstream passivation, a high-rack store, and a packing line. That means SMS group is responsible as a single-source supplier for core plants in the AMAG 2020 investment project. The facility will manufacture top-quality cold-rolled aluminum plate and strip. It is scheduled to go into production in 2017.

### **Tianjin Zhongwang Aluminium Co., Ltd., China: First construction stage starts production**

The first strip was successfully rolled on the aluminum cold rolling mill (CRM3) at Tianjin Zhongwang Aluminium Co., Ltd. on June 30, 2015.

The material from this plant is mainly destined for the manufacture of plate and composite strip. Capable of handling a maximum coil weight of 30 tons, an input stock thickness of up to 10 millimeters, and a maximum width of 1,000 to 2,150 millimeters, this rolling mill achieves minimum final thicknesses of 0.2 millimeters.

With production of the first plate on August 15, 2015, and the first coil on September 18, 2015, the 1+1+3 aluminum hot rolling mill also started operation successfully.

**Aluminium Norf GmbH, Germany: New sizing press increases roughing train capacity**

At its Neuss location in Germany, the world's largest integrated aluminum rolling and melting company, Aluminium Norf GmbH (ALUNORF), is implementing an extensive revamp project of its hot strip mill No. 1 with SMS group. Just one year after successful modernization of the roughing stand in 2014, the company reached another milestone: The second project stage involved replacement of the sizing press in the roughing train.

**Alcoa Inc. Knoxville, USA: Cold rolling mill for high-quality, durable aluminum for the automotive market**

Early last year, on February 14, 2015, the three-stand cold rolling mill of Alcoa Inc. Pittsburgh successfully went on stream. It was erected at the Alcoa location near Knoxville in Tennessee.

Alcoa's new rolling mill supplies growing demand on the automotive market for lightweight, durable aluminum. Even before this project, Alcoa chose the latest technologies from SMS group for previous supplies.

**Guangxi Alnan Aluminium, China: Final acceptance for 1+1 hot rolling mill and cold rolling mill**

At the beginning of 2015, Guangxi Alnan Aluminium Fabrication Co. Ltd. contracted SMS group to perform final testing and approval of its 1+1 hot rolling line. The line consists of a plate-type stand, a single-stand finishing train, and the cold rolling mill.

Guangxi Alnan uses the new equipment to produce a broad portfolio of high-quality aluminum plate and strip, including special alloys for the aviation and transport industries.



## MAJOR ORDERS

### HOT ROLLING MILLS

- Shandong Iron and Steel Rizhao, China; new high-performance hot rolling mill
- Outokumpu Stainless Oy, Tornio, Finland; modernization work and various drive components for stainless steel hot strip mill
- Tata Steel Strip Products Ijmuiden, Ijmuiden, Netherlands; new coiler No. 1 and increased rolling force for HSM2
- Tata Steel Ltd., Jamshedpur, India; modernization of the coil box
- Tata Steel Strip Products UK, Port Talbot, UK; new looper
- ArcelorMittal Asturias, Gijon, Spain; modernization of the double side trimmer in the heavy plate finishing line
- Shougang Jingtang United Iron & Steel Corp., Caofeidian, China; modernization of hot strip mill No. 2

### COLD ROLLING MILLS

- Shandong Iron & Steel Rizhao, China; pickling/tandem mill (PL-TCM)
- Gunung Raja Paksi, Indonesia; reversing cold mill (RCM)
- Nam Kim Steel Joint Stock Company, Vietnam; compact cold mill (CCM®)
- North American Stainless, USA; 20-roll cold rolling mill

### ALUMINUM ROLLING MILLS

- AMAG rolling GmbH, Austria; cold rolling mill with thermal treatment line and high-rack store

## COMMISSIONING PROJECTS

### HOT ROLLING MILLS

- SAIL RSP, Rourkela, India; heavy plate rolling mill: supply of ultrasonic inspection, cold plate straightener, side trimmers, and cross-cutting shear to finish heavy plates
- VDM Metals, Altena, Germany; cold plate straightener for special materials
- Baosteel, Zhangjiang, China; high-performance hot strip mill
- Wuhan Iron & Steel Corp., Wuhan, China; modernization of the coiler system
- SSAB Europe Oy, Raahе, Finland; modernization of the finishing train; drive line F1

### COLD ROLLING MILLS

- Bengang Steel Plates Co. Ltd., China; pickling/tandem mill (PL-TCM)
- Abul Khair Strip Processing Ltd., Bangladesh; Compact Cold Mill (CCM®)
- International Steel Ltd., Pakistan; compact cold mill (CCM®)
- KYCR Coil Industries Ltd., Bangladesh; compact cold mill (CCM®)
- Outokumpu Nirosta, Germany; modernized 20-roll cold rolling mill
- Ningbo Xingye Copper, China; final acceptance of two cold rolling mills for copper strip
- Gazi Metal A. S., Turkey; final acceptance of integrated cold strip complex

### ALUMINUM ROLLING MILLS

- Tianjin Zhongwang Aluminium Co., Ltd., China; cold rolling mills (CRM 2 and 3)
- Tianjin Zhongwang Aluminium Co., Ltd., China; 1+1+3 hot rolling mill
- Aluminium Norf GmbH, Germany; sizing press
- Alcoa Inc., Knoxville, USA; cold rolling mill
- Guangxi Alnan Aluminium Fabrication Co., Ltd.; final acceptance for 1+1 hot rolling mill and cold rolling mill

## BAOSTEEL ZHANJIANG: HIGH-PERFORMANCE HOT STRIP LINE

Baosteel Zhanjiang Iron & Steel Co., China, successfully commissioned its new high-performance hot strip line in November 2015. The plant was supplied by SMS group.

Installed at Baosteel's new steel location in the southern Chinese city of Zhanjiang, the plant boasts an annual capacity of 5.5 million tons. It is capable of producing hot strip with final thicknesses of 1.2 to 25.4 millimeters and widths of 800 and 2,100 millimeters.

The product options range from soft deep-drawing types to high-strength construction steels and pipe grades. Built to an optimized layout, the new hot rolling mill consists of a slab sizing press plus one two-high and one four-high reversing roughing stand, each with an attached edging stand. Also included are seven CVC® plus four-high finishing stands, a laminar strip cooling section, and two hydraulic coilers.

A whole range of Ecoplants technologies are implemented here. They ensure the plant sets a new benchmark in green, efficient, and cost-effective hot strip production. SMS group Ecoplants technologies simultaneously reduce energy consumption and increase yields.

One of these solutions applied in the roughing train of Baosteel Zhanjiang is the slab sizing press. It enables our customer to flexibly adjust the slab width. This improves coordination between the continuous caster and the hot strip mill. As a result, the slab sizing press supports slab heating and significantly reduces energy input. Furthermore, the slab sizing press increases production output in the upstream continuous caster.

The primary resource-saving features in the finishing train are our newly developed Sieflex®-HT high-performance spindles. All finishing stands at Baosteel Zhanjiang were fitted with this solution. It guarantees the transfer of higher rolling torques and forces, above all in the front stands of the finishing train. These factors are necessary for the production of high-strength hot strip. Moreover, the spindles are compatible with work rolls of optimized diameter. That helps reduce energy consumption.

[1] | Slab sizing press. [2] | Coiler. [3] | Four-high reversing stand. [4] | Finishing train.





## BAOSTEEL ZHANJIANG

Location: Zhanjiang, China

Also included among the Ecoplants components are our CVC® plus system with integrated work roll bending as well as profile, contour, and flatness control PCFC®, the hydraulic differential tension looper in the finishing train, and heat retention hoods between the rougher and finishing train, which reduce heat losses from the input strip.

There is a special solution here for strip cooling, a crucial metallurgical process stage. To meet the specific requirements of Baosteel Zhanjiang, SMS group implemented a custom design. It consists of a combination of zones with intensive laminar cooling plus standard groups. This delivers high cooling rates as well as flexible cooling strategies. Our customer benefits from cost-effective manufacturing of a broad product range.



View from the main control desk onto the finishing train.



## PROCESSING LINES AND FURNACE TECHNOLOGY

- Order intake increased for the second time in a row
- Successful entry into the market for aluminum thermal treatment lines
- Four strip processing lines as a systems supplier to Shandong
- New orders for furnace and thermal treatment lines for long products
- Further expansion of component and modernization business

Compared to the previous year, our Processing Lines and Furnace Technology Division increased its order intake by some 20% and sales by around 40%. This was the second time in succession that order intake increased year on year.

Characteristic of the coming years will be a slightly declining market with strong price pressure and competition. Plant owners will demand more process and operating know-how. Furthermore, they will expect eco-friendly solutions with low operating costs. The interconnection of various systems and models, also known as the fourth industrial revolution, is becoming ever more important. Already placed orders and completed commissioning projects demonstrate that the Strip Processing Lines and Heat Treatment Technology Divisions already meet many of these requirements and enjoy the trust of our customers.

#### **WIDE VARIETY OF ORDERS**

Attracting an order from Austrian company AMAG, we entered the market for heat treatment lines used in the production of aluminum strip for automotive and aircraft manufacturing. Moreover, new orders boosted our position on the market for reheating furnaces and heat treatment lines for rods, tubes/pipes, and bars. Leading companies such as Deutsche Edelstahlwerke GmbH, Germany, voestalpine Tubulars, Austria, and TMK-ARTROM, Romania, ordered new plants from SMS group. Business with components and revamps also developed well. For example, SMS group generated a number of orders for components such as side trimmers and air knives.

#### **REFINED COLD STRIP FOR THE AUTOMOTIVE INDUSTRY**

Right on schedule, in December 2015, the first of two annealing lines SMS group supplied to Baotou (BISG Baotou Iron & Steel Group – Rare Earth Steel Plate Co. Ltd.) of China went into production and annealed its first strip. Baotou awarded SMS group the contract for both continuous annealing lines, including six-high inline skin-passing stands. The second of the almost identical lines will go on stream as planned in mid-2016. Then the two plants will together be able to produce more than 1.5 million tons of refined



Dieter Rosenthal,  
Member of the Managing Board,  
SMS group GmbH

#### **Heads of the Division**

Dr.-Ing. Holger Behrens  
Dr.-Ing. Fritz Brühl

cold strip per year. Most of this material is destined for the automotive industry.

#### **NEW HEAT TREATMENT METHOD**

SMS group is supplying a heat treatment line to Deutsche Edelstahlwerke GmbH. This will make it possible for the first time to thermally treat bar steel up to 250 millimeters in diameter directly in the rolling line. That makes the usual separate heat treatment process superfluous. And it saves a considerable proportion of the heating energy. What's more, intermediate storage is no longer necessary, so the material throughput times are much shorter. The new heat treatment line will be integrated into the existing rolling mill. Due to commence production in 2016, the plant will be erected in accordance with current environmental standards for air, noise, and water, and will comply with the IEC Energy Efficiency Directive.

#### **DELIVERY OF USA'S MOST HIGH-PERFORMANCE BRIGHT ANNEALING LINE**

Along with a 20-roll cold rolling mill, SMS group is also supplying our US customer North American Stainless (NAS) with the country's highest-performance bright annealing line. The technological highlight is the fully electrically powered vertical furnace. The high operating efficiency means that energy consumption, at approx. 220 kWh per ton, is 60% lower than for a conventional design with a muffle furnace.

### **PICKLING/TANDEM LINE AND ANNEALING LINES FOR RECORD STRIP WIDTHS IN OPERATION AT BENXI**

Working for Chinese steel producer Bengang Steel Plates Co. Ltd. (Benxi), SMS group successfully commissioned several plants for the new cold rolling mill No. 3 erected in Liaoning Province, northern China. The high-performance pickling/tandem mill rolled its first strip in August 2015. Now Benxi can produce more than 2.2 million tons per year of quality cold strip on the plant. Next, in September and December, the two continuous annealing lines treated their first strip. All this gives our customer the capacity to process a total of almost 2 million tons of cold rolled material – including a high proportion of automotive qualities.

SMS group supplied the PLTCM (pickling line tandem cold mill) with continuous feed, scale breaker, turbulence pickling section, three horizontal loopers, ASC side trimmer, five-stand tandem mill with combined CVC® plus/ESS (enhanced shifting system) technology, roll changing equipment, carousel-type coiler, and offline strip inspection station. Also included in the scope of delivery was the emulsion plant.

Benxi uses the PLTCM to process low-alloy carbon steels as well as high-strength and ultra-high strength steels including multiphase and martensitic grades mainly destined for the automotive industry. Starting from a maximum input thickness of 6 millimeters, the strip is reduced to minimum final thicknesses of 0.3 millimeters. What's special here is not only the challenging quality mix, but also the width of the rolled strip, which can reach up to 2,150 millimeters. That's a world record for this type of plant.

The two continuous annealing lines stand out for the extremely efficient and eco-friendly operation of the annealing furnaces. This is combined with high production capacity and an extensive product range. Downstream of the annealing process, the inline skin-passing stands ensure perfect strip surfaces. The only difference between the lines is the strip width. One processes a maximum strip width of 1,630 millimeters, while the other handles a world record of up to 2,150 millimeters.

### **CONTINUOUS ANNEALING LINE FOR STRIP FOR HIGH-STRENGTH AUTOMOTIVE PARTS SUCCESSFULLY COMMISSIONED AT HANDAN**

Handan (Handan Iron & Steel Group), China, started up its new continuous annealing line and processed the first coil in November 2015. Once the commissioning phase is completed, the plant – completely supplied by SMS group – will be capable of processing 430,000 tons of steel strip per year. Most of this material will go into the manufacture of high-strength automotive structural components. This is already the second annealing line SMS has supplied to Handan in Hebei Province, northern China. The first went on stream in 2010 with an annual capacity of 1,000,000 tons.

One standout feature of the line is the high-performance annealing furnace with integrated ultra-fast cooling system. To enable the production of martensitic grades and ultra-high-strength multiphase steels, the plant includes an additional water-spray cooling system for rapid cooling. Both cooling systems achieve very even results. That means the strip form and surface quality meet very high standards.

Handan uses the new annealing line to produce grades including high-strength steels such as HSS, HSLA, DP, TRIP, PM, and MS, as well as commercial and soft grades. High-strength steels offer a double advantage in automotive applications: they improve safety as well as saving fuel. Handan produces strip in thicknesses of 0.5 to 2.5 meters and widths of 750 to 1,650 millimeters. The material progresses through the line at a process rate of 140 meters per minute, while 200 meters per minute are possible in the entry and exit sections.

SMS was responsible not only for engineering the mechanical equipment and manufacturing special components, but also for all the electrical and automation systems.





## MAJOR ORDERS

## NEW PLANTS

- Shandong Iron & Steel Rizhao, China; pickling tandem mill
- Shandong Iron & Steel Rizhao, China; two continuous annealing lines including furnace
- Shandong Iron & Steel Rizhao, China; hot-dip galvanizing line including furnace and air knife system
- MMK, Russia; hot-dip galvanizing line including furnace and air knife system
- NAS North American Stainless, USA; stainless steel bright annealing lines including furnace
- AMAG Austria Metall, Austria; heat treatment line with chemical passivation including furnace
- Nam Kim Steel, Vietnam; hot-dip galvanizing line including furnace and air knife system
- Deutsche Edelstahlwerke, Germany; heat treatment line for stainless steel bars
- Tulachermet, Russia; walking-beam furnace for a rolling mill
- TMK-ARTROM, Romania; heat treatment line for tubes
- voestalpine Tubulars, Austria; heat treatment line for tubes
- Tosyali Toyo, Turkey; acid regeneration plant

## MODERNIZATIONS AND COMPONENTS

- Rheinzink, Germany; modernization of a pre-weathering line for zinc strip
- Erdemir, Turkey; air knife system for a hot-dip galvanizing line
- Tangshan Iron & Steel Group, Tangshan/China; air knife systems for two hot-dip galvanizing lines
- Meishan Iron & Steel, China; air knife system for a hot-dip galvanizing line
- Baoshan Iron & Steel, China; air knife system for a hot-dip galvanizing line
- ArcelorMittal Sagunto, Spain; air knife system for a hot-dip galvanizing line
- voestalpine Stahl, Austria; air knife system for a hot-dip galvanizing line
- Severstal, Russia; side trimmer unit for a continuous pickling line
- ArcelorMittal Asturias, Spain; modernization of a walking-beam furnace in a wire rod mill
- Hebei Zhaojian, China; side trimmer unit for a pickling/tandem mill
- Tianjin Xinyu, China; side trimmer unit for a pickling/tandem mill
- ArcelorMittal Eisenhüttenstadt, Germany; modernization of an acid regeneration plant

## COMMISSIONING PROJECTS

## NEW PLANTS

- Ma'aden-Alcoa Joint Venture, Saudi Arabia; aluminum heat treatment line with chemical passivation including furnace
- Benxi Iron & Steel Group, China; two continuous annealing lines including furnace
- Benxi Iron & Steel Group, China; pickling/tandem mill
- Handan Iron & Steel, China; continuous annealing line including furnace
- Kobelco Angang, China; continuous annealing line including furnace
- BSG Baotou Iron & Steel Group, China; continuous annealing line including furnace
- Axis Pipe & Tube, USA; heat treatment line for welded tubes
- Vitkovice Steel, Czech Republic; pusher furnace for slabs
- GV do Brasil, Brazil; pusher furnace for wire and rebar steel mill
- ArcelorMittal Monlevade, Brazil; reheating furnace for wire mill
- Habas, Turkey; push-pull pickling line including acid regeneration plant

## MODERNIZATIONS AND COMPONENTS

- Tangshan Iron & Steel Group, China; air knife system for a hot-dip galvanizing line
- Benxi Iron & Steel Group, China; air knife system for a hot-dip galvanizing line
- TAGAL, China; air knife system for a hot-dip galvanizing line
- Wuppermann, Netherlands; modernization of a hot strip galvanizing line (side trimmer, pre-leveler)
- Outokumpu, Sweden; modernization of a stainless steel annealing and pickling line (pickling tanks)
- OneSteel Manufacturing, Australia; modernization of a walking-beam furnace for billets
- ArcelorMittal Asturias, Spain; modernization of a walking-beam furnace in a wire rod mill

## SHANDONG IRON AND STEEL RIZHAO

Location: Rizhao, China



### FOUR NEW STRIP PROCESSING LINES FOR SHANDONG

SMS group is supplying a complete flat steel complex to Chinese customer Shandong Iron and Steel Rizhao. Our innovative, cross-process quality assurance system (Product Quality Analyzer) plus operating know-how ensure high yield and quality. The Processing Lines and Furnace Technology Division will contribute four strip processing lines to this greenfield project.

The pickling tandem mill comes with an annual capacity of 2 million tons of premium cold strip produced from hot strip. Highlights of the facility are the eco-friendly pickling line including turbulence pickling, and the five-stand tandem mill.

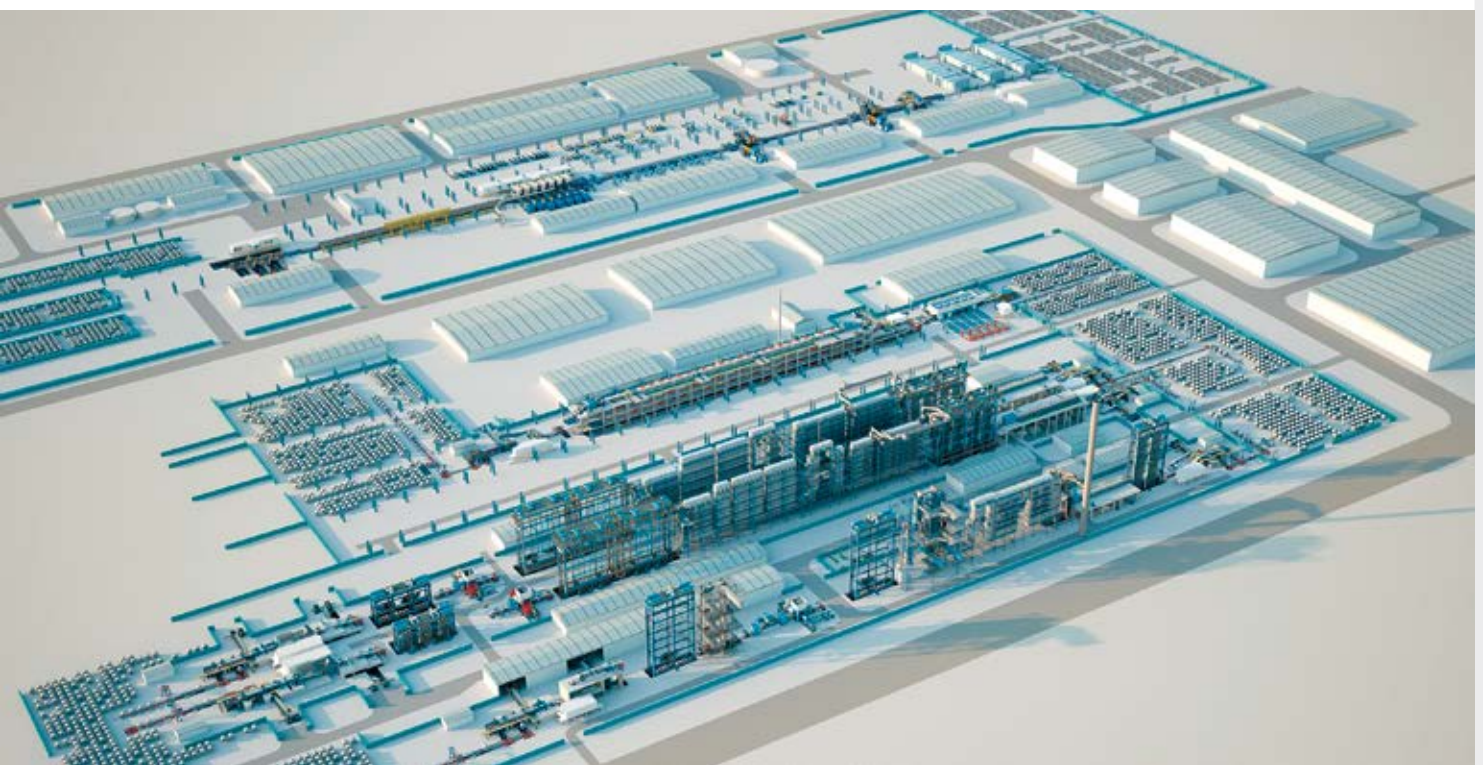
The cold strip goes into two annealing lines and a hot-dip galvanizing line for finishing. Common to all these lines is the ultra-fast cooling system that achieves the rapid cooling rates necessary to produce high-strength grades for the automotive industry. A high-quality air knife system is integrated in the hot-dip galvanizing line. It ensures the



Shandong will produce a total of 2 million tons per year of refined cold strip on the plants – mainly for customers in the automotive industry.

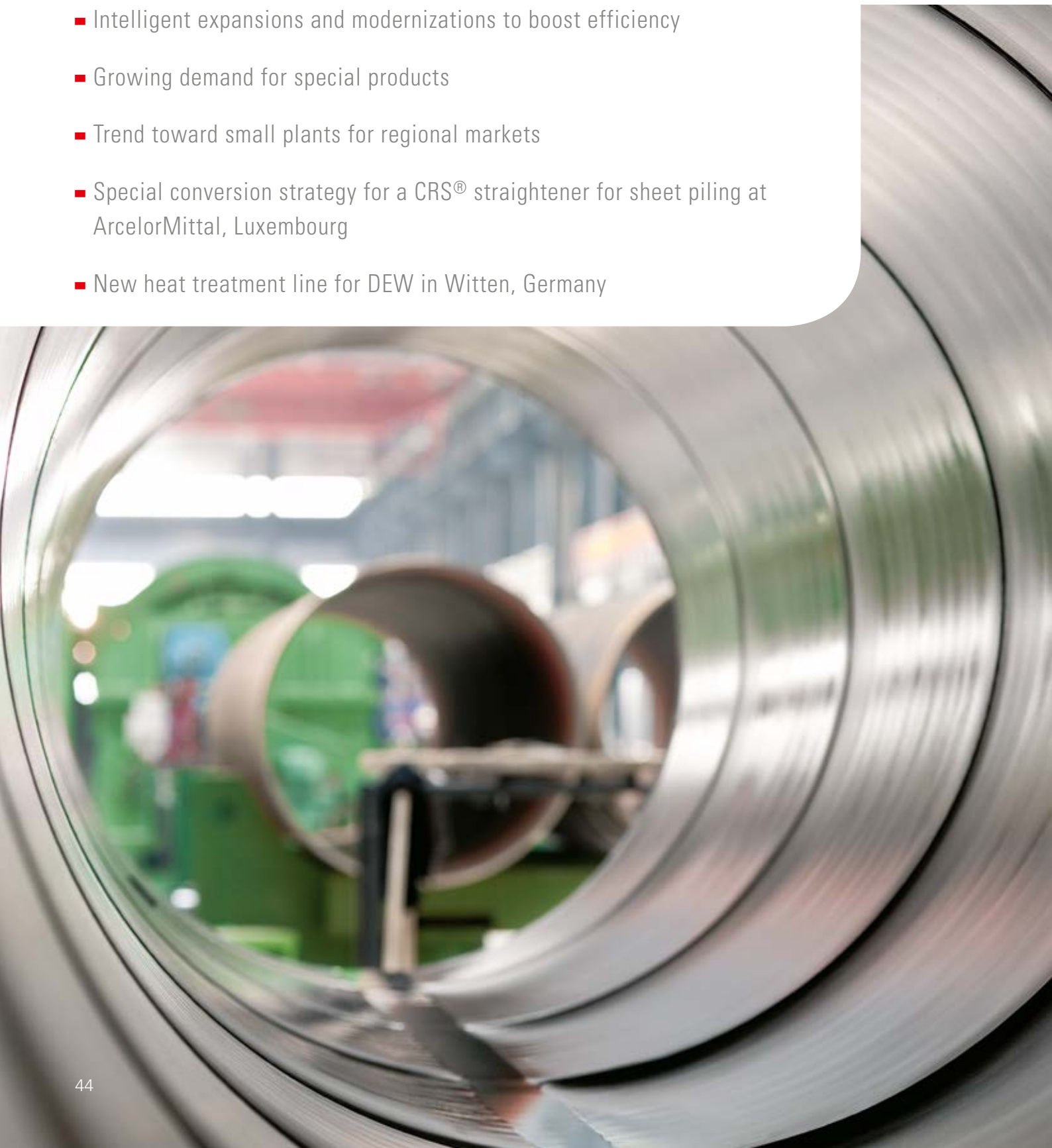
final products meet the extremely exacting surface quality requirements of the automotive industry. The two annealing lines have a capacity of 950,000 and 650,000 tons per year, while the hot-dip galvanizing line handles up to 400,000 tons per year.

The flat steel complex for Shandong Iron and Steel Rizhao.



## LONG PRODUCTS PLANTS

- Intelligent expansions and modernizations to boost efficiency
- Growing demand for special products
- Trend toward small plants for regional markets
- Special conversion strategy for a CRS® straightener for sheet piling at ArcelorMittal, Luxembourg
- New heat treatment line for DEW in Witten, Germany





The situation on the market for long products remained very tense in 2015. Overcapacities and political crises dampened spending. The financial crisis is still not over, and sanctions against Russia continue. Added to this is declining investment in China, one of SMS group's most important markets.

However, manufacturers are shelving many plant projects due to weak demand. Added to this is increased price pressure from Asian suppliers. The Russian and Eastern European markets continue to be affected by the difficult political situation, although some companies are still planning and implementing investments there.

Growth markets are shifting to regions that are not as densely occupied. This shift coincides with a trend toward localization, above all in Asia. There is a consequent increase in demand for small plants (so-called micromills).

## RETROFITTING PERFORMANCE MODULES

Especially in the current market situation, new technologies are in demand. Plant owners focused for many years on increasing production capacity. Now that has changed. To remain competitive, they need flexible production, better quality, and optimized or premium products manufactured to high standards. Only then can they resist today's high price pressure. Producers require solutions that directly boost efficiency at reasonable cost and with short ROI periods. Higher precision, shorter downtimes, more flexibility, tool savings, cost reductions due to higher productivity, and above all better quality products. Our performance modules offer all this not only in new plants, but also as revamp solutions.

## SEAMLESS TUBE PLANTS

The seamless tube market is directly linked to oil prices. As prices fall, pipe manufacturers are hit especially hard because the exploration of deep-lying shale gas or oil deposits is currently uneconomic. That destroys the demand for new tubes. This development and overcapacities in the OCTG sector mean the market for seamless tube plants remains weak.



Marcel Fasswald,  
Member of the Managing Board,  
SMS group GmbH

### Heads of the Division

Marco Asquini  
Norbert Theelen

We see opportunities in small plants for local markets as well as growing revamp business. We have also identified increased demand for special premium tube products. The cold pilger market remains steady due to stable demand for high-quality boiler tubes for the nuclear industry.

### First pierced billet for Vallourec Star on new high-performance cross-roll piercing mill

In November 2015, Vallourec Star rolled the first pierced billet on the new, high-performance cross-roll piercing mill at its Youngstown, Ohio, location in the USA. Decisive here was the total commitment of the on-site SMS team. Our crew not only supervised assembly and commissioning, but also trained the operating personnel.

The plant in Youngstown is Vallourec's main production site in the USA for hot-rolled seamless tubes used in oil and gas exploration.

Despite the difficult economic situation, the new seamless tube plants for Tenaris in Bay City and TPCO America in Corpus Christi, both in the USA, are under construction as planned. The halls for both plants were finished at the end of 2015, and assembly/installation will start in 2016.

## TUBE AND PIPE WELDING PLANTS

Generally, the market for welded plants (large-diameter, ERW welded, and spiral pipes) is developing in the opposite direction to seamless tube plants. Pipeline network expansions, pipeline modernizations, and the strong automotive industry are driving high demand.

## LARGE-DIAMETER PIPE PLANTS (LSAW)

A growing demand for revamps of existing LSAW plants opens up new opportunities. There is a constant need for manufacturing capacities in the MENA region. We completed a major turnkey order for our customer Al Gharbia in Abu Dhabi.

The trend in offshore pipelines is toward smaller diameters with thick walls. Also interesting is the potential for oiling pipes required for offshore wind farms. However, uncertain political framework conditions are dampening the market here.

### Corinth Pipeworks starts production in new large-diameter pipe plant

Greek pipe producer Corinth Pipeworks (CPW) has put its new JCOE® large-diameter pipe plant in Thisvi into operation. The company formed its first longitudinal welded pipe there in June 2015. As soon as August, the first order for pipes in the dimensions 30"/36" × 38.1 millimeters was fulfilled. In the future, the plant will produce 400,000 tons of pipes with outer diameters of between 16" and 56" in wall thicknesses of up to 40 millimeters and lengths of up to 18.3 meters. The input stock consists of high-strength steel grades up to X100.

It gives CPW the capacity to supply customers in the gas and oil industry worldwide with new pipes. "Our good partnership with SMS has paid off once again," says Athanasios Tazedakis, Vice Director of Engineering and Technology at CPW. "It ensured we were able to start up the large-diameter pipe plant bang on schedule."

The CPW large-diameter pipe plant comes with a much larger range of dimensions.

## WELDED TUBE PLANTS (ERW)

The market for ERW tube welding plants is not as dependent on the OCTG sector. That's why it could become a growth market. The major growth engine here is the automotive industry.

### Gazpromtrubinvest starts production with 16" HF tube welding line

Gazpromtrubinvest in Volgorechensk, in the Kostroma region of Russia, has successfully commissioned a 16" high-frequency tube welding line supplied by SMS group. The new plant comes with a maximum capacity of 300,000 tons per year. It can handle a product range with outer diameters ranging from 127 to 426 millimeters. The maximum wall thickness is 15 millimeters. These products are used as casing tubes in oil and gas exploration.

Gazpromtrubinvest can use the new plant to manufacture sophisticated casing tubes according to API 5CT with grades of up to N 80. Highlights of the production line include a cross-welding table with our new PERFECT arc® welding technology, proven URD® (uniform rigidity design) forming and sizing stands, a solid-state Eloweld™ 1200 HF generator, and a 2,800 kW EloSeam MF seam annealing unit.

### Extended product program – Huta Łabędy commissions tube welding line

In December 2015, Huta Łabędy welded the first tube on its 12¾" ERW tube welding line.

The plant in Gliwice, Poland, is designed to manufacture tubes with diameters of 4½" to 12¾", wall thicknesses of 3.0 to 12.7 millimeters, and lengths of up to 18 meters. It is Poland's largest and most modern plant for the production of electro-resistance welded tubes with longitudinal seam.

The finished products are high precision and thick walled tubes for pressure application in thermal engineering and for conveying fuels and other energy carriers as well as structural shapes with square and rectangular cross-sections.



## SPIRAL PIPE PLANTS

Spiral Pipe Plants are well established worldwide at the higher quality (API) end of the market. Ever-greater requirements of pipes are driving a growing demand for stronger steel grades. Pipe manufacturers are responding by modernizing their plants. However, here again fierce competition between plant producers is fueling a bitter price battle.

### **Altumet puts new pipe end finishing machine into operation**

Altumet SPA of Algiers (Algeria) has received a pipe end finishing machine from SMS. The new plant was integrated into our customer's existing line at the location in Algiers. It will finish up to 20 pipe ends per hour in three-shift operation.

The diameters of the pipes range between 8" and 42", wall thicknesses are 5 to 20 millimeters, and the plant handles pipe lengths of 5 to 13 meters. Grades up to X80 can be processed. The finished pipes conform with API 5L certification.

"We expect the new machine to enable us to produce a higher quality of finished pipes," says Farid Amrouche, CEO of Altumet in Algiers. "Knowing we will achieve a significantly higher throughput and lower maintenance costs makes us highly optimistic for our further investment program."

## SECTION AND BILLET MILLS

Our customers' focus on the market for section and billet mills is on increasing productivity, improving product quality, and expanding product range. This is reflected in orders and commissioning projects, which consist mainly of technological enhancements and upgrades.

**Our flexible, sophisticated designs ensured SMS group retained its leading position in this segment.**

ArcelorMittal Esch Belval in Luxembourg successfully commissioned a new CRS® straightener in summer 2015. It is specially engineered for straightening sheet piling and is the largest of its kind. We applied a special conversion strategy to ensure efficient dismounting and reassembly. As a result, we complied with the short downtime our customer specified, and full production resumed quickly. Another major contributing factor was testing and simulation of the mechanical and electrical functions in our workshop and simulation center.

Hyundai Steel in Pohang, Korea, fully modernized its tandem-reversing mill and restarted production after just a short shutdown period earlier than scheduled. The aim of the upgrade was to boost product quality and productivity with new hydraulic systems and automation.

There was also a successful commissioning operation at Xining Special Steel in China, where a large bar mill went on stream. This was the first time a combination of hydraulic adjustment in the final stands, a laser cross-section measurement system, and closed-loop controls were implemented to roll finished products in diameters of up to 300 millimeters with ¼ DIN-JIS tolerances.

Soon after final acceptance of a heavy section mill at Rizhao Group in China, our customer contracted us to supply a further section mill for medium section dimensions at the same location.

DEW in Witten, Germany, ordered a heat treatment line comprising an equalizing furnace and a special cooling line. This will be the first plant to treat large semi-finished dimensions directly in the rolling line. It eliminates the need for the usual separate heating and cooling process.

And it saves a considerable proportion of the heating energy. Compared to the previous process this in-line heat treatment will significantly cut the current long material cycle times and avoid intermediate storage.

We signed a contract with ArcelorMittal Asturias in Gijon, Spain, for the supply and installation of the mechanical and electrical equipment as well as the automation system required at the company's facility to introduce universal rolling technology. As part of the project, we will also supply the new roll stands and ancillary equipment.

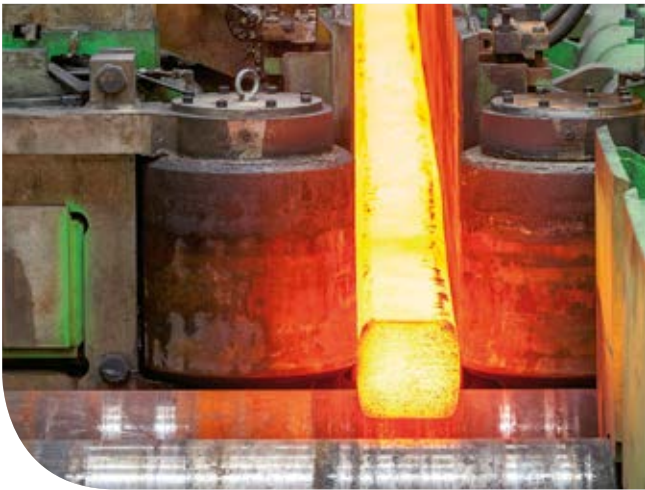
## MERCHANT BAR MILLS

Chinese company Fujian Luoyan Iron & Steel Co. Ltd. ordered a high-speed delivery (HSD®) system for extremely cost-effective production of rebars. Top productivity, maximum overall yield, and stable production with few wear parts add up to a fast return on investment with our advanced HSD® technology.

Rolling speeds of up to 50 meters per second and single-strand operation replace the slitting process so that plant owners can benefit from the substantial advantages of high-speed rebar production.

South Steel Company successfully started up its second combined 500,000 tons per year wire rod and bar mill in Jizan Economic City in the south of Saudi Arabia. We already supplied a complete mini mill to South Steel in 2007. This new combined mill finishes plain wire rod on a finishing block, which is the first in the region to feature our advanced MEERdrive® technology.





## BAR AND WIRE ROD MILLS

Newly in production at ArcelorMittal Monlevade S. A. in Brazil is a wire rod mill with a capacity of 1,000,000 tons per year. The 2-strand wire rod mill is fed by a 180 tons per hour reheating furnace. The rolling mill incorporates a single-strand roughing section with HL stands upstream of the 2-strand wire rod mill. Each strand features a cost-effective HL/CL stand arrangement with a 10-stand wire rod block in ultra-heavy-duty (UHD) design. Our customer has the option of adding a MEERdrive<sup>®</sup>PLUS sizing block in the future to increase the rolling speed to 120 meters per second.

After successfully integrating a 3-roll Precision Sizing Mill (PSM<sup>®</sup>) at Deutsche Edelstahlwerke Siegen, Germany, (DEW), we installed a new cooling bed for SBQ grades. Working over a downtime of just four weeks, we dismantled the existing cooling bed,

adapted the foundations, and completely installed and commissioned the new SBQ. The new cooling bed handles high-precision, quality round bars in diameters of 21.5 to 90 millimeters.

Saarstahl AG is set to integrate a new wire rod outlet into its Neunkirchen works. The unit will be installed parallel to the existing mill without any loss of production. Right on schedule, during the winter shutdown, we successfully completed the first phase. It involved installing a new loop with the relevant equalization zone and water cooling boxes. The remaining equipment will be installed parallel to the running mill. The main components are a high-speed shear, a new 4-stand MEERdrive<sup>®</sup>PLUS sizing block, a laying head, and a new 3-fan Loop Coiling Conveyor (LCC<sup>®</sup>). Exceptional here is the advanced wire rod outlet specifically designed for thermo-mechanical rolling to the tightest tolerances.



## MAJOR ORDERS

### TUBE AND PIPE PLANTS

- Al Gharbia Pipe Company, Abu Dhabi;  
large-diameter pipe plant
- Arvedi Tubi Acciaio, Italy;  
expansion of the 12¾" pipe welding line
- NWZ (Northwest Zircoladding Co., Ltd.), China;  
KPW 18 LC+ (2x), KPW 50 LC

### SECTION AND BILLET MILLS

- Deutsche Edelstahlwerke GmbH, Witten, Germany;  
inline heat treatment line including furnace and cooling  
line for optimum structural condition
- Rizhao Steel Holding Group, Rizhao, China;  
medium section mill for 1,500,000 t/year
- ArcelorMittal Espana SA, Gijon, Spain;  
modernization of rail mill with universal  
rolling technology
- Hyundai Steel, Pohang works, South Korea;  
medium section mill with HCS stands and hydraulic  
sizing mill for narrowest tolerances
- Trinecke Zelezarny A. S., Czech Republic;  
upgrade of the 700,000 t/year blooming mill by instal-  
ling a reversing blooming mill stand and a bloom shear

### MERCHANT BAR MILLS

- Fujian Luoyuan Minguang, China;  
HSD® High Speed Delivery system
- Hyundai Steel, Danjing works, South Korea;  
new cooling lines for quenching and self-tempering  
of rebars

### BAR AND WIRE ROD MILLS

- Hyundai Steel, Pohang works, South Korea;  
modernization of an SBQ mill including a PSM® 380/5
- OEMK/Metalloinvest, Stary Oskol, Russia;  
modernization of an SBQ mill including a PSM® 380/4
- Saarstahl AG, Neunkirchen works, Germany;  
new wire rod finishing line for improved quality  
and tolerance
- Yinkou Iron & Steel Co., China;  
new wire rod finishing line

### BRIGHT STEEL PLANTS

- Outokumpo Stainless Bar Inc., USA;  
BC35-type peeling line
- Schmiedetechnik Breitenfeld, Austria;  
PMH 350/F peeling line
- ZAPP Precision Wire Inc., USA;  
CDM KZ-R 1B/8/FNR combined drawing line
- Global Steel Wire S. A., Spain;  
CDM KZ-R 3B/20/FNR drawing line
- Valbruna Slater Stainless, USA;  
CDM KZ-RP-IIB/17 combined drawing line

## COMMISSIONING PROJECTS

### TUBE AND PIPE PLANTS

- Huta Łabędy, Poland; 12¼" HF pipe welding line
- Gazpromtrubinvest, Russia; 16" high-frequency pipe welding line
- Vallourec Star, USA; modernization and new high-performance cross-rolling mill
- Corinth Pipeworks, Greece; 56" large-diameter pipe plant
- Altumet, Algeria; pipe end finishing machine
- Vallourec Mülheim, Germany; hydrotester
- CAST (CNNC AREVA Shanghai Tubing Co., Ltd.), China; KPW 25 LC (3x), KPW 50 LC
- Michigan Seamless Tube LLC, USA; KPW 75 LC

### SECTION AND BILLET MILLS

- Xining Special Steel Co. Ltd., China; large bar mill with HCS stands and monitor control
- Rizhao Steel Holding Group, Rizhao, China; heavy section mill for 2,000,000 t/year
- Pangang Group International, China; new CCS universal stands for new rail and section mill
- ArcelorMittal Belval & Differdange, Luxembourg; new straightening machine for sheet piles
- Hyundai Steel, Pohang works, South Korea; revamp of reversing tandem mill and installation of new automation systems
- Anshan Iron and Steel Group Co., China; new breakdown mill stand at the existing rail and section mill including new automation system

### MERCHANT BAR MILLS

- Gerdau Midlothian, Texas, USA; upgrade of finishing end

### BAR AND WIRE ROD MILLS

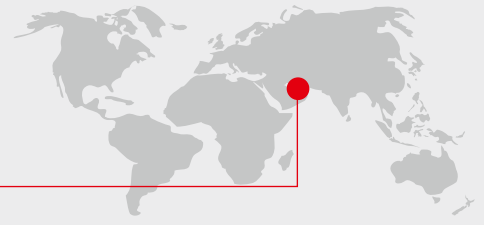
- ArcelorMittal Monlevade, Brazil; 2-strand wire rod mill for 1,000,000 t/year
- GV do Brasil, Brazil; 400,000 t/year bar and wire rod mill
- South Steel Co. (SOLB), Jizan Economic City, Saudi Arabia; 500,000 t/year combined rolling mill
- One Steel Laverton/Australia; new HL-stands bar mill, phase 1
- Deutsche Edelstahlwerke GmbH, Siegen-Geisweid, Germany; new SBQ cooling bed

### BRIGHT STEEL PLANTS

- BGH Edelstahl Siegen GmbH, Germany; PMH 600 peeling machine
- VDM Metals GmbH, Germany; PMH 320 peeling machine
- Gebr. Grieshaber GmbH, Germany; grinding and polishing machine Schleipo 1/FNR
- Abinsa Sa de CV, Mexico; upgrade of combined drawing and straightening machine for round and section KZ-RP 2B/17
- Buntmetall Amstetten GES.M.B.H., Austria; upgrade of drawing line ID

## AL GHARBIA PIPE COMPANY

Location: Abu Dhabi, United Arab Emirates



### **GREENFIELD PROJECT IN ABU DHABI: SMS GROUP TO SUPPLY TURNKEY LARGE-DIAMETER PIPE PLANT TO AL GHARBIA PIPE COMPANY**

Al Gharbia Pipe Company has awarded a consortium consisting of Larsen & Toubro Limited plus SMS group a contract for the EPC (engineering, procurement, construction) of a turnkey LSAW (longitudinal submerged arc welded) large pipe production facility. SMS group is responsible for the engineering and supply of the process equipment for the pipe plant in Abu Dhabi. Larsen & Toubro Limited – SMS's partner in the consortium – is responsible for the civil works and erection of the equipment.

The new LSAW pipe production plant located in the Khalifa Industrial Zone in Abu Dhabi (KIZAD) will start production in 2018. It will process material grades up to X80 and feature a production capacity of 240,000 tons per year. This pipe material is suitable for both offshore line pipes and onshore applications. The line is designed to produce pipes up to 12.2 meters long with external diameters of 18" to 56". The maximum wall thickness is 44.5 millimeters.

Besides the engineering and project planning, scheduling and coordination, SMS group will supply all the key machinery as well as the process equipment. Also included here are workshops, laboratories, and the MES (manufacturing execution system) equipment. The production line consists of an edge miller, a crimping press, a JCOE® pipe forming press, a tack welder, an inside and outside welder, a mechanical expander, and

a hydrostatic pipe tester. Developed by SMS, the JCOE® pipe forming process comes with a whole range of advantages. The plant operator can rapidly change over to other pipe dimensions. That means smaller batch sizes can be produced cost-effectively with the utmost precision. All presses are equipped with variable-speed pumps (VSP) to ensure an efficient hydraulic system with pressures of up to 450 bar. This reduces energy consumption compared to conventional hydraulic systems by 30%. The Shape automation system developed by SMS controls the forming process fully automatically. That improves performance and minimizes the influence of plate inhomogeneity on the forming process. Our customer will benefit from consistently high pipe quality.

Al Gharbia Pipe Company will manufacture longitudinal welded large-diameter pipes from high-quality steel mainly for the energy industry. It will target markets in Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

The extraction and production of gas and oil in these regions is forecast to remain stable, so it is safe to assume the demand for high-end steel pipes for transporting these commodities will increase.

Al Gharbia Pipe Company is a joint venture between the investment company Senaat, JFE Steel, and Marubeni-Itochu Steel (MISI). The new company is leveraging JFE Steel's technology for large-diameter longitudinally welded pipes made from high-grade steel, MISI's sales network, and Senaat's industrial footprint in Abu Dhabi.

Present during the contract signing ceremony; from left to right: Pinaki Chakraborty, Amit Swarnkar, Derek Michael Shah (all Larsen & Toubro Limited), Tadayuki Baba (Marubeni-Itochu Steel), Tariq Al Wahedi, Jamal Salem Al Dhaheri (both Senaat), Marcel Fasswald, Frank Lüth (both SMS group).



## FORGING TECHNOLOGY

- Success with green technology
- Newly developed RAW ecompact<sup>®</sup> ring rolling machine with attractive cost-benefit ratio
- Energy savings of more than 50% with HybrEx<sup>®</sup> extrusion presses
- Largest SMS extrusion press to date goes into operation



Ever more important, especially in the automotive industry, is lightweight construction leading to low energy consumption. This is why the market potential for aluminum extrusion presses is strong. On the other hand, the construction industry, which is traditionally the largest secondary market for light metal extrusion presses, is more hesitant. Development in the heavy metal sector is positive. It is driven by replacement investments in plants with higher pressing forces. Equally important here are special applications such as extrusion presses for high-alloyed seamless tubes or zirconium tubes.

Generally, aluminum is a material with high future potential and constant growth rates. Experts expect forged input stock, extruded structural parts, and crash management systems to play an increasing role in the automotive industry. Another extruded material for lightweight components that could become significant in the future is magnesium. Looking at heavy metal extrusion presses, the OCTG market (for oil field equipment) will rally in the medium term, despite the current difficult phase.

It remains hard to predict how the market for aluminum smelting and casting plants will develop. Overproduction of aluminum is an issue, above all, in China. That is why we anticipate stagnating demand for primary aluminum production. Driven by increasing environment-consciousness, demand for recycling plants will remain strong. However, our customers are very reluctant to invest in new or replacement plants.

### ITALIAN RING PRODUCER BUYS NEWLY DEVELOPED RING ROLLING MACHINE

SMS group developed a new ring rolling machine and has already attracted its first customer for the plant. Forgia Rapida in Bologna, Italy ordered a RAW 100/80-3000/480 ecompact® radial-axial ring rolling machine. This innovation features electro-hydraulic direct drives mounted on the roll shafts. New for this kind of application, the individual drive can reduce energy consumption by as much as 40% compared to conventional ring rolling machines.

The RAW ecompact® for Forgia Rapida will replace a smaller ring rolling machine in the Bologna works. It will roll rings with diameters of up to 3,000 millime-



Marcel Fasswald,  
Member of the Managing Board,  
SMS group GmbH

**Heads of the Division**  
Ralph-Andreas Surma  
Ulrich Vohskämper

ters and maximum heights of 480 millimeters. The radial rolling force will be 1,000 kN, and the axial force up to 800 kN. SMS group is set to deliver and install the machine in summer 2016. Then, production will start in September 2016. Short delivery times and speedy erection and commissioning are integral elements of the newly developed machine design. To test and verify the performance parameters, our customer can use standard-dimension rings or rings from current production stock. That ensures the machine reaches its full performance capacity within a very short time.

**“We were impressed by the excellent cost-benefit ratio of this new development,” says Lorenzo Badini, owner of Forgia Rapida, commenting on the investment. “We have no doubt our outlay will pay off in a very short time.”**

The RAW ecompact® costs around 20% less than conventional ring rolling machines. Furthermore, there is no need for the usual central hydraulic system. That does away with all the pipework for the machine and its foundations. This not only saves money, it also eliminates the risk of pollution from oil leakage. SMS group manufactures the new machines in a variety of sizes. The largest rings come with a maximum outside diameter of 3,600 millimeters with horizontal unloading.

Soon, the RAW ecompact® at Forgia Rapida will produce rings for radial compressors, reciprocating piston compressors, gas turbines, and more. Currently, the Italian manufacturer produces some 4,000 t of forgings per year.

### ROYAL UNITED ORDERS HYBEX<sup>®</sup> EXTRUSION PRESS AND BILLET HEATER FROM SMS GROUP

Royal United Metal and Glass of Dubai (United Arab Emirates) has ordered a HybrEx<sup>®</sup>32 extrusion press as well as the upline inductive billet heater from SMS.

The billet heater consists of two induction furnaces, each with a rating of 650 kW. Also installed here is CADEX<sup>®</sup> (Computer Aided Direct Extrusion) software. Applying the current process parameters, it calculates the optimum extrusion speed curve and the minimum billet temperatures required. Then the program controls the billet heater according to the results. CADEX<sup>®</sup> boosts productivity by up to 10% compared with extrusion without feedback.

Royal United will use the press for the production of aluminum profiles for facades and windows. It processes 9" billets and has a capacity of some 14,000 tons of profiles per year. The plant is scheduled to go into production in the fourth quarter of 2016.

### HINDALCO INDUSTRIES RELIES ON HERTWICH CONTINUOUS HOMOGENIZATION

Before entry into the press, extrusion press input stock undergoes thermal processing. Hertwich Engineering supplies continuous plants for this process that have conquered markets worldwide.

Looking for the ideal solution for the production of extrusion press input stock in its newly erected Madhya Pradesh works, Hindalco Industries chose thermal treatment in a continuous-feed furnace. The continuous homogenization and sawing plant for round billets (diameters 178 to 229 millimeters) installed by Hertwich Engineering comes with a capacity of 64,000 tons per year. It is the fourth plant of this type supplied by Hertwich to customers in India.

A member of the Aditya Birla Group, Hindalco Industries Ltd. ranks among the leading Indian companies in the raw materials industry, with 20,000 employees generating annual sales of USD 15 billion. To expand its input stock base, Hindalco supplemented the steel plant in Renukoot, Uttar Pradesh, with the newly

erected Mahan works in Bargawan, Madhya Pradesh. This facility, which also produces input stock for its own extrusion plant, went into operation in 2013.

When planning the expansion of billet production, the management decided against using chamber furnaces, as it had in the past. Instead, the company chose a continuous homogenizing plant from Hertwich Engineering. The plant we supplied went into production in 2015.

The cast round billets go through an inspection line, which is currently supplemented by an ultrasound testing device that detects cracks inside the billets. Then the head and tail ends of each bar are sawn off, also automatically.

Next in line, these bars are transported over a buffer section into the homogenizing furnace. Here, the heating zone heats them to the required temperature. The material then travels on into the holding zone of the furnace. Depending on its alloy composition, it is kept at the same temperature for between two and six hours. Here, air is used as the cooling medium. The plant operator can adjust the cooling rate over a wide range (350 to around 550°C per hour). That covers all the processes required. Furthermore, the heat treatment parameters of each individual bar are measured and documented here.

### SOUTH AFRICA EXPANDS ALUMINUM RECYCLING

South African company Hulamin Ltd. successfully commissioned an Ecomelt-PS 250 recycling furnace from Hertwich Engineering with an initial capacity of 50,000 tons per year.

Developed by Hertwich Engineering (a subsidiary of SMS group), Ecomelt smelting technology has firmly established itself on the global market.

So far, 30 Ecomelt furnaces have been supplied worldwide. This is one of the highest-rated versions we have ever delivered.

Hulamin Ltd. is headquartered in Pietermaritzburg, South Africa. Today, it is the country's most important producer of semi-finished aluminum. Our customer is expanding its recycling capacities in response to new

The HybrEx<sup>®</sup> saves up to 55% of the energy required by conventional presses.





developments. Local can producers as well as canning companies are switching to aluminum as their production material. As a recycler of returned beverage cans, Hulamin aims to handle higher volumes. That is why the company ordered an Ecomelt-PS 250 recycling furnace from Hertwich Engineering. Meanwhile, the plant has successfully started operations after a record construction time of just six months.

Conventional recycling of can scrap involves removing paint and residues in a separate process before smelting. First, rotary drum or belt furnaces remove the paint, then afterburners burn off the carbonization gases. Typically, the paint-free cans are then melted down in a sidewall smelting furnace.

The solution developed by Hertwich is different. That's because the Ecomelt-PS smelting furnace combines the paint-stripping and smelting operations in one continuous process. Furthermore, the energy from the carbonization gases goes into heating the furnace. The furnace installed in Pietermaritzburg meets all the necessary criteria regarding smelting performance, energy consumption, combustion, and emissions.

- It processes the planned material blend from contaminated can recycling materials (up to 65%) as well as thin-walled production waste with no problems.
- Equally important, the specific energy consumption is reduced by almost half compared to conventional solutions.
- The same applies to the net combustion values. It is already clear from the results achieved so far that these values are under 3%.
- What makes the furnace an excellent example of green technology are the low emissions of NO<sub>x</sub>, dioxins, VOC, and salts, as well as reduced fuel consumption leading to lower CO<sub>2</sub> emissions.

## MAJOR ORDERS

## RING AND WHEEL ROLLING MACHINES

- Forgia Rapida, Italy;  
RAW 100/80-3600/480 ecompact® ring rolling machine
- Peradotto, Italy;  
RAW 40(50)/32(40)-1000/210 EM ring rolling machine

## FORGING PRESSES

- Otto Fuchs, Germany;  
40 MN and 80 MN hydraulic closed-die forging presses
- Richard Neumayer, Germany;  
AMP 2000 closed-die forging press
- SHAANXI HONGYUAN AVIATION FORGING, China;  
SPKA 22400 clutch-operated screw press
- Hitachi Metals, Japan;  
100 MN class open-die forging press
- Hitachi Metals, Japan; 18 MN radial forging machine SMX

## EXTRUSION PRESSES

- Royal United, Dubai, United Arab Emirates; HybrEx® 32
- Heixing Aeronautical Materials, China;  
36 MN indirect tube press
- Buntmetall Amstetten, Austria;  
50 MN extrusion and tube press for heavy metal
- Astrex, Canada; 40/44 MN  
short-stroke, front-loading extrusion press
- SeAH Special Steel, South Korea;  
50 MN extrusion press line for steel tubes

## ALUMINUM PLANTS

- Georg Fischer, Austria; smelting/holding furnace
- AMAG, Austria; chamber homogenization furnace
- ETI, Turkey;  
continuous homogenization plant and sawing plant
- IMPOL, Slovenia; continuous homogenizing plant,  
sawing plant, and helical UT
- INALUM, Indonesia; vertical continuous caster and  
chamber homogenizing plant

## COPPER PLANTS

- MKM in Hettstedt, Germany;  
modernization of the CONTIROD® plant
- Cendres + Metaux, Switzerland;  
upgrade of three micro-plants for precious metals

## COMMISSIONING PROJECTS

## RING AND WHEEL ROLLING MACHINES

- Euskal Forging, Spain; RAW 1000(1250)/  
1000(1250)-9000/1700 ring rolling machine
- AVISMA-VSMPO, Russia;  
RiWa 8000/4000/1350/500 ring rolling machine

## FORGING PRESSES

- Nanshan, China; 80 MN stretcher
- Sona BLW, Germany; MT630 closed-die forging press  
with MEERtorque® drive

## EXTRUSION PRESSES

- Jilin Liyuan, China;  
36 MN direct/indirect tube extrusion press  
and 160 MN front-loading extrusion press
- Sarbak Metal, Turkey; 25 MN direct and indirect press  
for tubes and extruded products

## ALUMINUM PLANTS

- DUBAL, UAE; chamber homogenization furnace
- HINDALCO, India;  
continuous homogenizing plant and sawing plant
- AMAG, Austria;  
multi-chamber smelting and casting furnace
- GEORG FISCHER, Austria;  
smelting/holding furnace
- Reynolds Consumer Products, USA;  
Ecomelt PS-140 multi-chamber smelting furnace
- HULAMIN, South Africa;  
Ecomelt PS-250 multi-chamber smelting furnace

## COPPER PLANTS

- Anhui Tianda, China; CONTIROD®
- Seowon, South Korea; modernization of a horizontal  
continuous caster for brass billets
- Banco de la Republica, Colombia;  
modernization of two horizontal continuous casting  
plants for strip for coin alloys



## LARGEST EXTRUSION PRESS EVER BUILT BY SMS STARTS PRODUCTION

Shortly after commissioning, Jilin Liyuan Aluminium Company in Liaoyuan, Jilin Province, China, awarded SMS group the FAC (final acceptance certificate) for a 36 MN direct/indirect tube extrusion press and a 160 MN front-loading extrusion press. The 160 MN press is the largest extrusion press built by SMS so far.

It will be used, above all, for the extrusion of large profiles of medium-hard aluminum alloy for new high-speed trains and other rail-bound vehicles. The advantages: Large profiles mean less welding work in wagon construction plus greater stability and lower weight. The front-loading press produces billets with a diameter of 720 millimeters, a length of 2,500 millimeters, and a weight of 2,750 kg. They are used to manufacture profiles up to 800 millimeters wide and 35 meters long.

Jilin Liyuan is using the new second plant, the 36 MN direct/indirect tube press, to expand its seamless tube product spectrum. This press is capable of processing 300 kg billets of high-strength aluminum al-



loys with a diameter of 322 millimeters and a length of 1,350 millimeters. The billets are required to produce special tubes for use in power stations, oil and gas exploration, as well as profiles for the electronics and automotive industries. An outstanding feature of the SMS press is its high flexibility. Applying direct extrusion mode, Jilin Liyuan can also produce normal profiles. Jilin Liyuan is one of China's leading producers of extruded aluminum profiles and tubes. Now, with the two new presses, it is expanding its product portfolio particularly in the high-grade and profitable special segments. That will boost the company's competitiveness.



## ELECTRICAL AND AUTOMATION SYSTEMS

- Fit for the future with visualization of complex process sequences
- Mobile devices for fast and reliable evaluation of process results
- Ladle management system boosts productivity in steelworks
- PQA (product quality assessment) – a system for comprehensive quality assurance



Although order intake by our Electrical and Automation Systems Division fell short of the previous year's figure, sales grew by 15% in 2015. Generally, the market is very hesitant. Looking at 2016, customers will remain cautious due to existing over-capacities and unfavorable financing conditions for major projects. Our Electrical and Automation Systems Division expects good market potential in the future for modernizations that enable plant operators to manufacture more market-oriented and competitive products.

Installed in metallurgical plants, modern electrics and automation ensure reliable, high-quality production.

**SMS group meets growing automation requirements by developing and improving innovative technologies.**

### **X-PACT® VISION – OPERATION AND VISUALIZATION**

Our X-Pact® Vision solution sets new standards in the future-oriented visualization of complex process interactions. Here, we redefine plant operation in response to the needs of modern, highly automated systems. Applying web-based reporting, X-Pact® Vision provides access to processes from any location. The use of mobile devices ensures intuitive, reliable, and time-saving evaluations of manufacturing results. That means optimized processes. Ideally designed for revamps, our solution is easy to integrate into any plant configuration.

### **X-PACT® VISION PROCESS GUIDANCE SYSTEM**

Our process guidance system (PGS) meets the high requirements of automation in steelmaking plants. The entire visualization is geared to operator guidance. All functionalities of plant control and maintenance as well as metallurgical and material-specific inputs and outputs can be steered conveniently from one control station. To guide the operator through the complete process, we also devised a new, dynamic display format. Here, the user sees all the relevant



Harald Rackel,  
Member of the Managing Board,  
SMS group GmbH

**Heads of the Division**  
Christian Geerkens  
Bernward Reif

process information, entry prompts, and control elements at precisely the right times. Everything is presented automatically and is intuitive to use.

### **X-PACT® PQA SOLUTIONS**

Manufacturing first-class products is vital for the profitability of steel companies. That's why we teamed up with our subsidiary MET/Con to develop a comprehensive solution for quality assessment. The result is X-Pact® PQA (product quality assessment), which supports the entire sequence of production and further processing. This system logs production parameters from various data sources delivered by the process automation. Then it analyzes their impact on quality-relevant aspects. Building on our expertise and extensive practical experience, the core of our PQA solution consists of a quality guideline and a regulation framework. Once implemented, the system promptly identifies steel grade-specific deviations from the ideal and suggests corrective measures. Also included is final evaluation of every product in each processing stage.

### **COMPREHENSIVE LADLE MANAGEMENT SYSTEM**

To support maximum steelworks productivity, we have developed a ladle management system. It features a modern, intuitive user interface. Furthermore, an object-oriented structure makes it fast and foolproof to implement. Existing databases and other Level-1 applications can be integrated seamlessly into the

Fewer errors –  
lower costs

ladle management process. The holistic data storage eliminates the need for extra interfaces and manual data input. That drastically reduces error sources, slashes costs, and ensures smooth operation with seamless, automated ladle tracking. Technological highlights are the ladle temperature model and our patented ladle identification system using an infrared camera. To enable ladle identification, low-cost, heat-resistant panels with readable codes are attached to the ladles.

## EXAMPLES OF ELECTRICAL AND AUTOMATION SYSTEM MODERNIZATIONS IN FLAT ROLLING

Due to the overcapacities built up over recent years, fewer new plants are currently being built. Instead, the market demands modernization of existing plants to meet current quality requirements. Below, we present some examples of how SMS group applies its competence in modernizing complex plants within the shortest possible stoppage periods.

### Jindal South West Steel (JSW) CSP® plant, Dolvi

During a modernization project, JSW at Dolvi in India replaced its entire automation (Level 1 and Level 2). Furthermore, new low-voltage drives and controllers were installed throughout the plant. The entire revamp involved SMS group X-Pact® electrics and automation technology. Also integrated were new user interfaces and modern control desks with our X-Pact® Vision solution. In December 2015, after a standstill of just 25 days, the CSP® plant resumed production.

### Nucor CSP® plant, Crawfordsville, USA

Nucor's CSP® was the first of its kind worldwide. SMS group supplied it in 1989. Now, in 2015, Nucor contracted SMS group to revamp the plant. The modernization will take place in three phases. The first and most important stage consists of replacing the outdated automation hardware with the latest X-Pact® solution. This will boost plant availability.

The scope of supply covers Level-2-automation with pass schedule calculation, plus a profile, contour, and flatness model as well as Level-1-automation. Furthermore, we will replace the entire control and visualization system with our innovative and ergonomic X-Pact® Vision.

### Al Ezz Dekheila Steel (EZDK), Alexandria

EZDK awarded SMS group a contract to modernize its CSP® plant in Alexandria, Egypt. Major elements in the scope of supply are modernization of the automation (Level 1 and Level 2) in the CSP® caster and the CSP® rolling mill. We will also upgrade the CSP® rolling mill with a microstructure model. Included in the project are new voltage converters for the auxiliary and main drives as well as a new surface inspection system. We will upgrade the thickness and profile measurement system as well as the reactive-power compensation (SVC).

### Modernization of the cold tandem mill at Severstal, Cherepovets

Russian company OAO Severstal resolved to expand its product portfolio, improve quality, increase annual production, and prepare its rolling mill for future connection to a pickling plant. That's why the company engaged SMS group to revamp its four-stand cold tandem mill. We will completely renew the four roll stands and the entry area. The drive of the first mill stand with transmission, motor, and infeed will be fully upgraded with a medium-voltage frequency converter. The other stands will receive new drive spindles. Furthermore, we will install a new field control system in the Leonard converter for the drive of mill stands 2 to 4 as well as the tension coiler.

Our X-Pact® automation will boost the efficiency of the tandem mill (Level 1 and Level 2). We will also upgrade the technological measuring systems for strip thickness, strip tension, and rolling speed. To meet high strip flatness requirements, we will install an X-Shape flatness measuring system downstream of both mill stand 1 and mill stand 4. Our threading assistance system combined with the relevant models and controls will ensure lower thickness tolerances and shorter off-size lengths at the strip ends.

New automation  
solutions for high plant  
availability



## MAJOR ORDERS

### METALLURGICAL PLANTS AND ENVIRONMENTAL TECHNOLOGY

- PCC BAKKISILICON, Iceland; electrics and automation for a silicon reduction plant
- Saudi Iron and Steel Company, Saudi Arabia; replacement of Level 2 and Level 3 systems
- US Steel Fairfield, USA; electrics and automation for an electric-arc furnace
- Jindal Steel & Power Ltd., India; electrics and automation for an LD converter steelworks
- JSC TNK KAZCHROME, Kazakhstan; electrics and automation for a spare parts package for several submerged-arc furnaces

### FLAT ROLLING PLANTS

- Shandong Iron & Steel Group, China; electrics and automation for a 5-stand pickling-tandem mill
- Al Ezz Dekheila Steel Company, Egypt; electrics and automation for the modernization of a CSP® plant
- AMAG rolling GmbH, Austria; electrics and automation for an aluminum cold rolling mill
- North American Stainless (KY), USA; electrics and automation for a cold rolling mill
- PT. Gunung Raja Paksi, Indonesia; electrics and automation for a CVC reversing cold rolling mill
- Zhangjiagang Shajing Heavy Plate Co., Ltd., China; electrics and automation for the modernization of a heavy plate mill
- Nam Kim Steel, Vietnam; electrics and automation for a 2-stand reversing cold rolling mill
- Tata Iron & Steel, India; electrics and automation for the modernization of a coil box
- Nucor Steel Crawfordsville, USA; electrics and automation for the modernization of a CSP® plant

### STRIP PROCESSING LINES & THERMAL PROCESS TECHNOLOGY

- Shandong Iron & Steel Group, China; electrics and automation for a hot-dip galvanizing line and two continuous annealers
- AMAG rolling GmbH, Austria; electrics and automation for a strip continuous furnace
- North American Stainless (KY), USA; electrics and automation for an annealing line
- Tosyali Toyo Celik A. S., Turkey; electrics and automation for an electrolytic tin-plating line
- OJSC Magnitogorsk, Russia; electrics and automation for a hot-dip galvanizing line

## COMMISSIONING PROJECTS

### METALLURGICAL PLANTS & ENVIRONMENTAL TECHNOLOGY

- thyssenkrupp Steel Europe AG; Germany; electrics and automation for modernization of a 1 × 2 strand slab caster
- SNNC Co. Ltd., Korea; electrics and automation for a 135 MVA ferro-nickel submerged-arc furnace
- Salzgitter Flachstahl GmbH, Germany; electrics and automation for the modernization of a converter
- TATA STEEL IJMUIDEN B. V., Netherlands; electrics and automation for alteration of a converter

### FLAT ROLLING PLANTS

- Guangxi Alnan Aluminium Fabrication, China; electrics and automation for an aluminum cold rolling mill
- PJSC Vyksa Steel Works, Russia; electrics and automation for four shifting roller tables in a heavy plate rolling mill
- Salzgitter Mannesmann Grobblech GmbH, Germany; electrics and automation for a cross-cutting shear
- VDM Metals GmbH, Germany; electrics and automation for a cold plate leveler
- Outokumpu Stainless AB, Sweden; electrics and automation for the water supply system of a heat treatment line
- Gazi Metal Mamulleri, Turkey; electrics and automation for a cold rolling mill complex
- Nucor Steel Berkeley, USA; electrics and automation for the modernization of a cold rolling mill
- Ningbo Xingye Xintai, China; electrics and automation for two reversing cold rolling mills
- International Steels Limited, Pakistan; electrics and automation for the expansion of a reversing cold rolling mill
- KYCR Coil Industries Ltd., Bangladesh; electrics and automation for the expansion of a reversing cold rolling mill

### STRIP PROCESSING LINES & THERMAL PROCESS TECHNOLOGY

- Saudi Arabian Mining Company, Saudi Arabia; electrics and automation for a thermal/chemical strip treatment line
- Wuppermann Staal Nederland BV, Netherlands; electrics and automation for a side trimmer and a pre-leveler
- Gazi Metal Mamulleri, Turkey; electrics and automation for a pickling line





## PLUG & WORK

On a massive construction site in the USA, the new steelmaking facility of our customer Big River Steel is making good progress. Meanwhile, a delegation made up of plant operators and investors visited SMS group in Hilchenbach and produced the first virtual steel. That was in our test center, where we set up large parts of the steel plant automation system in running order, including switch cabinets, computers, control desks, and software. This enables us to test it thoroughly in near-reality simulations well ahead of commissioning. We can also train our customer's operating personnel at an early stage here. We have named this innovative method Plug & Work. It drastically reduces commissioning time in the real plant.

Daniel J. Murray, Board Member of Big River Steel, was enthusiastic: "It's really fascinating to experience

the functions and capabilities of our new steelworks in advance like this. We are now more convinced than ever our plant will set a new benchmark in the US."

Now there is an extra feature that improves Plug & Work even more. It consists of a professional, interactive 3-D graphic system embedded in our simulation environment. This enhances the representation and visualization of the production processes. Manuel Ortiz, the project manager of our customer EPSSN, is highly satisfied with the result of the 3-D Plug & Work test: "With 3-D visualization, we can actually see the mechanical elements and how they move even more clearly. That's a big help, especially for employees using the equipment for the first time. What's more, the 3-D image makes it easier to understand the individual process steps."

"It's really fascinating to experience the functions and capabilities of our new steelworks in advance like this. We are now more convinced than ever our plant will set a new benchmark in the US."

Daniel J. Murray, Board Member of Big River Steel



# PRODUCTION

- Closely linked international production and workshop network
- High quality built on decades of know-how
- Systematic investment in production locations to maintain competitiveness





Our Production Division was created in 2015 from the merger of SMS Siemag AG and SMS Meer GmbH into SMS group GmbH. It's responsible worldwide for the design and control of our workshops under the SMS group brand. A major objective is utilizing the synergies of a common global production network more effectively than before.

This strategy involved linking up the SMS group workshops in Mönchengladbach and Hilchenbach in Germany, our Chinese locations Zhangjiagang and Shanghai, and our Indian workshop in Bhubaneswar (Khurda), which opened in November 2014. The resulting production union employs a total workforce of 1,300 and generates annual sales of EUR 250 million.

The current crisis in the steel, copper, and aluminum industry with declining order volumes has resulted in ever-lower production capacity utilization at our German and Chinese locations.

We are currently implementing the necessary adjustments, for instance merging our two Chinese workshops at the Shanghai location.

Bucking the trend, our facility in India that opened in November 2014 is working at full capacity according to plan.

We are adhering to our philosophy of a closely linked, global network of production and workshop facilities. SMS group continues to manufacture all sophisticated machinery and plant components in reliable, German workshops – at a top technological level and with the know-how we have gained over decades.

Simultaneously, we count on a globally operating network of workshop, service, and production locations for on-the-ground manufacturing of special products geared to the local markets. That keeps us close to our customers and ensure competitive prices.



Harald Rackel,  
Member of the Managing Board,  
SMS group GmbH

Head of the Division  
Jens Overberg

## SYSTEMATIC INVESTMENTS TO MAINTAIN COMPETITIVENESS

### Hilchenbach production location

Once again in 2015, we introduced significant changes at our Hilchenbach location.

The repair center was re-integrated into the production shop. An assembly line for bending and shifting systems as well as AGC cylinders was successfully implemented according to lean production principles. Commissioning a welding robot considerably improved the quality of contract welding and its precision in our manufacturing network.

We changed over to a SLOT system (physical storage of representative bearing sizes) for plain bearing manufacturing. This significantly boosted and stabilized the entire performance level. It also reduced the delivery period for bearing bushes by 50%, for pivot bearings by 22%, and raised delivery reliability to 97% in 2015.

Furthermore, we expanded manufacturing capacity at the location by acquiring a Pama boring and milling machine (7,000 × 5,000). This unit perfectly rounds off our technical capabilities for cubic machining

of large components. It means SMS group can also supply customers beyond the traditional steel, copper, and aluminum industries.

For example, in the past business year we successfully manufactured our first machine carriers for customers in the wind energy industry. That also generated follow-up orders for 2016.

We processed the production orders for our major project Big River Steel in the US on budget and on schedule. As a result, supplies were delivered smoothly to the construction site.

We completed all special alterations and overhauls within the planned timeframe. Included here was an aluminum-billet chamfering machine for our customer Constellium in France. In a 48-hour campaign, we finished the entire job 8 hours earlier than planned.

#### **Mönchengladbach production location**

In 2015, our mechanical production department successfully wrapped up the 2020 investment plan with the supply and commissioning of two Tacchi large and long-format lathes. Our team complied with the time schedule as well as the budget. The machines supplied last were also installed according to plan, then inspected by the supervisors and operating crew.

Then, by producing the first large parts – including eight balancing cylinders for a forging press for Weber Metals, Inc. – our production staff demonstrated our capability of meeting new challenges. The cylinders and plungers weigh in at a massive 35 tons per unit. Production went largely without a hitch, and the result was good, just as we expected.

The new long-format lathe was first tested with relatively short turned parts in 2015. Then production of the connection anchors for the Weber Metals forging press started.

Especially impressive, both in the welding and the production shops, were the four pressure columns – each weighing 100 tons – for a plate stretcher. With the help of a mobile gantry crane and special turning devices, we were able to successfully manufacture

these heavy workpieces in our own welding shop. To save both time and money, we also annealed the parts in-house. That involved installing a mobile annealing furnace. We used the Schiess gantry for more than 1,100 machining hours – or over two months of full utilization!

For better visualization of the assembly procedures, we compiled the assembly plans in the form of Gantt charts instead of text-based plans. This format enables much better resource planning, which in turn ensures better performance in terms of time scheduling as well as earlier recognition of possible production delays.

Additionally, we introduced assembly preparation talks. They take place long before the planned assembly start and further improve the production flow. The focus here is on:

- Coordination of assembly tasks
- Consultation with the Product Units
- Evaluation of feedback from previous orders
- Corrective action when possible problems are identified

These methods were systematically applied for the first time to a project for Aleri in Germany. Here, we revamped a plate stretcher at the Koblenz location.

The on-site shop floor management assembly method proved a big success. This procedure involves the presence of everybody involved in the upstream and downstream processes plus the project managers. It speeds up decisions and enables direct implementation of solutions. Our customer was on site in our workshop during the entire final assembly.

#### **Production Department steps in for failed supplier**

One of our suppliers had problems with performance and order processing during production of a VDP 2000 trimming and calibrating press. So we simply took over final manufacturing in our own workshop.

Despite the hitch, we will supply the plant to our customer on schedule and in the required quality.



### **INVESTMENT AND MODERNIZATION PROJECT COMPLETED**

We wrapped up our Workshop Concept at the end of March 2015. That was not only right on schedule, but also on budget.

The 15 newly installed machines and plants are already fully run up. They have all been capable of top production capacity since the beginning of 2016.

Now, our focus is on optimizing production specifically in the areas of technology and processes.

Plant availability is more than 95%.

### **SERVICE WORKSHOP RELOCATED FROM AACHEN TO MÖNCHEGLADBACH**

As part of our SMS group restructuring program, we resolved at the end of 2015 to close our service location in Aachen, Germany, and to relocate corresponding capacities to our Mönchengladbach location in the current business year. This involves creating a shop-in-shop solution. Service assembly will occupy an area of some 1,400 square meters in Hall 1. The uniform assembly strategy in Halls 1 and 1a remains unchanged.

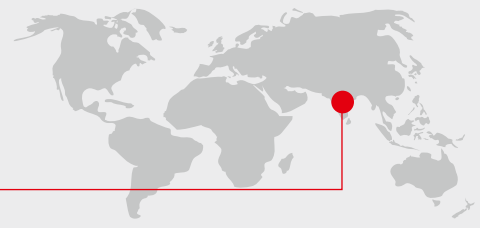
The same applies to Mechanical Production, which is currently housed in Halls 2 to 6. The machines from Aachen will supplement our machine stock here.

Specifically, we will transfer 13 units from Aachen and erect them in Mönchengladbach. Seven of the machines are earmarked for production to demand, which mainly takes place in manual operation. Included in the relocated equipment are two Bimatec Soraluze NC milling machines, two machining centers from DMU, plus two lathes from VDF and DMG. The latter ideally supplement the DMG ctx beta machine already installed in the workshop.

Next, we will compile a cost overview covering all the specialists required to carry out the relocation according to the agreed layout. Furthermore, a time schedule will specify all the necessary tasks as well as key milestones and target deadlines.

We have also launched the process of concentrating production in China at our Shanghai location. This move will enable us to take full advantage of the improved production flow and even better coordination at a single location.





## PRODUCTION LOCATION

Location: Bhubaneswar, India

### PRODUCTION LOCATION INDIA

Opened in 2014, our Indian workshop in Bhubaneswar (Khurda) went on stream and expanded its operations as planned. The Indian employees attended a training center for qualification according to German standards.

Initially, two main component types were manufactured in the workshop: pipes and pipe assemblies for cooling systems up to 7 meters in diameter, plus welded products such as ladle carriages weighing a total of up to 100 tons, and containers with approval certificates.

Meanwhile, the first stainless steel water cooling boxes for oscillators have been manufactured, including machine finishing, and delivered to customers.

According to our production-based workshop approach, we will gradually expand the range at this location to include other products. We expect further synergies from the interaction between our Technical Service Division and the Paul Wurth Service Division at the location. Ultimately, that will benefit our customers as well.



## TECHNICAL SERVICE

- Increased order intake as planned
- New approach for oil-film bearing systems
- Higher availability and shorter delivery periods for key spare parts
- Online monitoring system for key plant components protects our customers from downtimes







Our Technical Service Division succeeded in increasing order intake on the previous year. However, due to the general economic situation in the steel processing industry, the market remains tense. Capacity utilization of our customers' plants is low, tighter budgets and an increased focus on prices inform their purchasing decisions. As a result, customers are investing less in new plants. Conversely, they are spending more on spare parts.

We expect high demand in the future for larger repairs and modified, better spare parts. In the press sector, there is a high potential for upgrades and modernizations in North America, Russia, and India. The potential for modernizations of bright steel machines, including grinding and peeling systems, is high in North America.

### **MODERN, COST-EFFECTIVE OIL FILM BEARINGS**

**In the future, we will meet customer demand for more maintenance-friendly and production-boosting roll-neck bearings even more flexibly.**

To achieve this aim, we restructured our over 60-year partnership with Primetals Technologies USA LLC (formerly Morgan Construction Co.). Now, SMS group can supply both proven and innovative X-Roll® Oil Bearings on a whole new technological level. In the past, our specialists developed solutions to make our oil film bearing systems more process-reliable, greener, and maintenance-friendlier. The application of symmetrical support rolls with one fixed and one guide bearing is crucial to the excellent results achieved with SMS oil film bearing systems. Today's SMS group portfolio features its own effective seal systems that are geared to the special requirements of the various flat rolling plants

These new bearing systems have proven their worth both in newly built flat rolling mills as well as in revamps of older equipment. This is because they



**Dr.-Ing. Guido Kleinschmidt,**  
Member of the Managing Board,  
SMS group GmbH

**Heads of the Division**  
Johannes Kahlen  
Pino Tesè

are tailored to the needs of the processes in the rolling mill and the roll shop. Specifically, they offer savings potentials amounting to half the total operating costs. SMS group customers have confirmed reductions in oil consumption of up to 90%. Plant owners also profit from much higher work safety and easier operation.

### **SHORTER DELIVERY TIMES**

SMS group has revised its production method for expander tools. The result: much shorter delivery times. We have also optimized spare parts availability. Our American customer Standard Steel has particularly emphasized its satisfaction with our fast supply of spare parts for laser systems.

**Our new "Spare Parts Pool" service offers customers storage at SMS group of special spares they consider necessary for their plants.**

Then, whenever customers need them, we will deliver their parts just in time. This makes sense, because if plant owners keep stocks of all spare parts to cover contingencies, they acquire large inventories that bind a great deal of capital. Especially for large and critical components, on-site storage results in enormous costs for warehousing, management, and logistics. The capital it binds could be used more effectively elsewhere in the company.

Fast delivery of key spare parts

Our Spare Parts Pool eliminates this capital tie-up. We merely charge a fee according to the extent and value of the parts we keep in stock for the plant owner. SMS group guarantees its business partners exclusive access to spare parts in OEM-(original equipment manufacturer) quality. They can call up their parts 24/7 at fixed prices agreed in advance. Another advantage: customers don't have to dispose of outdated or worn parts.

### CUSTOMER SERVICE AROUND THE GLOBE

Once again in 2015, our Technical Customer Service employees supported customers on site with inspections, maintenance, and repairs. For instance, we manufactured a new tool holder in record time for Bohler Schmiedetechnik in Austria. The tool holder of our customer's SPKA 22400 clutch-operated screw press had broken. An immediate replacement of the 40-t-part was necessary. SMS group manufactured and delivered the part even before the agreed deadline. The press then resumed operation without a hitch.

Our service employees worked on major repair projects around the world. Included here was overhauling heavy plate mill stands in Germany, changing ladle turret bearings in Russia, supporting a maintenance stoppage in Belgium, and overhauling transmissions in Mexico and Brazil.

**Other routine activities for our experts were complex inspections and emergency support.**

These jobs consisted for instance of measurements of hot and cold strip mills, overhauls of plant components, and inspection of media systems in hot and cold strip mills. Furthermore, we signed new maintenance contracts and extended existing contracts. We concluded a framework maintenance contract with Daimler AG for various forging machines with a minimum run time of two years.

### EARLY WARNING SYSTEM PREVENTS DOWNTIMES

Our Genius Condition Monitoring (CM) system is a modular online monitoring solution. It tracks and documents the current condition of critical parts subject to wear.

**The advantage compared to traditional inspection and maintenance methods is the permanent monitoring of the plant components.**

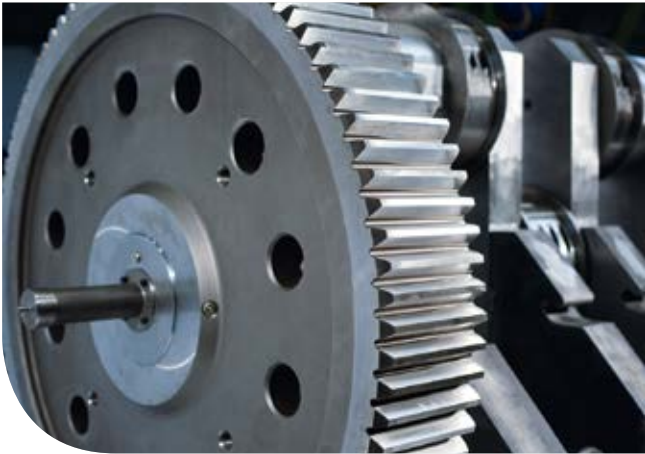
This means plant operators receive constant information about the current state and warnings whenever critical situations arise. For a customer in South Africa, we installed a chatter monitoring system complete with servo valve monitoring on a six-high aluminum stand.

### SUCCESS WITH TRAINING BY SMS TECADEMY

SMS TECademy looks back on a successful year. The market recognizes our learning program as a source of high-quality training for the metallurgical process chain. Our trainers conducted a large number of courses. Included here was a four-month course for more than 20 participants covering theory and practice over the entire steelmaking and rolling process.

### INTENSIVE BUSINESS RELATIONSHIPS

SMS group conducted instruction sessions at three locations of the SAPA Group on the topic of extrusion press maintenance. This helped us attract orders from SAPA Hoogezand for a 25-t-counter-plate and from SAPA Tonder for laminated tension rods.



## ELEXIS

- Diversification into different industries provides stability despite fluctuations in some areas
- Strategic expansion of activities in the nonferrous metal industry





In 2014, elexis AG's subsidiary BST International GmbH acquired 100% of the shares in eltromat GmbH. The objective behind this move was strategic expansion of the company's product competencies. The technology merger of the product platforms for print management solutions of the former BST and eltromat created a new technological standard under the brand name iPQCenter. iPQ-Spectral completes the product portfolio. This solution was developed in cooperation with X-Rite, the market leader in color management and measurement.

It's an inline spectral measurement system which is the first to replace conventional, manual color measuring with an online process.

**Due to its technical USP and measurement accuracy according to the XRG standard, the product places elexis far ahead of the competition.**

One particular focus is the packaging industry, characterized by growing quality requirements combined with increasing printing speeds and wider webs. elexis quality assurance systems for printed webs enable customers to inspect the entire web width for printing errors. They can also reset machine parameters while maintaining printing speeds. Now, after the takeover of eltromat, elexis supplies a complete family of quality assurance systems for the packaging printing, processing, non-woven material, tire, plastics, and foil industries.

The legal merger of the two companies in 2015 to form BST eltromat International GmbH, headquartered in Bielefeld, represents a major milestone in integration. The BST eltromat brand was established globally, which significantly increased sales power. BST eltromat aims to become the number one in quality assurance systems worldwide. Even today, the merger of the two companies means BST eltromat is already a big player on the relevant markets.

#### **EXPANSION OF AUTOMATED HANDLING SYSTEMS FOR THE PLASTICS INDUSTRY**

The products from the Automated Handling Systems for Plastics Division are suitable for a wide range of industries. Included here are the consumer goods and



Eckhard Schulte,  
Member of the Managing Board,  
SMS GmbH

**elexis management**  
Siegfried Koepp  
Edgar M. Schäfer

packaging as well as the automotive industries. The application know-how our experts gain from these industries is constantly transferred to new markets and solutions. This is how the elexis group succeeded in tapping into the medical technology market.

**Featuring cycle times of under four seconds, elexis petri dish handling systems rank among the fastest robot solutions available on the market.**

Weitere medizinische Gebrauchsgüter wie Pipettenspitzen, Inhalatoren oder Blutröhrchen werden ebenfalls auf Automationssystemen der Gruppe elexis produziert.

Other medical consumption goods such as pipette tips, inhalers, or blood vials are also produced on elexis automation systems. It's already clear that demand for medical technology is set to soar. An ageing society, higher health-consciousness, and technological progress in the sector will drive sustained growth. Strategically expanding our activities here will ensure we help shape new technological standards in the industrial production of medical technology.

#### **TREND TOWARD CONSOLIDATION IN THE METALS INDUSTRY**

Overcapacities in the metals industry prompted a number of consolidations in 2015. Furthermore, China, the engine of growth in recent years, suffered a decline in domestic demand. The consequence of this market development was a reduction in the number of major infrastructure and large plant projects as

well as revamps in the steel industry. Simultaneously, service and process optimizations for existing plants gained in importance. In the reporting year, the elexis group reacted flexibly to these altered demand structures. It will implement further moves in this direction over the current business year.

One of the major strategic approaches of our automation for metal products portfolio is a drive to tap into new markets and applications. It's not only crucial to apply holistic quality control of physical and process-related material properties during manufacturing. Equally important is performing continuous risk analysis of the materials used on the final customer markets. The sustained market transformation makes organizational modifications unavoidable. That's why our action plan includes adjusting capacities and cost structures, strategic analyses of make-or-buy projects, and expansion into contract production.

## FUTURE PROSPECTS

Since the end of the 2008–2009 financial crisis, global markets have not regained the stability of the previous years. It's true that upswings in individual industries and regions repeatedly created an underlying positive mood. Yet the overall global economic forecast for the coming year is once again muted.

Growth impulses from the industrialized countries of the USA and Europe remain hesitant. China, the powerhouse of past decades, is losing its dynamism.

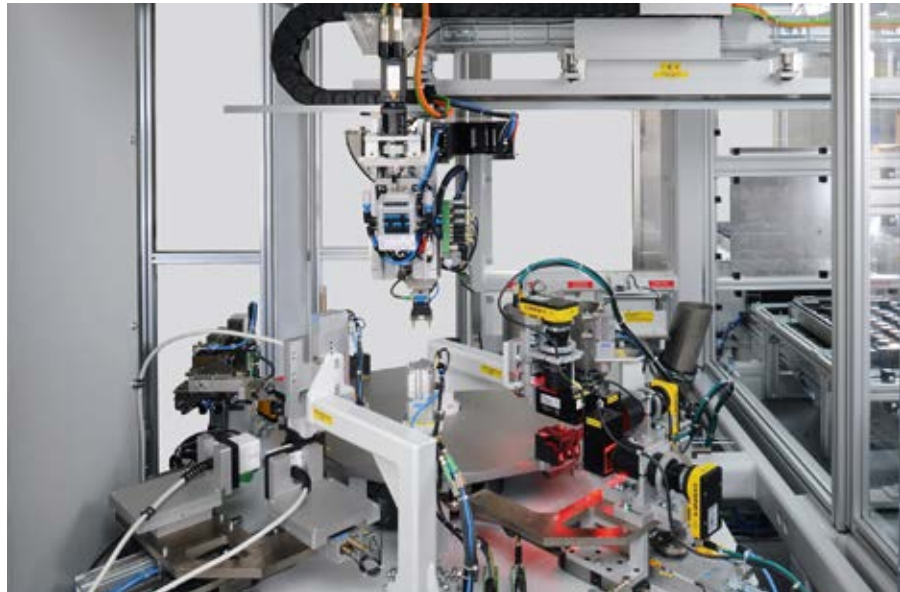
However, Asia – above all the countries in South-Eastern Asia – look set to be the growth region of the future. It's an important aspect here that product and price requirements on the Asian emerging markets are much lower.

Whereas demand in threshold countries is dominated by price, the industrialized nations will continue to demand increasing efficiency and process reliability in plants and systems. Known under the term "Industry 4.0", the interconnection of plants and components is the next stage of industrial development. The companies in the elexis group have identified opportunities here in the holistic optimization of quality as well as process sequences that reduce risk.

**The challenges for the elexis group lie above all in strategically adapting its product portfolio to the altered demand structure of the future.**

It's essential that we develop sustained optimizations throughout the value-creation chain in view of the continuing trend toward consolidation in the metals industry.

Facing up to changes in demand worldwide, the elexis companies are prepared for continuous strategic adaptation. Positive developments in the fields of nonferrous metals and medical technology will partly offset the negative effects in the ferrous metals industry.



## SMS ELOTHERM

- Inductive hardening for further weight reduction in vehicle construction
- Inductive hardening in the manufacture of large rolling bearings
- Innovative heating processes using regenerative energies



After two years with a relatively high business volume, order intake in 2015 contracted significantly. Compared to previous years, demand for plants is much lower than expected.

This applies particularly to steel and steel tubes. Service business developed on a satisfactory level, with moderate increases worldwide.

## GENERAL MARKET DEVELOPMENT

The automotive and automotive supplier industry is investing cautiously in hardening plants. International manufacturers are increasingly feeling the effects on their business of structural change and localization of production in China. That inevitably means the forging industry, which is largely dependent on the state of the mechanical engineering and automotive industries, is holding back on investments.

Most projects in the steel and steel pipe/tube industries have been shelved due to the steel crisis and continuing low oil prices. Included here are the segments reheating flat and long products in combined casting-rolling plants, and bar and pipe/tube tempering. The aluminum semi-finished products industry invested strongly in billet heating and extrusion presses in 2015.

However, the relevant market volume for 2016 is in line with the general, weak trend. Due to a sustained low purchasing price for copper, investment in the copper industry remains at a low level. However, we are pursuing promising projects for melting-casting plants for semi-finished copper materials in threshold countries.

## FUTURE MARKETS MOBILITY AND WIND ENERGY

### Hardening automotive components

Inductive and local hardening enables the production of ever-smaller components in vehicle drive trains. This is how inductive hardening contributes to even lighter-weight components, supporting CO<sub>2</sub> reductions that meet statutory requirements.



Dipl.-Ing. Siegfried Koepp,  
CEO of elexis AG

### Management

Dr. Johann Rinnhofer  
Martin Schultheis

### Hardening large rolling bearings

As the energy transition progresses, wind turbine volumes are increasing. Core components here are rolling bearings. They must be wear and maintenance-free over their entire service life, especially in offshore applications. Induction hardening technology plays a key role here, because conventional heat treatment is not possible for ring diameters above 4 meters.

## MODULAR MACHINES FOR CUSTOM SOLUTIONS

To achieve further growth, we are focusing on individual customer solutions with modular machines. The companies in the SMS Elotherm group supply innovative heating solutions that use regenerative energies and optimize existing industrial processes.

Inductive heating comes with advantages in all industrial heating procedures for metals – whether in forging, steel, steel pipes/tubes, or aluminum extrusion. The benefits are:

- The unique opportunity to use renewable electricity instead of fossil fuels in industrial heating
- Easy, energy-saving operation of plants, also under partial load
- Implementation of innovative, combined casting-rolling processes as well as energy-efficient heating processes

The high electrical energy density and heating rate of induction technology opens up entirely new possibilities. Some material grades can only be rolled into thin strip with inductive intermediate heating stages.

There are various growth opportunities on this market. To tap into this potential, we are developing stable process and plant technology for reheating long and flat products, as well as special applications for forming high-strength special alloys with a focus on the aerospace industry. All this involves close cooperation with SMS group.

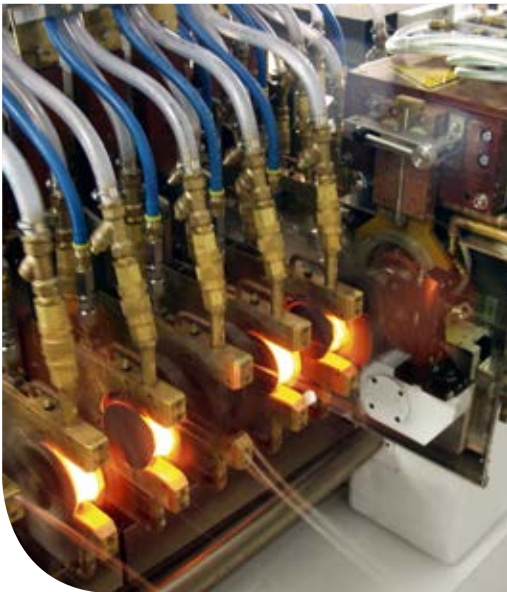
When it comes to services, we support the large number of SMS Elotherm and IAS plants installed on the market. We have identified further market openings in tool supply management for existing plants (inductors and coils). This will enable our customers to concentrate on their core business.

## R&D FOCUSES

Especially for the automotive industry, we are developing logistics solutions to further boost the productivity of hardening machines.

Development in the forging industry builds on our initial industrial successes here. Our focus is on formulating mathematical furnace operation models that better control scaling and temperatures in the partial-load range.

We are concentrating our efforts in the steel and steel pipe/tube industry on hybrid heating methods (combined fuel-powered and inductive heating plants). This will create energy and material-efficient total solutions.



# TECHNOLOGICAL DEVELOPMENT

- Digitization requires new ways of working
- HT (high torque) toothed spindles for greater loads
- Contact-free temperature measurement of moving surfaces
- Active oscillation damping in cold rolling mills





Today's globally established environmental awareness demands methods and processes that save resources and protect the eco-system.

Efficiency-boosting and therefore cost-cutting solutions often drive new investments in plant and process technology. We are dedicating extensive technological development activities to plants for high-end products.

Increasingly, innovative measurement systems and material models integrated in process models are improving process management.

### **INDUSTRY 4.0 REQUIRES NEW WORKING METHODS**

The latest advance after three industrial revolutions is digitization, also known as Industry 4.0. The term refers to the interconnection of production processes along with data digitization. Already, plant components are becoming increasingly intelligent, with self-learning capabilities. They can analyze large data volumes in real time and apply the findings for better process control. The buzzword here is Big Data. Industry 4.0 provides the basis for new developments in the steel industry designed to produce steel more cheaply and sustainably.

What our customers benefit from most is our greater ability to respond flexibly and rapidly to their requirements. Here are the elements of digital transformation that are crucial to the success of the industry: the Internet of Things in the industrial value creation chain, new business opportunities from digital platforms and services, and extensive use of Big Data for advance analysis.

"These are exactly the aspects we apply to develop new business models in cooperation with our customers," says Markus Reifferscheid. He is the Head of our Development Central Department and also the leader of a group of ten experts from various areas of SMS group. Specifically for this purpose, we relieved these employees of their former day-to-day duties in August 2015. Since then, they have been working in our "Ideation Lab" on marketable, future solutions for the digitization of business processes.

### **FOUNDATION OF A START-UP**

Recently, we established SMS DIGITAL. It's an independently operating subsidiary with responsibility for its own business and management. The purpose of the company is to build on the work already done to develop and market further digital products in direct contact with our customers.

### **FIRST USE OF HIGH-TORQUE (HT) TOOTHED SPINDLES IN PAIR CROSS STANDS (MAXIMUM WORK ANGLE 3.5°)**

It was a first in October 2015. That was when we installed HT spindles in our customer Baoshan's pair cross stand F2 in hot strip mill No. 3.

The toothed spindles usually available on the market come with the drawback that the transmittable torque decreases sharply at high angles. Applying a specially designed tooth geometry, we ensure the maximum transmittable torque is barely affected by the work angle. The toothed spindle type installed here can take approx. 1.5 to 2 times more strain than articulated spindles. This is why our customer chose the toothed spindle solution.

These elements are designed with a thermal resistance that enables a continuous output of 10,000 kW, a torque of 2,700 kNm, and a maximum working angle of 3.5° (bending angle and pair cross angle). To guarantee these properties, we performed extensive testing in our own laboratory. This was how we were able to define the correct parameters of the tribological system (surface structure of the toothing, lubricant).

Furthermore, we designed this part featuring the first stage of intelligent component technology. It's possible with the help of the spindle measurements to perform an online rapid analysis from any location. This then forms the basis for any instructions that may be necessary. Currently, a visualization of the analysis findings is available in the SMS group Intranet. Our specialists are still drawing up the security and maintenance plans required for global access.

## CONTACTLESS TEMPERATURE MEASUREMENT ON MOVING SURFACES

Even today, it's difficult under harsh conditions to reliably measure long-term temperatures on moving surfaces using infrared technology. A newly developed method involves positioning the optical measuring point very closely to the measured surface. Compressed air ejected through a flexibly guided suction head blows water off the surface and simultaneously prevents the penetration of impurities. The high flow rate between suction head and measured surface creates an underpressure which draws the head close to the surface so that it follows the movement of the measured object. To enable measurement of a roll surface, the suction head also comes in a concave version.

## DEVELOPMENT OF EMBEDDED SYSTEMS

An innovative modular platform is now available for micro-controller-supported recording of measurements in metallurgical and rolling plants. It comes in the format of a business card. The selected controller types range from high performance (STM32 series) to ultra-low power consumption (ARM Cortex-M3). All the sensors feature their own circuit boards for modular connection. Currently, the systems are capable of recording overloads with details of maximum value, date, and time as well as duty cycles. Here, they function as energy self-sufficient systems with a service life of over 1 year. When supplied with external energy, they also log torques, including angles and speeds.

The multiple-sensor platform consists of circuit boards produced in-house and connected together according to the required functions. They can be

adapted with minimum effort. Here are the versions developed in 2015: a battery board for testing and charging batteries, an ultra-low-power amplifier for elongation measurement to determine force and torque, gyroscopic sensors for measuring angles and speed, and temperature measurement via the I2C bus. Communication is via a BLE-capable Bluetooth 4.0 module or the USB bus.

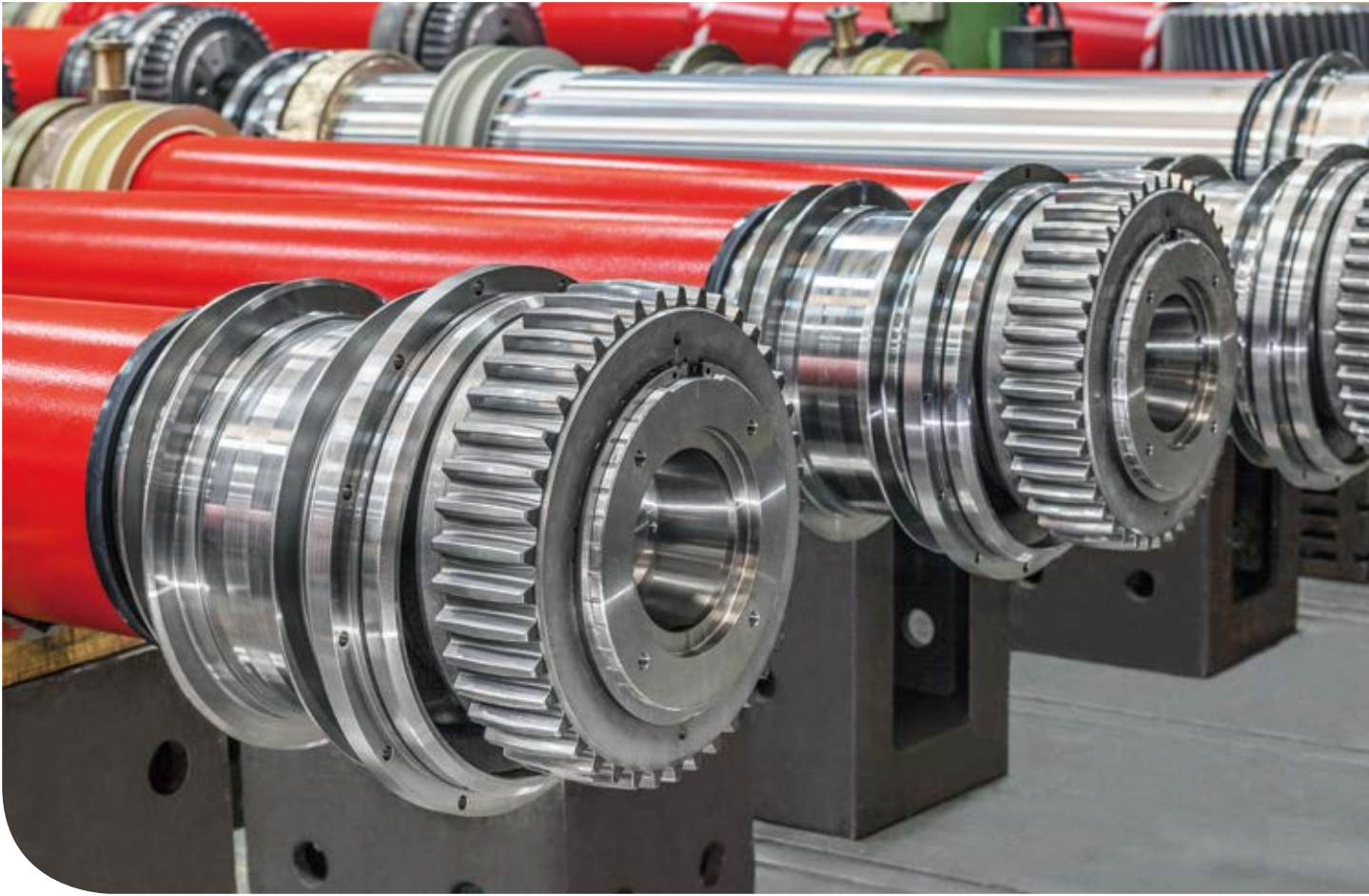
There is a wealth of future application fields, ranging from wireless installed parts monitoring, to transmission monitoring, to component tracking with permanent wear and service life logging.

## DEVELOPMENT OF MATERIALS ENGINEERING AND MICROSTRUCTURE MODELING

Modern materials engineering combined with microstructure modeling enables us to support customers even before commissioning of their plants by developing tailor-made heat treatment processes.

In our own materials lab, we use a quenching and deformation dilatometer to determine the technological requirements for our innovative MultiFlex-Quench plate tempering line so that it produces customer-specific tool steels. Then we apply the heat treatment parameters derived in our customers' microstructure models. That cuts commissioning times and improves material yields.

This model-based calculation of the processes relevant to microstructure formation monitors plate production. It's possible in advance and in simulation mode to virtually test the effects of various rolling or cooling strategies as well as different alloying options. The correlation between model forecasts and mechanical test results is very good.



### **INTELLIGENT FURNACE**

The conventional way of setting the desired material properties of cold strip in continuous annealing or hot-dip galvanizing lines is by applying annealing curves. Overwhelmingly, this does not take account of individual requirements that result from a modified chemical analysis, or of fluctuations in the pre-process stages. In cooperation with a European manufacturer of galvanized light plate, we achieved a technology leap using a big-data approach: The innovative coupling of mathematical modeling and high-performance sensors (Impoc® system from EMG) adapts the annealing process to suit each individual strip. That guarantees consistent high quality.

### **THE LATEST GENERATION: SIS-INJECTOR PLUS**

It's crucial to precisely coordinate all processes in the electric-arc furnace (EAF), from melting the input materials through to decarburization, and from temperature control to tapping. To increase productivity and save electricity, burner-injector combinations are used for melting the scrap and superheating the melt. The energy input and melt power are highest in the middle of the furnace, while cold spots form on the wall elements. This is where burners or injectors introduce additional thermal energy to ensure a homogeneous temperature distribution inside the

furnace. We improved the SIS injection system and achieved persuasive initial operating results.

- Furthermore, the new SIS injector is easy to use.
- There is no longer any need for a gas burner on the side to generate the hot enveloping gas jet.
- Now, air and fuel gas are directly and efficiently channeled into the coaxial jacketed piping and ignited there. This creates an enveloping gas jet of hot waste gas.
- In injector mode, the coaxial enveloping gas jet protects the central oxygen jet and shields it from the hot furnace environment. That considerably boosts the efficiency of the oxygen jet.
- Moreover, in standby mode the enveloping gas jet protects the entire injector from slag and melt spray.

The SIS plus prototype was installed at a single furnace position in the 125-t-EAF No. 2 at Peiner Träger GmbH and operated over a furnace campaign. SIS plus was designed for a roughly 17% lower oxygen quantity. Even with this reduction, the metallurgical results were almost constant.

## ACTIVE OSCILLATION DAMPING IN COLD ROLLING MILLS

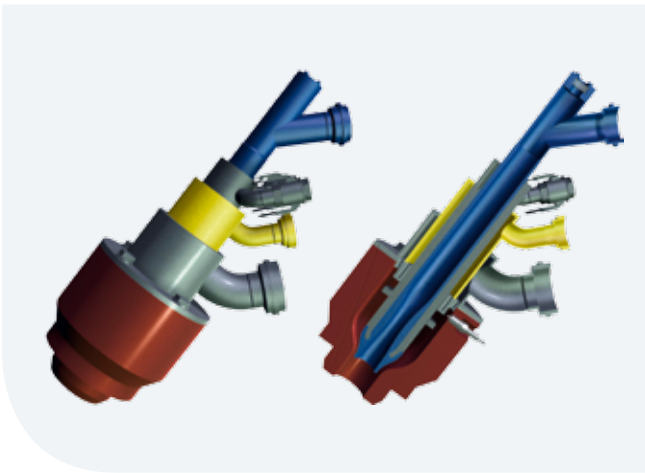
Operated at high rolling speeds, multi-stand tandem cold mills tend to generate unwanted oscillations, otherwise known as chatter. The causes of chatter in a rolling mill are complex. They can come from external or internal sources. Whatever the cause, roll oscillation always leads to incorrect thicknesses or shape faults of the rolled stock and frequently leads to strip breakage with corresponding equipment damage.

To prevent this kind of problem, early warning systems with acceleration sensors can slow rolling to an uncritical speed when there is a threat of chatter. However, that reduces productivity.

Working together with a partner, we are developing an active oscillation damping system to tackle chatter with precisely calculated counter-oscillations. It will allow producers to utilize the full performance power of their rolling mills. Here's how the solution works: piezo-mechanical actuators precisely apply high-frequency oscillations to the stand area, where they eliminate chatter.

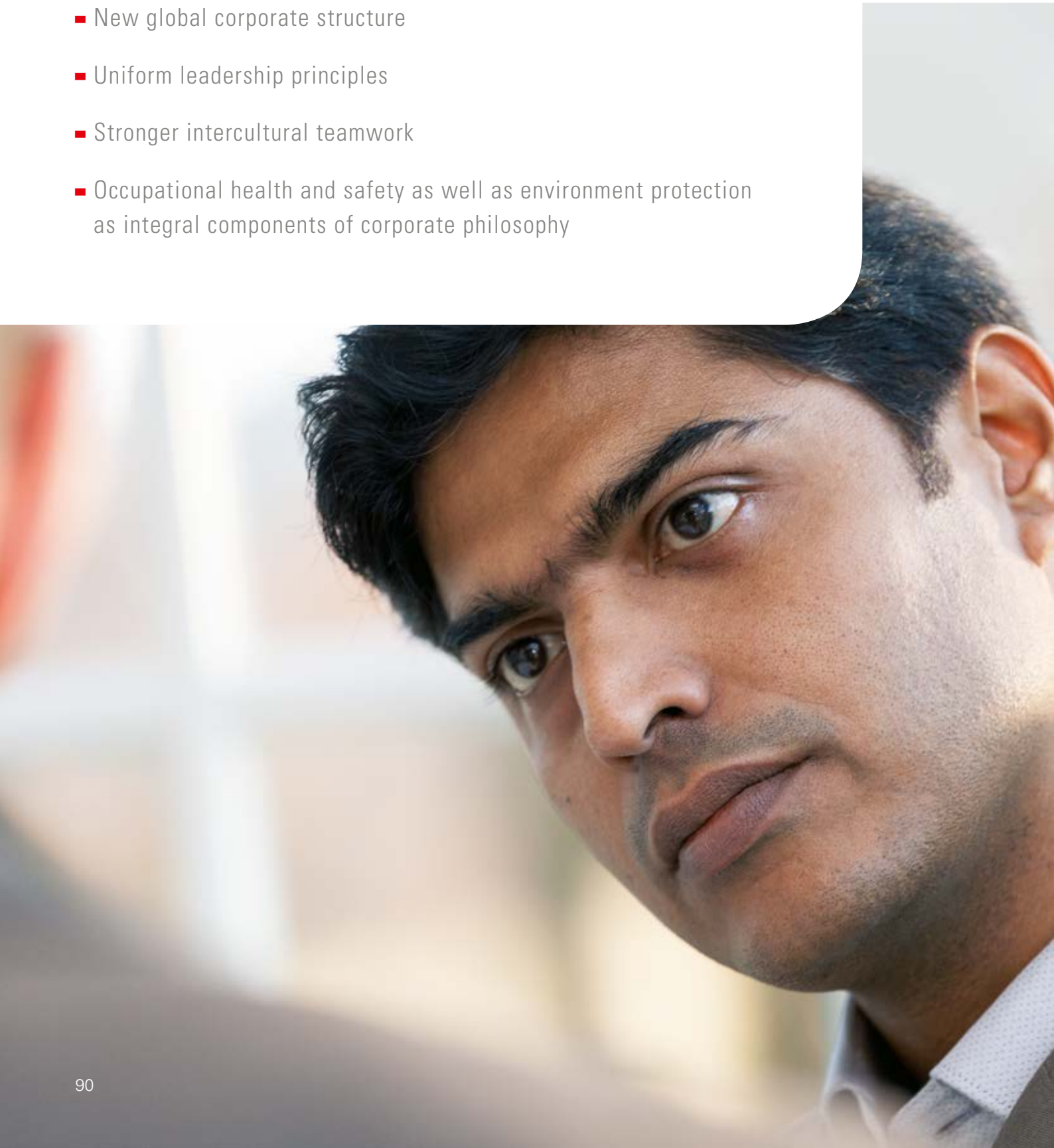
Currently, we are conducting tests to identify the best installation position, then we will build a prototype. The first application in a rolling mill is scheduled for mid-2016.





# EMPLOYEES

- New global corporate structure
- Uniform leadership principles
- Stronger intercultural teamwork
- Occupational health and safety as well as environment protection as integral components of corporate philosophy



To boost competitiveness and profits, we launched our cost-cutting project "SMS 2016" in 2014. Now, we have achieved our target of reducing costs by some EUR 370 million worldwide to a degree of 96% along the entire value creation chain (approx. 850 individual steps). Already, as of the end of 2015, a sum of EUR 153 million was saved. Here are some of the main elements of the program: merger of SMS Siemag AG with SMS Meer GmbH to form SMS group GmbH, closure of one workshop in China and concentration of production in Shanghai, intensification of direct sales in the Electrical and Automation Systems Division, and stronger positioning on the NF metals market. There are also many other measures and change projects geared to cutting costs and enhancing efficiency.

Yet the continuing crisis in the steel industry, which is holding back investments by our customers, demands even more action beyond "SMS 2016." That's why we decided at the end of last year to restructure our company. Specifically, we are further streamlining our organizational structures and establishing leaner operational procedures.

Essential cornerstones of the new structure are reducing capacities and strengthening products by concentrating resources in Product Units. In this context, we are planning, for instance, to pool sales and order processing. As a result, we will reduce interfaces to our customers and speed up processes.

The changes will involve reducing our personnel capacity in Germany by some 1,200 employees from 5,250 (as of the end of 2013) to 4,050. This represents a necessary adjustment to the permanently lower business volume. We will ensure most of the staff reduction takes place in a socially responsible way. Negotiations with labor representatives and implementation of the new organization are scheduled for the first half of 2016.

## EMPLOYEES

The average number of employees in SMS group increased by 339 to 14,342 (2014: 14,003).

The number of employees working for SMS group GmbH increased compared to the previous year by



Torsten Heising,  
Member of the Managing Board,  
SMS group GmbH

294. The year's average for 2015 was 12,668 (2014: 12,374). The breakdown was 10,283 employees (2014: 10,600) in plant and machinery production and 2,385 employees (2014: 1,774) in service business. As part of our ongoing strategic expansion of the Service Division, we recruited more employees in our foreign service companies. In total, 5,915 employees were on our payroll in Germany and 6,753 abroad.

Staff numbers at elexis/Elotherm increased in 2015 by 46 employees to 1,625 (2014: 1,579).

**On average, employees in SMS group have been working with us for some 18 years. This longstanding loyalty to the company guarantees the experience that is vital in plant and machinery construction.**

## PERSONNEL AND ORGANIZATIONAL DEVELOPMENT

### Leadership

Following the merger of the two companies SMS Meer GmbH and SMS Siemag AG, the focus in human resources development was on the creation of a joint, uniform, and future-proof approach to employee management. To increase customer satisfaction, we defined six strategic action fields: closeness to markets, innovative and attractive products, process excellence, leadership culture, competitive cost structure, and service growth. In this context, we conducted workshops for all managers. Here, the participants devised individual, concrete plans for their own areas of responsibility.

### Human Resources International

We supported the integration of the different areas with area and team development activities, intercultural workshops, and other change management instruments and methods.

### Transparent communication

change forums to encourage an open dialog between the Managing Board, responsible specialists, and employees. These activities promoted exchanges about all aspects of the newly founded SMS group GmbH. They increased transparency for our employees and provided opportunities to make suggestions for improvements.

### Project management

We drew up uniform project management principles at SMS group GmbH. They stand as globally valid regulations that are obligatory for all project participants. Also included in this area was establishing new training and certification contents. These moves guarantee globally uniform quality standards in project processing for our customers.

### Internal/external on-the-job training

On-the-job training and qualification of our employees remains a high priority. It creates an essential basis for our continued competitiveness. Responding to the needs of our specialist departments, we organized a tailor-made training program with 671 internal training units for 6,328 participants in 2015. That includes not only regular, standardized instruction, but also customized training courses and workshops. Another 801 employees were registered for one-off courses provided by external training companies and geared to their specific duties.

### SMS Akademie

SMS Akademie offers educational opportunities employees can voluntarily take up in their free time. As many as 1,631 participants attended 228 events in 2015. There is plenty of variety, ranging from classic talks, workshops, and guided tours, to joint activities. The SMS Webucation program covers web-based training, video tutorials, and podcasts. With 132 courses attracting a total of 898 participants (internal training and SMS Akademie), the webucation program enjoys consistently high demand.

### VALUE program – supporting knowledge and experience transfer

Our VALUE program underpins a structured knowledge and experience transfer. It focuses on employees close to retirement who pass on their years of experience and extensive expertise to their successors. In 2015, 12 transfer processes were completed; 23 more are still ongoing. In the coming months, we expect a continued high need for these activities due to the number of longstanding employees who will soon reach retirement age.

### Occupational health and safety, environment protection

We take our responsibility for the health and safety of our employees seriously. That goes for work at our own facilities as well as at our construction sites worldwide. It applies equally to the people active on our behalf. Just as passionate is our commitment to green technology. There are both ecological and economic aspects we consider before we apply a broad range of solutions aimed at preventing damage to personal health and nature.

This approach is integral to our corporate philosophy. It stands on an equal footing with our other company objectives. So, whatever decision-making processes we initiate, health, safety, and environment issues are included.

Supervisors will personally hand over to all employees the occupational health and safety/environment protection guidelines embedded in our newly compiled corporate policy.

We achieved a significant reduction in accidents at our large production locations in 2015 (–23%) as well as days lost due to accidents (–44%). Even so, we will intensify our occupational health and safety efforts to sustain this positive trend.

Some of our locations are already certified according to the internationally recognized standards OHSAS 18001 (Occupational Health and Safety Management) as well as ISO 14001 (Environment Management), and we are continually improving the conditions, processes, and regulations relevant to this area. Activities that ensure potential risks are detected at an early stage include regular recording and assessment of risks and environment aspects, regular incident reporting, and our continuous improvement

Permanent high value of on-the-job training



process. Equally important here are the duties of our managers, who process key figures, targets, and programs relating to these aspects. All this helps continually reduce risks for the company and our employees.

### **IMPULSE IDEAS MANAGEMENT**

In 2015, our IMPULSE ideas management scheme received 2,234 suggestions for improvements from employees. Their implementation saved costs amounting to EUR 2,994,000. We rewarded all the processed suggestions with bonuses totaling EUR 810,000.

### **VOCATIONAL TRAINING**

The qualification of young specialists in SMS group GmbH is a cornerstone of our corporate philosophy. That's why we continued our activities in high-level vocational training in 2015. This is reflected above all in the once again high number of new apprentices. One hundred youngsters embarked on their training on September 1, 2015. The number of apprentices in Germany in 2015 was on average 345. Our apprenticeship quota is some 7%.

Continued high quality  
of apprenticeship  
opportunities

Equally important is nurturing young academic talents, especially engineers in the disciplines mechanical engineering, electrotechnology, and metallurgy. This is why we forge contacts with students while they are still at university and offer them a whole range of support. Included here are our own scholarship program and participation in the German Scholarship scheme as well as dual study opportunities, internships in Germany and abroad, and support with Bachelor and Master dissertations.

In the area of knowledge management, the support program for young academics has evolved into a key component of integrating new employees into the company, especially young engineers. The aim here is to smooth new colleagues' path into their jobs through an organized phase of getting to know contacts and overall structures. On average, participants complete the program within six months. We completed 10 of these support programs in 2015.

# CONSOLIDATED FINANCIAL STATEMENTS AS OF DECEMBER 31, 2015

## BALANCE SHEET (IN THOUSANDS OF EUR)

<b>ASSETS</b>	<b>Dec. 31, 2015</b>	<b>Dec. 31, 2014</b>
Intangible assets	400,700	436,700
Property, plant, and equipment	709,000	707,011
Investments in unconsolidated, affiliated companies	10,059	21,932
Shares in investments accounted for using the equity method	49,716	58,026
Other equity investments	48,967	30,101
Investment securities	94,619	80,604
Deferred tax assets	110,419	102,221
Other non-current assets	62,914	7,481
<b>Non-current assets</b>	<b>1,486,394</b>	<b>1,444,076</b>
Inventories	949,817	923,315
Trade receivables	897,738	858,828
Receivables from income taxes	42,680	57,682
Other current assets	179,155	150,859
Securities	551,066	701,170
Cash and cash equivalents	971,687	931,645
<b>Current assets</b>	<b>3,592,143</b>	<b>3,623,499</b>
<b>Total assets</b>	<b>5,078,537</b>	<b>5,067,575</b>

<b>LIABILITIES</b>	<b>Dec. 31, 2015</b>	<b>Dec. 31, 2014</b>
Issued capital	10,000	10,000
Capital reserves	109,125	109,125
Retained earnings	615,644	596,732
Income and expense recognized directly in equity	72,753	119,997
<b>Equity attributable to shareholders of SMS Holding GmbH</b>	<b>807,522</b>	<b>835,854</b>
Non-controlling interests	128,540	134,361
<b>Equity</b>	<b>936,062</b>	<b>970,215</b>
Non-current financial liabilities	20,606	33,063
Provisions for pensions and similar obligations	706,417	744,376
Deferred tax liabilities	193,335	209,941
Other non-current provisions	45,209	41,908
Other non-current liabilities	1,159	12,203
<b>Non-current liabilities and provisions</b>	<b>966,726</b>	<b>1,041,491</b>
Current financial liabilities	147,460	107,574
Trade payables	384,967	387,677
Liabilities from income taxes	29,257	50,417
Advance payments received	858,295	841,985
Other current provisions	1,473,817	1,397,792
Other current liabilities	281,953	270,424
<b>Current liabilities and provisions</b>	<b>3,175,749</b>	<b>3,055,869</b>
<b>Total liabilities</b>	<b>5,078,537</b>	<b>5,067,575</b>

## CONSOLIDATED INCOME STATEMENT

(IN THOUSANDS OF EUR)

	Dec. 31, 2015	Dec. 31, 2014
<b>Revenue</b>	<b>3,310,147</b>	<b>3,405,966</b>
Cost of sales	-2,714,292	-2,753,069
<b>Gross profit</b>	<b>595,855</b>	<b>652,897</b>
Selling costs	-301,377	-312,001
General administrative costs	-144,555	-146,794
Other operating income	14,449	20,498
Other operating expenses	-222,065	-223,808
Result from investments by equity method	2,424	2,045
Net investment loss	-11,440	-2,697
<b>Earnings before interest and taxes (EBIT)</b>	<b>-66,709</b>	<b>-9,860</b>
Net financial income	73,899	40,615
<b>Earnings before interest and taxes (EBT)</b>	<b>7,190</b>	<b>30,755</b>
Income taxes	-2,116	-12,122
<b>Net profit for the year</b>	<b>5,074</b>	<b>18,633</b>
Of which attributable to:		
Shares of the shareholders of SMS Holding GmbH	5,761	17,962
Non-controlling interests	-687	671



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