

compact steel

Issue 01/2017

The thyssenkrupp steel magazine
thyssenkrupp-steel.com



Four point zero

The dawn of a new age –
thyssenkrupp Steel is gearing up
for digital transformation

engineering. tomorrow. together.



thyssenkrupp



Embracing digitization

We discussed the deep technological change brought about by the **fourth industrial revolution** in our lead interview with CFO Premal A. Desai (right) and consultant Andreas Winiarski.

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What looks like a steel skeleton are parts precision-built by FlammMotec using steel from thyssenkrupp.



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Off they go on a mail run:
The StreetScooter is an e-car
produced by Deutsche Post.
It wouldn't be the same with-
out steel from thyssenkrupp.



Andreas Goss reflects on...

disproportionate demands!

In February, the European Parliament acknowledged key demands voiced by the steel industry. Hence, it is all the more disappointing that the EU Environment Council did not follow this lead, instead proposing even stricter regulations. This counteracts the clear message of parliament not to recklessly put the competitive strength of the European industry at risk by passing overly restrictive climate legislation.

The policymakers in Brussels should remind themselves that all EU nations combined generate only approximately ten percent of the global greenhouse gas emissions. The continent has the most climate-friendly steel plants on the planet – and they need to be protected. It will not do the climate any good if a misguided political agenda ruins our key industries and destroys jobs. This would only help non-European competitors, most of whom are much bigger polluters while offering lower social standards.

Of course we too, are responsible for the global climate. thyssenkrupp takes on the challenge of sustainable production by investing in projects such as Carbon2Chem. The ingenious idea underlying this project is to collaborate with scientists, the power sector, and chemical companies to convert gases generated at our steel mills into resources for the chemical sector. If we succeed, this technology could contribute to significantly lowering the CO₂ emissions of the steel industry on a global scale.

This path, however, will only be viable if the EU Commission's emissions trading scheme does not drastically worsen our financial situation. If implemented as planned, and depending on general market developments, this could impose additional costs of up to three billion euros between on thyssenkrupp 2021 and 2030. This is much more than we can realistically compensate. No competitor outside of Europe is burdened to this degree. But ongoing negotiations among parliament, the council and the commission mean that there is still time to avoid this misstep. The European Parliament's decision is a step in the right direction.

Sincerely,
Andreas J. Goss
CEO thyssenkrupp Steel Europe AG

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View

Laser precision: A plasma cutting system speeds up quality audits on hot-rolled sheet performed at the Duisburg test center.

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News



Solarcar – This is the third round of thyssenkrupp and Bochum University's partnership, forged to develop a highly efficient e-vehicle.



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Development

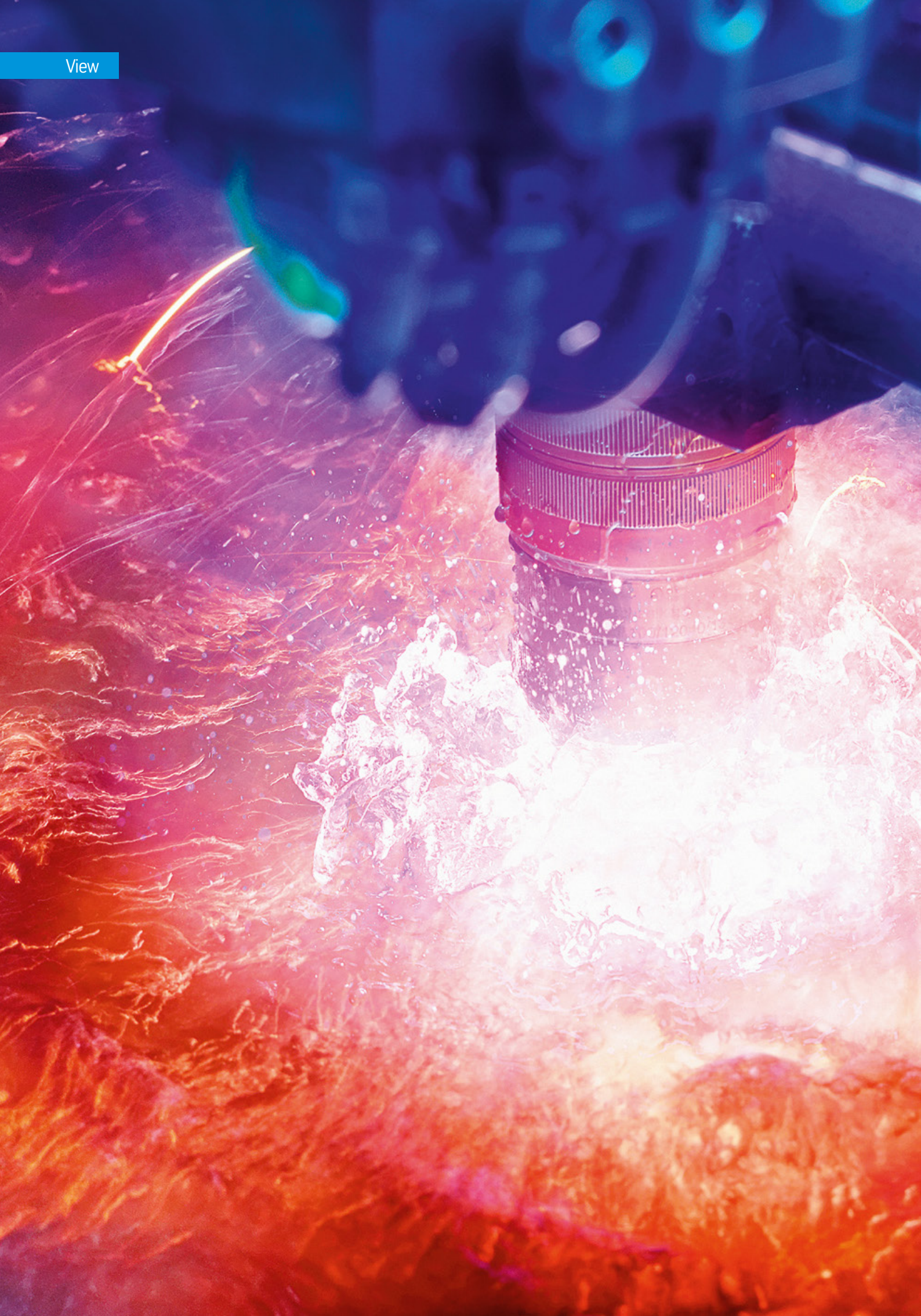
Hot forming – It's the MBW® 1900's debut in a mass production scenario in the Asian market.



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We got the power

Without electrical steel, electrical power is basically useless. The material is needed to generate, transport, and consume electricity.





Things are heating up here

A cutting head hurriedly makes its way across sheet metal, cutting out samples at speeds of up to 2,500 millimeters per minute. The state-of-the-art cutting unit for the acceptance test accomplishes its job using a plasma process that melts the steel by heating it to approximately 30,000 degrees Celsius. Another impressive feature is the high degree of automation; every step in the job is automated, from inserting the sheet metal and labeling it to ejecting the finished sample. Cutting takes place under water to keep emissions low and to prevent the sample from getting warped.

Before they go to the customer, the coils are tested at thyssenkrupp Steel to ensure they have the mechanical properties specified in the order, including yield strength, tensile strength, and notch impact energy. The acceptance testing team conducts approximately 25,000 tests per month. Individual labeling prevents each sample from being mixed up with the others. The new unit has shortened the lead time significantly, thereby enabling orders to be delivered to customers sooner and improving how we handle deliveries. The ability to determine parameters quickly is also advantageous when creating and developing new materials.

Building a tower in Duisburg



A new filter system for the sintering process helps keep the air clean by reducing dust emissions.

Environmental protection is of major importance to thyssenkrupp Steel. To meet this goal, the company consistently invests heavily in modernizing its facilities. The most recent example is the construction of a stack for the world's largest dust collection system, which keeps the sintering process operated in Duisburg-Schwelgern clean. A special crane was needed to erect the stack, which rises nearly 100 meters up in the air and weighs around 400 metric tons. Given these dimensions, the crane's boom had to be extended to accommodate this construction project. Four separate parts were transported on river barges and then assembled on site.

Sintering is the process of mixing fine-grained iron ore with coke and materials including lime, heating it up, and baking the product. Gas permeability is a property of sinter that makes it highly suited for use in the blast furnace during pig iron melting. Production of the so-called sinter cake relies on suction air, which absorbs a lot of dust during the process. The additional cloth filter system will capture almost all of the sinter dust, greatly reducing emissions. The system that will help conserve the environment is about to go operational.

For more information on sustainability, visit this page:
www.thyssenkrupp-steel.com/sustainability

Modern pickling delivers cutting-edge hot-rolled strip

When it comes to the quality of pickled hot-rolled strip, demands are rising constantly. Thanks to extensive modernization measures taken to upgrade the hot-strip pickling line at the southern Duisburg site, thyssenkrupp Steel is more than able to satisfy its customers' needs. This project involved a technological overhaul of the pickling baths and the introduction of a central process control system and various measuring and control devices. Moreover, the plant now automatically removes straps and has a new sample removal station.

50 competitions

Steel continues its support for the 'Jugend forscht' youth scientific research competition. The winners of the 51st round of the regional competitions, which were also held in Duisburg, will compete on the state level in April. Those who come out on top will qualify for the nationwide finals in late May.

BOF melt shop 2 extends its service range

A new machine slitting slabs was commissioned in Duisburg-Beeckerwerth, further extending the cooperation between the thyssenkrupp MillServices & Systems, the steel mill service experts, and thyssenkrupp Steel. Operated in three shifts, the machine will produce slabs of even higher quality and in line with individual customer specifications. The finishing services team cuts the materials using a burr free process, making post-processing unnecessary. Delivery performance is also taken up a notch or two thanks to faster processing.

Photos: thyssenkrupp Steel Europe Photography (3), Shutterstock



Arnd Köfler, the new Chief Technology Officer, is in charge of steel production.

New board member for technology appointed

At the beginning of the year, Dr. Arnd Köfler joined the ranks of the thyssenkrupp Steel Europe AG Executive Board. In his new function as Chief Technology Officer (CTO), he directs all upstream activities in the steel production process, from pig iron and crude steel all the way to the finished slabs. After completing a degree in mechanical engineering, he initially worked at Hüttenwerke Krupp Mannesmann GmbH. In 2013 he moved to the thyssenkrupp Steel division, where his most recent function was Head of Production (rolling and coating) in Duisburg-Beeckerwerth. Now, at 49, Köfler succeeds Dr. Heribert Eichelkraut, who will continue to share his experience with the Group as a consultant.

Galmed S.A.: Spain is back in business

Demand for hot-dip galvanized steel sheet is on the rise. In response to this promising trend, the Steel division decided to recommission the galvanizing line of thyssenkrupp Galmed S.A. that was shut down in 2013. Back then, around 50 Spanish employees took advantage of the option to relocate to Germany. Now production is back online, most of them are returning to their former jobs in Sagunto near Valencia.



The sun bears witness: The World Solar Challenge takes contestants 3,000 kilometers across the Australian outback.

Here comes the sun – blue.cruiser is ready for action

Bochum University and thyssenkrupp are all geared up for the **solar car world cup** – and the vehicle they built together has more to offer than just breathtaking design.

The futuristic speedster was baptized the thyssenkrupp blue.cruiser. While its shape and other exterior features are still under wraps, car enthusiasts can rest assured that they will love its elegant lines. This prototype represents the third generation in an ongoing research cooperation between thyssenkrupp and Bochum University. It follows in the tire tracks of the successful thyssenkrupp PowerCore® SunCruiser (2013) and thyssenkrupp SunRiser (2015). This time around, the engineers placed a strong focus on sustainability and efficiency. The thyssenkrupp blue.cruiser's body is made from state-of-the-art lightweight materials delivered by thyssenkrupp Steel and was built according to cutting-edge construction principles. The drive and batteries are also powered

by thyssenkrupp: high-quality electrical steel from the Steel division and magnetic technology courtesy of Materials Services. But there's more. High-end solutions from Components Technology and innovative materials contributed by Materials Services enhance the solar racer's steering system and shock absorbers. The main objective behind building the solar vehicle is to test the different aspects relevant to constructing highly efficient electrical vehicles, thereby contributing to climate protection. But thyssenkrupp also hopes that this project and the race will help to boost the popularity of solar and electrical vehicles among the general public.

For more information, see #SolarChallenge in our blog at: <https://engineered.thyssenkrupp.com/en/>



We are world champions

Toni Eggert (right) and Sascha Benecken won this year's doubles at the Luge World Cup. thyssenkrupp contributed significantly to this victory. The Steel division developed the high-tech material for the runners, the luge's rails and racing pod were designed by Components Technology, and the TechCenter Carbon Composites built the cladding.



A modern, minimalist interior space with large, curved glass windows and doors. The floor is dark and reflective. In the foreground, there are several square objects with black and white QR codes. The lighting is soft and even.

Space — for new ways of thinking

What risks and opportunities does the fourth industrial revolution hold in store for companies? **Premal A. Desai**, Member of the Executive Board at thyssenkrupp Steel AG, and **Andreas Winiarski**, a digital transformation consultant, discussed their views on this topic.

Mr. Desai, Mr. Winiarski, how relevant is Industry 4.0 to the steel sector?

Winiarski: Steel already played a major role in the first industrial revolution, so it only makes sense for thyssenkrupp to lead the field in the fourth revolution once again.

Desai: Friedrich Krupp established his first iron foundry back in 1811. Take away steel and the steam engine, and there wouldn't have been an age of mechanization – what we now refer to as the first industrial revolution. And, of course, we also contributed to Industry 2.0 and 3.0.

Winiarski: It's important to note that each successive industrial revolution happened in a shorter time period than the one before. Today's digitization trend is evolving exponentially faster and has a broader scope than any previous revolution. We'll only be able to successfully brave the challenges associated with digital transformation if we constantly remind ourselves of its all-encompassing sweep.

Wouldn't it be more appropriate to differentiate between the terms Industry 4.0 and digitization?

Desai: Quite right. The increasing digitization of everyday life is having a lasting impact on our society. PCs and smartphones are highly visible indicators, but the changes run much deeper. Now it's up to us to find new solutions for human coexistence. How are social patterns changing in a digitized world? What's the limit to how transparent we should become? How freely do we, as a society, handle the vast amount of information shaping our lives?

Winiarski: The industrial sector could have gone digital 20 years ago, but this didn't start to happen before radical changes took place in other sectors and digital everything became part of day-to-day life. Now digital processes are revolutionizing the industrial production landscape. Its impact will be strongest where most value is created: in the areas of mechanical engineering, systems engineering, toolmaking, and the automotive industry.

Desai: Industry 4.0 isn't about social models; it's about business models. And depending on where you look, the level of digital compatibility differs. Some products and services can go 100% digital since they depend on data and information. This applies to the media, insurance, and financial industries, just to name a few. What they have in common is that their products can be created without any spatial constraints. At thyssenkrupp Steel, however, we deliver the base material steel. You can't fully digitize the production flow. While there are many more bits and bytes involved than meets the eye, the process equally depends on 200 years of blast furnace and rolling mill know-how.

The dynamics of Industry 4.0

— Physical megatrends

Autonomous vehicles and additive production based on 3D printing technology will soon be the 'next normal' in our digital, interconnected world. **Sophisticated robotics** will take human-machine cooperation to a new level, and intelligent materials will make their mark on the production floor.

— Digital megatrends

The Internet of Things, blockchain technology, and web-based platforms are revolutionizing the way in which **individuals and institutions** interact and cooperate.

— Biological megatrends

DNA sequencing (keyword: customized DNA) will continue to have a huge impact on medicine and agriculture. It also raises the question of how we **define a human being** in an age where altering our genetic code has become possible.

How far down the road is the steel industry today in terms of embracing the new industrial revolution?

Desai: We didn't have to start from scratch, for example, when it comes to logistics, connecting with our customers, controlling and optimizing production processes, as well as research and development. With some customers we started to exchange information years ago via electronic data interfaces, which transfer millions of production and order transactions. Then there's the 'Steel Online' platform that enables intermediaries to conveniently purchase merchandise from us and trade with it. This means that our customers can procure the required steel both easily and individually. And our Precision Steel business unit provides up-to-date information on the production status. Within limits, this even allows our customers to take action themselves, for instance, if they want to postpone an order.

What are your plans for making your company even more digital?

Desai: Customer-oriented business is key. The digital transformation presents us with various opportunities for more closely integrating with our customers. But before we can get there, we need to optimize internal processes and implement them consistently across the Group. What we're aiming for is functional excellence. In other words, our first goal is to improve transparency and establish a process-oriented mindset for bringing about a cultural transformation in the company.

Winiarski: Focusing on the customer is absolutely the right strategy. According to the system theory developed by Niklas Luhmann, large systems tend to drift towards a state of self-perpetuation. This means to say that, while they perform well, they're at risk of wasting time by focusing on too many small, internal issues, and thereby losing sight of the reason why they exist. Digitization is shaking up the status quo and allowing companies to turn their attention back to what's really important. Customer satisfaction thus becomes the measure of all things.

How does digitization impact daily life at the workplace?

Desai: We're used to seeing the world through an engineer's eyes, so we analyze everything and look for 'either-or' results. But it's clear now that the future will hold a lot of 'as-well-as' scenarios in store for us, both on the personal and the business level. After all, diversity is an attendant phenomenon of Industry 4.0. Things that contradict each other on the surface will evolve and coexist side by side. So the question



Andreas Winiarski
(top) and Premal
A. Desai met
in Berlin for an
interview.



“

We need to build a bridge between the digital hub of Berlin and the locations that generate most of our industrial value.”

Andreas Winiarski



Premal A. Desai and Andreas Winiarski are in full agreement: The Group needs to be there where its customers are.



is: How can we channel this? Core processes that have been running smoothly for decades will remain largely untouched. But as for other aspects of our business, we'll create space for new ways of thinking. This will involve experimentation with new concepts as well as questioning longstanding traditions.

Winiarski: It's not only the business models and production processes that are changing; the way we work is undergoing a fundamental change. Back at the turn of the millennium, Manuel Castells coined the term 'network society,' which is characterized by flatter hierarchies and less compartmentalization, giving way to a more unifying approach to cooperation. Digital tools play an ever-increasing role in this context.

Interview

— Premal A. Desai

joined the thyssenkrupp Group in 2006. Initially in charge of the Group's own business consultancy and the central Technology/Innovation/Sustainability unit, the 47-year-old manager was appointed CFO of thyssenkrupp Steel in 2015.

— Andreas Winiarski

was Chief of Communication at Rocket Internet, Europe's largest start-up group. Previous occupations include press officer at Axel Springer and later Editor-in-Chief of the Bild newspaper. Aged 38, he is presently a Partner at Earlybird Venture Capital and senior advisor at the Hering Schuppener communication consultancy, which has offices across Europe.

Desai: Of course we need certain rules and must ensure certain conditions are being met, but in the end it all boils down to figuring out when and where people collaborate best. The next step is to establish the right environments to foster this kind of collaboration while never losing sight of our key production processes.

Winiarski: I agree. Digitization and the technological revolution need guidance and must be accompanied by a broad public debate. We need to keep our society from becoming even more polarized. This will prove a key task in the near future for politicians and business leaders alike to tackle, while both players are still in the process of learning how to go about this.

Desai: Exactly, and this also calls for responsible corporate management. We have to focus on protecting sustainable jobs rather than fueling a winner versus loser mindset.

We are having this talk in Berlin, and there's a reason for that. What's the connection between the German capital and digital transformation at thyssenkrupp?

Winiarski: Berlin is a wonderful example of the things you can achieve without setting up complex corporate structures and processes that are etched in stone. This is why we need to link up Berlin, the digital center of our nation, with the locations that generate most of our industrial value. Foremost among them are the North Rhine-Westphalia, Baden-Wuerttemberg, Bavaria, and Saxony regions. Without this connection, Berlin would be nothing more than a fabulous B2C tech hub that casually disregards the reality of all the traditional industrial businesses out there.

Desai: This is why we decided to establish a local network and presence here. The goal is to take this famous Berlin enthusiasm and have it inspire the other locations. This spirit needs to carry across the country and beyond national borders. All of Europe must open up to modern technologies and ideas, rather than acting as a protector of traditional industry.

Winiarski: Let me point out, though, that it's not only the establishment, the so-called old economy, that needs to adapt to the new economy. The same applies in the opposite direction. Many local start-ups don't know the first thing about sustainability, social responsibility, or working under great public pressure. But these things lay the foundation for a morally-driven, responsible way of running a business – and they need to be upheld in any industry.

What makes Berlin attractive to companies?

Winiarski: Today, most major corporations have a digital representative office in Berlin. How

these are being used differs greatly from one company to the next. There are accelerator programs that offer seed capital and options for cooperation to young entrepreneurs in return for a share in the business. Other companies set up venture capital funds to support start-ups. Another strategy involves co-working spaces, which are either set up by a company to bring in other start-ups or to concentrate all of its brands in small units. Other options include innovation hubs or think tanks, which focus on generating new solutions and then delivering them back to the company.

Desai: This is what customer orientation is all about: putting your Group where your customers are. So, when they come to Berlin to sound out new possibilities, ideas, and solutions, we need to be a part of that. And this means getting the big picture and offering our support as a partner, be it in terms of materials, logistics, planning, or data.

You just mentioned data. How do you protect this digital resource?

Desai: Attacks by hackers confirm that data have become a valuable asset to be protected at great lengths. This comes at a cost, but that's a reality we simply have to live with. On the other hand, data can also be used as merchandise, which is why we are a founding member of the Industrial Data Space Association. It is this group's objective to create a safe data space for digitally connected business.

Winiarski: Constant vigilance is still important. Threats include cybercriminals who steal data or business models; the idea is to let you do the costly work of designing a production process and then, once your trade and logistics have reached a certain level of maturity, they jump in and leverage their global platforms to snatch a key business area from your grasp. Sure enough there are plenty of financially strong competitors out there. Given this backdrop, successful digital transformation takes some real guts – and you need to be fast.

Desai: At the end of the day, there's only one goal: to serve the customer. Our steel is just one piece of the final product, whether it's a car, a production machine, or a can of peas. All that we do must serve the consumer. So we need to go beyond the point of understanding our immediate customers – we also need to know their customers. This means understanding the end customers' needs and wants, the trends that cause large markets and societies to change, hot topics such as mobility, urban living, and environmental impact. We go to great lengths to understand these things. After all, we don't succeed unless our customers succeed.





The series of pictures entitled 'MA-JA-Code Project, Data-Matrix-Code-Pix Installation' created by Berlin painter Falk Richwien served as an eye-catching backdrop. Scan the QR codes to learn more about his artwork.

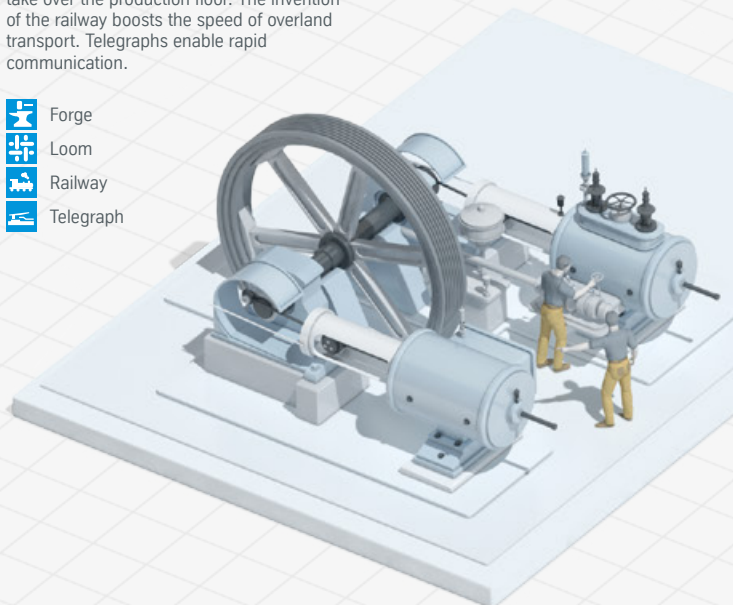
History of industrial change

Technological innovations have shaped the way people work throughout the ages. The **fourth industrial revolution** is certain to also deeply affect our everyday life for years to come.

Industry 1.0 (1800 onwards)





Machines driven by waterpower and steam take over the production floor. The invention of the railway boosts the speed of overland transport. Telegraphs enable rapid communication.

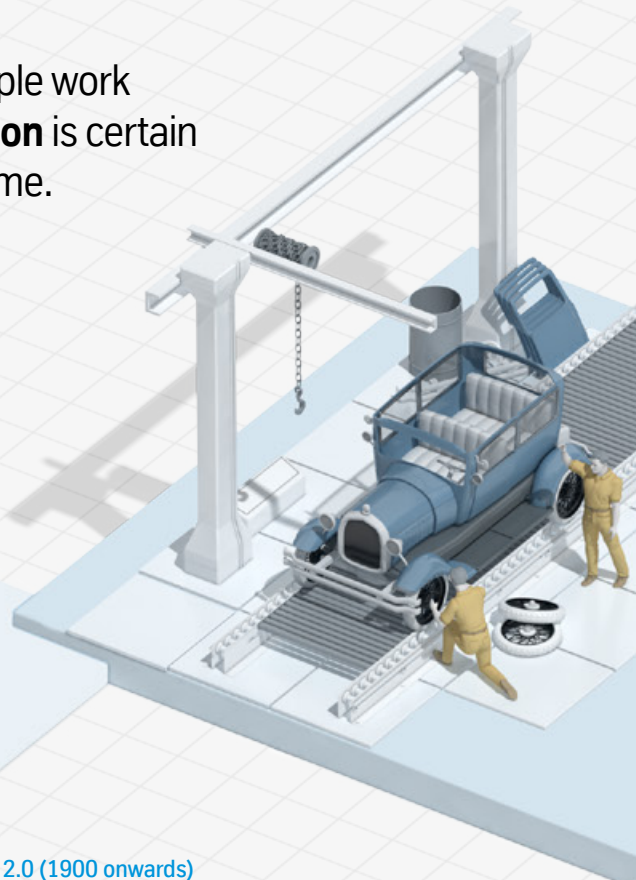
-  Forge
-  Loom
-  Railway
-  Telegraph



Industry 2.0 (1900 onwards)

Electricity becomes the new power source. Assembly line manufacturing heralds the age of mass production. The manufacturing process becomes specialized and is subdivided into efficient partial tasks. The range of goods and communication increases.

-  Sea transport (goods)
-  Assembly line (manufacturing)
-  Automobile
-  Telephone



Industry 4.0 (2000 onwards)

IT becomes an integral part of the manufacturing process. Digital networks orchestrate machines, thus saving both time and resources. On-demand production becomes economically viable, even for small batches.



Cloud



3D printing



Drone



USB



Artificial intelligence



Tailor-made DNA



Bitcoin



Smartphone

Industry 3.0 (1970 onwards)

Breakthrough of automation by means of electronics and IT. The PC becomes an everyday tool at home and in the office. Goods are available across the globe, communication goes mobile.



Computer



E-mail



Cell phone



Automation



Air transport (goods)

China makes light work of it

Chinese auto manufacturer FAW Car makes its bumpers from **MBW® 1900**, a lightweight material delivered by thyssenkrupp.

Text Judy Born

Photos Jonathan Browning



Customer meeting in Changchun (left to right): Dr. Yan Wang, Yong Xu (both FAW Car), Sadet Kökcü and Shunbing Yu (both thyssenkrupp Steel).

It is hard to say whether around 60 years ago anyone could have guessed that Changchun would one day become the center of the Chinese automotive industry. It all began in 1953 with the opening of First Automotive Works (FAW), the first automobile factory in the People's Republic. It only manufactured a single model: a medium-sized truck. But demand rose quickly, and production expanded to include city and tour buses.

Today, FAW also manufactures light trucks and heavy-duty trucks, cars in all vehicle classes, and tailor-made chassis for buses. What started in Changchun gradually expanded over time, and now there are 18 additional plants across China. The production numbers increased as the product portfolio grew more diverse. In 2015, FAW delivered 2.55 million vehicles. First Automotive Works became First Automotive Group Corporation. The acronym FAW remained, with the word 'Car' added at the end.

Licences expand the market

In an effort to adapt to changing market conditions and to meet buyers' expectations, the Chinese automotive pioneer began cooperating with a number of different international manufacturers. Whereas in the beginning FAW Car only manufactured its own models and only did so for local customers, the company went on to establish a worldwide presence. Since the year 2000, it has concluded licence agreements with Toyota, Mazda, and GM. But it all started back in 1991 with German carmaker Volkswagen.

That event also marked the beginning of a business relationship with an important material supplier from Germany: thyssenkrupp. "We're celebrating our 20th anniversary this year," says Dr. Yan Wang, Chief Engineer of Punching Technology at FAW Car. "When we produced the Audi 100 in 1997, we used steel from Duisburg for the first time." Much has happened since then. The worldwide automotive market has changed, as have the demands placed on the automobile in general. The material requirements have increased with regard to composition, processing options, applications, weight, and more. When FAW initiated



Off-the-shelf material is not suitable for producing these bumpers.

a project for a new vehicle model a few years ago, the company went looking for a suitable material for the bumpers. Dr. Wang and his colleagues decided to go with MBW® 1900 from thyssenkrupp Steel. "This manganese-boron steel combines a number of characteristics that are important for the component," says Dr. Wang. "The material reacts exceptionally well to hot forming. It is extremely rigid and offers very high resistance to deformation." Yong Xu, an employee from Dr. Wang's team, adds: "And thanks to its lightweight construction properties, it decreases the weight of the bumper."

The timing was perfect on both sides. "Production readiness of MBW®1900 coincided more or less with the new project from FAW Car," says Sadet Kökcü, who heads the local technical customer service department and represents the Duisburg steel group locally in China. However, it took some time before the MBW®1900 first appeared on the Asian market. "The processing parameters had to be adapted to the material," says Kökcü, "Which means that test stampings and

"Intensive consultation on site is a given for us."

Sadet Kökcü, Senior Manager Technical Sales, Business Unit Automotive

modifications had to be made before volume production could begin. To ensure that the hot forming worked properly, experts from Germany provided the colleagues here in China with extensive consultation." Once someone in China decides to do something, it gets done in the shortest possible time. "The decision-making paths are much more dynamic than in Europe." MBW®1900 is a special grade of the highest strength and this gives Steel a competitive advantage. But cars are not built from materials alone. "The fact that thyssenkrupp provided not only the material, but also intensive engi-

neering support was a very important factor in FAW Car's choice of supplier," says Shunbing Yu, a customer service representative in the Steel division and a colleague of Sadet Kökcü. "We are proud that we were able to supply MBW® 1900 for production use on the Chinese market as the first steel manufacturer, and that we accomplished this in cooperation with FAW Car."

For Dr. Wang, however, there was yet another very different factor that played a crucial role in FAW Car's decision to go with the product from Duisburg. "It is the long relationship of trust that we have. The perfect combination of outstanding expertise and a reliable partnership." And that is why he is convinced that we will celebrate many more anniversaries together.

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We call it precision work

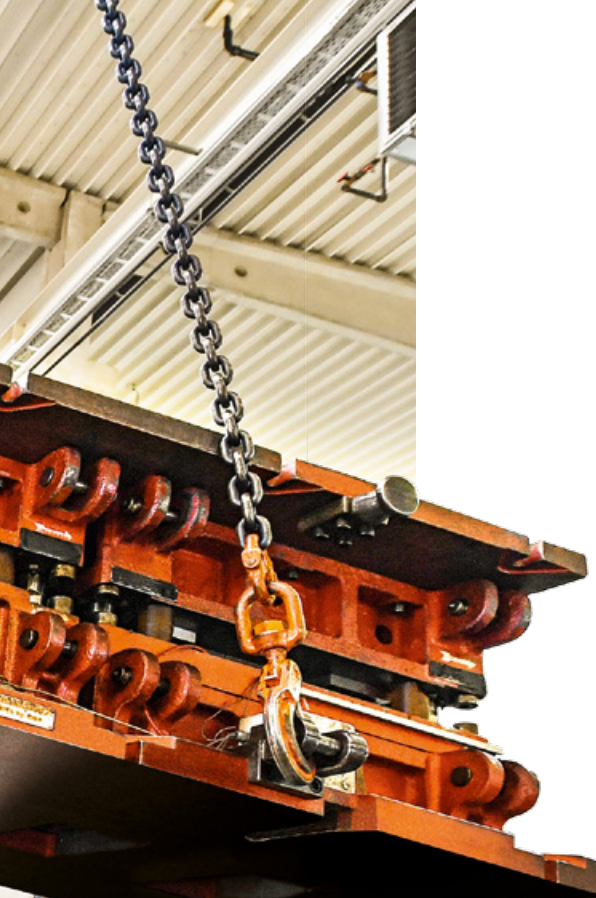
How thyssenkrupp's Steel division and Service Center worked with automotive supplier **FlammMotec** to develop the ideal material.

Text Judy Born
Photos Max Lautenschläger

Five years ago, when FlammMotec GmbH competed for a contract from a renowned German car manufacturer, the supplier was faced with a major challenge: None of the tested materials on the market were capable of meeting the component requirements specified by the OEM in the long term. "We were unable to use a normal grade to produce the required component in a satisfactory way," says Frank Reichmann, Purchasing Manager at FlammMotec's Nauen location near Berlin. The material had to meet strict requirements. It had to have a very narrow thickness

tolerance and support welding using all standard processes. And it had to offer lightweight construction potential and uniform mechanical properties across the entire length of the coil strip.

Word of this spread to Ralf Schumann, a sales employee at thyssenkrupp Materials Processing Europe (MPE) in Radebeul, where FlammMotec obtains many of the raw materials it uses to manufacture automobile components. What's more, the specialist in stamped and drawn parts is supplied by the Service Center of thyssenkrupp Materials Processing Europe in Krefeld, as well as by the Steel



division. Together with Achim Peuster, a technical customer adviser at Steel, Schumann organized a meeting at FlammMotec to learn about the company's production difficulties first hand. "That's part of our service offer," says Peuster. "We work together to figure out what we can optimize when manufacturing the material, but we also try to identify aspects of the customer's process that could be improved."

One important help was the detailed documentation that FlammMotec was able to present to the experts from thyssenkrupp. "We recorded and com-

mented on each step in production for all the steel grades we tested," says Managing Director Dirk Ermster. "What was good or bad to process and where inaccuracies arose." This made it possible to check what could be improved in the technical department during manufacture. In the course of development it became clear that the component could only be manufactured using a special type of product such as scalur®.

Continuity pays off

For Frank Reichmann, the material is a godsend, because the automobile manufacturer's production tolerances are minimal, and that is precisely what the product delivers. "On the one hand, we need a certain thickness tolerance for processing, and on the other, the OEM stipulates that it be as low as possible to rule out process fluctuations. The only product that supports the narrow tolerances we need for the job is scalur® from the casting-rolling line." The material is certainly no off-the-rack product and cannot be compared to normal grades. That has its price. "scalur® meets the highest standards and was even modified by thyssenkrupp especially for our purposes," says Reichmann. The purchasing manager believes that continuity in internal production is worth it.

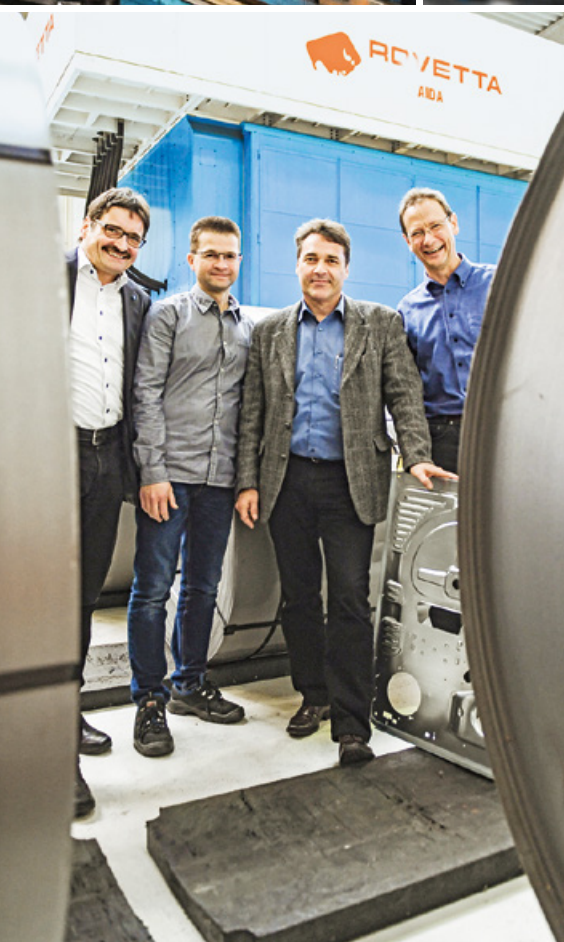
This success can be attributed in part to the intensive consultation provided by thyssenkrupp Materials Processing Europe in Radebeul. For roughly five years, the Steel Service Center has been much more than just a slit strip supplier or a materials controller. In the words of Reichmann, "Given the quantities we purchase as a mid-sized company, we're relatively small potatoes. But Mr. Schumann and his colleagues represent us in the thyssenkrupp Group, especially when there are special requests. Mr. Schumann knows who he has to approach at the factory and what the development options are."

For Managing Director Dirk Ermster, the high level of process reliability achieved by his company is the deciding factor in this joint development.



Made in Nauen: cross beams arranged in rows (top).

A powerful team (left to right): Ralf Schumann (MPE Radebeul), Frank Reichmann, Dirk Ermster (both FlammMotec), and Achim Peuster (thyssenkrupp Steel).



Forming, installing, machining

FlammMotec GmbH in Nauen is a class A supplier for the automotive, household appliance, and electronics industry. It manufactures safety parts and components from high-strength materials for lightweight construction, sandwich elements on large-scale presses, and assembly modules.

The company is part of the FlammGruppe, a global player that also produces components for the aviation industry, traffic and railway technology, and solar technology at its eight locations.

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Silent delivery

The first emission-free, low-noise **StreetScooters** are delivering letters and packages throughout Germany. thyssenkrupp was a partner from day one.

Text Dagmar Haas-Pilwat

Photos Dominik Pietsch

Achim Kampker's first job is as a professor at RWTH Aachen University, where he recently established and developed the Chair of Electric Car Production. The startup for electrical vehicles was originally conceived as a university research project. "E-mobility makes it possible to invent things that were unthinkable ten years ago," says Kampker. "We wanted to prove that e-mobility can be affordable in small quantities and that it doesn't require long development times."

The attempt to link economy and ecology has succeeded. The StreetScooter, a commercial electrical vehicle, is ready for mass production. It runs quietly, saves 0.3 metric tons of environmentally harmful carbon dioxide per year, and is fast and maneuverable. It is also a one-of-a-kind mail carrier, now that the startup has become a subsidiary of the world's largest logistics corporation, the Deutsche Post DHL Group. The yellow trucks with green engines drive throughout Germany, delivering packages and letters. But the company couldn't have done it alone.

Lots of thyssenkrupp inside

Ever since the early stages of the project in 2010, thyssenkrupp has collaborated as a strategic development partner. The technology group supports the construction of the StreetScooter and delivers materials and components for the new e-car. "We have focused on affordable lightweight construction and designed a steel body structure

that is paneled with a plastic outer skin," says Andreas Breidenbach from the Technology and Innovation area at thyssenkrupp Steel. Instead of using expensive tools and costly facilities, the project team manufactured components using affordable production methods such as roll forming and simple bending processes. "It was a major challenge," says Breidenbach, "because the chassis had to protect not only the driver and passengers, but also the battery of the electrical vehicle."

As a result, the majority of the chassis' A and B pillars are composed of high-strength and ultrahigh-strength hot-formed steels. To prevent the

battery from getting damaged in an accident, it is built into the floor between the longitudinal chassis beams. "The new solutions we've developed have demonstrated that our steel has a place in electromobility."

The same goes for the shock absorbers from thyssenkrupp Bilstein: The total allowable weight of a fully loaded StreetScooter is 2,130 kilograms. At the end of a long day of deliveries, the weight may be reduced by more than half a ton. To ensure balanced damping characteristics despite weight differences, tuning must be done very carefully. As a result, interface design and cooperation between different branches became central to the success of the project. "We arrived at a brilliant design through close collaboration," says Kampker.

The first prototype was so attractive that Deutsche Post took note. "At the time, they were looking for an affordable and functional electrical delivery truck." The StreetScooter model was a perfect fit for Post's 'Go Green' concept, and so the package carrier acquired the startup company in 2014, thereby becoming an automotive manufacturer.

The prototype had to meet many criteria: It had to be functional, economical, and environmentally friendly. Weighing in at 1.5 tons, the truck with green engine technology had to start up and shut down up to 200 times a day, and it had to offer up to 650 kilograms of loading capacity for letters and packages.

By 2016 there were already 2,000 emission-free StreetScooters on the



In line: Up to 10,000 commercial electrical vehicles roll off the line in Aachen each year.

Photo: Andreas Kuehken/StreetScooter GmbH



High atop the yellow truck: Achim Kampker (StreetScooter GmbH, left) and Andreas Breidenbach (thyssenkrupp Steel).



A sense of mission: Achim Kampker (left) and Andreas Breidenbach are convinced that the StreetScooter concept will catch on.

“We arrived at a brilliant design through close collaboration.”

Achim Kampker, Managing Director of StreetScooter GmbH

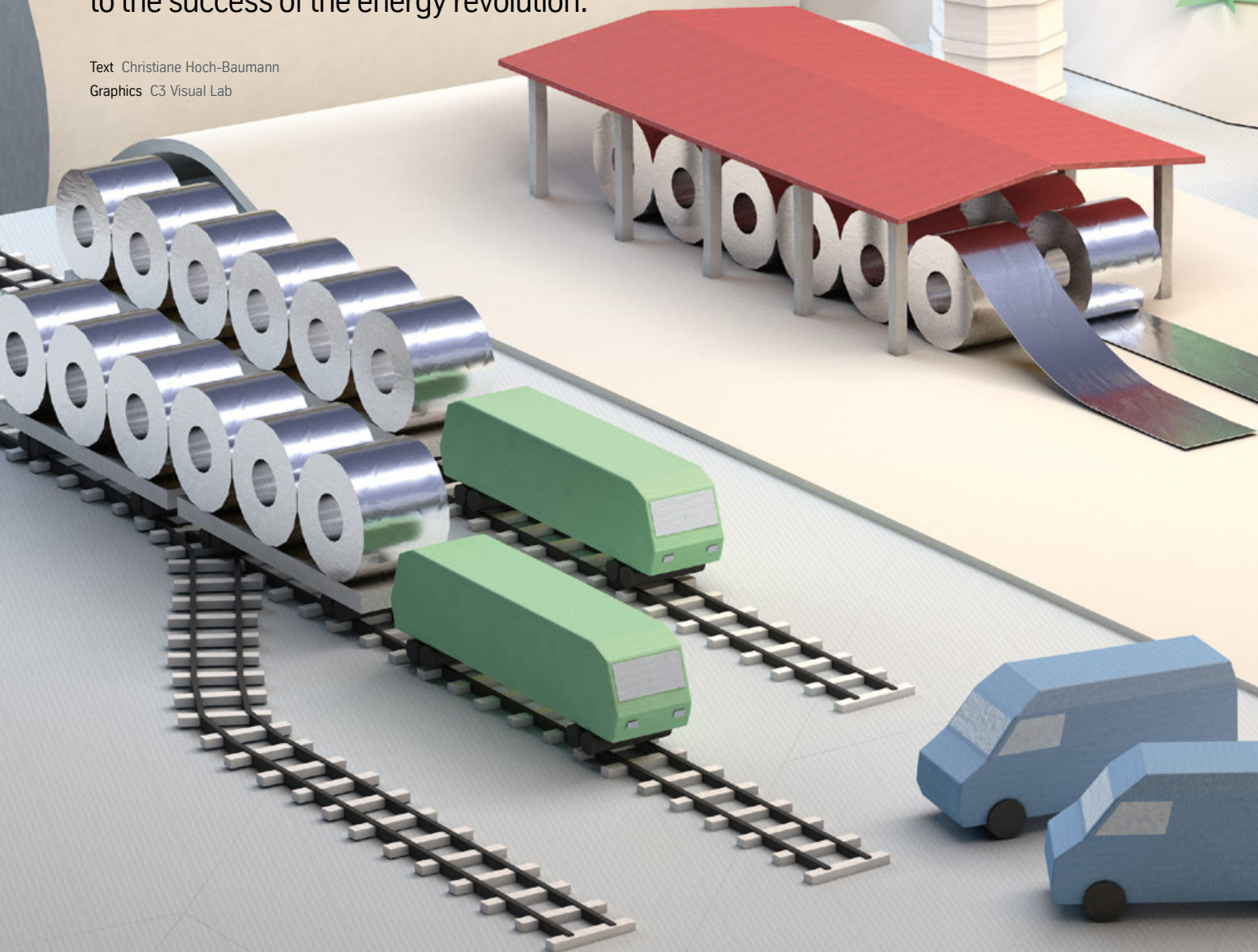
streets of Germany – with lightweight elements from thyssenkrupp Steel and shock absorbers from thyssenkrupp Bilstein. And the plans are ambitious: “Post’s conventional delivery fleet, which numbers almost 45,000 vehicles, is to be replaced as quickly as possible,” says Kampker, who serves as Managing Director of Electromobility at Deutsche Post. There is already a version with eight cubic meters of loading capacity, and another will follow. Interested parties from Germany and abroad contact them daily. “Demand is incredibly high,” says Kampker. In his view, cars with internal combustion engines will be phased out sooner than the experts expect.


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A highly charged atmosphere

Electrical steel from thyssenkrupp plays an important role in **power supply** and **e-mobility**. More importantly, it is crucial to the success of the energy revolution.

Text Christiane Hoch-Baumann
Graphics C3 Visual Lab





It may currently be the most underrated material of the future: electrical steel. Nothing less than our energy supply and the success of the energy revolution depend on it.

That's because electrical steel plays an important role in situations where electrical energy is efficiently generated, converted, and put to use. The best example of this is the area of electromobility. thyssenkrupp has prepared itself well for these challenges.

Demand for electrical energy is constantly growing. According to the latest forecast from British energy group BP, demand increases by 1.4 percent each year. By that estimate, the world will use roughly one third more energy than today in 2035. The World Energy Council predicts that by 2060 demand for electricity will even be double what it is today. And renewable energy sources are expected to meet a majority of the rising demand. This is necessary, on the one hand, because fossil fuel supplies are finite. On the other hand, the use of oil, coal, and gas accelerate climate change, thereby making it absolutely essential to phase out conventional methods for generating energy.

Electrical steel from thyssenkrupp supports the energy revolution. The steel alloy contains iron and silicon and determines the efficiency level of generators, transformers, and motors, which should be as high as possible, as well as their energy loss, which should be as low as possible. Energy should be used efficiently, whether generated by a factory or a wind turbine. "Wherever energy efficiency is required, you'll find electrical steel from thyssenkrupp inside," says André Matuszyk, CEO of the Automotive business unit, which is responsible for marketing non-oriented electrical steel in the company. His colleague Dr. Jens Overrath, CEO of the Electrical Steel business unit, adds, "As legislators impose stricter standards, the requirements placed on our materials increase and the materials have to get even better."

The two experts from thyssenkrupp are working with their teams from the Steel division in close cooperation with their customers to improve their products even further. And that includes products used in generating renewable energy, a sector in which a new gener-

ation of non-oriented electrical steels play an important role, for example, in state-of-the-art generators contained in hydropower plants and wind turbines. The soft magnetic steel concentrates and amplifies the magnetic flux inside the generators, which allows the mechanical rotational energy generated by the turbines to be transformed into electrical current without significant losses. "The performance of the generators and the efficiency of the plants is largely determined by the material properties of the electrical steel," says Matuszyk.

Transformers regulate voltage

Dr. Jens Overrath continues: "In order to transport the electricity generated by the plants across large distances, it has to be raised to a higher voltage than it had when it was generated." This is a job for transformers, which have grain-oriented steel built into them. "Electricity is transported at voltages of up to a thousand times higher than those found in a household electrical socket. Before the electricity can be used, the voltage has to be reduced, and transformers are required for that, too." A major challenge for the Electrical Steel business unit and its grain-oriented electrical steel is that it has to fulfill the European Union's Ecodesign Directive. Among other provisions, the Directive specifies which energy efficiency requirements have to be met by power transformers, distribution transformers, and generator transformers. The first phase went into effect in July 2015. The requirements stipulated for transformer efficiency will become increasingly strict over time

"Our high-tech materials make a major contribution to sustainability."

Dr. Jens Overrath



Electrical Steel business unit —
CEO Dr. Jens Overath

The Electrical Steel business unit of the Steel division of thyssenkrupp is the only manufacturer in Europe that produces a full range of high-quality grades of grain-oriented electrical steel and sells them worldwide. Thanks to two innovative electrical steels known as powercore® H and powercore® C, Electrical Steel is able to make a major contribution towards minimizing energy losses associated with the transfer and distribution of electrical power.



to ensure that the amount of energy lost during transport continues to decrease. “Half of Denmark’s annual consumption: That’s how much energy could be saved by Europe’s transformers alone by the time the second phase of the Ecodesign Directive is implemented in 2021,” says Dr. Overrath. In Germany alone, the loss rate is still between two and three percent. “In the future, an even broader portfolio of electrical steel grades will be required if the goals are to be met. We are well-positioned today where the most important grades are concerned, and we’re supporting development with grain-oriented products of exceptionally high quality.”

It takes an enormous amount of technological expertise to produce grain-oriented electrical steel, and Electrical Steel has it in spades. Over the past 20 years, this business unit of thyssenkrupp’s Steel division has increased the energy efficiency of electrical steel by nearly 40 percent, and counting. What’s more, the top varieties are capable of reducing not only energy consumption, but also noise levels. “The electrical steel has been optimized down to a thickness of only 0.18 mm and makes transformers quieter,” says Dr. Overrath. “This is partly thanks to highly successful cooperation with our customers, who value the fact that we combine innovative product development with a high level of expertise in dealing with materials.”

Improved magnetic properties

The Energy Efficiency Act has much the same effect on non-oriented electrical steel from the Automotive business unit as the Ecodesign Directive has on grain-oriented electrical steel. Manufacturers of motors for industrial drives have to maintain a certain level of efficiency depending on drive classification.

Household appliances, too, offer opportunities for savings. PP grades come into play here; after stamping, the stamped parts are annealed, thereby removing the effects of processing and further improving the properties of the material. “They exhibit high magnetic conductivity with extremely low losses,” says Matusczyk. For no matter how perfect and highly efficient a grade of electrical steel may be, each mechanical

“Steel will play an enormous role in e-mobility as electrical steel and as a lightweight construction material.”

André Matusczyk

influence on the material influences its magnetic properties in turn. Furthermore, highly efficient electrical steel is an indispensable part of electromobility both now and in the future. “There is no electromobility without steel. Electrical steel is absolutely essential to the manufacture of e-motors,” says Matusczyk. For that reason, thyssenkrupp also offers high-strength types of electrical steel that make it possible to build drive motors capable of high rpms. Thanks to their improved magnetic properties, they make motors more efficient, thereby increasing the range of the vehicles. “And that is one of the main features that will lead to broader acceptance of electrical cars,” says Matusczyk.

Non-oriented grades of electrical steel designed for use in vehicle motors are tested in a thyssenkrupp e-mobility center built especially for that purpose. “We are testing how the product performs at various processing stages in the final application. This is important, because an electric motor designed to be used in a car has to meet a different set of requirements than an industrial motor,” says CEO Matusczyk. It has to perform very different tasks, from driving on the highway at a constant speed to driving up a hill or suddenly accelerating when passing another car in stop-and-go traffic in a congested city.

Thanks to its long tradition and high level of technical expertise, the Automotive business unit cooperates intensively with all German automobile manufacturers. There is a lot happening

in the areas of motors, electronics, batteries, and lightweight construction. For years, the Steel division of thyssenkrupp has supported a variety of projects, for example, the StreetScooter project for Deutsche Post, where it primarily works to facilitate affordable lightweight steel construction and to ensure that e-car batteries are installed in the most crash-proof position (see page 20 for more). “The question is not whether electromobility can or should be implemented, but when,” says Matusczyk. “The market is still reacting cautiously, but the dynamic is recognizable. And we’re ready.” The speed at which things will be done depends on the legal environment, the budgets provided for investment and development, and the available infrastructure. Issues such as vehicle range and

charging station availability play an important role for consumers. As the number of charging stations increases, so does the number of feed points or distribution transformers that are needed. “It’s very simple,” says Dr. Overrath. “As the number of electricity consumers rises, the capacity for distribution has to be increased, regardless of what the electricity is being used for.” Electromobility exacerbates this situation, because the distribution networks in Germany and Europe would currently be unable to handle it. “Intelligent energy distribution is an integral part of the energy revolution.”

Intelligent distribution networks, or ‘smart grids’, are required. Now is the time to start managing and offsetting fluctuating demand for electricity. This task will become even more complex

in the future as the use of renewable, sporadically available energy continues to increase. A data network operating in parallel to the power grid is therefore needed to coordinate the generation, storage, and distribution of energy with the help of innovative transformer concepts. “The demand is there,” says Dr. Overrath. “We are already capable of supplying the grain-oriented electrical steel that these smart transformers require.” In other words, the energy revolution would be impossible without thyssenkrupp.

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Automotive business unit — CEO André Matusczyk

In addition to supplying innovative materials for the automotive industry, the **Automotive business unit** of thyssenkrupp's Steel division also offers powercore®, a high-tech, non-oriented electrical steel. Thanks to this product, the business unit is able to make a valuable contribution to worldwide environmental protection and sustainable energy.

2017

May



COILWINDING/CWIEME 2017

20–22 June, Berlin, Germany

Once again we will be attending the world's largest industry event for international representatives of the coil winding, insulation, and electrical manufacturing sector. The Automotive and Electrical Steel business units from thyssenkrupp's Steel division will be presenting the latest innovations for grain- and non-oriented electrical steel. thyssenkrupp Magnettechnik, a subsidiary that specializes in magnetic technology, will also be exhibiting. Please note the new booth location: Hall 2.2, 22 A 29.



ALIANKINTA 2017

26–28 September, Tampere, Finland

This trade fair for industrial subcontracting is a permanent highlight on the event calendar for thyssenkrupp Steel's Heavy Plate business unit. As a co-exhibitor at the booth of its longstanding trade partner Flinkenberg, the heavy plate specialist will showcase high-strength steels from the N-A-XTRA®/XABO® and perform® families, as well as wear-resistant steels from the XAR® family.

METPACK 2017

2–6 May, Essen, Germany

Once every three years, the metal packaging industry meets in the German city of Essen for the METPACK trade fair. Whether the sector is food and drink, cosmetics, pharmaceuticals, or confectionery, the demands on merchandise and its packaging and presentation are continually growing, and for this reason there is considerable interest in innovative technologies and materials. The Packaging Steel business unit will be in attendance at the international trade fair as an innovative partner of steel packaging manufacturers.



TRANSFORM Americas 2017

7–9 June, Orlando, USA



As a member of the TRANSFORM network, the Electrical Steel business unit will present innovative grain-oriented solutions for electrical steel at TRANSFORM Americas. TRANSFORM is a conference and exhibition that serves as an international forum for sharing information about sustainable solutions for the transformer industry. The event also highlights future trends in the supplier industry for transformers.

September

Marcus van Marwick, Head of Brand & Customer Communications, is responsible for all publications and events geared towards customers and business partners.
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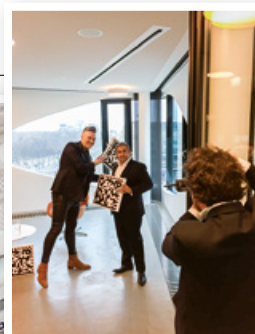
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For the lead interview we invited the participants, Premal Desai and Andreas Winiarski, to the premises of the Ottobock Science Center on Potsdamer Strasse in Berlin. With the Reichstag in the background, the capital city offered us one of its most distinctive sites. And Berlin artist Falk Richwien allowed us to use his series of oil paintings entitled 'The MA-JA-Code Project, Data-Matrix-Code-Pix Installation' as props for the photo shoot.



Illustrations: C3 Visual Lab, Photos: thyssenkrupp Steel Europe
Photography (2), C3 (5), PR (4)

How many
metric tons of
steel were used
to build this?

The Elbphilharmonie,
a concert hall in Hamburg.
Although it looks light and
airy, it weighs a whopping
two hundred thousand
metric tons. Write to us if
you think you can guess
how many tons are made
of steel.

One winner of an iPad mini3
will be chosen at random
from all the correct entries.

Enter the competition online at www.thyssenkrupp-steel.com/compact-challenge. Or e-mail your answer to compact.tkse@thyssenkrupp.com with 'Competition' in the subject line. All entries must be submitted by **20 June 2017**. The winner will be chosen at random from the correct entries. The entrant is not required to pay a fee or perform a service to participate. Employees of thyssenkrupp steel Europe AG and their dependents are not eligible. The judges' decision is final. Note: Your personal data will be used for the purposes of the competition only.