

SALZGITTER AG

BEST OF 2017



Steel and Technology
Made in Germany

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Photos Gunnar Gams

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Photo: © Michael Helm

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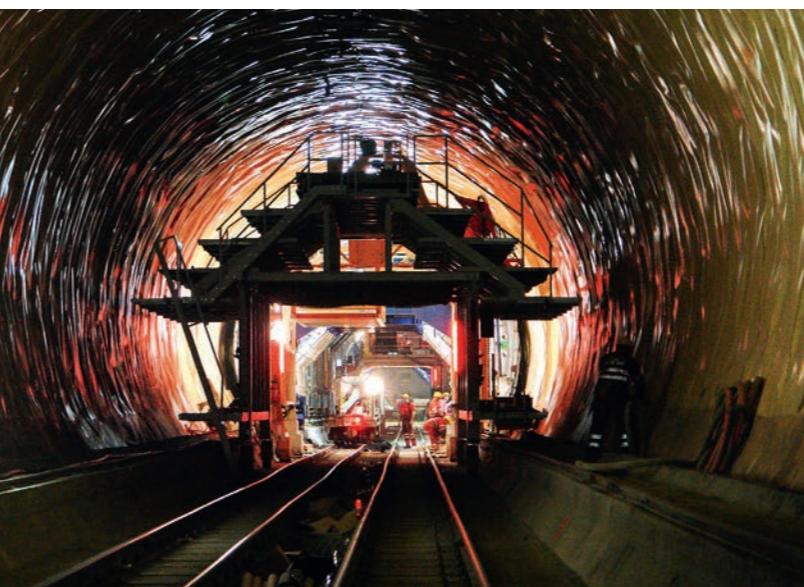


Photo: © AlpTransit Gotthard AG
The mountain called, Peine supplied: mine supports for the St. Gotthard base tunnel.
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Welcome!

For each “Best of” issue, collecting the topics resembles a short journey through the business units and a completed year of business at the Salzgitter Group.

In addition to many fascinating stories from the subsidiaries, we were also able to announce the fourth increase in earnings in a row for fiscal year 2017, in spite of challenging conditions.

Unlike much larger companies, the Salzgitter Group does not aspire to be seen as a global player. On the contrary, we attach great importance to having our diverse customers in Germany and abroad perceive us as reliable partners on equal footing. Our more medium-sized structure quite possibly makes us a quantum swifter and more nimble than others, and always helps us to remain in close contact with our customers.

This is also the impression we got when we travelled with Salzgitter Mannesmann Handel's sales and logistics team to Albania, where we portrayed the work of laying the TAP pipeline. Our roundtrip in Baden-Württemberg strengthened this perception when we spoke with the medium-sized companies that are so typical for this German federal state and are often globally successful companies as well.

But we feel just as answerable to the environment as to our customers. Frugal and cost efficient handling of resources has always been firmly established in our DNA as a steel and technology group. And our ingenious closed loop of resources and energy in our steel mill comes across as impressive, time and time again. We, too, were surprised to learn that this is the source of a river that is clean enough for swimming.

Come along with us on a journey through the Salzgitter World.

I wish you enjoyable reading

Bernhard Kleinermann

Bernhard Kleinermann
Head of Group Communication

Steel reborn

Steel is indestructible and can be endlessly recycled without diminishing its quality. Most steel products are melted down a number of times, and around 70% of all steel ever manufactured is still in use today. Some screws, gear-wheels and pipes experience an unusual new use if they end up in the hands of the northern German "Giganten aus Stahl" artist group. Then they are reborn as sculpture, as an automobile, as a steel warrior, or as a life-sized equestrian figure (see page 20).



“When you’re going against the current, you need to follow a clear cut course”

STIL spoke with Chairman of the Board Prof. Dr.-Ing. Heinz Jörg Fuhrmann about the good economic indicators and remaining challenges

Trade and environmental policy topics as well as the competitors' merger plans dominated headlines in the steel industry during the year 2017. The Salzgitter Group's development during this same period was comparatively calm and continued to consistently chart a positive course.

STIL: The Salzgitter Group will report an improved year-end result for the fourth time in a row at the end of February 2018. So: Clear sailing ahead?

Prof. Fuhrmann: Yes, the facts and figures will clearly reflect how successfully we have been working in recent years. This is the gratifying result of strategic corrections to our course at the right times and diverse in-house efforts that are now yielding results.

This is why the Executive Board, after exchanges with the group staff council, decided to pay a bonus with the April 2018 payment to employees in those companies that made special contributions to the profit posted in the 2017 financial year. The amounts of the group's voluntary payments will be finalized once the annual financial statement has been completed. This profit sharing will be paid to employees covered by collective bargaining contracts, while separate policies apply to other employees and to management executives.

All of these achievements were possible because we resolutely took action and very actively worked on our internal fitness. At the same time, we have always held fast to our basic convictions, such as autonomy as the heart of our corporate policy and our DNA as a steel group.

It is absolutely appropriate to enjoy what we have accomplished, but this is not the time to sit back with great complacency, because the environment for all business units in our group was, is and will remain challenging. We have to push ahead and remain on track!



Photo: Salzgitter AG

STIL: What are the main factors driving the necessary adjustment processes?

Prof. Fuhrmann: These are naturally the market, our customers' needs, and the competition. They determine the standards and objectives that we use to guide us. In addition, in our globalized world, everything is in a constant state

The environment in which our group and its business units operate was, is and will always be challenging

of flux. We are currently experiencing serious upheavals at many different levels, and we must adapt to these. To put it simply, new products and services are developed in quick succession, and as material manufacturers, special system constructors, and service providers, we must offer the right solutions, or at least contributions, for them. At the same time,

both the competition and our customers are becoming more international. Those who rest on their laurels will not develop viable prospects for the future.

STIL: Are the general conditions in the current business environment favorable?

Prof. Fuhrmann: No, for the most part they are not. We remain confronted with a number of obstacles created outside the company that continually result in additional stress for us, because they demand special dedication

and significantly impact the necessary planning reliability for our strategic corporate development. These include the known topics from the climate and energy policy in Germany and the EU, as well as international trade policies that are currently moving towards restrictions of free and fair world trade.

It is surely not an exaggeration to view

some current cases as almost international trade war. While the EU market is comparatively open and the steel imports here, in spite of numerous trade litigation cases, are at a historically high level, other regions are increasingly sealing themselves off. It must be kept in mind that 40% of all global trade defense measures affect steel products! This is why as a company, we must maintain a constant dialogue with the policy makers in Berlin and Brussels and firmly advocate for our position with regard to the development of a fair foreign trade policy. We cannot leave this exclusively to trade associations, because the nature of German industry's interests are naturally not always aligned. Both China and the USA are both prominent exporters and importer of the widest range of goods.

STIL: The climate and environmental policy in Germany and the EU is an ongoing issue. Have there been new developments in this connection?

Prof. Fuhrmann: In principle, an important realization has become widely established: If a strong industry is to continue to serve as a basis for economic prosperity, employment, and social balance in the EU and Germany, internationally competitive conditions in terms of the environmental policy are absolutely essential. This is necessary in order to allow domestic companies to work economically, offer decently paid jobs, make long term investments, and consequently be successful. On the other hand, radical-leaning environmental policymakers continue their call for forced global decarbonization. Since this idea is not supported by countries such as China, India or the USA, they want to see Germany play a lead role.

We say that the transformation to a less carbon-based society should not be pursued at the expense of countless jobs in our domestic industry! Because it is readily apparent that if we further expand our already existing regional disadvantages due to stricter emission trading and the Renewable Energy Law (EEG) apportionment, the insidious de-industrialization process will accelerate. If the steel industry and other energy-intensive sectors in Europe shrink or even disappear altogether, the urgently required products will be produced in other parts of the world under worse environmental and social standards. The climate and people

will not benefit, that much is quite clear! Noble intentions alone do not create jobs or help the world's climate. As an engineer, I sometimes find the public climate protection discussion to be frighteningly irrational. I can only urgently campaign for an approach based on facts and logical reasoning.

STIL: Some steel companies are studying the question of how to exploit or even avoid the CO₂ that develops during the blast furnace process. How are we proceeding?

Prof. Fuhrmann: We prefer the course of preventing CO₂. In order to achieve a significant reduction in our current level of CO₂ discharge, we want to test new methods and innovative process technologies in the framework of the SALCOS – Salzgitter Low CO₂-Steelmaking – concept. Steel production's CO₂ emissions

After a phase during which our business activities necessarily focused on restructuring and cost containment, we are now turning our attention to growth and innovation topics

could be greatly lowered by replacing carbon with hydrogen as the reducing agent. This hydrogen should be produced with electricity from renewable sources. This is not yet feasible on an industrial scale, and is also currently not economically viable. But we do see realistic prospects.

Researchers and experts from our company, the Fraunhofer Society, and additional partners are therefore working together to develop technologies for direct reduction with hydrogen and the inclusion of these technologies in an integrated iron and steel works, as well as in an energy system to be based on renewable energy in the future.

The concept must furthermore ensure our future competitive ability. Our ambition is to meet all of these criteria, and we are working on appropriate solutions with SALCOS. Of course we still have a long way to go.

STIL: What is your opinion of the discussion of electromobility, seen against the background of the “climate debate”?

Prof. Fuhrmann: I am very astonished at how carelessly the German automotive industry, the technical orientation, and their representatives are sometimes judged. It is pure populism to demand a

ban on combustion engines in the near future. Because the fact is that electric cars run on today's electricity mix are more damaging to the climate than conventionally powered vehicles. And it is going to be some time until renewable sources are able to generate sufficient power, if this can ever be accomplished. The topic of where the raw materials for batteries come from and which tremendous energy expenditure is required for their manufacture is gladly swept under the carpet. In this respect, I am more of a supporter of hydrogen-based fuel cell technology.

By the way: If they are to be affordable, electric cars must also be manufactured from steel. The current e-Golf is a salient example. The Salzgitter Group supplies a number of components for the chassis for the vehicle's series production. In general, we actually expect more steel to be used for electric cars than for conventional ones.

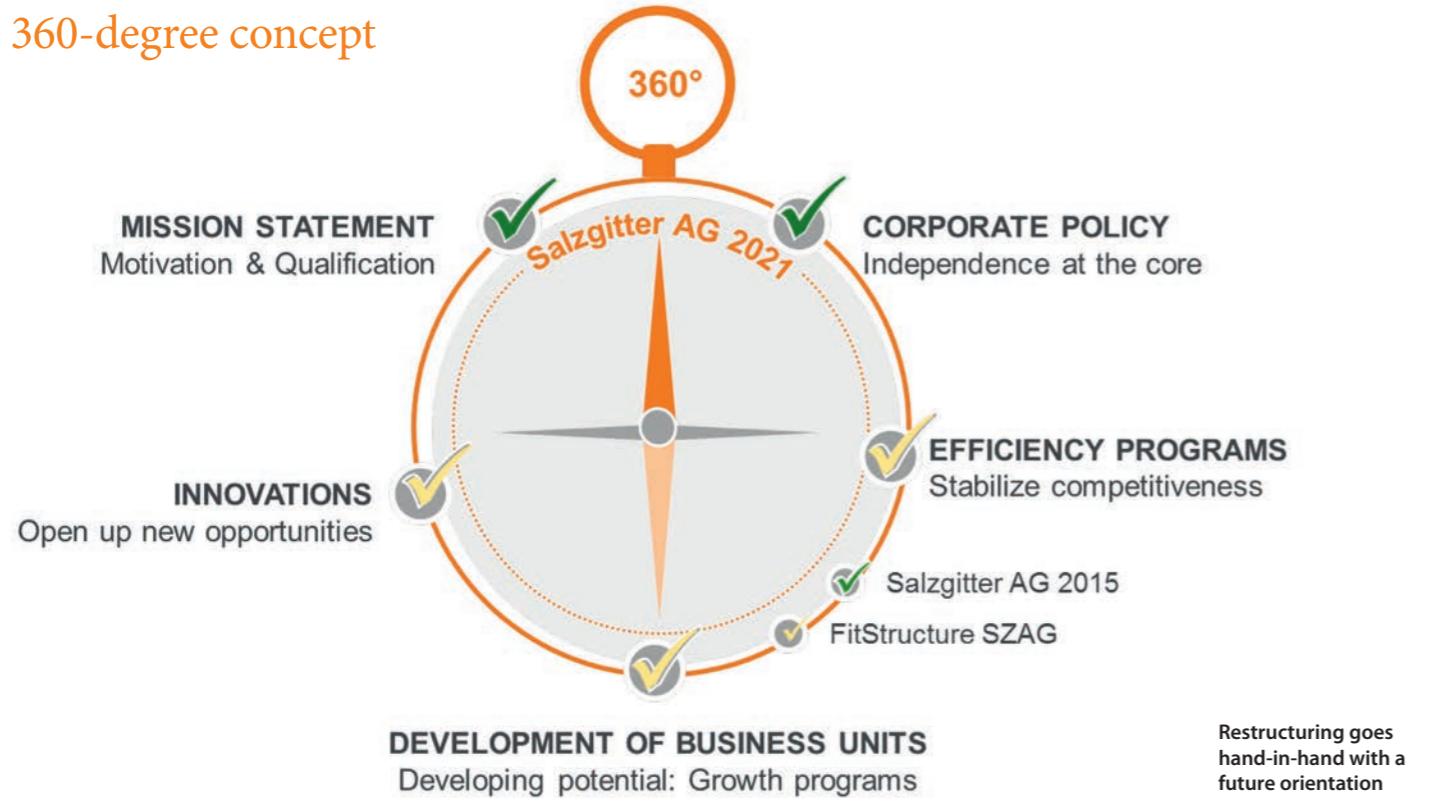
STIL: In 2017, we were also the subject of distinctly unpleasant discussions: The Bundeskartellamt, whose task is to protect competition in Germany, initiated investigations.

Prof. Fuhrmann: Offices were searched and documents were confiscated in our group, at other steelmakers, and at the German Steel Federation. Here we find ourselves confronted with a type of general suspicion, because there were no complaints from the authorities regarding specific illicit bilateral agreements, and instead the investigation was primarily targeted at the exchange of information of a general character at the federation level. Here it must be remembered that until 2002, the exchange of information in the European steel industry was actually organized by the authorities. In the following period, the regulatory requirements within our association were naturally routinely adjusted to the instructions based on antitrust law, and these were also constantly referenced.

Although even today we are not aware of any culpable action, we take the subject and the actions of the authorities very seriously. It will likely take some time to achieve clarity on all sides.

STIL: Catchword “changed business environment”: ThyssenKrupp's steel unit is set to merge with Tata Steel Europe and form a new company. What effects do you expect from this?

360-degree concept



Prof. Fuhrmann: Mergers and takeovers are basically normal in business. Viewed unemotionally, the global degree of concentration in the steel industry has been comparatively low in the past, particularly compared to the raw material side, where there are some significantly larger groups operating than on the steel side.

I am not particularly worried about this process in the short to medium term. Salzgitter AG is flexible, innovative, technically well-positioned, and economically sound. But it is naturally an additional reason to strive for continual development in order to maintain our ability to compete as a medium-sized steelmaker in the future. A look at the last almost 20 years since our flotation in 1998 shows that we are on the right course with our long-term-oriented and conservative corporate policy.

The group sales have tripled and the number of employees has more than doubled. At the same time, the market capitalization and equity capital today are actually more than four times as high as back then. Few people believed that we would be so successful. The final realization is: "If you're going against the current, you need to follow a clear cut course!" Moreover, it is better to avoid wasting efforts by changing course too frequently.

STIL: Is it true that Salzgitter AG's ability

to go it alone was repeatedly questioned at the outset?

Prof. Fuhrmann: Yes, that is absolutely true! And because a "German Steel Corporation" was recently the subject of public discussion again, I would like to repeat here that the Salzgitter Group is not generally against cooperation. After all, we work with competitors such as Hüttenwerke Krupp Mannesmann and EUROPIPE. But when it comes to merger speculations, even after all these years we have never been presented with a concept that describes an alternative better than our successful path of entrepreneurial independence. We therefore plan to retain Salzgitter AG's autonomy and to guarantee a high level of security for the overwhelming majority of the jobs in the group.

STIL: What developments are in store for the Salzgitter Group?

Prof. Fuhrmann: The group has been diversifying since 1998, when the new Salzgitter AG was launched. The most important external steps were the takeover of the Mannesmannröhren plants and the Klöckner sites. This means that starting in 2000, we moved from being a pure steel company towards a diversified group. We will be continuing this corporate policy in our unique way: calmly and purposefully. Our "Salzgitter AG 2021" strategy defines the key points in the group's further de-

velopment. The goal is to develop the de facto revenue and value-added portfolio with profitable growth from the current 60% steel and 40% "non-steel" towards a 50/50 situation. The 360-degree concept describes the route to this goal with specific projects in the areas of efficiency, development, innovation, motivation, and qualification.

STIL: What does this mean for the business units?

Prof. Fuhrmann: Without wanting to go into every detail at this point, I can state the following guiding principles: Rolled steel production and parts of the tube and pipe production can grow only in terms of quality, not quantity, due to the known conditions. We have no alternatives here, neither drastic reduction of investments nor split-offs or mergers with competitors. On the contrary: We are continually investing in major projects in steel. Two examples: A third hot-dip galvanizing line is being set up in Salzgitter and water-quenching equipment for quenching and tempering heavy plate is being installed in Ilsenburg. These are key components in the strategy of qualitative growth. There is an increasing demand for high and ultra-high strength steels for the automotive supply industry and automakers, and we are meeting these demands with the new hot-dip galvanizing solution. Installing the quenching system

in Ilsenburg shows that the Salzgitter Group is sustainably acting from strategic motives, regardless of short-term market conditions. At the same time, it is a commitment to steel production in Ilsenburg. As already stated once here in STIL, for us restructuring goes hand-in-hand with a future orientation.

STIL: How should the reduced participation in Aurubis AG be viewed?

Prof. Fuhrmann: The reduction in the partial ownership of Aurubis does not have any strategic nature whatsoever. The exchangeable bond that we issued on roughly half of our Aurubis shares in 2010 matured on November 8, 2017. We exercised our option and decided to utilize the underlying shares. In that particular situation, this was the better, calculable alternative. With a 17% share, we are currently still a core shareholder and, who knows, perhaps our involvement will continue to develop.

STIL: What about external growth? Where is this possible?

Prof. Fuhrmann: As I said, quantitative growth is only possible in activities far removed from steel, particularly in the Technology Business Unit. No one in the world is waiting for more steel tonnage.

External growth through company acquisitions is not absolutely necessary for the group's positive development, although it is certainly desirable for the Technology Business Unit, particularly for program and technology expansion. Due to the persistent low-interest phase, however, the purchase prices for companies have reached dizzying heights. It is absolutely a seller's market at this time. There are also still priority internal topics in the Technology Business Unit. A future strategy program is currently being formulated for KHS GmbH.

The precision tube group's realignment shows that both internal fitness and international growth are on our agenda. The objective is a sustained increase in the pre-tax return with a focus on profitable products, an expanded value chain, and intensified internationality. For example, we are expanding our plant in Mexico to double its capacity. This is in response to the requirements of our customers in the NAFTA zone. In addition to investments, a comprehensive program comprising no less than 180 individual measures for the future has been drawn up to increase the precision tube group's profits.



If one were to formulate one motto that covers the measures at both KHS and precision tubes, it would be, "The formation of stringently aligned, market leader company groups with strategy and management that are consistent in every respect".

STIL: What are the group development's organizational aspects?

Prof. Fuhrmann: In accordance with our 360-degree concept, we are continuing to inject life into our "YOUNITED" mission

We know where we are heading and remain on course by following our compass – the 360-degree concept

statement. The current value that we are focusing on throughout the group is the customer focus. The procedure has been put into practice and has already proven its worth. Instead of coming along with colorful presentations that quickly disappear into the files, we use workshops with numerous business teams to formulate specific measures whose actual implementation is rigorously pursued. Further cultural developments in the company cannot be mandated from above, and must instead be based on a strong movement.

The digital Roadmap 2022 describes how we want to follow the Salzgitter path to "Industry 4.0." I see "Industry 4.0" as a design task for the entire socio-technical system in our future working world. It relates to more than the consistent and all-encompassing penetration of production technology with information technology all along the value chain. The

2017 REVIEW

FEBRUARY



The Salzgitter Group releases the key data for fiscal year 2016 with a profit before tax of € 53.2 million, far exceeding the figure for the previous year. The Salzgitter 2021 growth strategy sets the key points for the group's continuing development.

MARCH

At the financial statement press conference, the executive board informs the financial press of the most important economic indicators and presents the current annual report to the public.

APRIL



EUROPIPE GmbH booked another major order and will be supplying 635,000 tons of large-diameter pipes for the European Gas Pipeline Link (EUGAL). EUROPIPE is a joint venture of the Salzgitter Group and AG der Dillinger Hüttenwerke.

At the Hannover Messe, the Salzgitter Group presents a new concept focusing on Industrie 4.0, renewable energies, and sustainability. Together with Continental AG, the group hosts the Lower Saxony Evening for representatives from politics, industry and commerce, and administration.



MAY

The Salzgitter Group's economic upswing solidifies. In the first quarter, the group posts € 77.1 million profit before tax. One important factor: The internal programs of measures are paying off.



JUNE

By a large majority, the general meeting approves the dividend proposed by the supervisory and executive boards and votes to pay a dividend of € 0.30/share. The group consequently emphasizes dividend continuity.

"My heart beats for steel," is Salzgitter's motto at IdeenExpo, an event that focuses on interactive ideas and surprising exhibits. Lower Saxony Minister President Christian Weil and Andrea Nahles, Federal Minister of Labor and Social Affairs, were just two of the interested visitors.



At the "Efficient and emission-free expansion of hydrogen and fuel cell applications" conference, Salzgitter AG presents the project "GrInHy - via reversible high-temperature electrolysis". 190 participants from politics, administration, industry and commerce, research, and associations attend.

The Second Lower Saxony steel dialog is held under the motto "Together for the Steel Industry's Future". The Ministry of Economics invited representatives from politics, the steel industry, and trade unions to discuss the sector's current challenges.

AUGUST

The Salzgitter Group posts a strong first half in 2017. The € 100 million profit before tax marks the best figure since 2011. The strip steel and trading business units and the programs of measures are making significant contributions.

€ 100 MIL

SEPTEMBER

The Salzgitter Group joins international partners in the project "GrInHy - Green Industrial Hydrogen via reversible high-temperature electrolysis". With EU funding, the project will research new hydrogen production methods that could contribute to CO₂-reduced steel manufacturing in the future.



A third hot-dip galvanization line is to be constructed at the Salzgitter location. It is a key component in the "Salzgitter AG 2021" strategy with its rigorous focus on higher quality product ranges. The line is scheduled to start operations in 2020.

OCTOBER

The Salzgitter Group is putting even more emphasis on the name MANNESMANN. The business unit started using that name again in summer 2016, and now it is time to take the operational steps for a uniform choice of name under the umbrella brand Mannesmann.



NOVEMBER

Blechexpo is one of the most important trade fairs for steel manufacturers and processors. The Salzgitter Group and its subsidiaries showcase such exhibits as the Initiative Automotive in their role as an important partner for the automotive industry.

€ 174 million profit before tax is the best 9-month result since 2008. The main drivers were the flat steel and trading business units, as well as the programs of measures.

Closing the loop: the resource cycle

Recycling, environmental protection, and sustainability are a basis for all Salzgitter AG production processes. Steel scrap, which is prepared in Salzgitter, is one good example

The group has established loops for resources such as steel and water, and has developed ways to use steelmaking's by-products, such as slag. Scrap metal is consequently indispensable for the steel production in Salzgitter. This important raw material accumulates there on Germany's largest scrapyard, belonging to the Salzgitter subsidiary DEUMU "Deutsche Erz- und Metall-Union GmbH".

When the sun shines on the DEUMU site, it sparkles as silvery and metallic as a treasure. The

impression is not at all misleading – each of the mountains of scrap here is worth several tens of thousands of euros. DEUMU plant manager Marko Klickermann and Uwe Mauersberger, head of production and process engineering, are two of the people who tend to the treasure. Both know exactly what is to be utilized, and what not. "More than 95% of a steel car is recovered," says Marko Klickermann, and Uwe Mauersberger adds, "On the other hand, today no one knows how it will ever be possible to recycle elements made of carbon."

The DEUMU site not far from the blast furnaces. The scrap is meticulously sorted here. Shown are stacked slab sections, already-split girders and the pressed steel cubes from automobile production



Photo Gunnar Gams

Marko Klickermann nods in agreement. "Steel recycling also does not result in any so-called down-cycling, such as occurs with paper and plastic. Steel remains steel, and it has the same quality after recycling that it had when it was first produced."

The German steel industry would be inconceivable without steel scrap, which covers 43% of its requirements. The global proportion is roughly 33%, partly because in China, which produces almost half of the world's crude steel, only 10% of the production comes from scrap.

In this moment, another truck rolls into the DEUMU grounds. But it cannot simply unload its scrap. The DEUMU experts carefully examine each delivery. Although the material has been declared, everything is inspected, including for radioactivity. Sensors have even been installed in the excavator's claws to sound an immediate alarm if necessary. Weak radiation is sometimes recorded, but this is a very rare event.

A distinction is also made with regard to the various types of further processing: What should go into the shredders or shears, what belongs in

the scrap breaker, and what can be split up by hand with a blowtorch, such as rail tank cars?

"We see twelve different finished scrap types and classify these according to size, physical characteristics, and chemical composition," explains Uwe Mauersberger. Single-type scrap is the most valuable, because mixed and impure scrap must be prepared and separated. The single-type material is usually scrap that comes back directly from production, such as the leftover pieces of the coils and slabs from Salzgitter's own steel production. Steel sheet cuttings from car manufacturing are also high quality.

Thanks to the inspection and sorting, mountains of scrap that are very different from one another, but each homogeneous, accumulate on the site. There is a pile of steel plates, coated with a reddish rust film, that will be cut to make machine components for the steel processing industry. Next to it is the car industry's production scrap. And nearby large machine parts are piled into a heap crowned by the rest of a bus, with steel arms extending into space: what used to be robot arms from industrial automation have already come here to be recycled.

DEUMU preserves the meticulously sorted, high

quality and single-type ingredients for its mixtures, whose compositions must be observed with precision because each mixture must be exactly set up and dosed for steel production. Not far from DEUMU, the SZFG blast furnaces are producing pig iron. This is put into the steel mill's converter, where pure oxygen helps to burn off unwanted by-elements and excess carbon. The result is extreme heat of more than 3000°C (5400°F). Steel scrap is added to the converter in order to maintain temperatures between 1700 and 1740°C (3092 - 3164°F). The DEUMU employees must know exactly which mixture of which scrap they have to supply to the converter. "For good measure, we conduct an analysis and inspection after each melt in order to avoid downgrading the steel," Marko Klickermann reveals.

This process feeds roughly 35,000 t of the externally supplied scrap back into the SZFG manufacturing process each month. Another 65,000 t come from the company's own production. However most of the purchased scrap, some 100,000 t a month, goes to Peiner Träger GmbH (PTG).

The electric steel plant in Peine converts the old steel to new steel in a 1:1 ratio. PTG covers 100% of its requirements with scrap. An electric arc furnace melts 115 t scrap at 3000°C (5400°F) in each load. DEUMU often also sends old girders, and sometimes the stamps show that they had been manufactured in Peine many years ago. This is the moment that closes the loop. More and more such closed loops will develop over the long term. In foundries and other electric steel plants, the rate is currently already at 90 to 95%; as already pointed out, in Peine, where steel scrap is the only raw material, it is 100%.

The scrap metal of the future will be more difficult to process

The loop has also been closed at DEUMU: The 2.4 million t of recycled scrap are offset by only 50,000 t of extraneous adhering matter, which can be thermally recycled or disposed of. This is just 2.1%. In other words, just under 98% of the delivered quantity is fed back into the production process. This is an impressive recycling rate and exceeds the average of roughly 93%. In the "closed loop" discipline, the steel industry is the world champion, and Salzgitter AG is a top performer.

It will not be easy to further increase the rate in the future. Scrap increasingly contains foreign materials such as plastic. Increasingly complex products also contain new unwanted accompanying substances. This poses a challenge for steel recycling that must be met with new analysis methods and sorting technologies. DEUMU sees this development as a task, but not an obstacle: Marko Klickermann and his colleagues are certain to be supplying Salzgitter and Peine with high quality steel scrap in the future.

Uwe Mauersberger (left) and Marko Klickermann: The parapet of the scrap breaker, where large pieces of scrap metal are broken into small pieces, gives them a good view of the site



High-grade scrap: The production scrap from automobile production has been pressed into cubes that have the same quality as freshly produced and delivered steel



Each ton of steel and iron scrap that is used avoids the mining of 1.5 tons of iron ore



Steel is the world's most recycled material



Around 70% of all steel ever manufactured is still in use
30% of today's steel is produced in electric steel plants and 70% in blast furnaces (oxygen steel production)



Steel scrap covers more than a third of the world's requirements for crude steel production

Photos: Gunnar Göttsche



The river's source is the mill

Exemplary, possibly record breaking, stunning: The Salzgitter Flachstahl GmbH water cycle – how waste water becomes safe for swimming



Steelworkers need ore, coal and - water! To cool the plants and to quench the steel and slag. This is why most steel mills are built close to the water. Although there is not a river to be found in Salzgitter, seven groundwater streams flow together far underground. Some 450 million m³ of water (almost 120,000 million gallons) collect in an underground gravel basin each year. The Salzgitter Flachstahl GmbH (SZFG) waterworks draws water from more than 80 wells at depths of up to 65 m (over 200 feet). It is deacidified, filtered, and disinfected. Then the Adersheim treatment plant passes a portion on as drinking water, while groundwater from the SZFG plant is added to the service water. Finally the water is softened with lime.

Collection basins and bacteria: the process to clean waste water

According to Cord Strathmann, head of TZW Wasserversorgung und Abwasseranlagen (water supply and sanitation facilities water technology center) and SZFG water protection officer, in 2016 513 million m³ of water (over 135,520 million gallons) circulated in the operations. 77% of this, or 396 million m³ (over 104,600 million gallons) is used as cooling water, and the rest is used as process water in production.

In the Salzgitter Flachstahl GmbH wastewater treatment plant, on the other hand, wastewater flows from the plant site, the industrial area, and the outer areas. This is joined by rainfall from the roughly 20-km² (almost 5,000-acre) drainage area. The mechanical-biological wastewater treatment plant runs the whole year through and treats up

to 8,000 m³ (over 2,000,000 gallons) of water per hour.

The process starts with a coarse screen system that removes all solids from the drain water. Then solids settle on the bottle of the primary sedimentation tank, while light substances are cleared away from the surface. The waste water now collects in two additional basins. This outside area is perhaps the most idyllic spot on the company grounds, with meadows, trees, and the branch canal.

A pumping station pumps the waste water into the biological cleaning step, where bacteria break down the remaining substances. Before this, process wastewater from the coking plant, sludge water from the slurry treatment plant, street runoff and slightly dirty cleaning water and ingredients for bacteria growth are mixed in.

This mixture collects in the first aeration tank, into which air is constantly blown. "We must always maintain optimal living conditions for various types of bacteria," explains Dirk Nowak, Wasserversorgung und Abwasseranlagen SZFG. The microorganisms' metabolism also biologically decomposes phenols and cyanide, as well as nitrogen compounds. These processes continue in additional aeration tanks. At the end, a mixture of water and "activated sludge" collects in two clarifier tanks. Gravity ensures that the heavy bacteria slurry mass deposits and the newly arriving waste water from the mechanical cleaning can be mixed in again.

The cleaned waste water is routed into the small river Aue via the Lahmann Ditches. It is an important source of the Aue. And so a river flows from the mill in Salzgitter. It is so clean, that it meets the requirements for swimming.

Decalcified service water on the cooling line in the hot-rolling mill: important for the steel grade



Via the loading station on the Mittelland Canal, Holcim transported some 415,000 t granulated blast furnace slag on the waterway by barge in an environmentally friendly way in 2016 alone



Waste? No way!

Making steel also means making slag – and this by-product can be marketed and used in many ways

When the liquid pig iron flows out of the Salzgitter Flachstahl GmbH blast furnace B, the slag floats on top, which makes it easy to separate it from the iron. Slags are industrially created "substance mixtures" and are produced in many steel production processes.

The crystalline, non-metal melting residue produced when extracting metals from ores is called blast furnace slag. It forms in the blast furnace when additives such as quartz sand and lime are added. Steel production results in other types of slag in the converter and when scrap is recycled in the electric furnace.

As a result, there are very different types of slag. "For example, our blast furnace slag consists of 96% lime, quartz, clay, and magnesium oxide," says Dr. Jürgen Pethke, Director Blast Furnace Operations at Salzgitter Flachstahl GmbH. It is important to have the correct mixture in the blast furnace, because slag will only liquefy there if the composition is right. Its later use also plays a role. "Cement needs a special slag. This is why we have to supply the composition that is right for it, while also ensuring that the slag fulfills its function in the pig iron extraction," says Dr. Pethke. Because the quality depends on the type of ore and the accompanying minerals.

Most of the blast furnace slag from Salzgitter goes to the cement industry as granulated blast furnace slag. One characteristic of cements that contain granulated blast furnace slag is their long setting time, which can be advantageous depending on the building situation. Concrete made of

granulated blast furnace slag cements is also very resistant to chemicals and road salt. The use of granulated blast furnace slag also significantly reduces the CO₂ emissions during cement production because energy is required only to ground the granulated blast furnace slag cement. There is no need to burn the clinker in an energy-intensive process. Some of the slag is also used for road construction. Depending on the lime content, slag can also be used as fertilizer. Another option is to use the granulated blast furnace slag for sand blasting, for instance, to remove paint from metal.

The industrially generated stones, granules, and sands consequently find a meaningful use. This is also why Dr. Pethke does not like to hear anyone calling slag a "waste product". "Slag is a specifically produced by-product, and not waste," he states.

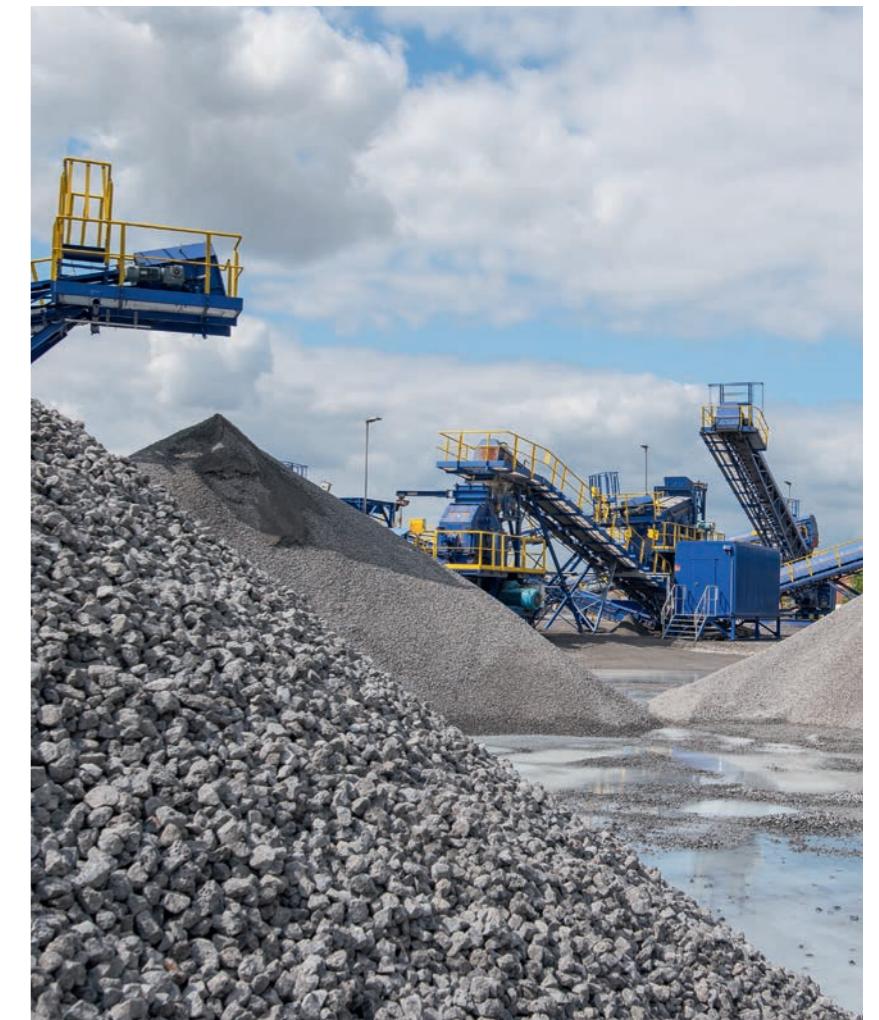
Whether fine or coarse-grained: slag has many uses

Two firms in Salzgitter are responsible for recovering this by-product from the pig iron extraction and steel production: Cement producer Holcim and the Erich Friedrich corporate group

Holcim Deutschland GmbH operates granulation plants on blast furnaces A and B. This is where the liquid blast furnace slag, which can have a temperature of from 1400 to 1500° C (2550 - 2730°F), is quenched with up to 3,300 m³ of water (almost 872,000 gallons) an hour. The sudden cooling bursts and glazes the slag, and results in the light,



The beginning of slag: Pig iron tap on the Salzgitter Flachstahl GmbH. blast furnace B It is tapped about twelve times a day so that the liquid pig iron runs off



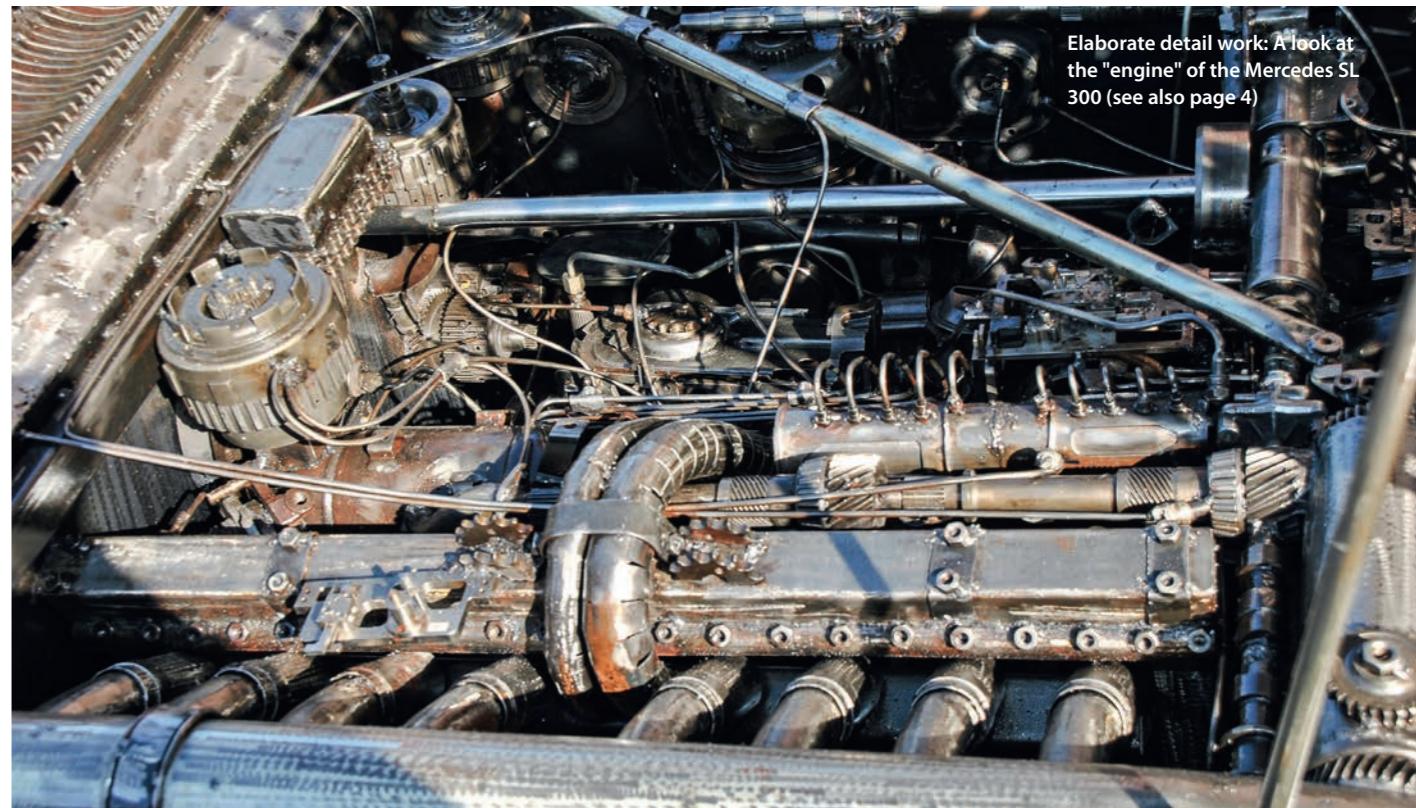
Would you like the grains a little coarser? The Erich Friedrich corporate group's screening machine

The horse that used to be a car

Old steel in new splendor: How northern Germany's "Giganten aus Stahl" artist group creates sculptures from screws, gearwheels, and other pieces of scrap



The figure of this show jumper weights 1,000 kg (roughly a ton) and was made from 6,000 car and motorcycle parts. Four photos served as the model



Elaborate detail work: A look at the "engine" of the Mercedes SL 300 (see also page 4)

The museums of diverse automakers have some, but private individuals also own sculptures from the "Giganten aus Stahl" (Steel Giants) artist group – like the fan from Lithuania, who has meanwhile decorated his entire property with steel figures, such as a large-than-life moose and the show jumper. The group makes what the people want. "90% of our work is commissioned," says Steffi Glück. She is the head of the group, which makes it home far in the north of Germany, in Kiel on the Baltic Sea.

Fourteen years ago, the first enthusiasts started to weld screws, leftover engine pieces, chains, gearwheels and other scrapyard parts into figures. At the beginning, they used whatever they found at the scrapyard, but today they selectively shop and have also continually refined their technique. The sculptures appear oily, even here in the photos, but in truth they are bone dry. "We achieve this effect with a special primer and our own paint mixture," says Steffi Glück, without wanting to reveal the mixture and technique. But this much she will say: The steel is brushed and not sandblasted so that it retains a certain roughness.

Ten freelance contributors give the steel giants their shape today. Most of the sculptures are on a 1:1 scale, but many

are also completed in large-than-life sizes. Prices for large sculptures start at € 8,000 and can go far beyond €10,000; smaller figures can be bought for prices from € 100 to € 200. But whether large or small, each work remains unique.
Info: www.giganten-aus-stahl.de



Steffi Glück is the head of the artist group. She also drives the truck used to transport the creations to exhibitions



Street scene in Tirane: Pedestrian stroll through a newly designed pedestrian zone, with some street cafés still open at the end of October

Photos: Gunnar Garms

Albania – the unfinished land

A pipeline and many more major construction sites in Albania, a country facing many changes.
A discovery tour through the land of the Shqiptars

Albania? Seriously?“ The bookseller looked as amused as she is perplexed. “A travel guide for ... Where exactly is that?” Travelers, if you want to go to Albania, be sure to pack some ridicule, preconceptions and, best of all, lack of knowledge in your bag. But once you have arrived, you will encounter fascinating geography, friendly people, and an unfinished land that now seems to be on the right path after years of turmoil and twists.

Travelers can see the new epoch as soon as they drive from the airport to the capital of Tirana. An honor guard of new structures stands on either side of the highway: feats of architectonic boldness

Stabilization after years of isolation and political turmoil

whose heroes dare to copy the Las Vegas Strip. A bluish, shimmering glass pyramid houses a furniture store, a structure built in a pseudo-classical style actually holds a hotel casino, and crammed between them are shipping companies, gas stations, car dealers and other business activities: Life is hustling before the gates of Tirana. Many buildings are still half-finished shells - a first indication of the unfinished land.

The country's largest construction project is the Trans Adria Pipeline (see page 26), but in Tirana construction sites are also popping up everywhere between new glass-paneled buildings and modern shopping centers. The shells of the high-rise buildings and the Xhamia e Namazgjasë - growing in the middle of the city and soon to be the largest Mosque in the Balkans - announce: In Albania, the buildings are normally made of concrete, not steel.

Sheshi Skënderbej (Skanderberg Square) in front of the Historical Museum is also being rebuilt. It is a symbol of Albania's eventful history. The statue of the dictator Enver Hoxha was enthroned here until 1991. He established a communist tyranny after the war. When he broke away from the Soviet Union in 1961, the Warsaw Pact in 1968, and China in 1978, Albania fell into isolation, and was at best remembered in Germany when the German National Soccer Team struggled against bravely battling Shqiptars. Hoxha died in 1985, but it was not until a good ten years ago that the country stabilized again after agitation, turmoil, and the Kosovo War. Albania has been an official candidate country for the European Union since June 2014.

The structure of Skanderberg Square has changed many times in these years, and now the

traffic is to give way to a pedestrian zone. Speaking of traffic: on Tirana's main streets, it is tremendous, chaotic, and, in one respect, strange: Of the countries not ruled by a sheik, Albania is probably the country with the largest proportion of Mercedes Benz vehicles on its streets.

And the vehicles that are beeping and flashing are not at all ones that were withdrawn from service in Germany a long time ago. Most of the cars on Albania's streets are from this millennium.

In Albania, it is just a short step from donkey carts to a Mercedes, as we discover on a tour through the villages. Wherever we stop for a bite to eat, we are warmly welcomed, and we meet someone who speaks German almost as often as we see trucks on the streets that still bear the names of southern German tradespeople. Estimates state that from 25 to 50% of the Albanians live abroad.

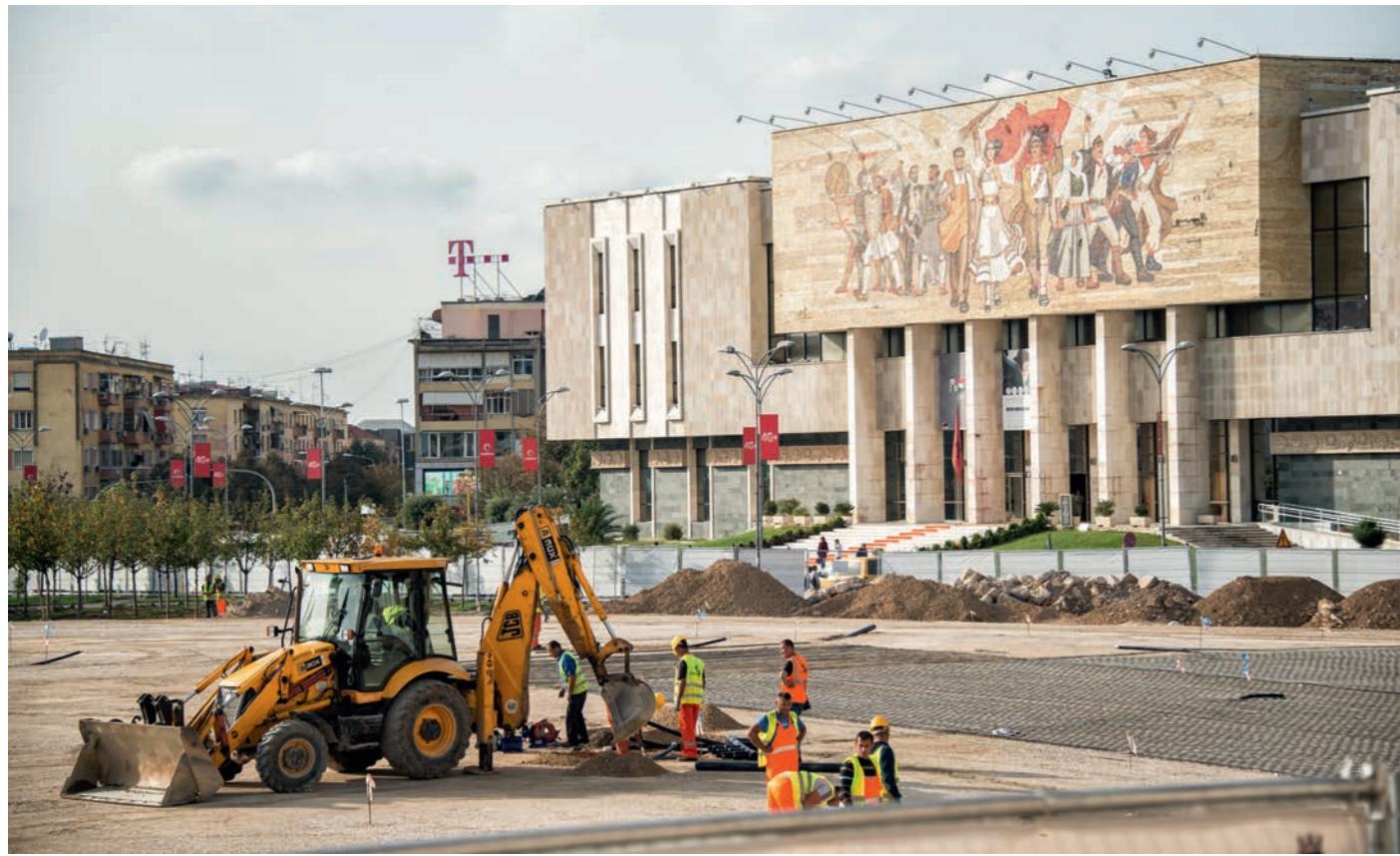
The countryside is likewise full of construction sites, and the style is not modest. Often we see how one level is finished and already long occupied, while the second one over it is holding up the roof, but consists of only concrete columns in a shell construction without any outer walls. But even the



Inhabitants: 2.89 million
Capital: Tirana (617,000 inhabitants)
Annual per capital income:
3,360 euros (2015)
Independent since 1912
Source:
German Foreign Office



A shopping center in Tirana shortly before its official opening. New structures like this one can be found everywhere in the capital.



Above: Skanderberg Square in front of the Historical Museum is currently being rebuilt. The previous green area had to give way in 2011.

Right: Near the TAP construction site, our SUVs panicked a flock of turkeys. But the farmer did not get angry. He knows what an asset the pipeline will be for the country and its infrastructure. Lower left: Retirement in Tirana. Lower right: The Trans Adria Pipeline construction site. It traverses the entire country from east to west and should one day transport gas from Azerbaijan to the Adriatic



Photos: Gunnar Garms

houses that appear to be finished almost always have iron reinforcing bars sticking out of the roof.

The rusty iron fingers even reach for the sky from gas stations and schools. The peculiar phenomenon has a simple explanation: As long as a building is still under construction, no taxes are due. The unfinished state has a purpose in Albania.

Corruption and environmental problems: still a long way to Europe

We also find many shells and new buildings in Tirana's outskirts. On the empty building sites in between, a boy grazes his cow, just like farmers unblinkingly tend their herds along the highways or stop traffic with their sheep.

This juxtaposition of the traditional and modern worlds disappears, however, when we dive into Tirana's nightlife. In the Blloku district, street cafés, restaurants and clubs set the scene. A mild Mediterranean climate gives us the feeling of being in an Italian seaport. Some waiters are startled

when addressed in a foreign language. But they then manage to find a menu in English somewhere under the counter, while there is someone in the kitchen who can at least speak English.

Despite all the good impressions, Albania remains a land full of problems. The environmental pollution is some of the foulest in Europe. Organized crime and corruption, especially in the judicial system, are heavy burdens for the country and obstacles to its admission to the EU. There are many rough spots, but some of the differences are also congenial. For example, some Albanians absolutely refuse to understand how tourism works. On the day we flew to Tirana, we read in the newspaper that GIZ, a German group that promotes international cooperation, is attempting to develop tourism in the country. This includes teaching farmers to accept money from overnight guests. This is inconceivable in families following a traditional lifestyle, because it goes against an old common law, which says, "The home belongs to God and the guest."

New buildings and unfinished shells everywhere. As here in Tirana's outskirts, they strengthen the impression of an "unfinished land": In between, cows, which are just as natural for many city dwellers, graze



Gas for Europe

The Trans-Adria Pipeline (TAP) is to supply western and southern Europe with gas from Azerbaijan from 2020 onwards. Salzgitter AG provided the large-diameter pipes and pipe bends



The route the natural gas will take: it will be extracted from deposits at a depth of 500 m in the Caspian Sea and will be transported over a distance of 3,500 km via the South Caucasus Pipeline (SCP), the Trans-Anatolian Pipeline (TANAP) and the Trans-Adria Pipeline (TAP) to Italy, where it will be fed into the western European gas network

As part of the so-called Southern Gas Corridor, the TAP passes through Albania and the Adriatic to Italy, covering a distance of some 870 kilometers. In 2016 the Salzgitter Group began supplying 270 kilometers of large-scale pipes and 1,559 pipe bends for the project. These were produced in Duisburg and Mülheim, then bent and shipped in Brake.

The work in Albania started in June 2015 and is due to be completed in 2019. Gas will start flowing through the pipeline in 2020. 12,000 pipes weighing 126,000 t are to be laid on the Albanian mainland – the equivalent of 17 times the Eiffel Tower.

The transport capacity of the pipeline has been estimated at 10 to 20 billion cubic meters of natural gas per year. In the long term, the pipeline will meet up to one fifth of the demand for natural gas in the EU (TAP is the European section of the Southern Gas Corridor, covering a distance of 878 km out of a total of 3,500 km).

The total cost of building the pipeline is estimated at EUR 4.5 billion.

Some of this will go towards infrastructure facilities such as roads and bridges which will benefit the country in the long term. The project is the biggest direct foreign investment in Albania. For details, see: www.tap-ag.com



The main storage facility of the TAP project, near the port city of Durrës: here the large-diameter pipes are stacked in three or four layers, depending on their diameter. Two workers wait for the next truck for loading

Teamwork in the customer's service

The TAP order is placing high demands of logistics and service

Those responsible at Salzgitter Mannesmann International (SMID) put together a giant package for the major contract: the production and delivery of 270 km of large-diameter pipes and 1,559 pipe bends with a total tonnage of 170,000 t for the onshore part of the Trans-Adria-Pipeline (TAP) in Albania. In addition, more than 71,000 t of large diameter pipes for the 105 kilometer long offshore part of the pipeline across the Adriatic Sea to Italy. Also included are coating services and the delivery of the sacrificial anodes needed for rust protection, and the buckle arrestors needed for offshore pipelines.

In addition to Salzgitter Mannesmann International (SMID), additional businesses and Salzgitter companies are involved in the TAP contract. Hüttenwerke Krupp Mannesmann (HKM) in Duisburg produced the steel in material grade L485 and cast it into slabs. Salzgitter AG holds 30% of HKM through Mannesmannröhren-Werke. Salzgitter Mannesmann Grobblech in Mülheim rolls the slabs from Duisburg into steel sheets. In turn, EUROPIPE, a joint venture with the Salzgitter group and the AG der Dillinger Hüttenwerke each

holding 50%, manufactured longitudinal welded large-diameter pipes from this heavy plate.

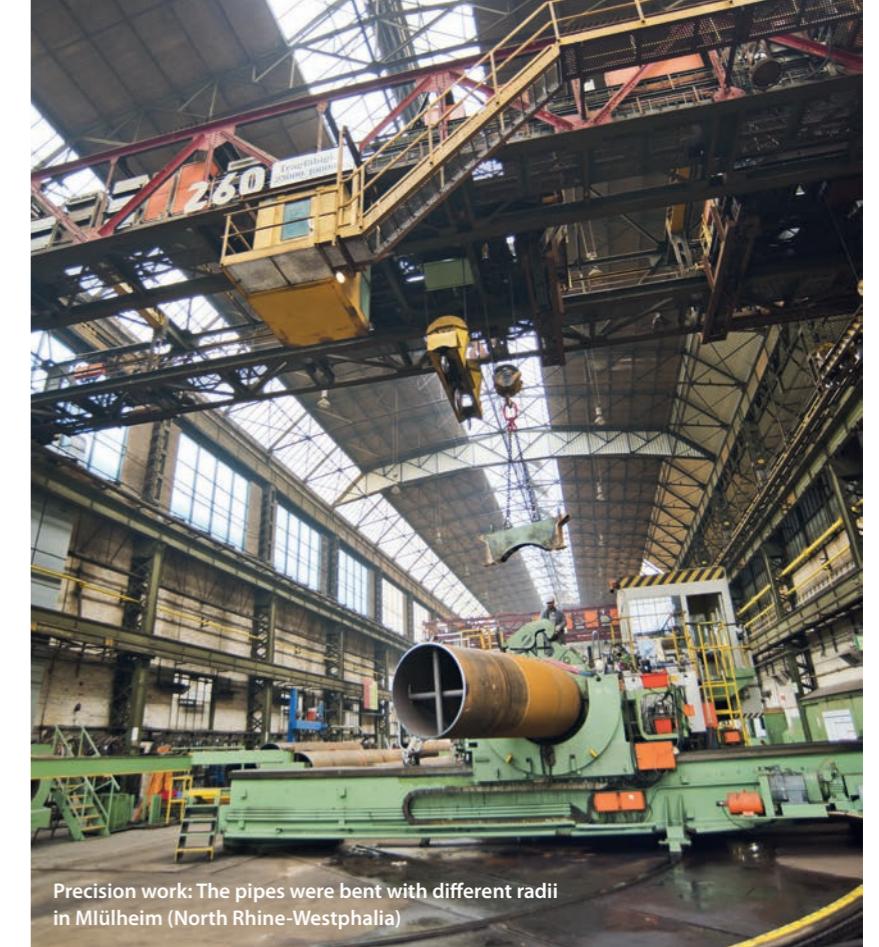
For Elke Muthmann, Director Pipe Bending Plant, the successful cooperation of all these companies and businesses led to the contract award. "We were able to offer a group solution. Not only did the products fit together, the coordination was also often smoother. The customer greatly appreciates this, particularly when the time frame is ambitious." The TAP contract was the pipe bending plant's largest order in its 30-year history, and is kept the 50 employees busy around the clock from November 2015 until early in 2017. The finished pipe bends also underwent a so-called tempering treatment to give them characteristics for the specific material. They were then coated on the insides with Epoxy-Flowcoat and the outside with polyurethane.

The large delivery volume place big demands on the pipe bending plant's manufacturing and delivery capacities. Eight to ten of the pipe bends, which weighed between 1,680 and 8,050 kilo were produced each day, which meant the schedule was very tight. Joern Hoppe, project supervisor

for the TAP order in the pipe bending plant's Sales Department, remembers, "We received the inquiry on March 3, 2015, and the contracts were signed on September 24. We bent the first pipe on November 2.

The large-diameter pipes and bends were delivered in 18 shipments from the port of Brake starting in March 2016. We met all production and delivery deadlines. "The greatest challenge was to direct the requested quantity to the agreed location at the required time," says Steffen Hillig von Salzgitter Mannesmann International (SMID). It was necessary to calculate the required ship's hold.

In addition to planning, the logistics also had to be carried out. Steffen Hillig's responsibility started at the boundary of the harbor in Brake. He had to fully document the transport and inform the parties responsible for TAP not only of the departure, loading, load capacities and arrival time, but also report regularly on the status of the matter to the TAP project management. But none of this posed a problem, and Steffen Hillig can only report on positive events. "The work with the client went very well."



Precision work: The pipes were bent with different radii in Mülheim (North Rhine-Westphalia)



Shipping the pipes in the northern German harbor of Brake. Here at the lower stretch of the Weser River between the cities of Bremen and Bremerhaven, the pipes and bends were loaded onto bulk carriers such as the "RED JACKET". It took around two weeks until the ship entered the Albanian port town Durrës after its trip through the North Sea, Atlantic, and Mediterranean



Passenger trains can pass through the tunnel at a speed of up to 250 km/h. They are to run every half hour, and shorten the travel time between Zürich and Lugano by 45 minutes

The mountain called, Peine delivered

Steel for the new St.-Gotthard Base Tunnel: Mine support sections, produced by Peiner Träger GmbH, quenched and tempered in Bochum

The Gotthard Base Tunnel opened in Switzerland on June 1, 2016. The term "base tunnel" refers to the underpasses without entrance and exit (ramp), that are designed with little slope or pitch and are correspondingly longer. The Gotthard Base Tunnel is the most important component in Switzerland's traffic policy.

Peiner Träger GmbH produced around 32,000 t of TH70/44 mine support sections for the tunnel construction from 2001 to 2010. TH stands for Heinrich Toussaint and Egmont Heintzmann, who invented the TH support system. It has been used in mining and tunnel construction since 1932 and has undergone continuous improvement. TH70 is the code for the last enhancement in 1970 and 44 stands for a section's weight: 44 kg per meter.

The steel for each Peiner section comes from steel scrap. This scrap is melted down in electric arc furnaces, which liquefy 100 t of metal in 40 minutes. Following this, the steel receives a metallurgical treatment, is alloyed and sent to the continuous casting lines to be cast into blooms and so-called beam blanks to produce the section. Then the continuous cast slabs are again heated to 1,100 to 1,200° C (roughly 2,000 - 2,200° F) in one of the two rolling mills so that they can be formed again. In a number of steps, the strands are rolled there until they take on the required shape. Their typical V-profile is clearly apparent at the end of the line, where the steel slowly cools. After this, the

sections still have to be straightened and cut to the required length.

The sections are then transported to Bochumer Eisenhütte Heintzmann GmbH & Co. KG, which shares a long business relationship with Peiner Träger GmbH. The company, which was founded in 1851 as an iron bending plant, gives the steel strength and toughness in a quenching and tempering procedure and bends the sections. Quenching means: the steel is made harder and more elastic during heating in two continuous furnaces.

In the first furnace, the sections are heated to 1000° C (1832° F) and then quenched in a water bath. 210 m³ (55,476 gallons) of water per hour are blasted onto the metal, which still has a temperature of 950° C (1742° F). This gives the steel a finer-grained structure, which hardens it and gives it greater tensile strength. Barely cooled, the sections glide into the tempering furnace, where they are again heated to 700° C (1292° F). After some 30 minutes, the stresses that built up in the first step are relieved again. The steel gets tougher.

The bending machine is the last step for the mine support sections. The machine's power bends the steel in a purely mechanical step and forms it into curved segments. The bend radius is measured again and again, a last quality inspection before the profiles are bundled together and transported for loading – not only to St. Gotthard, but also to other tunnel construction projects in Europe.

Photo at top: A Peiner Träger GmbH rolling mill. Rolls for various sections are stored at the left, and on the right, the glowing beam blanks drive to the rolls. Right: At the end, the quenched sections are bent in Bochum; an employee checks for the correct curvature



The steel skeleton of the mine support sections during the tunnel construction. It can be very clearly seen how the sections mesh and are held together by the connection pieces



SALZGITTER GROUP IN FIGURES

Crude steel production

2017 6,955,000 t

2016 6,804,000 t



Finances 2017

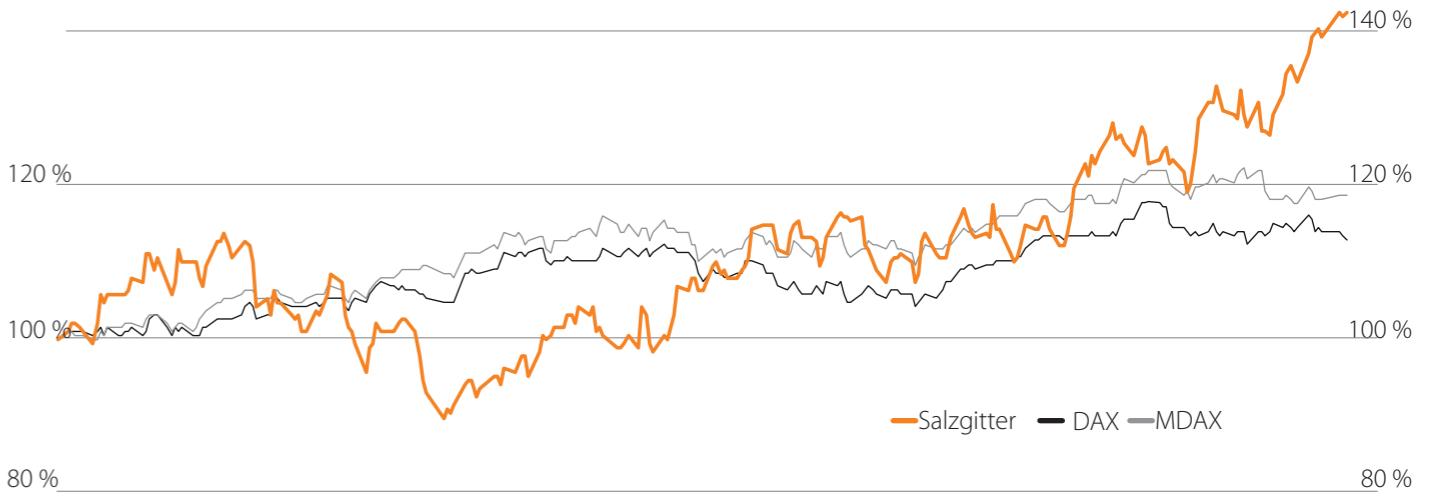
| | | 2017 | 2016 ¹⁾ |
|---|--------|-------|--------------------|
| External sales | Mio. € | 8,990 | 7,906 |
| Strip Steel Business Unit | Mio. € | 2,160 | 1,815 |
| Plate / Section Steel Business Unit | Mio. € | 1,024 | 742 |
| Mannesmann Business Unit | Mio. € | 1,093 | 999 |
| Trading Business Unit | Mio. € | 3,230 | 2,855 |
| Technology Business Unit | Mio. € | 1,285 | 1,300 |
| Industrial Participations / Consolidation | Mio. € | 198 | 195 |
| Earnings before taxes (EBT) | Mio. € | 238 | 53 |
| Strip Steel Business Unit | Mio. € | 182 | – 2 |
| Plate / Section Steel Business Unit | Mio. € | – 58 | – 32 |
| Mannesmann Business Unit | Mio. € | – 6 | – 22 |
| Trading Business Unit | Mio. € | 71 | 45 |
| Technology Business Unit | Mio. € | 7 | 28 |
| Industrial Participations / Consolidation | Mio. € | 42 | 36 |
| Net income/loss for the financial year | Mio. € | 194 | 57 |
| Earnings per share – basic | € | 3.52 | 1.00 |
| Key figures | | | |
| Return on capital employed (ROCE) ²⁾ | % | 8,6 | 2,7 |
| Cash flow from operating activities | Mio. € | 274 | 290 |
| Investments ³⁾ | Mio. € | 287 | 352 |
| Depreciation/amortization ³⁾ | Mio. € | – 390 | – 357 |
| Balance sheet total | Mio. € | 8,318 | 8,450 |
| Non-current assets | Mio. € | 3,566 | 3,700 |
| Current assets | Mio. € | 4,752 | 4,750 |
| Equity | Mio. € | 2,990 | 2,852 |
| Liabilities | Mio. € | 5,328 | 5,598 |
| Net financial position ⁴⁾ | Mio. € | 381 | 302 |

Disclosure of financial data in compliance with IFRS: 1) Without sheet piling activities; 2) ROCE = EBIT (= EBT + interest expenses excl. interest portion in transfers to pension provisions) divided by the sum of shareholders' equity (excl. calculation of deferred tax), tax provisions, interest-bearing liabilities (excl. pension provision) and liabilities from finance leasing, forfaiting, derivatives; 3) Property, plant and equipment and intangible assets, excluding financial assets; 4) Including investments, e.g. securities and structured investments

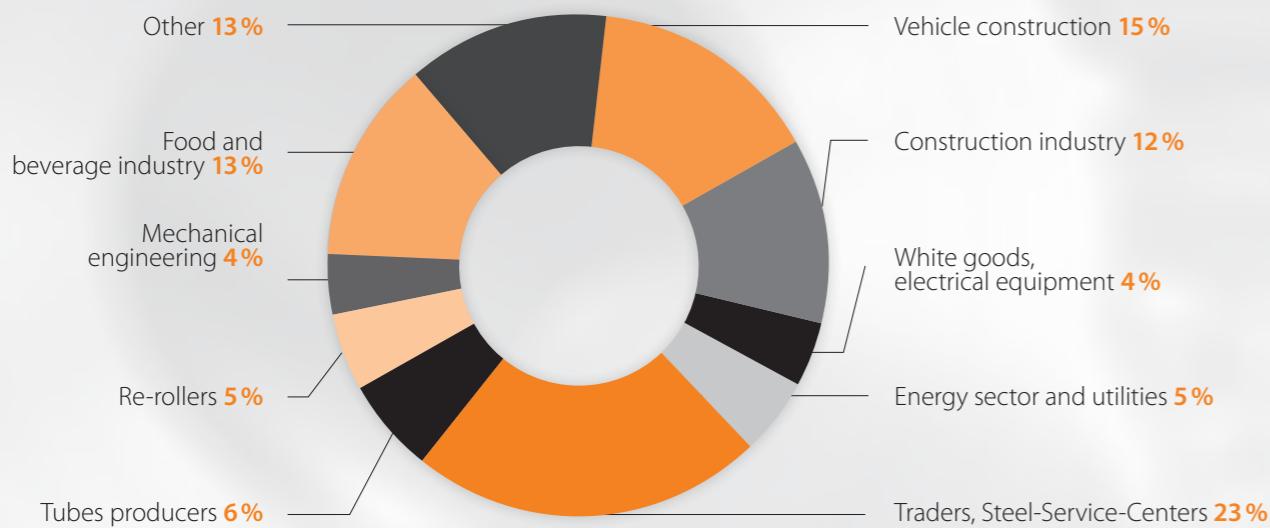
Salzgitter development – 2016 share prices

Compared to DAX and MDAX, in percent

100 % = Start of 2017



External sales 2017 by customer industries

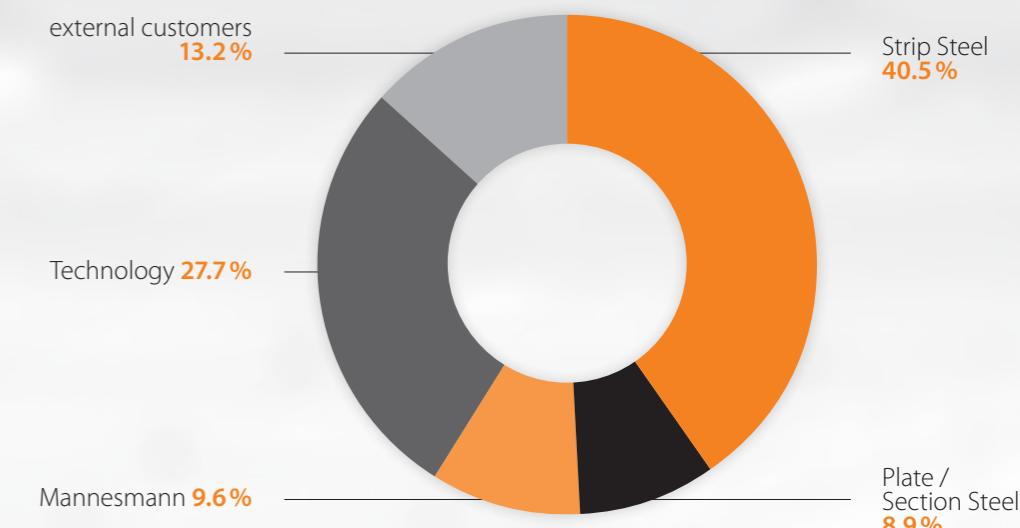


Research & Development

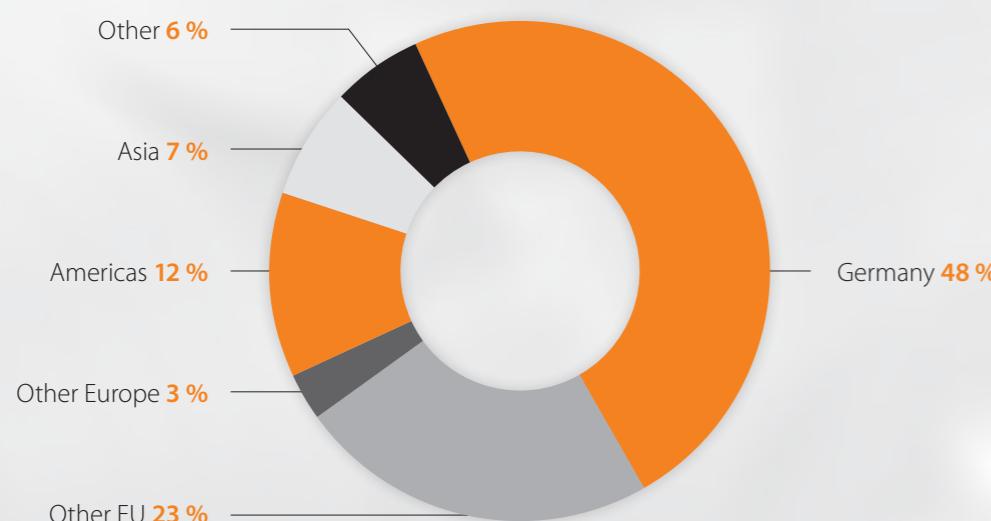
€ 102.8 million

In 2017, the Salzgitter Group spent € 102.8 million on R&D and R&D-related activities.

Research and development expenses by business unit



External sales 2017 by regions



Non-active age-related part-time employment
513 -51*

Apprentices, students, trainees
1,422 -30*

Industrial Participations / Consolidation
2,585 +26*

Technology
5,386 +85*

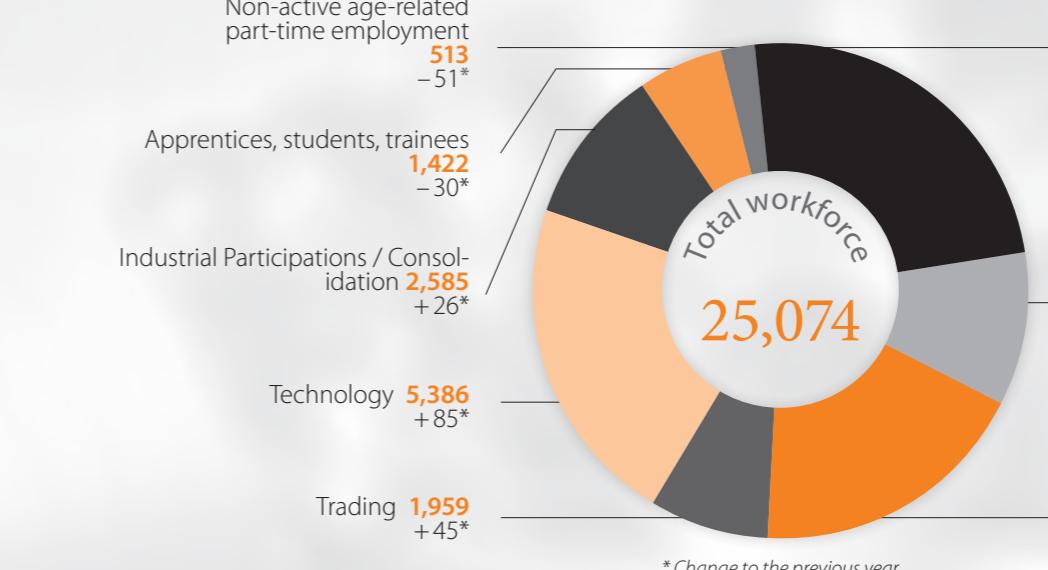
Trading
1,959 +45*

Strip Steel 6,092
+30*

Plate / Section Steel 2,479
-106*

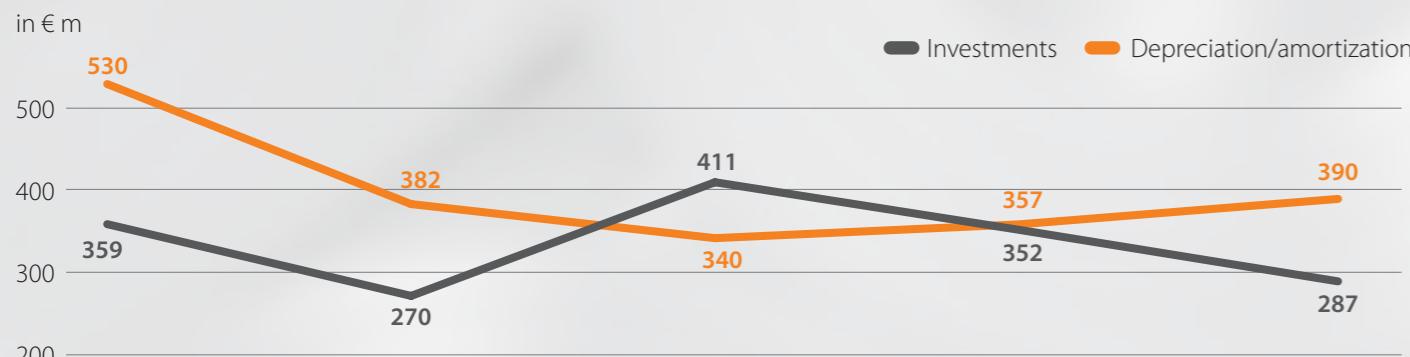
Mannesmann 4,638
-93*

Trends in the workforce

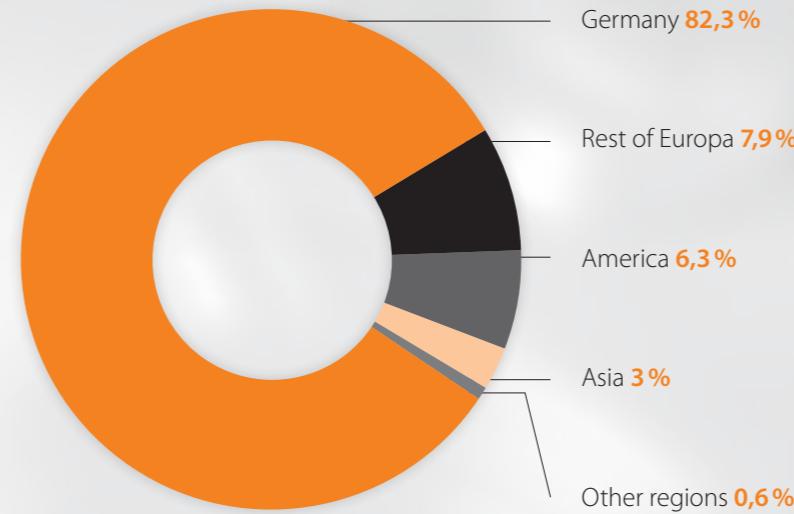


Depreciation/amortization 2013–2017

Property, plant and equipment and intangible assets, excluding financial assets



Regional distribution of the core workforce



You can find further information and details in our 2016 annual report at: www.salzgitter-ag.com

Download: PDF GB 17



STEEL DIGITAL

Digitalization is presenting industry and commerce with major revolutions. And this includes the steel industry. Salzgitter AG is meeting this challenge with its own strategies

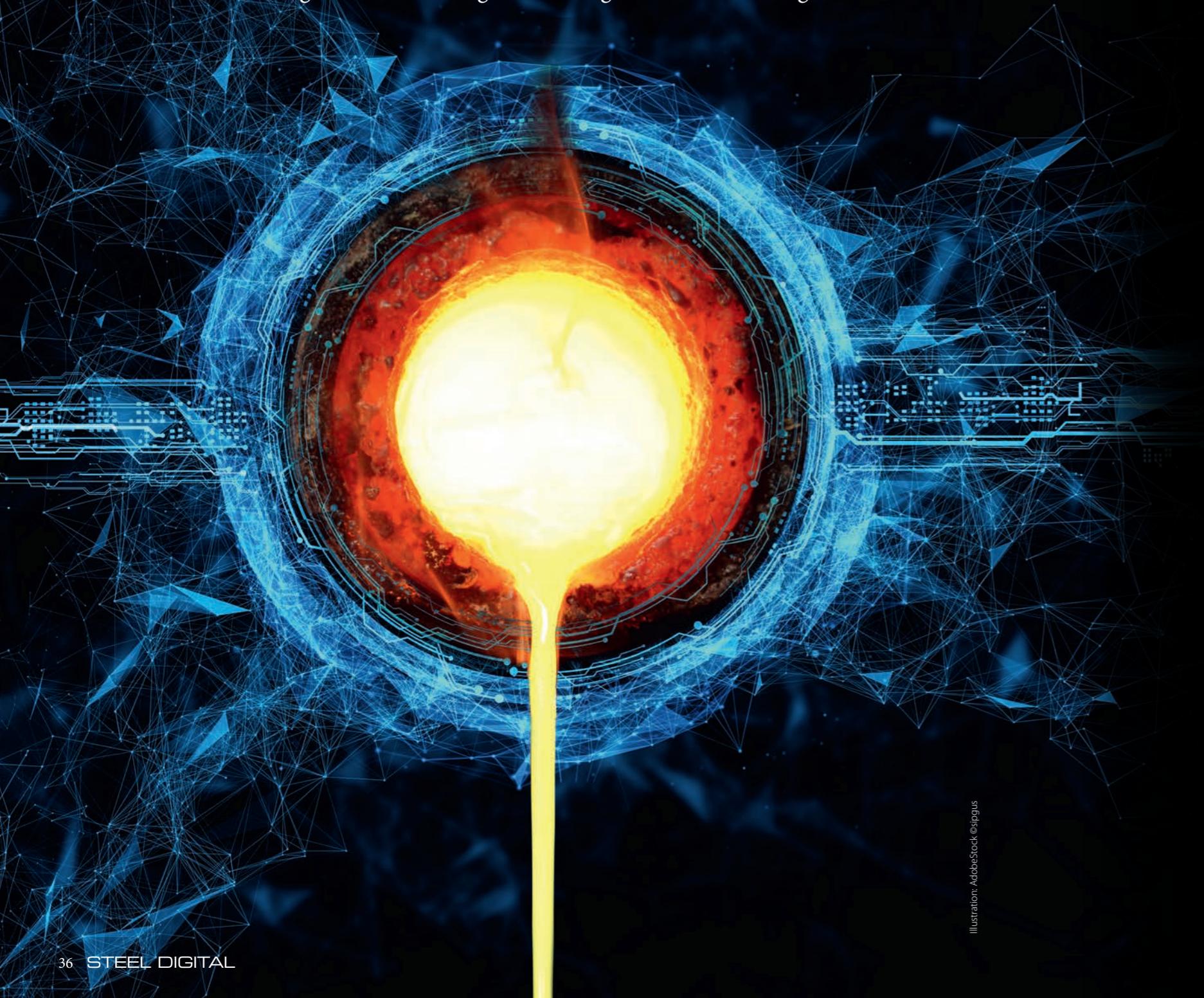


Illustration: AdobeStock ©sipgus

The digitalization of industry

Data are the most important raw material in the 21st century. Those who "mine" and own data and know how to use them or swap them skillfully acquire crucial competitive advantages. This makes data an economic good. They are sought after and valuable, and correspondingly must be protected.

Data collection, linkage, administration and exchange are penetrating and changing all processes in economic activity. New professions, departments, business models and even industries are being created and continually expanded. Relationships among protagonists - politics, companies and customers - are transforming and becoming more transparent. Example: A customer knows in real time when the supplier hands the goods over to the shipper and where the delivery truck is at any given time. In combination with the traffic data, the customer can calculate the exact delivery time and align the production processes accordingly. If there is a delay, the customer is immediately able to re-coordinate the production flow.

Digitalization is also facilitating new processes in production: The unfinished product on the assembly line "sees, hears, thinks" - and, in "consultation" with the machines themselves, decides which step should come next in order to keep production running as efficiently as possible. Networked machines are using software and sensors to monitor and control the production. They can also "learn" and optimize the processes based on collected data or, if you will, based on "experience."

Not least, the employees are also profiting from digitalization in many ways due to improved working conditions, increased safety at the workplace, new career opportunities, and reduced workloads.

No company and no industry can escape the change. The efforts to meet the challenges and the hopes for new opportunities are correspondingly great, but so are the worries about not being able to keep up with the development. In the digital age, it is easy to fall behind: Kodak and Nokia are warning examples of the perils of missing the boat to the future.

This also applies to the steel industry. The production and quality control of steel grades, sales via e-SHOP, and simulations in research are three examples of how Salzgitter AG is exploiting the opportunities provided by digitalization.

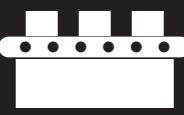
This is rapid development that found a catchword with the term "Industrie 4.0". An analogy from the supermarket explains the difference between Industrie 3.0 and Industrie 4.0: Today (3.0) customers at the checkout simply look for the shortest line. In the 4.0 world, customers use "data" to make the decision. Their IT systems know the type and number of all the goods in every shopping cart, the different times needed to record the price (weighing, scanning or manual entry) and the speed of every customer and every cashier. An app then makes a real-time calculation to determine the checkout line that will allow the customer to finish the process in the shortest time – and this does not have to be the one with the shortest line.

Industrie 4.0

Following mechanization, electrification, and automation, in the course of digitalization we speak of the fourth industrial revolution or "Industrie 4.0" for short. This means more than just the collection and use of data, however. The crucial steps are networking and communication. Production means, goods, and people exchange their knowledge with one another in order to optimize workflows. Knowledge is power, according to the old saying. In Industrie 4.0, knowledge is strength.



1.0
First industrial revolution
MECHANIZATION



2.0
Second industrial revolution
ELECTRIFICATION



3.0
Third industrial revolution
AUTOMATION



4.0
Fourth industrial revolution
NETWORKING

Heading into the digital future

Salzgitter AG is developing clear strategies for Industrie 4.0: Objectives and measures using Salzgitter Flachstahl GmbH and Salzgitter Mannesmann Forschung GmbH as examples



Photos: Gunnar Garms

Salzgitter AG is focusing on digitalization and Industrie 4.0. Work groups are developing strategies and projects, formulating objectives and considering their implementation, and examining measures and application scenarios. One example is the steering committee Intelligent Manufacturing (SKIM) at Salzgitter Flachstahl GmbH.

Standardization

Salzgitter AG is a member of the Industrial Data Space Association and is consequently actively participating in the development of the standards for data traffic in the future (see page 41). The objective of the company as a whole and also of SZFG is group-wide networking and structured administration of "non-aggregated" (isolated) and "aggregated" (summarized) data.

For example, communication interfaces and protocols for these are standardized throughout the mill and processes such as slab transport are digitally monitored and controlled. Salzgitter AG provides its production sites with uniform monitoring tools for this purpose. All aggregated data should also be centrally managed and administered, while the software employed and the IT infrastructure should be standardized.

Network infrastructure

The data exchange within the group and with other companies places requirements on the volume, quality, and speed of the network infrastructure. SZFG is developing a concept for this and networking production systems and planning and control systems with one another. In addition, WLAN networks must be set up and departments, such as the warehouse, must be equipped with mobile devices.

IT security

The security of data and data traffic is perhaps SZFG's most important objective. First it is necessary to guarantee IT system availability by means of a monitoring system, safety technology, and the physical protection of the technology, such as a safe computer center and secure server areas.

Most important, however, is protection for the data and the production plants against manipulation and unauthorized access. An infrastructure and networks that focus on reliability and security create the fundamental requirements, but there is also a demand for employee discipline. SZFG ensures that the workforce is aware of such factors as the need to use only encoded data media and not to connect private devices to the company hardware.

SZFG initiated the "Smart IT 2021" strategy project in order to take concrete measures. The project's objective is to create an overall IT concept, derive specific IT projects from the corporate strategy, and to unite these in the "Roadmap Industrie 4.0".

"The project work was completed in the second half of 2017, and the results have been compiled



"Show us your feet and we will make a custom-fit shoe." DESMA Schuhmaschinen GmbH fulfills special customer demands with the help of digital technology



Example of digitalization's playful side: The "speaking bottle" from KHS. A link on the bottle causes an app on the tablet to "speak" its label

in a manual. The Intelligent Manufacturing (SKIM) steering committee is responsible for the implementation," says Gerd Baresch, Salzgitter Flachstahl GmbH plant area director for Technical Service, Energy and Environmental Protection.

Work environment

The activities in the work environment must also be adapted to digitalization's requirements. The objectives here are automation, linking the real world to the digital one, and involving the employees, who should master the new systems and processes as planners and decision makers.

The employees must consequently always be familiar with the processes and product location

and status while receiving support from intelligent IT capable of learning. Mobile assistance systems such as tablets or smartphones should also supply them with the necessary information.

Education and training

Digitalization involves changes in the working world that call for new approaches to education and training. The fundamentals of information technology and an understanding of the requirements of IT security are new training contents. Some job descriptions are also changing. For instance, the requirements for a mechanic are migrating to those of a mechatronic technician. Digital means can be used to convey knowledge. E-Learning with web-based exercises and virtual training scenarios helps overcome any initial fears regarding the new technology and media.

Research

Three examples show how virtual computational models can supplement research experiments and in some cases even replace them in processes, components and materials.

The virtual improvement of microalloyed steels during the hot rolling of heavy plate or hot strip is an example for a process. Here temperatures and forming steps must be precisely matched to the alloy. The ideal process window for this is determined in many laboratory experiments or field trials.

Computer simulations should soon reduce the number of necessary tests. Since the middle of 2014, a four-year cooperation project involving SZMF in Duisburg and Salzgitter and TU Wien has been developing a simulation program that predicts the development of the inner structure of microalloyed steels after any desired forming and temperature steps. In addition, SZMF's Process Analysis and Numerical Simulation Department is working on an "optimizer". This device should

test variations of temperatures and shaping on the computer and search for the mathematically optimal configuration.

An example from automobile manufacturing shows that no crash tests are needed for the safe design of a component that is 17% lighter but just as safe. Working with AUDI AG, the SZMF Application Technology's Engineering and Simulation Department successfully achieved this for the A7 door intrusion beam. In the event of a side collision, the door intrusion beam counters the impacting mass with as much force as possible. This property can be tested and optimized in experiments or virtually.

Microstructure simulation for large diameter arctic pipes is an example of how this works for materials. The permafrost demands a large pipe diameter, high operating pressures, and thick pipe walls. This leads to more stringent demands on the large-diameter pipe's strength, toughness and weldability.

Microstructure development simulations commissioned by EUROPIPE GmbH are testing the connections between the steel composition, the welding process, and the resulting microstructure. The simulations can vary the process parameters and steel compositions more strongly than would be possible in experiments. During the cooling, a phase transformation across a broad temperature range can lead to harmful structure proportions. Today it is possible to simulate this process. In the future, it will consequently be possible to estimate harmful microstructure components and select the alloys in a way that reduces the negative effects.



Illustration: ©ksenyaadmeva, ©StefanWeichert - stock.adobe.com

In automobile manufacturing, the function and safety of components can be investigated without building prototypes and without crash tests. It is sufficient to have material data and appropriate research models, for example

Big bang in the new data universe

A German initiative would like to develop standards for national and international data traffic in global industry – with assistance from Salzgitter AG



The big bang of the digital age

Data is produced in every machine, at every workplace and in every company. Companies and industries will increasingly be exchanging and linking such data with one another. But right now, unfortunately no one knows exactly how the data traffic should be handled on a large scale.

Which rules the data should follow to take which paths without the data or the company incurring damage. The industry is at square one here. After the big bang of digitalization, the data masses from institutions, industries and companies are conglomering into a big data universe, and no one knows its ultimate form.

The Industrial Data Space

Like the universe, industry in the age of digitalization needs a space and natural laws for data traffic: the "Industrial Data Space". This is the name of a project started by industry and commerce, politics and research at the end of 2014. The initiative is organized as a research project of the Fraunhofer Society and Association (see below) and is being funded by Germany's Federal Ministry of Education and Research (BMBF). The project aims to create a safe data space, with standards and a generally applicable regulatory framework for safe data exchanges.

Data security and sovereignty

The Industrial Data Space is likewise aiming at data security and data sovereignty. This means: Owners of data maintain control over their data and pass it on only to certified and trustworthy partners. The Industrial Data Space should develop and define rules for this. The German initiative also wants to supply international industry and commerce with standards. The first milestone is to create a "reference architecture" for the Industrial Data Space. In informatics, this is the name for something like a template that later solutions can use as a basis for the implemented data traffic.

The Industrial Data Space Association

In January 2016, 70 internationally operating companies from a number of countries joined together to form the "Industrial Data Space Association" as part of the research project. Among other assignments, they form work groups, contribute their suggestions and experience to the development of the reference architecture, and test it using applications from their day-to-day business. They focus on three main points: logistics, production, and customer processes. Audi, Bayer, Bosch, SAP, Siemens, Volkswagen – and Salzgitter AG – are some of the association's members.

INDUSTRIAL DATA
SPACE ASSOCIATION



The association:
Industrial Data Space e.V.
info@industrialdataspace.org
www.industrialdataspace.org



The research project
[http://s.fhg.de/
industrialdataspace](http://s.fhg.de/industrialdataspace)

Digital in the hot-roll line

Glowing steel, rolls weighing tons, and rotating coilers: The Salzgitter Flachstahl GmbH rolling mill is a rough world - but it works thanks to digital precision technology



Mario Rodrigues commands the control room for the coiling and coil output. When he looks out the window, he sees the rotating coilers, but he has a better view when he uses the live images on his monitors

Monitor, indicator lights and switches: If you enter Mario Rodrigues's control room, you might think you are where watching the control of an airport's operations. But instead of guiding airplanes to the runway, Mr. Rodrigues controls and monitors the hot-roll line's coiling system at Salzgitter Flachstahl GmbH in Salzgitter. Slabs (steel blocks) weighing up to 35 t are heated to 1,200°C (2,200°F) in the rolling mill, rolled into hot-rolled strip up to 2,000 m (1.2 miles) long, cooled and then wound into coils.

There are no people to be seen on the lines. Only in the control rooms are keen eyes and fast computers watching over the processes. Thousands of sensors record more than 120,000 pieces of product data in real time for processing by more than 400 computers. "Digitalization is engaging in all points of the manufacturing

process," says Thomas Rothe, head of the hot-roll line. Digital technology not only controls and monitors the systems, it also handles the process control. It is what allows the products to be configured and manufactured automatically and swiftly for each individual customer. Sometimes completely different hot rolled strips move through the rolling mill one following the other, and digitalization is what makes this manufacturing possible. "Humans would not be able to do this," says Thomas Rothe. The same is true for the quality control. The steel grades are continually monitored digitally during production, as this is the only way to guarantee consistent quality. Digitalization has also made it possible to produce far more steel grades in Salzgitter today than 20 years ago.

The digital management and control ensure a high level of precision in the

production flow. The strips move through the rolling mill at a speed of 70 km/h (over 40 m/h), and the distances between them are regulated automatically.

Digital technology is even indispensable in the furnaces. Some 100 temperature sensors are mounted in the gas firing, but none of these can measure the temperature inside the steel. It takes a computer using complicated computing models to determine the slabs' correct temperature from the 100 measured values.

At Salzgitter Flachstahl, some 80 computer specialists make sure that all digital systems are running perfectly. At the same time, they must ensure that no one can manipulate the steel group's control systems and databases from the outside. Because unfortunately this is also a common part of digitalization and Industrie 4.0; daily attacks from the outside and attempts to hack into the system.

Totally digital: The Salzgitter e-WORLD

When a mouse click sets the forklift in motion: The Salzgitter Mannesmann Stahlhandel GmbH digitalization concept with e-CONNECT and e-SHOP



Customers who have ever shopped online know the advantages of an E-Shop: they can order products around the clock, check if a particular item is available, configure it to suit their needs, and track its shipment.

The Salzgitter Mannesmann Stahlhandel GmbH also offers these advantages to its customers. The e-WORLD der Salzgitter Mannesmann Stahlhandel GmbH (SMSD) It comprises e-CONNECT, a digital interface between the customer and the steel trade, as well as the e-SHOP, which started with the TUBE 2016 trade fair. "The e-WORLD transfers the complex business processes between suppliers and customers into the digital world," Jens Rojahn, SMSD executive director summarizes in a nutshell.

"Thanks to e-CONNECT, our customers have direct access to our inventory levels and, where necessary, can convey orders from their system directly into our system, already with numerous pre-processing services, such as sawing, drilling or priming the ordered steel." An offer, that customers gladly accept: "Currently 63.5% of the stock issued

undergoes pre-processing steps," reports Martin Walde from the SMSD executive board. Volker Schult, member of the group management, sees the combination of high material availability with the supplementary pre-processing options as a clear competitive advantage: "These makes us less interchangeable as a supplier, and customers can reduce their own inventories."

Customers can also retrieve/display the majority of the product line in über den e-SHOP können Kunden. New customers can also access any batch sizes seven days a week. Another advantage of online sales is that craftman's business, for example, order small quantities and consequently can be acquired as new customers..

But there is still a lot of convincing to do, because in Germany, customers are more cautious about buying steel in the e-SHOP than in many neighboring countries. The responsible people are therefore working on additional improvements. "The service in the e-SHOP is gradually being broadened to include expanded pre-processing and the inclusion of external products," says

Volker Schult. Meanwhile, Salzgitter Mannesmann Austria is also operating an e-SHOP for customers in Austria.

The SMSD e-WORLD reveals the opportunities by way of example, but also the challenges of digitalization. It simplifies and accelerates the trade's business processes and binds customers by linking the systems of the two partners. Exclusive customers can even call up the SMSD stocks from their own IT architecture. The next step calls for customers to be able to make digital inquiries and orders for flame-cut parts, for example. However this calls for the data security and integrity to be guaranteed at all times. And ultimately, the employees must be willing to join the move to the digital future and to learn how to handle the digital technologies. "We must and shall accompany our employees on this journey," Volker Schult says and, looking ahead to the future of the e-WORLD, he adds, "Naturally the objective is for all activities to make useful additions to the existing range of services. Personal contact still remains a key factor for success in the steel trade."



"We rely on our employees and are going to prepare them to master the challenges that digitalization holds."

Martin Walde, Executive Director Salzgitter Mannesmann Stahlhandel GmbH



"The connection between our Exclusive Partnership offer and e-CONNECT results in a very strong relationship based on mutual trust with our customer"

Jens Rojahn, Executive Director Salzgitter Mannesmann Stahlhandel GmbH



"The digitalization process' speed creates a competitive advantage."

Volker Schult, Executive Director Salzgitter Mannesmann Stahlhandel GmbH and member of the group's executive management

Ten key statements about digitalization

- Digitalization is advancing the industry to a new stage of evolution, and its significance is comparable to that of the three previous major development leaps mechanization, electrification, and automation.
- Digitalization is speeding up automation.
- Digitalization is penetrating all industries and processes.
- Digitalization is a global process, and ignores all regional and national borders.
- We are still at the beginning of the development into a digitalized industry; still missing are, e.g., standards for the data traffic's infrastructure.
- The digitalization process is inevitable and without alternative: to tackle it incorrectly or initiate it too late will mean penalization from the competition.
- Data fuel the digitalization process, and this fuel is explosive: IT security may be the industry's most important challenge.
- Digitalization offers opportunities for new business models and ideas, and provides economic dynamism..
- The progress in digitalization is changing the working world and requirements place on the workers, but it also holds advantages for the workforce.
- Digitalization is changing the relationship between producer/service provider and customer – it is creating a new closeness.

Supermoon above the rolling mill in Ilsenburg

HEAVY PLATE/STEEL SECTIONS Sven Müller managed to take a particularly impressive photograph on November 14, 2016. The dedicated photography enthusiast took a picture of the so-called "supermoon" over Ilsenburger Grobblech GmbH, in which it appears to be resting on the chimney stack. Sven Müller planned the picture a long time in advance: he had to find a spot that offered the best perspective and then wait for the precise moment at which the moon reached the desired position.

The last time the full moon was as close to the Earth as this was in 1946. The "super moon" appears 14% larger than usual – approximately the difference between a EUR 1 and a EUR 2 coin. It also shone 30 % brighter than usual. The next time a full moon comes this close to the Earth will be on December 25, 2034.

Sven Müller is from the town of Stapelburg in the Harz mountains in northern Germany and especially likes taking photographs of landscapes and the night sky. He spends much of his time outdoors and usually has his complete set of photographic equipment with him. Several of his family members work for Ilsenburger Grobblech GmbH, including his father.

For more impressions, see: www.zweene-photo.de



Photo: Sven Müller

Fresh spotlight for an old name!

The Salzgitter AG business unit presents a new look

MANNESMANN In future, the companies of the Mannesmann business unit will go by the name of MANNESMANN only – as used to be the case. This casts a new spotlight on a tradition-steeped name.

Mannesmann is highly valued brand name – synonymous with top quality steel tubes and therefore a door-opener at the international level.



MANNESMANN. Das Rohr.

Since this also applies to the MW logo, a new symbol/wordmark was developed with the agreement of the Salzgitter Group management which will be used for all the companies of the business unit. It is made up of the symbol MW, the wordmark MANNESMANN

and the supplement of the respective company. The MW symbol itself was adapted very slightly. The claim "MW Mannesmann. Das Rohr." (English: "MW Mannesmann. The Tube.") has already been positioned in recent years and will be used more for promotional purposes in future. The companies adopted the new logo in their names in October 2017.

An exception here is Mannesmann Stainless Tubes (MST).

In this case, only the headquarters will be renamed: the subsidiaries will retain their existing titles for the time being. The holding companies Hüttenwerke Krupp Mannesmann and EUROPIPE will not be affected by the renaming.

MANNESMANN PRECISION TUBES
Ein Unternehmen der Salzgitter Gruppe

MANNESMANN GROSSROHR
Ein Unternehmen der Salzgitter Gruppe

MANNESMANN LINE PIPE
Ein Unternehmen der Salzgitter Gruppe

MANNESMANN STAINLESS TUBES
Ein Unternehmen der Salzgitter Gruppe

Open House at DESMA

Two-day information event organized by Klöckner DESMA Elastomertechnik GmbH

TECHNOLOGY Welcome to DESMA Open House! Let's talk future!" – some 500 visitors attended this international industry event organized by the mechanical engineering specialist on September 27 and 28, 2017. The main focus area were pioneering production solutions, digitalization and automation.

To get things started, Managing Director Martin Schürmann talked to the audience at Stadthalle Tuttlingen about megatrends and the solutions DESMA is offering in response to these by major DESMA. He also had some positive figures to present: DESMA Group sales virtually doubled over the last ten years from just under EUR 50 million to more than EUR 100 million. What is more, investments of EUR 23 million were invested across all sites. The total investment volume for 2017/2018 is EUR 6.5 million. Every year, DESMA invests almost another EUR 1 million in initial training and professional development.

The event also included an expert dialog session. The Marketplace of Partners provided an opportunity for contact with universities and institutes with their various research projects. The first day was rounded off with five workshops: e-drive cold runner technology, flexible automation cells, Visualization DRC 2030 TBM, SmartConnect 4.U and SmartCommunity.

On the second day, Technology Director Dr. Harald Zebedin presented the DESMA Future Lab which has been installed in the new assembly hall in Fridingen. A guided tour also gave visitors the chance to find out about complex automation systems harnessing cutting-edge robot technology – including a demonstration of automated and complex production cells with four robots.



A humanoid robot welcomed guests to the DESMA open house event



Visitors had a look at the DESMA machines on a guided tour



Great interest in DESMA machines



Fascinated visitors view the Future Lab installed in the new assembly halls

A strong foundation

Salzgitter companies supply the heavy plate for Johan Sverdrup drilling platforms.

HEAVY PLATE/ STEEL SECTIONS

Norwegian energy giant Statoil undertook initial deep-sea drilling work in the North Sea oil field Johan Sverdrup in March 2017. When oil production goes ahead as planned at the end of 2019, 315,000 to 380,000 barrels will initially be produced per day, increasing to 650,000 barrels when

development is complete. Ilsenburger Grobblech GmbH and Salzgitter Mannesmann Grobblech GmbH supplied 66,000 t of steel (ILG: 48,000 t, MGB: 18,000 t) for four platforms (drilling, production, processing and residential), which were anchored in the seabed at a depth of some 120 m using steel constructions. The client is the Norwegian company Kvaerner, which handles

engineering, purchasing and production for the Statoil project.

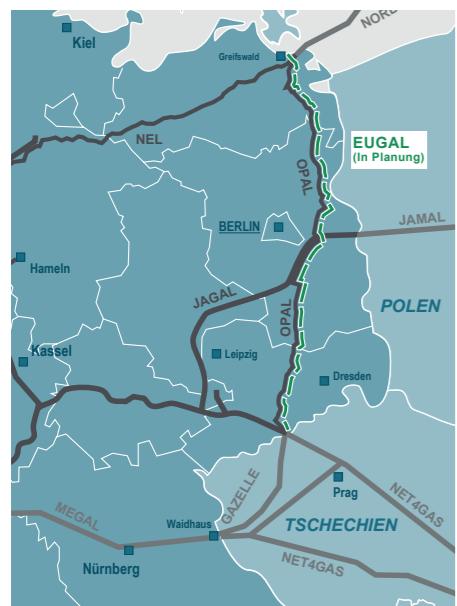
The contract is highly demanding: In addition to weldability approval according to EN 10225 for wall thicknesses up to 64 mm and 90 mm, there are very complex material requirements as well as a tight schedule, extensive reporting and an enormous amount of administrative work.



This is what the four platforms will look like – rising out of the North Sea

EUGAL: Large-scale contract for EUROPIPE

Salzgitter AG joint venture EUROPIPE supplies 620,000 tons of large-diameter pipes for the EUGAL pipeline



The planned route of the EUGAL

MANNESMANN EUROPIPE GmbH was able to land another large-scale contract in 2017: the company is supplying some 620,000 tons of large pipes with a diameter of 56" (1,420 mm) for the European Gas Pipeline Link (EUGAL).

EUROPIPE is a joint venture of the Salzgitter Group under the umbrella of the Mannesmann business unit and the AG of the Dillinger Hüttenwerke.

In Germany, the EUGAL will run southwards from Lubmin on the Baltic coast as far as Deutschneudorf in Saxony and then on to the Czech Republic. This means it will cross the German federal states of Mecklenburg-Western Pomerania (approx. 100 kilometers), Brandenburg (approx. 275 kilometers) and Saxony (approx. 110 kilometers). The total length

will be approx. 485 kilometers, with some sections planned as a dual string.

The project developer is German long-distance network operator GASCADE, which runs Germany's biggest natural gas infrastructures. Even though natural gas will not be flowing through the new pipeline until the end of 2019, the EUGAL project involves extensive planning and construction and will take several years. After completion of the regional planning process, the plan approval procedure started in summer 2017.

Production of the pipes started in Mülheim an der Ruhr in 2017 and will last until 2019. The primary material for the large-diameter pipes is provided by the EUROPIPE partners, while the pipe coating is supplied by MÜLHEIM PIPE-COATINGS GmbH.

Anniversary of the Ilsenburg rolling mill

The plant has now been part of the group for a quarter of a century



The contracts for privatization of Walzwerk Ilsenburg and acquisition by Preussag Stahl AG were signed on March 5, 1992

HEAVY PLATE/ STEEL SECTIONS

The rolling mill in Ilsenburg (North Germany) became part of Preussag Stahl – later Salzgitter AG – on March 5, 1992.

From the outset the aim was to improve the company's market position and profit situation in the heavy plate product segment. This was achieved by means of investment and organizational restructuring. Heavy plate production was

concentrated in Ilsenburg in 1995, while Ilsenburger Grobblech GmbH was established in 2001. Examples of the company's development include the widening of the rolling stand in 1995, the construction of the quenching and tempering unit in 1998, the start of wind industry prefabrication and the construction of the cutting and shipping hall with the establishment of firing capacity in 2004. Key steps in carving out an excellent market position also included investments in the sibling

company Salzgitter Flachstahl, including secondary metallurgy and the Continuous Casting Plant 4 in 2010. The recent decision to install Finishing Shop II will be another milestone in the history of the group's longest-standing site – after all, the "Ilsenburg Copper Mallet" was founded as long ago as 1595! "This pioneering investment indicates a clear commitment on the part of the Salzgitter Group to steel production in Ilsenburg", said Prof. Dr.-Ing. Heinz Jörg Fuhrmann.



Photos: SZAG, AdobeStock ©markus dehitz

Plastics and the environment

KHS presents its sustainability report



Focus of the KHS sustainability report: PET and sustainability – a contradiction in terms?

TECHNOLOGY In 2017 the Salzgitter Group subsidiary KHS GmbH published its sustainability report for the years 2015/2016. Here, the system provider for filling and packaging systems for use in the beverages, food and non-food industry documents its ongoing measures, accomplishments and targets in the

areas of strategy, social affairs, ecology and economy.

One particular focus is the topic “PET and sustainability – a contradiction in terms?” The KHS sustainability report first came out in 2015 and is published every two years; it can be viewed in its entirety online.

Key regional project

EUROPIPE supplies large-diameter pipes and pipe bends for the Bavarian long-distance natural gas pipeline MONACO



MANNESMANN “Monaco” is how Italians refer to the city of Munich (“Monaco di Baviera”). Hence the name of the new long-distance natural gas pipeline from Burghausen on the Bavarian state border (Upper Bavaria) to Finsing near Munich.

The 60,000 t of large-diameter pipes required for this purpose are produced at the EUROPIPE GmbH plant in Mülheim in lengths of 18 m. Most of these are coated with epoxy on the inside and polyethylene on the outside by sibling company Mülheim Pipecoatings.

Investing in the future

Third hot-dip galvanizing plant built in Salzgitter

FLAT STEEL This project implements a key element of the group strategy Salzgitter AG 2021 for Salzgitter Flachstahl GmbH (SZFG) – namely a consistent focus on high-quality product areas.

The new Hot-Dip Galvanizing Plant 3 supplements SZFG's two existing facilities with an annual capacity of 500,000 t, thereby underpinning the company's market position in the area of high-strength and super high-strength steels for the automotive industry. Commissioning of the facility is planned for the second half of 2020.

“The investment again signals our commitment to steel production in Germany. This plant will allow us to continue to expand the role of Salzgitter Flachstahl GmbH as a supplier to very demanding customers, both in Europe and worldwide,” says Executive Board Chairman Prof. Dr.-Ing. Heinz Jörg Fuhrmann.

The flying pipe bend ...

Why pipes produced by Mannesmann Line Pipe were flown to Australia

MANNESMANN 27 pipe bends were flown to Western Australia in three large wooden cases. They were required for the installation of a gas storage unit as part of the Tubridgi Gas Storage Project: the pipes themselves had already been shipped out and some had already been laid.

The air freight was required because there was uncertainty as to whether the old gas fields could be used as caverns (underground storage facilities, ed.). One thing was definite, however: if the drilling and tests did turn out to be positive, the pipes would be needed the very next day. So the customer had to weigh up between long delivery times and a project delay or fast delivery times and the potential risk of having pipes which – in a worst-case scenario – would not be needed.



Preparation for air freight: packing the finished steel pipe bends in wooden cases

Photo: Jens Reichwald

Vacuum treatment for liquid steel

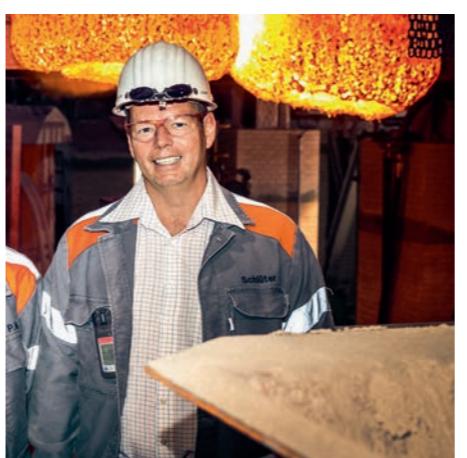
Commissioning of the new RH system at Salzgitter Flachstahl GmbH

FLAT STEEL In an RH system, liquid steel undergoes vacuum treatment for the purpose of decarburizing and degassing so as to further improve the properties of the steel as it is processed further. After three years of planning and construction, the RH system at Salzgitter Flachstahl GmbH (SZFG) is now going into operation step by step. This is the only way the company can succeed in becoming a leading provider in a target segment where there is increasing market demand for certain grades. SZFG's existing capacity was no longer sufficient.

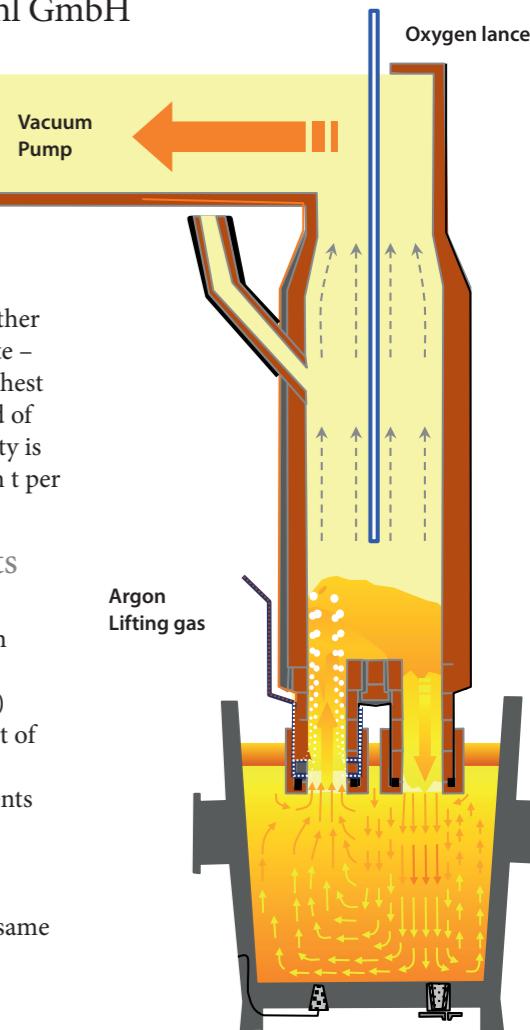
The new plant aims to eliminate this bottleneck: SZFG customers in the automotive industry in particular want grades with a very high forming capability. They are used for the outer shells of vehicles, for example. “For other market segments – such as heavy plate – we also require grades of the very highest purity,” adds Christian Schlüter, Head of Secondary Metallurgy. The new facility is designed to produce some 1.3 million t per year.

The new RH system in facts and figures

- Total investment: EUR 80 million
- 1.3 million t annual capacity
- 2 treatment lines (RH6 and RH7)
- approx. 2,000 t of steel used, 100 t of pipes
- approx. 2,500 engines / components
- approx. 750 measuring points
- approx. 6,000 cables (250 km)
- 6.3 MVA of electric power – the same as that of a container ship



Christian Schlüter, Head of Secondary Metallurgy



Quelle: Tenova

Welcome to Baden-Württemberg

The federal state in the south-west of Germany is one of Europe's most economically strong regions. Many global corporations are active here, including Salzgitter AG

Landscape, industry and traffic: a view of the River Neckar near Plochingen – a small town with a population of 14,000 located 25 km to the south-east of Stuttgart. In the small port, the steel warehouse of Salzgitter Mannesmann Stahlhandel GmbH can be seen on the left



The area that is known today as the state of Baden-Württemberg was created after the war by merging three territories that existed separately up to 1933: the "Free State of Baden", the "People's State of Württemberg" and the Prussian province "Hohenzollernsche Lande". The fusion was not all plain sailing, however: the people of southern Baden in particular were opposed to the formation of a large south-western state, fearing that Württemberg would dominate. Those in favor of the merger pointed to the economic and political benefits. Since the three regional governments were unable to arrive at an agreement, a federal law was eventually passed requiring a referendum to be held. In December 1951, 70% voted in favor of establishing a joint federal state. But while in Württemberg 92% were in favor, only 57% gave their consent in northern Baden – and in southern Baden a majority of 62% were against the unification. The state of Baden-Württemberg was founded on April 25, 1952 – the only German state to be established based on a referendum. The people of "old Baden" were determined not to give up, however: they ap-

pealed to the Federal Constitutional Court in 1956 and another referendum was ordered. But this was not held until 1970 and resulted in a majority of 82% in favor of staying in Baden-Württemberg. The cultural division can be felt to this day: Karlsruhe in Baden and Stuttgart in Württemberg each have their own state theater, state gallery, state museum and state library.

In this south-western state, it wasn't so much a case of organic cultural fusion but more of a union based on political and economic strength. In Baden-Württemberg the economy is mainly based on industry and commerce, which is where almost 40% of the workforce is employed. Agriculture is an important sector, too, with cereals, feed production, fruit farming and wine – in fact the two wine-growing areas of Baden and Württemberg account for more than a third of all German viticulture: only the Palatinate and Rhenish

Hesse produce more grapes. But of all the German states, Baden-Württemberg also has the highest industrial share of the country's GDP. It boasts top economic indicators – not only within Germany but in many cases at European level, too: the state as a whole – in particular the districts of Stuttgart, Karlsruhe and Tübin-



BADEN-WÜRTTEMBERG:

Founded: 25.4.1952
Population: 10.9 million
Capital: Stuttgart (population: 624,000)
Unemployment rate: 3.8% (nationwide: 6.1%)

Facts:
– Federal state with the highest industrial share of the GDP
– High export rate: 43%
– 40% of wage-earners are employed in industry and commerce

"Maultaschen" (pastry squares filled with meat and spinach) are a typical speciality of south-western Germany



Photos: Addobestock (@nullplus), © ALLEKO, © Yvonne Stadtfeld (d)

In terms of surface area, Baden is the third largest and Württemberg the fourth largest of Germany's 13 wine-growing areas

gen – are among the most economically strong and competitive regions in Europe today. The Greater Stuttgart Area is even regarded as Europe's biggest industrial center. Baden-Württemberg generates 15.2% of the German GDP even though only 13.2% of Germany's population live there. Another figure is astounding, too: almost 30% of all German patents are applied for in Baden-Württemberg.

Innovation is one of the cornerstones of the state's economic success. Some 5% of GDP is in-

vested in research and development: the average for Germany as a whole is only approx. 2%. This puts Baden-Württemberg in the number one position by a significant margin in terms of the ranking of the 97 EU regions. Nowhere else is the proportion of patents to population as high as in the south-west of Germany. It is no coincidence that many research institutions are based here, too – such as the institutes of the Max Planck Society, the German Cancer Research Center in Heidelberg, the German Aerospace Center in Stuttgart, the Center for Solar Energy and Hydrogen Research and several institutes of the Fraunhofer Society.

Many inventors of past ages were from Baden and Württemberg as well. The bicycle, the motorcycle and the automobile were all born here in the 19th century – it might even be described as the cradle of modern mobility. Only in the case of the airplane did others get there first – possibly because a certain Albrecht Ludwig Berblinger – better known in Germany as the "Tailor of Ulm" – crashed into the River Danube with his flying machine in 1815. After this, people in Baden and Württemberg preferred to stay firmly on the ground. Nonetheless, it was a native of southern Baden – Count Ferdinand von Zeppelin – who invented in Friedrichshafen what was probably the grandest form of air travel: the airship that was named after him.



Swabian-Alemannic carnival celebrations with the typical wooden masks are a colorful custom

Nowadays products for modern mobility are a key driving force behind the state's industry: some 25 % of industrial sales are generated by the automotive sector and associated suppliers. This is followed closely by mechanical engineering and plant construction with a share of 20 %, and the metallurgy and electrical engineering industries with 7 % each. This makes Baden-Württemberg an important market for steel sales and trading, served by Salzgitter AG through Salzgitter Mannesmann Stahlservice GmbH in Karlsruhe and Salzgitter Mannesmann Stahlhandel GmbH based in Plochingen. You can find out more in the pages that follow.

Salzgitter Mannesmann Stahlservice GmbH in Karlsruhe is a good example of the economic culture and structure that is typical of Baden-Württemberg and so crucial to its economic success: it is this brand of medium-sized enterprise that forms another key cornerstone of the state's economy. In addition to famous giants such as Bosch and Daimler, who employ a total of some 170,000, and numerous less well-known but likewise globally active companies such as Trumpf (mechanical engineering) and Freudenberg (see page 56) with a total of 12,000 employees, there is also a multitude of smaller firms – in fact 99 % of all companies in Baden-Württemberg have a workforce of no more than 250 people.

Many of these are family-owned enterprises originally dating back to small craft workshops founded in the 19th and early 20th centuries. They are big enough to be strong but small enough to

retain an ample degree of flexibility. It wouldn't be uncommon for a business traveler to be chatting casually to the managing director of a local firm in a small town with a population of 2,000 and discover to his surprise that the company in question is the international market leader in this or that segment.

There are some 100 of these so-called "hidden champions" in Baden-Württemberg – developing and producing highly specialized technological products for the global markets.

SMEs exist all over Germany, but the mentality is somewhat distinctive in the south-west. In addition to their diversity and flexibility, these companies also enjoy a physical proximity and willingness to collaborate that sets them apart from those elsewhere. The economic landscape in Baden-Württemberg is rather like a housing estate: people know each other and provide mutual support – even between competitors. In this case not by helping out with butter and salt but by offering storage capacity, transportation facilities or whatever else is needed to solve shortage problems.

In particular there is a culture of cooperation across industries and institutions: another outstanding feature of the state is the fact that it has so many so-called clusters. Baden-Württemberg boasts some 120 alliances of companies, research institutes and public bodies, each with its own regional focus: biotech in Mannheim, environmental technology in Freiburg, aerospace by Lake Constance and of course the automotive industry in Stuttgart.



Deep in the south-west: Baden-Württemberg with its external borders to France and Switzerland



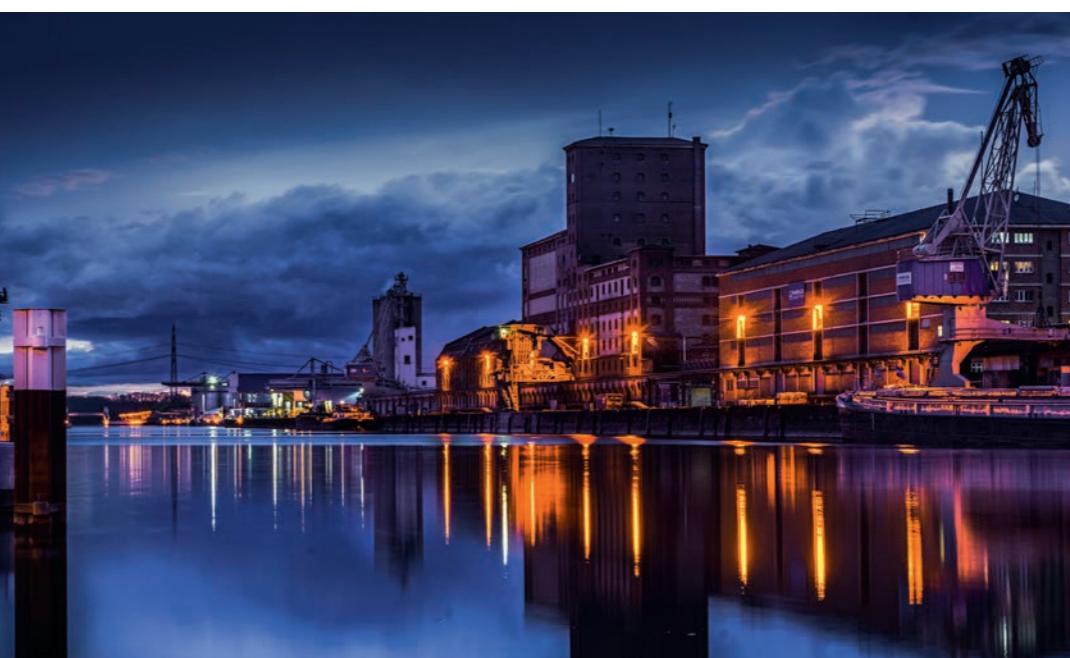
Planning talks at Salzgitter Mannesmann Stahlservice GmbH in Karlsruhe, Baden

The state is well aware of the benefits this generates, and in 2014 the Baden-Württemberg Ministry of Economic Affairs founded the "ClusterAgentur BW" to specifically promote regional cooperation. The agency supports regional cluster initiatives and state-wide networks by providing development and professionalization services.

So the success of this state is shaped by a remarkable sense of creativity and a thriving medium-sized business sector. But there are problems too, of course. Anyone who has ever been stuck in traffic Stuttgart will be aware of the inadequate infrastructure. And the shortage of qualified specialists means that companies in search of applicants to fill vacancies need to have something special to offer. Here again, flexibility and creativity are required.



Automobile production at Mercedes: Mercedes-Benz car production: automobile manufacture is the most important industry in Baden-Württemberg



The port of Karlsruhe. The city has a population of 308,000, making it the second largest in the state, just ahead of Mannheim (306,000)

The invention of mobility



1817 Baron Karl von Drais, a native of Karlsruhe invented a running machine. The Draisine is generally regarded as the original forerunner of the bicycle. The Baron's first "running trip" was from the center of Mannheim to what is today the district of Rheinau



1885 Gottlieb Daimler and Wilhelm Maybach built the world's first motor-powered two-wheeler. Wobbling along on support wheels, the "Daimler Ride Car" completed its first test run from Cannstatt to Untertürkheim – traveling at up to 12 km/h and with an output of 0.5 hp.



1886 Carl Benz built the "Patent Motor Car Number 1" in Mannheim. It is regarded as the first modern automobile with a combustion engine. The three-wheeler with an output of 0.75 hp first got rolling on the streets of Mannheim

Rings that hold the world together

In Oberwihl near the Swiss border, Freudenberg Sealing Technologies produces seals for the whole world – using machines made by Klöckner DESMA Elastomertechnik GmbH based in Fridingen, Baden Württemberg, a Salzgitter AG company



Freudenberg Sealing Technologies is the largest business group of Freudenberg & Co. KG and has been based in Oberwihl for 60 years. Here, the world's leading manufacturer of shaft seals produces O-rings – circular seals with differing diameters, thicknesses and profiles. Freudenberg Sealing Technologies is a supplier to both development and service partners in the automotive industry, civil aviation, mechanical engineering, shipbuilding and many other sectors. The seals are to be found everywhere – in radiators, water pipes, in the brakes and assistance systems of cars and in wristwatches.

The development of expertise was a key focus, even in the early days of the company: in fact the shaft seal celebrated its 85th anniversary in 2017. In 1932, engineer Walther Simmer – an employee at the Carl Freudenberg leather factory at the time – used leather leftovers to develop a liner seal, for which he and his team designed a production machine. Today, Freudenberg Sealing Technologies is the world market leader for rotary shaft seals – as this type of seal is correctly termed.

1,810 rubber compounds for seals, made of some 1,000 raw materials

Innovations remain the key to the success of Freudenberg Sealing Technologies to this day. One good example of this is the virtually frictionless slide seal Levitex launched in 2012. It comprises two rings separated by an air cushion, thereby reducing friction in the sealing of an engine compartment by 90 %. Less friction means the engine has to produce less power, so this cuts down fuel consumption. The company offers a range of sealing solutions to minimize friction with its "LESS" portfolio (Low Emission Sealing Solutions).

Each seal is based on a specific elastomer compound, the character of which is very important in terms of the manufacturing process applied. One formula might be suitable for pressing while another has to be produced using an injection molding machine. In Oberwihl there are currently more than 40 CMs (compression molding machines) and 40 IMs (injection molding machines) in operation. The injection molding machines are made by Klöckner DESMA Elastomertechnik GmbH (KDE).

The latter builds equipment for producing molded rubber and silicon articles and is regarded as a leading manufacturer of injection molding machines. More than 8,500 of them are in worldwide use today. Like DESMA Schuhmaschinen GmbH (KDS), it belongs to Salzgitter AG's Technology business unit and is based in Fridingen (Baden-Württemberg). From here it is just over 100 km to Oberwihl.

This geographical proximity is an advantage but no means a deciding factor in terms of smooth collaboration between Freudenberg Sealing Technologies and DESMA. "DESMA is one of the few providers that only produces elastomer machines and is able to focus entirely on these," says Claus



Links: DESMA injection molding machines at Freudenberg: the elastomer compound is injected into the mold at pressure levels of up to 3,500 bar. The compound is heated to approx. 180 degrees and as liquid as water. Right: After pressing the O-rings have to be deburred



The product: O-rings in various sizes and colors



Inspection using a magnifying glass, naked eye and finger: manual quality control in Oberwihl
Photos: Gunnar Girms, Freudenberg



The site of Salzgitter Mannesmann Stahlservice GmbH in the port of Karlsruhe, complete with its own shipping pier

The fusion of Stahl Metall Service GmbH and steel service specialist Hövelmann & Lueg to form Salzgitter Mannesmann Stahlservice GmbH in 2014 created a company with huge growth potential. It is capable of handling some 640,000 t of steel per year and offers a wide range of processing services. In order to be able to meet customer requests swiftly, the company has some 70,000 m² of hall space with more than 110,000 t of steel in storage – including coils weighing up to 30 t. It is able to supply steel that is hot-rolled, cold-rolled, surface-finished and plastic-coated. It also manufactures coils and split strips, as well as sheets and cuts of various grades.

Good motorway and rail links prove very useful here, as do the company's branches in Schwerte and Karlsruhe and its site in the port of Karlsruhe where it has its own shipping pier. The former head office of SMS is the present company's headquarters, too.

The main supplier of Salzgitter Mannesmann Stahlservice is Salzgitter Flachstahl GmbH. Products range from simple basic quality and warehouse grades through to super high-strength, micro-alloyed automotive grades, covering black hot strip through to FolaSal® products for the household appliance industry. The reputation of Salzgitter Flachstahl as a developer and manufacturer of high-quality steel products has elevated SMS to an entirely new status on the market. Involvement in the group with its joint marketing strategy has brought numerous benefits – in terms of the supply program and logistics as well as on the labor market.

As a Salzgitter Group company, SMS is better placed to attract trainees. The shortage of trained specialists is a major problem in Karlsruhe as it is elsewhere: SMS has a workforce of 300, so the only way of gaining new recruits is through the training program.



Material supply within the group: a coil from Salzgitter being unloaded in Karlsruhe
Photos: SMS

Jöst, who is the Director Purchasing Capital Equipment and responsible for purchasing machines at Freudenberg.

Claus Jöst praises the partner company's "high level of process expertise" as well its "technology and innovation competence": "DESMA demonstrates an understanding of the manufacturing processes that no other competitor can offer." He has a whole catalog of selection criteria for class A suppliers on his desk and begins to enumerate them: technology and problem-solving competence, consultancy, flexibility, supply quality, value for money, adherence to delivery schedules, service presence, partnership approach, global presence, solidity and a future-proof set-up. Regional Manager Germany South DESMA Peter Hurrel nods in agreement. He is aware of these demands – and knows that DESMA is able to meet them. He realizes how important it is for companies to be able to respond swiftly to customer requests and ensure the machines supplied are always immediately ready for use.

Collaboration is close and based on partnership. This is reflected in joint development processes that generally extend over a period of one or two years – as was the case in connection with new products required for electric mobility since 2016. A large-scale DESMA machine will shortly go into operation for test purposes in Oberwihl. The very good order situation at Freudenberg Sealing Technologies means that a total of more than 20 new DESMA presses will be leaving here by the end of the 2017/2018 fiscal year. And many of them will be heading for Oberwihl.



Steel of all kinds as far as the eye can see: Plochingen expanded its storage capacity to 30,000 t with the addition of a newly built hall

Where steel comes and goes

In Plochingen, Salzgitter Mannesmann Stahlhandel GmbH runs a warehouse with an extensive range of value-adding services

In Plochingen, steel is warehoused, transshipped, processed – and on an impressive scale, too. Up to 30,000 t can be stored on a surface area of 20,000 m². In a second smaller group of halls there is more noise and sparks fly: here the steel undergoes initial processing, e.g. cutting and descaling. Additional material is stored in the outdoor area.

A total of 600 t of steel leaves the warehouse in Plochingen each day.

Flat products and pipes exit through the gates, some of which have been processed according to customer specifications. The range of services includes blasting up to a width of 3,100 mm, oxy-fuel welding and cutting up to a thickness of 450 mm and straightening at a pressing force of up to 900 t. Coating, descaling, slitting and thread trimming are also provided as external services. Here it is possible handle pieces weighing up to 40 t.

Both the positive and negative aspects of the state of Baden-Württemberg can be felt here: when the power supply failed because of damage to a transformer, good neighborly relations enabled it to be swiftly restored. But one negative aspect is the shortage of qualified specialists – a problem that is prevalent throughout the region. Companies have to actively seek out trained personnel. The focus is on providing initial training and professional development for existing staff.

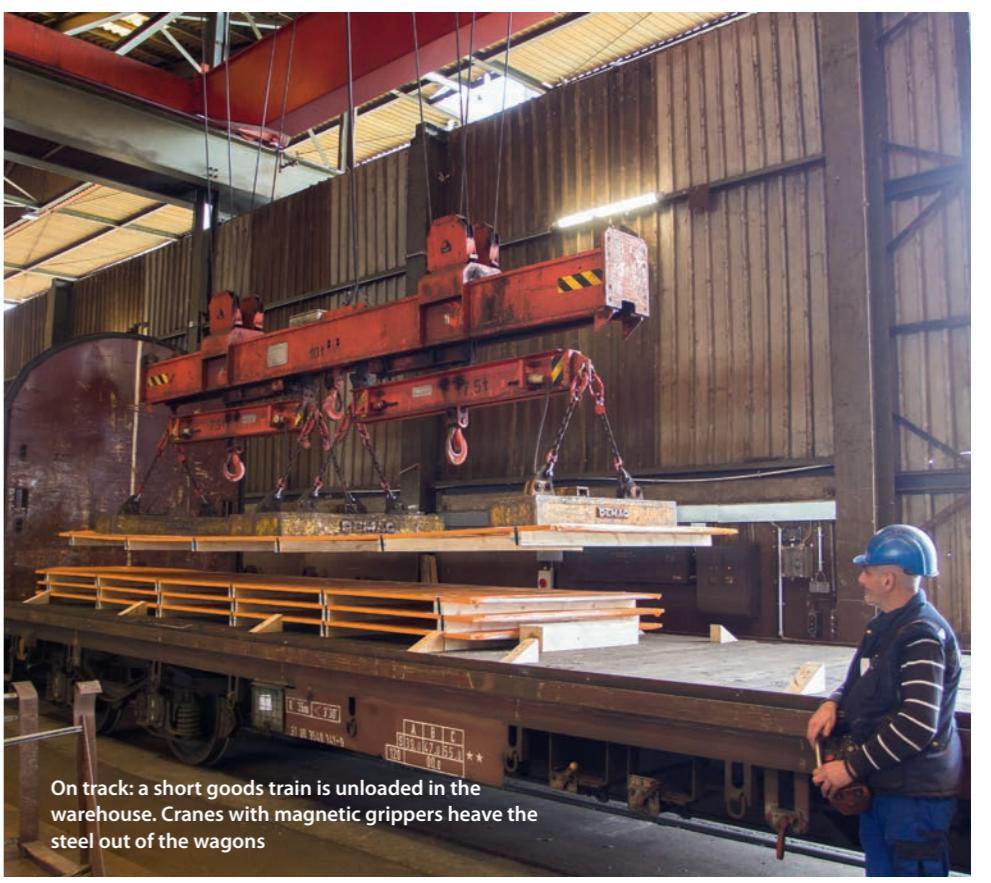
Customer contact is one of the success formulas for steel trading in Plochingen. Delivery standards are developed in collaboration with customers and visits are made to group steel production facilities. Sound integration and collaboration within Salzgitter are crucial factors here, and provide considerable advantage over many competitors. After all, the entire group is ultimately available to support the customer.



Hollow steel sections are also stocked



Photo: Thomas H. Pressel, SZAG
Processing orders for a perfect fit



On track: a short goods train is unloaded in the warehouse. Cranes with magnetic grippers heave the steel out of the wagons

Rolling steel – 200 years of the bicycle

Mannesmann became a part of bicycle history when founding brothers Max and Reinhard were granted a patent for continuous steel tubes in 1885

The bicycle celebrated its 200th anniversary on 12 June 2017. But when Karl Drais shocked the people of Mannheim with his velocipede or *Draisine*, he was actually running, not riding. The brothers Max and Reinhard Mannesmann – whose companies later merged to create the tube manufacturer Mannesmannröhren-Werke AG – set a milestone in the development of the bicycle in 1885: they were granted a patent for continuous steel tubes that also enabled the construction of modern bicycle frames. These tubes were used for many decades.

More recently the trend has been towards frames made of aluminum and carbon fiber. But steel remains a highly popular material has a large community of fans to this day. "A manually crafted steel frame has a soul and a personality. Its graceful, filigree elegance makes you want to touch it," writes Iwo Randoja in his blog *Stahlrahmenbikes*.

de. Others put forward more objective arguments, such as the manufacturer Nöll-Fahrradbau: "Special high-strength CrMo frames have better long-term fatigue resilience than aluminum, so fatigue damage occurs much later."

The company vsf fahrradmanufaktur also prefers steel: "It offers a high level of tensile strength – more than 700 N/mm² in the chrome-molybdenum alloy 25CrMo4 – and steel frames have an elasticity that ensures excellent ride comfort." But fans will probably find the most aesthetically attractive steel bikes in Senad Sarac's workshop. The Hamburg specialist repairs vintage bikes that can be anything up to 100 years old: he fits them with wooden pedals and handles and sells them on his Hamburg premises as well as through the online shop Levelobikes.de. He has more than 2,000 bicycles in stock. It's highly likely that these include one with a Mannesmann frame.



Traditional, popular and indestructible:
a bicycle frame made of steel



Photos, above: Senad Sarac in his workshop. The Hamburg specialist lovingly restores historical bicycles, preserving their patina by applying special stabilization finishes and replaces missing parts that perfectly replicate the original. Photos, right: Brand plate from a Mannesmann bicycle frame of the 1970s; a historical advertising poster which emphasizes the distinctive characteristics of the steel frame



Photos: levelobikes ©Dennis Lofka

2017 PHOTOS OF THE YEAR



Sarah Knorre of Salzgitter Mannesmann Stahlhandel welcomes guests to the trade show stand at Blechexpo 2017: from 7 to 10 November, Salzgitter AG was once again represented at the trade show in Stuttgart with its companies Salzgitter Flachstahl, SMS Stahlservice, Salzgitter Mannesmann Forschung, Salzgitter Europlatinen and Salzgitter Mannesmann Stahlhandel



Dipl. Ing. Heiko Stötzel received the 2017 Duty of Care Award in the category "German SMEs" on behalf of KHS for its handling of staff on foreign assignments



A worker on the Trans Adria Pipeline construction site in Albania makes friends with a stray but friendly female dog



Regionalization: at KHS Machines in Nigeria, 30 staff out of a workforce of 31 are from Nigeria



Prof. Dr.-Ing. Heinz Jörg Fuhrmann promotes quality at Group Trading in the Netherlands



Peter Hurrel (Regional Manager South KDE, left) meets Freudenberg representatives Markus Lehnen (Lead Center Manager O-Rings Automotive), Dr. Rainer Weiss (Lead Center Manager O-Rings Industry) and Claus Jöst (Director Purchasing Capital Equipment) (from left)



200 colleagues from all departments met with the Executive Board for a workshop in Hanover. The event marked the introduction of the new value of the year as part of the mission statement YOUNITED: "Clear course on customer!"



Honeymoon with a difference: Salzgitter Group employee Monika and Frank Eggert cycling through the Himalayas

Photo: Eggert

Photo: Cäsar Börd



His Excellency Shi Mingde, Ambassador of the People's Republic of China to Germany, spoke at the 2017 Salzgitter AG Group Forum in Hanover and was presented with a gift by Prof. Dr.-Ing. Heinz Jörg Fuhrmann: a steel version of the Brandenburg Gate

Photos: Carsten Brand



Several employees from the Salzgitter Business Service GmbH (SZBS) site in Dortmund took part in the AOK company run at Lake Phoenix

Photo: SZBS



Lined up for a group photo: KHS employees at the production site in Ahmedabad, India

Photo: KHS



"Schrotti" – the disused dummy on the premises of DEUMU – found a friend in Bernhard Kleinerman, Head of Group Communication



Three experts provided background information on slag for STIL: Bernd Ziethmann, Technical Director of Erich Friedrich Handel GmbH, Dr. Jürgen Pethke, Director Blast Furnace Operation at Salzgitter Flachstahl GmbH, and Siegfried Bartsch, Managing Director of the Erich Friedrich Group (from left)

Photos: Gunnar Girms



Photos: Gunnar Girms

Carolina Eidt of Salzgitter Mannesmann International (SMID) inspects pipe bends supplied by Salzgitter AG at the main TAP warehouse



Photo: Thomas H. Pressel

The Salzgitter Mannesmann Stahlhandel GmbH team of coordinators at the Plochingen site (from left.): Benjamin Wild (Warehouse/Logistics), Johann Bachleitner (Processing/Flat Products), Karl-Heinz Mack (Precision and Stainless Steel Tubes), Peter Geißler (Plant Manager), Wolfgang Schley and Gunnar Jansen (both Sales Management)



Photo: DESMA

Everyone is in a good mood at the 2017 DESMA Technician Days in Achim, where the new Customer Service Center was inaugurated

Whatever your plans may be.

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