

The Magazine

for the Digital Enterprise

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Is it worth it?

Discover the value of the Digital Enterprise

#mindsphere

Cover story
Utilizing the potential of digitalization

Special
Digital industry solutions

“Those who fully and
rigorously
implement the digital
transformation will
profit from it!”

Profiting from the digital transformation



Industrial production is undergoing a fundamental transformation. Products are becoming increasingly individualized and new business models are being created that change ways of collaboration within value chains. New methods for product development and production, such as simulation or additive manufacturing, are enabling enterprises of every size and in every industry to more flexibly individualize their products.

That digitalization is also important for your company is beyond a doubt. Whether you have already digitalized a number of processes or are in the midst of doing so, you've made a key decision: You have intentionally made an investment that should pay off in the end. You have determined the advantages digitalization would bring for your machines or systems, and assume that your company and your customers will ultimately profit from these benefits.

In this issue of *The Magazine for the Digital Enterprise*, professionals from various industries offer some practical insights. There is no industry that cannot profit from digitalization and the many advantages it offers. How much faster can you respond to changing market demands? How much money can you save with efficient energy management? Can you always comply with and document ever more complex regulations regarding quality and security? How can you turn data into business successes?

Under the motto *Discover the value of the Digital Enterprise*, we show you how industrial companies of various sizes and in different industries can profit from digitalization – such as through the intelligent and comprehensive analysis of data collected in MindSphere, our cloud-based, open IoT operating system. How can you shorten your time-to-market, achieve greater flexibility and efficiency, or improve your quality? Only those who fully and rigorously implement the digital transformation in their companies and for their products will profit from the digital transformation and use it to gain a competitive edge.

Find out in this issue how you can also profit from digitalization. I wish you an enjoyable read and some valuable insights!

A handwritten signature in black ink, reading "Klaus Helmrich". The signature is fluid and stylized, with the first letters of the first and last names being capitalized and prominent.

Klaus Helmrich
Member of the Managing Board of Siemens AG



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BioNTech AG



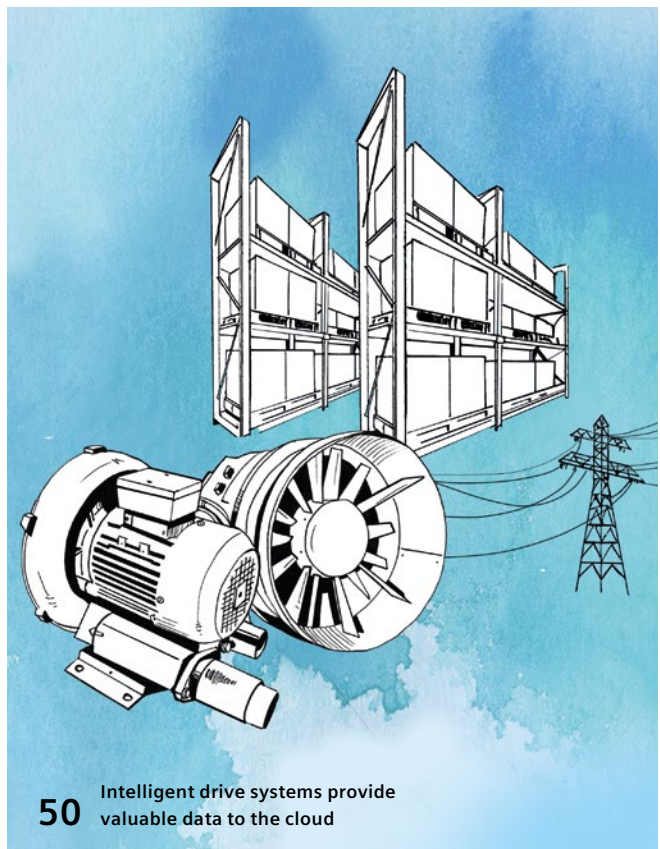
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Cover photo:

Risk assessment is important – for ice climbers, like the ones here on the Fox Glacier in New Zealand, as well as for companies. For one of them, this means life or death, and for the other, survival among the international competition.

(gettyimages/Bo Tornvig)



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World record for vertical flight

The aerobatic aircraft Extra 330LE circles through the air almost noiselessly. You cannot see how much power is hidden beneath the hood of the small electric plane. And yet just recently, it broke the world record for vertical flight, rising 11.5 meters per second into the air.

The Siemens experts optimized the motor that made this world record possible, along with all of its components, and took it to its technical limits. For example, they were able to reduce the weight of the end shield – an absolutely safety-critical component that is exposed to extreme forces – by more than half. It is usually rather massive and heavy. To slim it down, the product lifecycle experts developed a specific algorithm which, using the NX Nastran CAE software, virtually dismantled the end shield into more than 100,000 individual components and then simulated the forces acting on each of them. The software identified those elements that carry barely any load, making them dispensable.

Thanks to digitalization, this resulted in a technical solution that even a team of top engineers would have never been able to achieve working at a desk using the old, traditional methods.

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Is it worth it?

Today manufacturing companies probably rarely ask themselves whether they should tackle digitalization. Most of them are already right in the midst of it – albeit in various phases. But what kind of potential does digitalization really offer? “Is it worth it?” – a simple question that all entrepreneurs have asked themselves since analog innovations arrived in leaps and bounds, and that is now as relevant as ever.

About US\$ 11 trillion worldwide – that is the number the McKinsey Global Institute (MGI), an international think tank, estimates the economic added value of modern IoT applications will amount to by the year 2025. The Internet of Things (IoT) has the potential for the greatest impact in factories (up to US\$ 3.7 trillion of economic added value), for example, due to cost or time savings. But who ultimately benefits from this added value?

Consumers have long learned to appreciate the benefits of digitalization: custom products available in a very short time at a reasonable price and of the best quality. As a result, companies have had to shift their focus from homogeneous market requirements to the needs of each individual customer. The key to a multivarious and customized range of products lies in digitalization.

According to the latest study by MGI, companies need to set their goals very deliberately, keeping an eye on the current and future development of digitalization, in order to improve the return on investment for digital assets. “Only those who are familiar with the progress of digitalization in their industry and can assess the impact of this development on their economic performance will be able to implement their own strategy in a goal-oriented manner and be successful” is one conclusion of the investigation. The starting point for different industries in terms of the degree of digitalization required and their current progress varies. Even the question where digitalization will have the greatest impact depends on many industry-specific conditions in each individual case. Read more about this starting on page 24 of this issue.

that in addition to the digitalization of processes per se, the resulting opportunities for comprehensive data analysis have the greatest impact on value creation. Data are the key to making full use of the potentials of digitalization. It is only when data from machines and plants are collected, processed, and used in a secure environment that production processes and equipment can be streamlined on an ongoing basis. “All in all, you can say that data analysis is increasingly contributing to the creation of value in companies,” summarizes Thomas Erwin, the head of studies at KPMG.

The Digital Enterprise is Siemens’ digitalization solution for industry and comprises software and automation components for every sector and for companies of every size. It integrates software and hardware solutions that enable a seamless integration and digitalization of the entire value chain, including suppliers. The result is a digital twin that maps the entire value-added chain – from product design to service – on the basis of a single data model as a perfect digital copy. Companies can use this to simulate, test, and optimize in a completely virtual environment. The process industry benefits from a consistent data model of the entire plant lifecycle. The data also form the basis for analyses, which are conducted with Siemens’ MindSphere, the cloud-based, open IoT operating system. Read more about how companies are already creating value today using the Digital Enterprise model. ■

Data create added value

The KPMG study titled “Creating values with data,” conducted in collaboration with Bitkom, also shows

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When it comes to **quality**, nobody wants to compromise. What are the benefits if I **digitalize** my production?

Today, consumer goods are as **individual** as the people buying them. How can I simplify my production processes?

I am only ahead of the competition if I can offer my product on the market **in the shortest possible time** and at an **attractive price**.

Unscheduled downtime is a problem at any stage of production and has far-reaching consequences. That is why I need the 24/7 **service**.

Quality is only one benefit of **digitalization**.

To draw on all the benefits, businesses must first achieve an end-to-end integration of their data.

This requires the integration of **industrial software and automation**, the expansion of **communications networks, security** in the area of automation and the use of business-specific industrial **services**.

For individual production, **machines** need to be **retooled quickly and flexibly**. Virtual tests and **3D models** simplify this process and facilitate detailed planning.

Integrated engineering is a great solution in this regard. With comprehensive automation software and digital workflows, processes can be parallelized, saving **time, resources, and costs**.

Operational safety and plant availability, projectable maintenance intervals, preventive measures, and fast and smooth repairs if required: Digitalization sets new standards for **service**, cuts costs, and increases performance.

Industrial Security

Industrial Communication

Industrial Services

Engineering

Software

Operation

\$11 trillion

in added value worldwide thanks to modern IoT applications by 2025.

(Source: McKinsey Global Institute)

#digitalenterprise

With innovative **software**, AGCO can use 80% of the production data collected at other locations, saving time and money. Read the whole story starting on page 34.

Digital Twin

80%

less power consumption with additive manufacturing at the Siemens plant in Finspång.

Using **software** for digital product development and lifecycle management, Nissan has reduced the time from deciding on a model to starting production from 20 to 10.5 months. Read the whole story at siemens.com/magazine/2d0002.

Process

With an intelligent network control platform, Grupo México reduced downtime in a copper mine by 60%, optimizing **its operation**. Read the whole story starting on page 48.

\$3.7 trillion

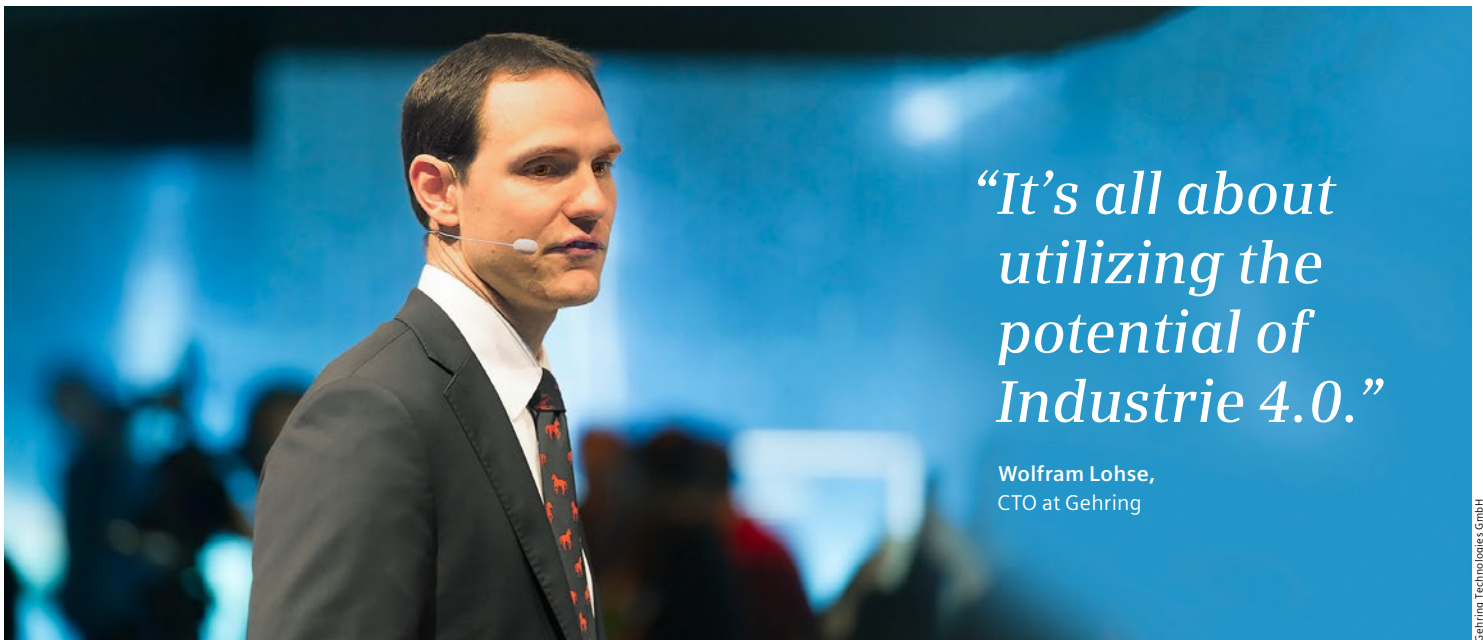
in economic added value for plants thanks to the IoT.

(Source: McKinsey Global Institute)

30% greater efficiency in **engineering** – that is the objective Bausch + Ströbel are aiming for with a digital twin by 2020. Read the whole story starting on page 16.

Reduced downtime thanks to data management and analysis – that is how Gehring profits from **MindSphere**. Read the whole story on page 12.

Energy Analytics creates valuable transparency about the energy flows at a pharmaceutical company. In the pilot project the energy consumption of compressors was reduced by 12%. Read the whole story at [siemens.com/magazine/2w0431](https://www.siemens.com/magazine/2w0431).



“It’s all about utilizing the potential of Industrie 4.0.”

Wolfram Lohse,
CTO at Gehring

Gehring Technologies GmbH

Reducing downtime by gathering data

Transferring data to the cloud has its advantages – everyone says so. But what are the exact implications, and what advantages does a cloud-based application bring compared with conventional digital services? Engineering company Gehring has recently started to visualize and analyze the data of its machine tools in MindSphere.

Precision and longevity are the hallmarks of our tooling systems – according to the company’s website – and “It’s all about utilizing the potential of Industrie 4.0,” says Wolfram Lohse, CTO at Gehring. The analog and digital world at Gehring joined forces a long time ago. In order to further reduce machine downtime, Gehring has recently begun to manage and analyze data using the cloud-based, open IoT operating system MindSphere.

Transparent machine conditions

Gehring specializes in honing and is part of the vanguard in this field of advanced technology. Honing is a cutting procedure that creates defined functional surfaces on

bores. Increased machining time results in wear and tear on honing stones. In order to avoid delays and downtime during production, the material should be replaced before critical threshold values are reached and the tool’s useful life comes to an end. Thanks to the visualization and analysis of the machine data generated via the cloud platform MindSphere, the condition of all integrated machines is made transparent and comparable. Among other things, the application makes a prognosis for the remaining tool life. This results in a diagnosis that better reflects the mechanical strain and maintenance requirements of the machines, which reduces downtime.

Data help reduce costs

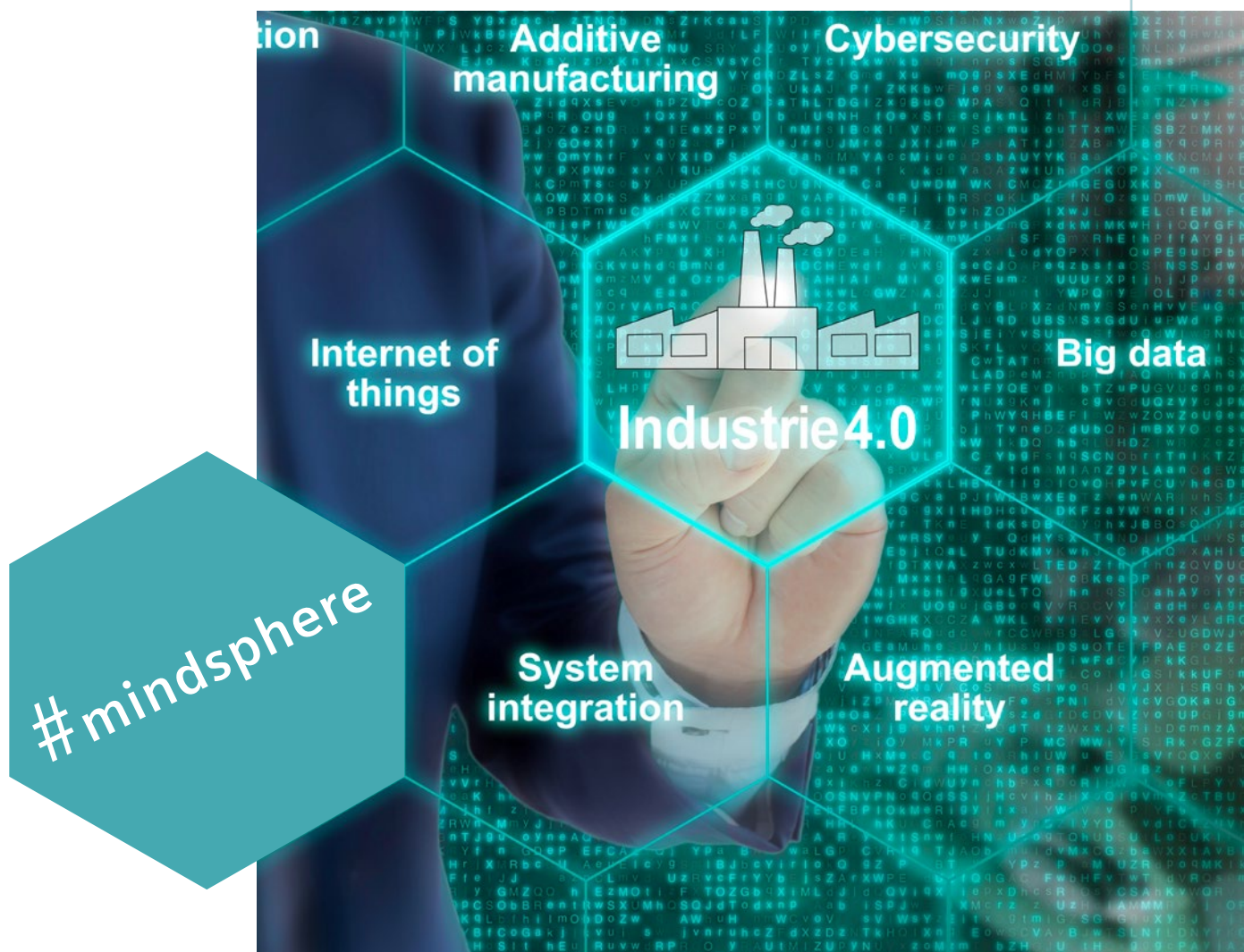
“When it comes to digital solutions, we profit greatly from the data generated by the machines deployed in our customers’ environments,” Lohse explains. “Based on the data that is gathered, we can try to evaluate the reasons for an observed effect, including the influence of upstream processes. The data give us more insight into the influences on overall equipment effectiveness, and therefore contribute to better planning security and cost-efficiency.” ■

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IIoT snapshot: Two experts weigh in

The United States and Germany: two advanced manufacturing locations that have embraced the Industrial Internet of Things (IIoT) on a wide scale. What impact has IIoT had and what are current trends? We spoke to two engineering experts on both sides of the Atlantic to get answers: Dr. Dagmar Dirzus, member of the Technology and Science board at the Association of German Engineers (VDI), and Dr. Dean L. Bartles, President of the North American Manufacturing Research Institute.

>



getty images/leebright



VDI/Dr. Dagmar Dirzus

Dr. Dagmar Dirzus

is a member of the Technology and Science board at the Association of German Engineers (VDI), responsible among others for community voluntary work in the VDI division Measurement and Automation Technology. She holds a doctorate in engineering from the RWTH Aachen University, Germany, and has worked in various engineering organizations. Her areas of expertise include smart automation, robotics, Industrie 4.0 and business model innovation for the digital transformation.

“The challenge is to bring these different innovation cycles together. I think modular designs will be a great lever.”

Dagmar Dirzus

IIoT: Where do we stand? What's got you excited?

Dirzus: Modular designs. Let me explain: Technologies are coming at us at different paces. Let's consider mechanical elements, like a pump in a process industry installation built to operate for 30 years or longer. In the same plant, we have IIoT technologies that change much faster, maybe every few years or so. The challenge is to bring these different innovation cycles together. I think modular designs will be a great lever.

Bartles: A clear advantage with IIoT is shortened lead time. Companies can start profiting more quickly when new products are introduced to the marketplace. Digital twins is another area. A digital twin is basically a digital representation of the final product; a record of every screw and all deviations from the original plans. The advantages are really clear with complex products like an airplane. If at some point there's a quality issue, it is easier to get to the source.

Cybersecurity is a concern everywhere.

Is the fear justified?

Dirzus: Yes and no. German manufacturers are extremely sensitive about cybersecurity. There have been advances, but you have to remember, there is no 100% guarantee for anything. I would go so far as to say that cyber concerns could cause the German industry to miss the boat on some IIoT technologies.

Bartles: Of course. Hackers can do great harm, which is not always apparent at first sight. A professor at Virginia Tech collected programming assignments from his students on a 3D printing project. During the review, he built in a void, on purpose. The only student who caught the void was the one who stood by the 3D printer and watched the piece being printed. Imagine if that was a sensitive machine part? And it was noticed only when it was too late?

What do you think needs to be done now for better cybersecurity?

Dirzus: Attention needs to be on secure cloud IT infrastructure. The Fraunhofer Institute for Manufacturing Engineering and Automation has come up with Virtual Fort Knox, a platform for secure cloud IT infrastructure. Different centers have been set up across the country where manufacturing companies can test out different possibilities for cybersecurity solutions.

Bartles: The National Defense Industrial Association (NDIA) is working heavily on cybersecurity. I think manufacturers could make better progress in cybersecurity if the highly secure encryption technologies used in the defense sector were made available to protect advanced manufacturing.

In the face of IIoT, the required skill sets in engineering are changing. How can young engineers arm themselves for the future?

Dirzus: Today teams are more interdisciplinary than they ever have been before. That requires good communication skills and the ability to think outside of the box. Of course, competence in software is essential – I’m not saying engineers have to study computer science on top of engineering, but they do need to have basic knowledge in writing code.

Bartles: Engineers will have to learn to write and understand code, because every new product being developed includes IIoT to some degree. Another issue that comes up is that people are afraid of jobs being lost to robotics and IIoT. I do not see that being the case. Of course, some lower-skilled jobs will be lost. But for each lower-skilled job lost, I believe that there will be a net increase in higher-skilled jobs.

Much as China did some 30 years ago, many emerging countries around the world are setting up an industrial base of their own. What role do you think IIoT will play for these countries?

Dirzus: I think we’re going to see a very fast learning curve. In some ways it will be easier in these countries because they are starting out with an IIoT mindset, instead of trying to transform already existing industrial infrastructure.

Bartles: If these new industrial bases want to keep up with manufacturers in the United States, Europe and many parts of Asia, they are going to have to introduce IIoT from the very beginning.

Looking into the future, what should manufacturing experts keep an eye on?

Dirzus: More smart services. Manufacturing companies will own less and less, and will instead pay a monthly fee for the assets they need. Take the aviation industry, for example: airlines are paying to have turbines at their disposal, they do not actually own the turbines they use.

Bartles: Smart materials. It is amazing what some of these materials can do. Some can change their properties according to external stimuli, like temperature, moisture, or magnetic field. I think they’re going to have a big impact in the future. ■

“Smart materials. It is amazing what some of these materials can do. I think they’re going to have a big impact in the future.”

Dean L. Bartles



Dean L. Bartles

Dr. Dean L. Bartles

is a leading figure in US manufacturing. He has served on many advisory boards – for example in 2016 as the President of the Society of Manufacturing Engineers, and this year as the President of the North American Manufacturing Research Institute. He also has over 40 years of management experience in various companies. Bartles holds a PhD in technology management from Indiana State University and a doctorate in business from Nova Southeastern University.

The digital twin comes to life

The demands in special-purpose machine manufacturing for the pharmaceutical industry are changing. The strategy of the mechanical engineering company Bausch + Ströbel in Ilshofen, Germany, is based on achieving significant increases in efficiency using digital twins of its machines in order to be able to meet requirements faster.

The pharmaceutical industry is a demanding clientele and expects more than “just” technological innovations from mechanical engineers: “On the one hand, clients are asking for highly specialized plants with extensive customer service. On the other hand, there is a trend toward standardized machines with a high degree of flexibility and short delivery periods,” explains Dr. Hagen Gehringer, managing director of Bausch + Ströbel. In order to meet both goals, he maintains a close collaboration with Siemens in the areas of digital engineering and automation. He has also adapted the structure of the company’s work groups to the possibilities afforded by digital technologies. Their goal is to increase engineering efficiency by at least 30%.

Virtual testing of machines

In the past, a full-sized wooden model based on customer specifications was produced to test factors such as mechanical characteristics, ergonomics, and transport routes. It was not until the tests had been completed that the actual machine was built and then programmed.

Bausch + Ströbel, which has been using NX for CAD construction and Teamcenter as its data backbone, began taking a new direction as early as 2012. The data from the digital design of the machine with NX for Design are used, among other things, for mapping

the new machine at a scale of 1:1 and in 3D on a large screen in the company’s virtualization center. In this early concept phase, it is possible to simulate complete motion sequences. That allows both Bosch + Ströbel clients and engineers to see the design and functions of a machine at a very early stage in a virtual environment. Special glasses and stereoscopic 3D vision provide a realistic impression, because the movements of the users are also recorded and reproduced on-screen. The effects are so lifelike that users quickly forget they are only dealing with a virtual model.

Mechanical engineering company Bausch + Ströbel

It is hard to miss the Bausch + Ströbel Maschinenfabrik Ilshofen GmbH & Co. KG production plant in the outskirts of the peaceful little village of Ilshofen in Baden-Wuerttemberg, Germany. For nearly 50 years, filling and packing plants for the pharmaceutical industry have been manufactured here with great success, and have to a large extent been exported worldwide. The mechanical engineering company has been relying on the strong market acceptance of Siemens hardware for a number of years. The company uses software and digitalization as a key to consistency in its engineering.

The first realistic reproduction of a machine is made possible for engineers and clients of Bausch + Ströbel in the virtualization center, thanks to stereoscopic 3D vision with special glasses



Alle Fotos: Siemens AG



The digital twin allows the early detection of flaws; the commissioning period is thereby significantly shortened

“What helps us enormously is the parallel between the physical construction of the machine and the digital model. It enables us to align the digital images with the client and start programming,” says Dr. Gehringer. The development teams that up to now had been separate units at Bausch + Ströbel were merged to form interdisciplinary units. Today the opportunities of digitalization can be leveraged so that all work relating to design, electronics, mechanics, and programming can happen simultaneously and as a joint effort. All findings from the simulations and testing with the digital twin of a machine go back into the data pool, which is managed with Teamcenter. The digital twin enables a virtual commissioning where flaws can be reliably detected and corrected. This significantly shortens commissioning time.

Anticipated improvement

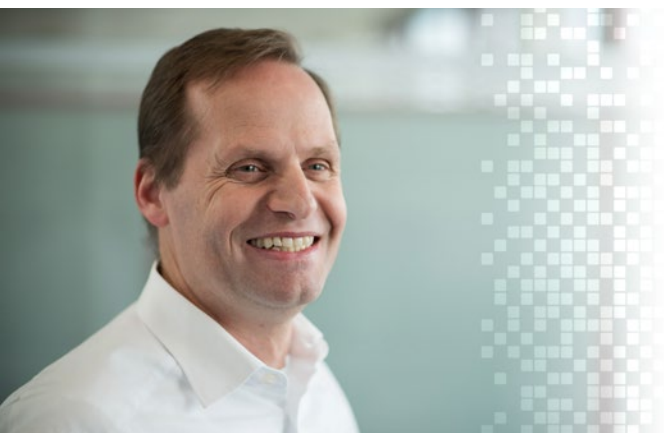
The digital twin is used beyond the construction phase and delivery of the actual machine. Findings and data gathered during operation are remitted to Bausch + Ströbel, so the company has a virtual copy of each machine at hand at all times. This is ideal for providing customer service and is a real competitive advantage.

Another advantage is the time saved during engineering. Dr. Gehringer expects an increase in efficiency of at least 30% until 2020 – and Bausch + Ströbel has joined forces with Siemens to achieve this goal. Totally Integrated Automation Portal (TIA Portal) will support the company from now on to reduce isolated solutions and increase engineering efficiency.

Imprint

“What drives us when it comes to digitalization is that it will bring added value to the client.”

Dr. Hagen Gehringer,
Managing Director of Bausch + Ströbel



This is the goal defined by Dr. Gehringer: “We know that we have the right take on digitalization if the client approaches us with an order and we can configure it within two days on-site, so that processes and modules are defined and we can get started with the development process very soon.” The digital twin plays an important role in this process. ■

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Personalized therapy

With its personalized vaccine, BioNTech is a pioneer in the battle against cancer. To enable the active pharmaceutical ingredient (API) to be produced faster and in large quantities, the company has installed an entirely paperless manufacturing system featuring Simatic IT eBR and Preactor.

The development of personalized therapies was long considered a daring experiment, entailing major challenges – not just scientifically, but also in terms of production costs and time. In recent years, however, new developments in the field of oncology have shown that personalized therapies might well be able to revolutionize cancer treatment in the foreseeable future.

Personalized therapy at an affordable cost

BioNTech AG in Mainz, Germany, works on tailored medications, developing new-style, personalized immunotherapies against cancer and other serious illnesses. To this end, the biotech company is pushing ahead with its IVAC® (Individualized Vaccines Against Cancer) Mutanome platform to make personalized cancer therapies available rapidly and at an affordable cost.

BioNTech founder and CEO Dr. Ugur Sahin explains: “The production of the IVAC® Mutanome individualized vaccine is based on a standardized process that enables the creation of tailored products that vary widely in their composition according to individual patient characteristics.” This is initiating a paradigm shift in clinical development: The focus is no longer on the end product as such, but rather on the overall production process of medications tailored to individual patients. This approach also entails new conceptional, regula-

tory, technological, and clinical challenges. Immunotherapy using IVAC® Mutanome is based on decrypting the individual mutation patterns of tumors in each individual cancer patient. The appropriate synthetic RNA vaccines are then produced and matched precisely to the mutation profile for each patient.

Experienced digitalization partner

To test and verify the efficacy of these new-style therapies in extensive study programs, two key prerequisites must be met: First, the production of the personalized vaccines needs to be accelerated, and second, the vaccines must be made available in larger quantities. Running production processes in parallel and speeding them up can achieve higher capacity. Paperless manufacturing is essential to this process. Since 2015, in its efforts to optimize production time and costs, BioNTech has been drawing on Siemens’ extensive experience in digitalization to establish a fully automated, paperless, digital manufacturing process. Dr. Sahin says, “We aim to be in a position to provide hundreds of thousands of patients with personalized medications within less than five years. That will require the development and convergence of innovations in a range of different advanced technologies, such as big data, artificial intelligence, and fully automated analytics and production lines. The various components will in the future be fully

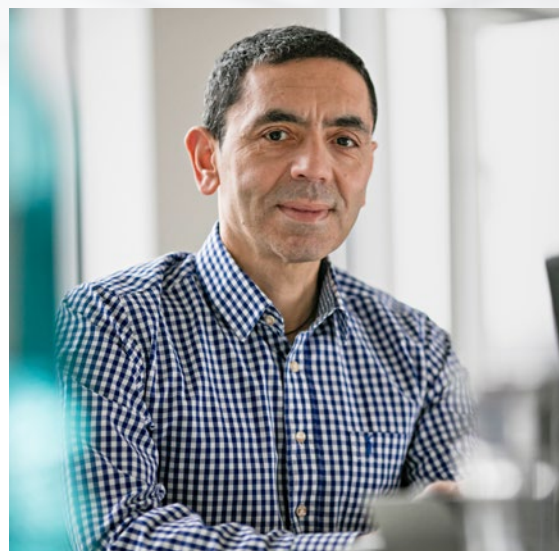




BioNTech AG

“The production of the IVAC® Mutanome individualized vaccine is based on a standardized process that enables the creation of tailored products that vary widely in their composition.”

Prof. Dr. Ugur Sahin,
Founder and CEO, BioNTech AG



BioNTech AG

digitalized and will collaborate with one another within interconnected processes. We believe Siemens has the necessary know-how to provide us with optimal support in attaining our goals.” BioNTech also greatly appreciates Siemens’ extensive portfolio and large workforce, which enable it to handle even such major projects quickly and reliably.

High quality thanks to automation

The Simatic IT eBR and Preactor manufacturing execution system (MES) are used to implement paperless manufacturing. As a result, the necessary information can be retrieved from all production processes and subsequently analyzed, archived, and applied to generate reports. This creates “regulated” flexibility, which is an essential element of state-of-the-art pharmaceutical manufacturing. The solution almost entirely eliminates time-consuming manual actions – whether in the lab, in production, in logistics, or in quality assurance. Full automation enables personnel to be deployed in an optimal way, process steps to be executed correctly, and releases to be issued as and when required. This is important in terms of the quality of documentation, and thus for compliance with all internal and regulatory requirements.

Unified process

Because the production of IVAC® Mutanome vaccines takes several weeks and involves a sequence of process steps, precise operational planning is essential. The unified MES solution comprising Simatic IT eBR and Preactor links two separate operating locations into a single continuous process – from production planning to analysis to the finished personalized medication in lot size 1. Siemens successfully ran a concept study beforehand and subsequently drafted the functional specifications in the blueprint phase. The company’s comprehensive process and pharmaceutical know-how, combined with the deployment of an experienced project team with high-caliber experts, proved ideal. The contract also includes the factory acceptance test (FAT) and site acceptance test (SAT), as well as the production of qualification documents.

Pioneering role as a challenge

With its pioneering role in research, clinical testing, and manufacturing, BioNTech is well on its way to revolutionizing the treatment of cancer through personalized mRNA-based immunotherapies. “Our pioneering

BioNTech AG, Mainz

BioNTech is a holding company with several subsidiaries combining all the technology platforms and competencies for research, clinical development, and marketing under a single umbrella. The subsidiaries specialize in different, complementary biopharmaceutical and diagnostic platforms and in the manufacturing of medications for human use.

The company’s strategy is to devise new technologies and converge innovations in order to develop and market personalized treatment approaches offering unique medical potential. As a result, BioNTech has in recent years taken on a pioneering role in the field of personalized cancer vaccines. Because every cancer case exhibits differing features, an average of only 15% to 30% of cancer patients with advanced tumors benefit from commonly available drug treatments.

Treatment tailored to the individual cancer and patient is expected to deliver much higher therapeutic success and improve chances of a cure.

work routinely throws up challenges that we have never before encountered, which means we must continually come up with new ideas and methods in order to find appropriate solutions,” states Sahin. Thanks to the global presence of Siemens and the commitment of an international team, all the preconditions for implementation of BioNTech’s planned global production rollout were met. The first market approval of the new vaccine is scheduled for the year 2021. ■

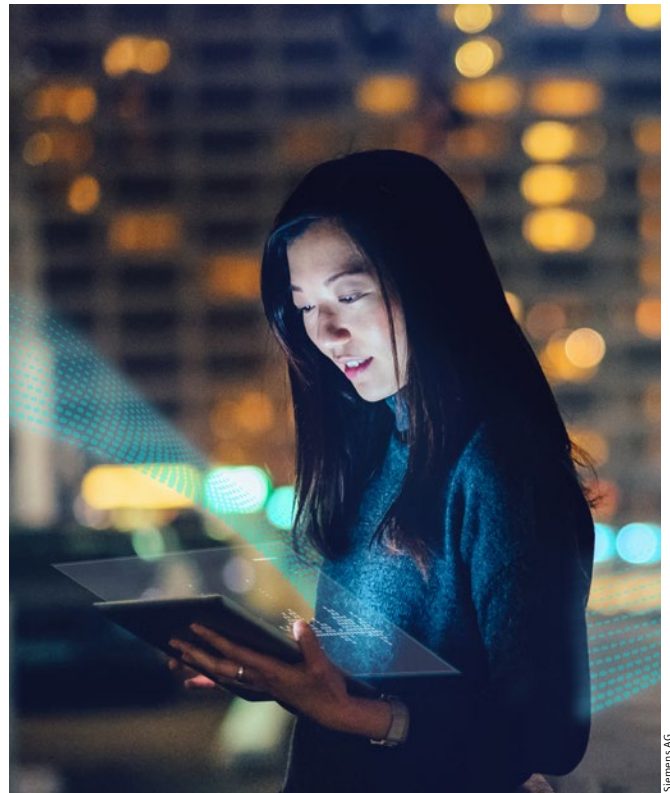
➤ [siemens.com/ingenuityforlife](https://www.siemens.com/ingenuityforlife)

Digital opportunities are fundable

Investors are increasingly interested in how companies can improve their competitive edge with the help of promising digitalization projects. In its online special, The Magazine shows how this transition can be funded.

Experts at Siemens Financial Services (SFS) are offering new and intelligent funding methods. These include use-oriented solutions such as leasing, lease financing, and asset financing. On the other hand, results-oriented financing is also becoming increasingly important. In this case, companies make investments based on the expected operating results. If a company “pays for results,” numerous options can be covered, including increases in productivity, faster market launches, higher volume capacity, energy savings, cash-flow optimization, and improvements to health protection.

➤ [siemens.com/magazine/2d0011](https://www.siemens.com/magazine/2d0011)



Siemens AG

Transformers: Data reduce costs

Energy-intensive industries such as the aluminum, steel, and automotive industries use their own transformers. A new design concept for transformers by Siemens was just recently honored with the if Award. The basic concept is the transformer as a digital high-tech product. Digitalization enables a virtual evaluation of the transformer's condition, thanks to online monitoring and the resulting comprehensive data analysis. Intelligent monitoring based on these data reduces the maintenance required as well as the operating risk, because up to 70% of developing faults can be identified in advance. This allows for predictive planning and an overall increase in grid availability, while also reducing costs.

➤ [siemens.com/transformers](https://www.siemens.com/transformers)

New servodrive system

Packaging machines, handling applications such as Pick & Place, wood and ceramic processing as well as digital printing – in all these applications companies can benefit from a new servo drive system. Working in combination with the Simotics servo motors, the new Sinamics S210 converter enables the highly dynamic movement of minimal loads as well as ultra-precise movement of medium and high loads.

Siemens is offering the new servo drive system in five power classes ranging from 50 to 750 watts. The converters come with integrated safety functions and enable rapid engineering. They are connected to the higher-level controller over Profinet and allow simple commissioning using a web server and one-button tuning.

➤ [siemens.com/sinamics](https://www.siemens.com/sinamics)

Digitalization: No two paths are the same

What's in it for my business? How will digitalization help me make significant progress? When will my investments pay off? Is there really no way around it? As digitalization continues to spread, it is becoming increasingly clear that there is no "one size fits all" approach to this trend. Every solution has to be planned according to individual requirements, and only those who can precisely identify their challenges will be able to tap the full potential of digitalization. Many examples from different sectors confirm this.



Automotive

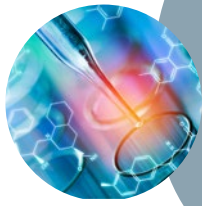
Winning the race with digitalization

In Nissan's view, the global automotive industry is now engaged in one of the greatest engineering competitions in history. This competition is all about ongoing time-to-market pressures, the consumers' mandate for more environmentally friendly cars, and a global customer base and supplier network. To ensure that Nissan is one of the winners in this race, the company has initiated its V-3P (Value Up for Product, Process and Program Innovation) plan. Siemens PLM Software provides the main solution for

Nissan's innovation process. Its digital product development and life-cycle management software gives all engineers easy access to a single source of accurate and up-to-date vehicle information. Processes are streamlined and timelines are shortened. The Siemens software for digital product development forms the basis for a system of knowledge capture and reuse that includes the entire team, from design engineers to suppliers. It enables a team to be more efficient and more innovative. In addition, digital data forms the

basis for virtual validation. This helps to find issues very early in the design process. A virtual test gives the company's engineers more time to work through design alternatives to find the best overall solution or countermeasures.

Since implementing the V-3P program, new cars have gone from styling freeze to start of production (SOP) in only 10.5 months instead of 20 months in the past. Quality has improved significantly as well under the V-3P program. Nissan achieved fewer design changes and



Chemical

Industry

Avoiding risks through simulation

Butachimie is considered one of the largest producers worldwide of polyamide 6.6. The beginnings of the Butachimie manufacturing plant in Chalampé in France go all the way back to 1955. Since 2010, the plant has been undergoing a comprehensive modernization: The company management decided to make massive investments to make the location future-proof and to bring the entire plant up to date.

Changing a system is always a risk, especially since many problems only become apparent during implementation and commissioning. With the help of digitalization it is possible to end this uncertainty, as simulation software makes it possible to create a completely virtual processing plant and run and test

all of its functions before a single mechanic has even appeared on site. Vincent Masztalerz, head of the process automation division at Butachimie, is convinced: "Digitalization is becoming the decisive factor in the industry for overcoming challenges such as increasing competitive pressure and ongoing developments in legislation, markets, and technologies." The ability to simulate the modernization project was the key to its success – in France, the plant serves as an example for the factory of the future. ■

Read more about the modernization at Butachimie and the potentials of digitalization in the chemical industry in our online special.

What's in it for... Chemical Industry?

The products of the chemical industry and their production are often accompanied by elevated risk. The requirements for securing the processes as well as maintaining constant production quality are enormous. Many plants run for decades and are only shut down for maintenance work. Digitalization not only makes it possible to modernize plants while simultaneously controlling risks – for example, via simulation – it also helps to intelligently control processes and indicate changes ahead of time in order to prevent escalations.

➔ [siemens.com/magazine/2d0003](https://www.siemens.com/magazine/2d0003)

fewer problems reported after a vehicle was released to the market. And finally, the company reports that the V-3P program exceeded the originally expected return on investment. ■

Read more about the potential of digitalization for automotive in our online special.

What's in it for... Automotive?

The automotive industry is a very competitive and capital-intensive industry. Digitalization supports automotive manufacturers and their suppliers mainly in managing the growing complexity. Thanks to the digital twin, the ridgeline is reached sooner after commissioning of a new plant. The product as well as

the production process was built up, checked, and tested in a simulated world beforehand. Thus, failures during production are prevented right from the start. The amount of valuable production data is used to optimize production and to design new models.

➔ [siemens.com/magazine/2d0002](https://www.siemens.com/magazine/2d0002)



New growth areas

What has been happening for years in the pulp and paper market can without a doubt be called a paradigm shift: The demand for paper has been continuously declining by about 5% every year since the early 2000s. Stora Enso, a leading supplier of renewable solutions in the area of packaging, biomaterials, wood construction, and paper, was forced to adapt its strategy.

The challenge was to turn the problem of a changing market into an opportunity. The company began by cutting back on production of graphic paper; instead, it invested in new growth areas, such as wood-based building materials, packaging materials for the food industry, and wood-based biochemical products. “Electrical engineering and automation technology play an essential role.

There’s practically no other industry with a similarly high density of technology as there is in a paper machine. At the beginning of the process alone, we have to control 50 process parameters while handling natural materials with a high degree of variation. For this, we need a correspondingly powerful process control system,” explains Dr. Heinz Felder, head of Group Investments and Capex at Stora Enso. “One of the most important new investments by Stora Enso was a factory for liquid cardboard in China, where the technical foundation for future digitalization was laid with a state-of-the-art automation system. Among other things, we implemented a cloud-based system for analyzing the process controllers,” says Engelbert Schrapp, the responsible key account manager at Siemens. “In

Stora Enso’s pulp and paper mill, the cloud technology is intended to help make the performance of the overall plant more efficient. Digitalization means a wide variety of ways to intelligently utilize volumes of data that are becoming increasingly larger. In view of this, the company is also increasingly investing in modernizing and expanding existing plants as well as in new plants.” ■

Read more about the potentials of digitalization for manufacturers in the pulp and paper industry in our online special.

➤ [siemens.com/magazine/2d0004](https://www.siemens.com/magazine/2d0004)

What’s in it for ... Fiber Industry?

Using simulation software, production lines are engineered in a very short time. The data generated during this process are saved on a platform and used for process optimization. The same data are also the basis for

a predictive maintenance concept: Using the load data, it is possible to plan the replacement of components ahead of time, which prevents downtime. This results in greater and more secure production availability. Digitalization makes it possible to intelligently control process and processing steps and ensures the quality of the product at a consistently high level.

The secret ingredient: data

Food safety and quality control are key for dairy producers. A container of milk passes through 35 production steps and is subject to 105 tests before reaching consumers. The China Mengniu Dairy Company Limited is leading the way in this transformation by rolling out quality control information management and enterprise resource planning systems at 36 labs and facilities throughout the country.

As the Mengnui company grew, inspectors had to process an ever-growing mountain of data. Mengnui has long been aware that there is an urgent need to upgrade the traditional manual quality control to a digitized system. Mengnui turned to Siemens for help. The result: a twofold software and hardware solution combining the Laboratory Information Management System with Totally Integrated Automation solutions.

Since the go live in 2015, testing times have been reduced by 10% to 25% and efficiency increased by more than 15%. Mengniu can now trace quality problems to any step,

from receiving or preprocessing all the way to the exact location in the warehouse. ■

Read more about the potential of digitalization for food and beverage in our online special.

➤ [siemens.com/magazine/2d0005](https://www.siemens.com/magazine/2d0005)

What's in it for ...

Food & Beverage?

For companies in the food and beverage industry, made-to-order products and their marketing is playing an increasingly important role. The necessary flexibility can be accomplished using digitalization. Intelligently connected horizontal and vertical processes of the value added chain can also improve transparency, planning security, quality, and customer focus in food production. In addition to this, digitalization also helps optimize energy consumption, production processes, batch tracking, or the use of raw materials and to generate production-related operating figures for the management.



Glass



Higher flexibility through digital engineering

Independent from the degree of automation, every modern glass plant and every OEM generates and collects digital data. But much of this information is lost. The data need to be evaluated, combined intelligently, and expanded with the help of additional sensors and probes to optimize the plants.

The US glass manufacturer Gallo Glass successfully implemented this approach. To retrofit its plants, the company commissioned EME Maschinenfabrik Clasen GmbH to configure and upgrade the batch plant and parts of the cullet return

system at its glass bottle production facilities. At the same time, the end-to-end automation system for the entire plant was equipped with a standardized process control system with simulation software – which was also a first. Especially for the batch plant, this was a challenging task. There were several hundred different combinations and transportation routes that the batch (raw materials) could follow on its way to the furnaces. With the new solution, weighing, mixing, and conveyor applications could be integrated

into the automation system, taking considerable pressure off the operating staff. As an overall result, the production process could be designed to be more flexible and safer. ■

Read more about the potentials of digitalization in glass production in our online special.

➤ [siemens.com/magazine/2d0006](https://www.siemens.com/magazine/2d0006)

What's in it for... Glass production?

Digitalization makes it possible for glass manufacturers to effectively and comprehensively collect plant data that are generated during operation. This creates optimization potentials that can permanently reduce operating costs for glass plants – if applied consistently. The digital twin is tested prior to the commissioning of plant sections, which makes it possible to optimize the entire plant during operation – without limiting productivity and availability.

Efficient engineering reduces development costs

“Increasingly shorter project times combined with sophisticated requirements from our customers for the quality, flexibility, and performance of control software made us look for solutions to make the automation process more efficient, while also optimizing the engineering process,” says Andreas Schöller, corporate vice president at Eisenmann. The plant manufacturer from Böblingen, Germany,

relied on TIA Portal to create a sustainable automation standard. Using the in-house E-PASS standard, Eisenmann harmonized the entire control software for all plant types. This new standard is based on TIA Portal and the Simatic S7-1500 control. The advantage for Eisenmann: The software can be created using automation, leading to a shorter development time while ensuring the high quality of the software.

In addition, virtual commissioning ensures that there are no functional faults in the software. The plant manufacturer can familiarize the operators with the plant model and train their employees at a very early stage of the project. Change requests can also be integrated in the development early on. In the future, Eisenmann’s project data will be stored in a cloud. To realize this, the developers connected a first test plant to MindSphere, the cloud-based, open IoT operating system from Siemens. “Cloud-based systems enable an increase in plant performance by collecting and analyzing huge amounts of production data,” Schöller explains. ■

Read more about the potential of digitalization for machine and plant construction in our online special.

➔ [siemens.com/magazine/2d0007](https://www.siemens.com/magazine/2d0007)

Machinery



What’s in it for ... Machinery and Plant Construction?

Digitalization helps machine and plant manufacturers react flexibly and swiftly to continually changing customer requirements. Using powerful engineering platforms, their plant software can be configured and programmed efficiently, ensuring that the project starts quickly and with no problems. With a digital twin, it is possible to test the plant beforehand and the customer can give feedback early on, allowing them to be part of the development process. Cloud solutions such as MindSphere have the potential to use the enormous amount of field data for ongoing development and new services: for example, predictive maintenance.

Construction

Plant

One system connecting all sites

For Brazilian mining operator Vale, a Manufacturing Execution System (MES) provides comprehensive transparency along the entire value chain – from the pit right through to the port. By the end of 2017, 40 of Vale's sites will be connected to the new MES.

The wish for simpler, more flexible operation, with standardization across all communication as well as user interfaces – that is what drove Vale to search for an MES for its mining sites around the Brazilian cities of São Paulo and Belo Horizonte. Since October 2016, 13 of the 40 planned plants have already been connected to the MES from Siemens; the remaining 27 are set to follow during the course of 2017.

With the new MES, Vale profits from the ability to compare the operating performance indicators from all sites to one another. That provides a high degree of transparency along the entire value chain.

What's in it for...

Mining?

Declining ore grades and price volatility are two of the biggest challenges facing mining operations. Through the intelligent use of process data, it is possible to improve asset utilization, logistics, and maintenance. Streamlined operations are the result. Furthermore, with a higher degree of digitalization mines can increase their flexibility and be able to more quickly adjust to changes in the market.

Thanks to an open structure, continuous system improvements can be made at any time – and the MES is also configured to allow expansion in step with Vale's growing requirements. To date, 19.5 million tons of iron ore have already been shipped using the newly commissioned MES. ■

Read more about the potentials of digitalization in mining in our online special.

➤ siemens.com/magazine/2d0008





P_{harmaceutical}

Industry

Affordable personalized therapy

BioNTech is doing pioneering work in the fight against cancer with a custom-made vaccine. In order to produce this personalized active ingredient faster and in larger amounts, the company relies on a completely paperless production. For optimizing production time and costs, BioNTech has been collaborating with Siemens as a partner since 2015 to design a fully automated, paperless, and digital production process. Prof. Dr. Ugur Sahin, founder and CEO of BioNTech AG explains: “It is our goal to be able to provide hundreds of thousands of patients with customized medicine in less than five years. This means we will need to develop and merge innovations from different future-oriented fields such as big data, artificial intelligence, and fully automated analytics and production plants.” You can read the entire story on page 20 of this issue. ■

What's in it for... Pharmaceutical Industry?

Digitalization makes new production technologies possible: For example, the continuous production of pharmaceutical end-products and active ingredients as well as modular production technologies and the production of individual medicines. Using integrated engineering to connect the worlds

of plant planning and automation, it is possible to shorten planning and setup time in plants, which accelerates the introduction of medicines to the market. Consistent data storage from product development all the way to production increases quality by preventing transmission errors.

Read more about the potentials of digitalization in the pharmaceutical industry in our online special.

➔ [siemens.com/magazine/2d0009](https://www.siemens.com/magazine/2d0009)

Smart sewage treatment

At its newly built treatment facility in Gaobeidian, the Chinese company Beijing Drainage Construction Company (BJDC) has set an example in how to complete the transition from waste management to waste recycling. To reduce secondary pollution, BJDC utilizes cutting-edge recycling technology developed by the Norwegian Cambi company, combined with Siemens process instruments.

BJDC's recycling plant now creates a host of reusable byproducts, including electricity from the methane gas, biological fertilizer, and construction materials.

What's in it for ...

Water Industry

From a global perspective, clean water is a scarce and valuable resource. In order to provide clean tap water for drinking and manage sewage waste in urban areas, resources need to be managed. Automation and digitalization are crucial to managing a stable and reliable supply process by monitoring and optimizing the process, but also to physically achieving real-time decentralized control. Based on this, smart water management provides resource and energy efficiency.



Water

Industry

Prior to its installation, BJDC was concerned that the process instruments might not be easily implemented into the remotely designed system in the real-world recycling plant. However, the modular design of the flowmeter ensured that the engineers could install it in segments while taking on-site conditions into consideration.

Despite the corrosive atmosphere, the instrumentation has run reliably and accurately since the first day. The technology proves to be truly robust, designed for long-term use in harsh environments, suitable for all-around applications, and ensures high measuring accuracy. ■

Read more about the potentials of digitalization in glass production in our online special.

➤ [siemens.com/magazine/2d0010](https://www.siemens.com/magazine/2d0010)



Siemens AG

Plant modernization made simple in the virtual world

Integrated and linked 2D and 3D information is an important precondition for the digital twin. The digital twin is a virtual image of a process plant that is generated during the engineering process. It allows operators to consistently and efficiently manage and maintain their plant and engineering data throughout the entire lifecycle of the plant, and it gives them a better overview of their operational costs and lets them detect and avoid conflicts in time.

Siemens and Bentley Systems have merged their digital engineering models. The data are kept consistent with an interface between the engineering solutions Comos and Bentley's OpenPlant. This is especially beneficial for modernization projects, because the real, existing plant can be digitalized even if it has already been in operation for years, if not decades. This means that the worlds of planning and operations are in perfect synergy at any given time, and also ensures efficient workflows and higher productivity and quality.

➔ siemens.com/magazine/2w0535

Flender under a new umbrella

Flender gears and couplings have been an integral part of the Siemens product portfolio since 2005. Until the present, this field was managed by the Mechanical Drives Business Unit in the Process Industry and Drives Division of Siemens AG.

To expand its room to maneuver and align it more strongly with business-specific requirements, Siemens will now manage the business selling Flender gears and couplings as an independent company under the Siemens umbrella. In the medium-sized business environment, the company can optimally tailor its products and services to its customers' needs. By focusing on mechanical drive technology, it will be possible to provide even more goal-oriented consulting services. Processes will be trimmed back and accelerated. This will also have an impact on services, since the worldwide service units will become a fixed component of the new company. With condition monitoring and condition diagnostics systems, the mechanical components will be integrated into the digital machine and plant world with increasing intelligence.

➔ siemens.com/drives

More flexibility in process automation

Digitalization is already well on its way in the field. That is why the new V9.0 version of the Simatic PCS 7 process control system is focused even more intensely on Profinet. The Simatic ET 200SP HA and the CFU (Compact Field Unit) have also been added to the innovative hardware I/O portfolio. The process control system also offers new functionalities in the software area. It accelerates the configuration process from the engineering and commissioning stage all the way to the ongoing plant operation, thus helping plant operators and maintenance personnel be more productive.

➔ siemens.com/pcs7

Design anywhere, build anywhere

A global leader in agricultural solutions uses Teamcenter and Tecnomatix to support their “design anywhere, build anywhere” strategy. At AGCO Corporation, this results in improved data and production quality and enables the company to respond faster to changes.

With its global footprint, AGCO Corporation has pursued a design anywhere, build anywhere strategy in tandem with a platform product architecture. The goal is to more efficiently develop, manufacture, and manage the company’s large portfolio of products. With that goal in mind, AGCO adopted Teamcenter software for product life-cycle management (PLM) and Tecnomatix software for digital manufacturing – both from Siemens PLM Software. They first deployed the software at the company’s Hesston, Kansas facility.

Several factors influenced AGCO’s decision: the need for manufacturing work instructions and their practice of using stand-alone, paper-based work

instructions; their need to better manage design engineering process changes; issues with the use of the engineering bill of materials (EBOM) in the company’s manufacturing resource planning (MRP) system and manufacturing execution system (MES); and their desire to better serve the needs of manufacturing engineering in developing the manufacturing bill of materials (MBOM) and process plans.

Reuse results in huge savings

“We build the same product at various sites,” explains Susanne Lauda, global project lead, manufacturing automation at AGCO. “We want to reuse the bill of process, we want to reuse the MBOM, and we want to



Teamcenter and Tecnomatix provide more traceability of single products throughout the year

AGCO Corporation

AGCO Corporation is a global leader in the design, manufacturing, and distribution of agricultural solutions that support more productive farming with a full line of equipment and related services. AGCO products are distributed globally in more than 140 countries. AGCO is headquartered in Duluth, Georgia, and had net sales of \$7.5 billion in 2015. Founded in 1990, AGCO has grown dramatically and now has a strong global presence with more than 40 manufacturing sites around the world.



Siemens AG

High-tech solutions from AGCO support farmers feeding the world

reuse the majority of our electronic work instructions, so it makes a lot of sense that our manufacturing engineers work on a common global platform. With the use of Teamcenter, we're able to have one site that basically does 80% of the work that is necessary for all sites that are building the same product – so that is a huge savings."

"In the case of design anywhere, build anywhere, all of our new product introductions are going to be platform-oriented and will reuse data," says Gary D'Souza, manufacturing engineering lead, global manufacturing PLM at AGCO. "In our design engineering, we're trying to standardize the part numbers and the designs of parts so we can reuse them from platform to platform, from module to module, and from region to region," he says.

Managing various sites

One of AGCO's first initiatives using the new software was aimed at providing electronic work instructions (EWIs) to replace hard copy work instructions at its manufacturing sites. The goals are to achieve more traceability for model year changes, to provide a better understanding of the product structure, and to better manage different structures at different manufacturing sites.

"This detailed step-by-step process of how to assemble a machine gives the operator better visibility of the process," says Anvesh Kulkarni, a manufacturing engineer at AGCO's Hesston plant. "The new operators coming in can pick up very easily compared with what it was like when we had paper bundle work

"In the case of design anywhere, build anywhere, all of our new product introductions are going to be platform-oriented and will reuse data."

Gary D'Souza,
Manufacturing Engineering Lead,
Global Manufacturing PLM at AGCO Corporation

instructions. These electronic work instructions have created better training materials, and not just for the shopfloor. They're also used in new product introductions to analyze and establish a better process." ■

➤ [siemens.com/teamcenter](https://www.siemens.com/teamcenter)

➤ [siemens.com/tecnomatix](https://www.siemens.com/tecnomatix)



Control cabinet manufacturers benefit from a digital twin that allows them to virtually double-check almost every step

Control cabinets – planned and built digitally

Digitalization has arrived in control cabinet engineering. Virtual planning and digital processes throughout the entire lifecycle create unimagined competitive advantages for control cabinet manufacturers.



“Siemens supports control cabinet manufacturers with software and interfaces to build an end-to-end digital workflow.”

Heiko Schielzeth,
Siemens Control Products,
responsible for Sales & Marketing

Control cabinets are the core of every plant. Today the planning and engineering of control cabinets is already completely supported digitally. The digital workflow has numerous advantages. Tasks that used to be performed successively can now be done at the same time, which dramatically reduces project time.

Digital twin in control cabinet engineering

A digital twin allows the e-engineers to virtually double-check almost every step of their plans. This saves time, ensures quality, and reduces engineering costs:

For example, when changes that will have an impact on subsequent steps in the workflow can be simulated virtually beforehand.

An added bonus, thanks to digitalization in control cabinet engineering, is that all data are stored and are reliably and permanently accessible, from technical product data, simulation data, and results to analysis and diagnostics data.

Every process step can be digitalized

The digital workflow in control cabinet engineering includes three major process steps: mechanical design, automation, and electrical

design. Mechanical design determines what actuators and sensors will be used in production. In automation, the control and communications components are selected and the process logic is programmed. And finally, in electrical design the circuit diagram and the switching and protection components are defined and the mechanical setup of the control cabinet is planned. There are efficient software tools for optimizing the progress of the individual phases for every one of these process steps.

Digitally from one step to the next

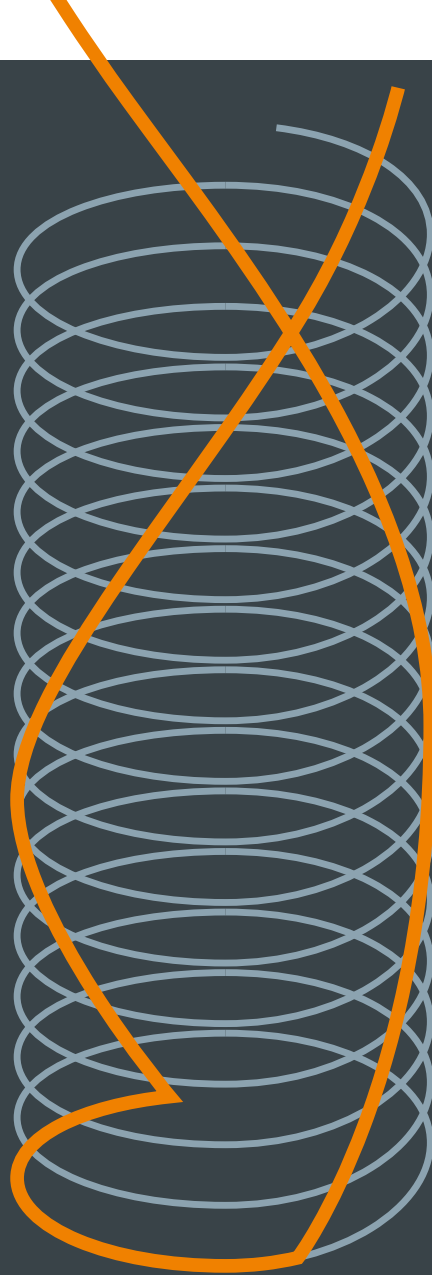
“We see great potential mainly in the transition from one project phase to the next,” says Heiko Schielzeth, who is responsible for distribution and marketing at Siemens Control Products. Thanks to the digital forwarding of reliable data, the effort necessary for data collection and the subsequent changes are reduced. “That is why Siemens supports control cabinet manufacturers with software and interfaces to build an end-to-end digital workflow, not only in control cabinet planning but also throughout the whole lifecycle of the control cabinet,” Schielzeth explains. ■

Support in the event of new legislation

Guaranteed support in case of new guidelines: When new European guidelines were adopted in national legislation in April 2016, Siemens helped its customers put the requirements into practice using its own software and configuration tools. For example, the heat calculation tool Simaris therm can be used to calculate and document the heating limits of low-voltage switchgear combinations. The software contains data on the verified, maximum dissipating power of more than 25,000 products.

The Siemens Industry Online Support Portal (SIOS) fulfills the increasing demand for documentation. Electronic documentation, single chapters, or text blocks can be neatly combined and structured in a webbased software tool. In addition, an individual handbook can be compiled for every control cabinet as well as every machine and plant – at the push of a button, even in several languages.

➔ [siemens.com/panelbuilding](https://www.siemens.com/panelbuilding)



Thread – punched, not formed

Engineers at Emuge-Franken and Audi have revolutionized a small but mighty part of automotive production with a new method for thread forming. Production time has been reduced by 75% compared with conventional technologies.



Siemens AG

Dietmar Hechtle (right), head of the engineering office at Emuge-Franken and Alois Penzkofer, Siemens, put the Punch Tap technology into practice

“Punch Tap represents a completely new technology for producing internal threads. And we were able to support them with our mechatronics experts.”

Alois Penzkofer, responsible for the development of Punch Tap technology, at Siemens Motion Control

Drilling, milling, forming – internal threads have been produced based on one of these three technologies for decades. It used to be clear to many industry experts: This is how it is and there is no way to change it. Think again. “With Punch Tap, experts at the tool manufacturer Emuge-Franken and the automotive manufacturer Audi have created a new technology – and we were able to support them with our mechatronics experts,” says Alois Penzkofer of Siemens.

The so-called helical thread forming is a combination of punching and forming – a revolution.

Compared with the other processes, the internal threads can be produced 75% faster.

Vital impetus from Audi

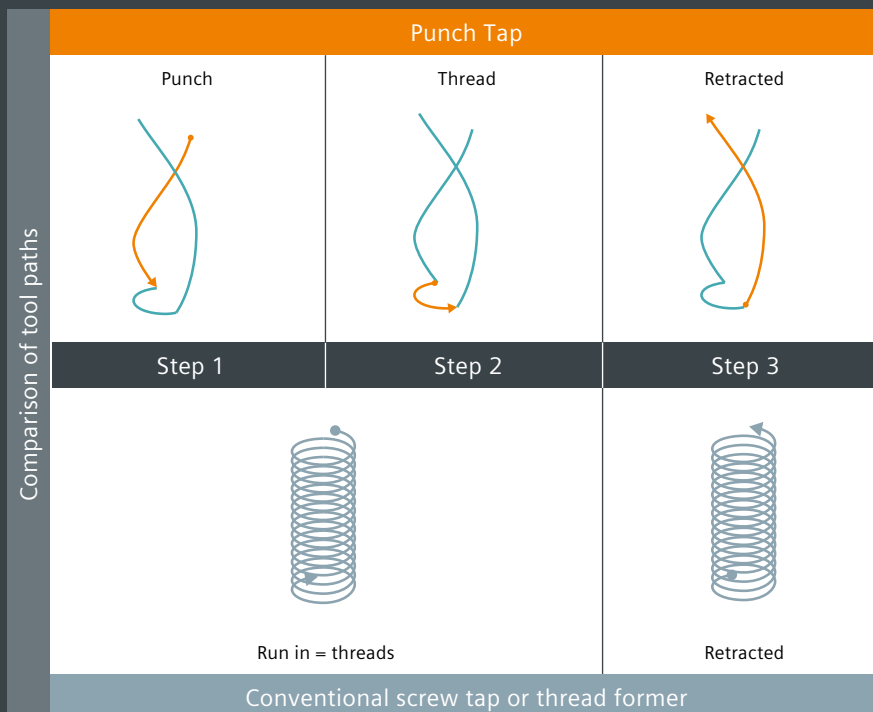
“Audi initiated the development of the Punch Tap technology and provided crucial impetus,” says Penzkofer. The automotive manufacturer emphasized a clear geometry and strong retention forces for the punched internal threads. Emuge-Franken managed to produce the thread size M6, the size most used in motor blocks, in aluminum at a comparable quality using the new, patented principle.

To find out what forces occur at specific spots on the machine during punch tapping, Emuge-Franken got mechatronics experts from Siemens on board. Virtual data also supported the development of the new technology. Using a finite-element model, the engineers simulated the stresses occurring during Punch Tap on a computer. They then examined the sensitive spots in the machine and determined benchmark data based on their findings that processing centers must fulfill in order to be suitable for Punch Tap.

“At the same time, we developed a cycle that enables operators to simply integrate the helical thread forming in a CNC program, which is possible with the latest generation of controls from Siemens,” explains Penzkofer.

Huge demand

The new technology is much in demand because it provides a huge competitive advantage. That is why Audi and Emuge agreed on a retention period for companies in the automotive sector. Automotive suppliers can already use Punch Tap, but manufacturers will only be allowed to use it beginning in January 2018. Good news for all other industrial branches: They have access to the new technology immediately. ■



➔ [siemens.com/sinumerik](https://www.siemens.com/sinumerik)

Finish the job faster with additive manufacturing

A small team in Finspång in Sweden has revolutionized the development, production, and repair of gas turbine components – using additive manufacturing. Here Siemens is proving just how powerful this technology is and showing what is needed for successful implementation.

Acquired by Siemens in 2003, the Finspång plant produces industrial gas turbines up to 54 megawatts. At the new production site, more and more components will be printed in 3D. This will bring unexpected design possibilities and is faster and more flexible than conventional production.

“This technology has nothing but advantages compared with standard production,” says Vladimir Navrotsky, chief technology officer of the Distributed Generation Service Business Unit at Siemens. “Our production is more flexible, cheaper, and more economical. At the same time, our customers receive upgrades faster.” The significant reduction in cycle time makes both Siemens and its customers more competitive, he adds. In Finspång, lasers flash as they melt metal powder and create eight gas turbine burners at once out of millions of layers.

This is additive manufacturing (AM) in its most advanced form, with unique 3D printers using four lasers that were developed for Siemens in collaboration with the manufacturer EOS. Now Siemens can finish what once took almost a year in just a few weeks – 10 times faster than before. Because 3D printing processes consume up to 80 percent less energy and therefore produce fewer emissions, they are also environmentally friendly.

AM as an element of digitalization

In Finspång, what experts anticipated from 3D printing for years is now becoming a reality. This example clearly shows the advantages that production with AM technology can bring. “We want to give our customers a chance to tap the full potential of AM applications.

Siemens has been active in the field of developing and using additive manufacturing for some time now,

Additive manufacturing today

AM-specific product design and simulations can be generated using the PLM software NX. The coherent data management in Teamcenter guarantees consistent data. The scalable and consistent portfolio of the Sinumerik and Simatic automation systems is perfect for automating machines and downstream processes. The engineering software TIA Portal enables efficient engineering and the highest level of flexibility.

In the future, detailed order planning and control that provides accurate parameters and traceability throughout the entire process chain can be performed with software modules from the Manufacturing Operations Management portfolio.

and is the only company to offer an end-to-end software and automation solution for this technology,” says Martin Gehringer of the Siemens Additive Manufacturing Competence Center. “We combine innovation with years of experience in traditional applications and sectors such as aerospace, automotive, and energy. We are making AM a reality.” Especially in industrial settings, machines have to work reliably and be available at all times. “Integrated intelligent automation concepts with measurement and control technology working in real time make an important contribution,” Gehringer explains. “They ensure efficient production processes and high machine availability, and lay the foundation for horizontal and vertical integration into the manufacturing landscape.”



Lasse Burell

Additive manufacturing
in Finspång

3D printers

with four lasers

10x

faster

80%

less power required

Additive manufacturing produces unexpected design possibilities, and the manufacturing of gas turbine components is faster and more flexible than conventional production

New: completely integrated data

There are still obstacles when integrating classic and additive manufacturing. The design for 3D printing is based on completely different design methods and creates completely different data formats. In the context of digitalization, the industry also relies on integrated software tools for all phases of product development as well as on a seamless documentation of all relevant data on the product. To integrate additively manufactured parts into these systems, previous data formats need to be converted or product information added. Siemens has now closed this gap.

Siemens has developed a completely new technology, Convergent Modeling. Convergent Modeling is now part of the Siemens PLM software NX, which

means that, in the future, product developers can design products for 3D printers using the CAD tool they are familiar with, without having to convert their data. The seamless traceability of all product-relevant information is ensured. ■

➤ Read the whole article on 3D printing of gas turbines online at [siemens.com/magazine/3w0175](https://www.siemens.com/magazine/3w0175)



Reliable under extreme conditions

In a desert country such as Oman, the operating conditions can get very challenging for the communications infrastructures. The technology has to be rugged enough to withstand temperatures of up to 50°C to avoid production outages.

The Sultanate of Oman is located at the southeastern tip of the Arabian Peninsula and mostly consists of desert. Extreme climatic conditions dominate the scene: Along the coastline, up to 90% humidity and monsoon-like rains are the norm. In the rest of the country, temperatures can rise as high as 50°C. These are challenging conditions for the network infrastructure of Petroleum Development Oman (PDO), which accounts for 70% of country's oil and gas production and exploration.

Rugged communications technology in the desert

In the past, the company used communications equipment that required air-conditioned enclosures, but these systems proved to be too unreliable and costly. Therefore, PDO commissioned Siemens with the task of modernizing the technology.

The requirements were highly demanding: A cluster of oil wells can stretch across an area of 30 km². Each of them is equipped with numerous sensors. The individual sites are connected to a

central gathering manifold station via a fiber-optic cable. From there, the data is transferred via another fiber-optic cable to a local control room. Here, the production process can be monitored from a safe distance with the help of visualization software. At the same time, the data is delivered to the PDO headquarters in Muscat, the capital of Oman.

The company has been using Ruggedcom components at every key point of this networked system for several years. They can withstand temperatures between -40 and +85°C, have no fans, and also do not require an air-conditioned control cabinet. PDO also benefits from the ability to fully manage and monitor the components from any remote location.

Avoiding costs and risks

Ruggedcom components are ideal for communication and control tasks in industrial sectors in which sending a service technician to remote production sites is not only time consuming but also a costly and dangerous procedure. "Since we installed the first Ruggedcom switch seven years ago, we have not had a single failure," says Al Kharusi, project engineer at PDO. ■

"Since we installed the first Ruggedcom switch seven years ago, we have not had a single failure."

Al Kharusi,
Project Engineer at PDO

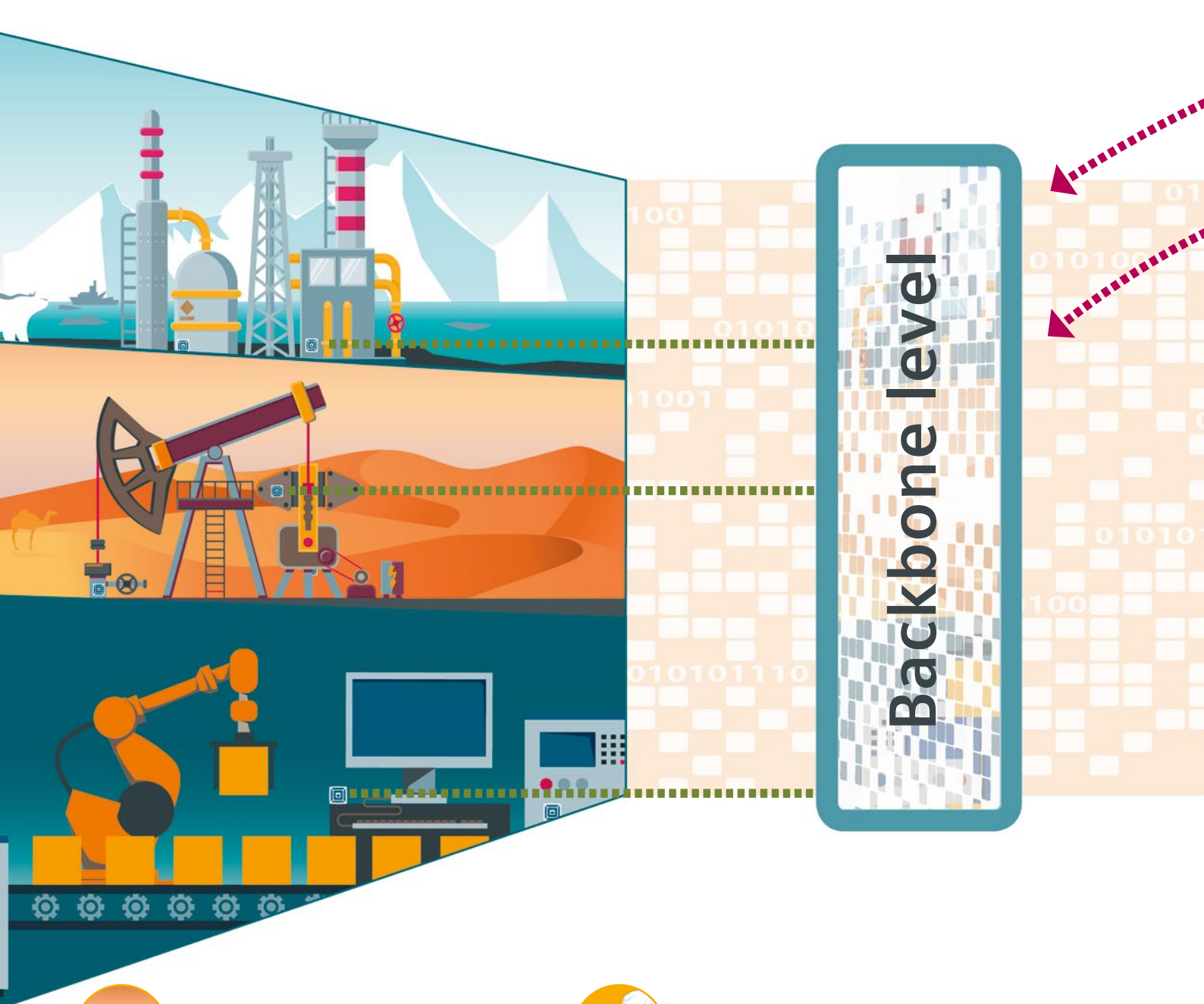
Secure and easy data exchange

Industrial digitalization would not be possible without industrial communications networks. They enable the seamless exchange of information between a company's automation and IT levels and make connectivity with cloud platforms possible: for example, MindSphere, the cloud-based, open IoT operating system.

Powerful industrial communications networks are a vital prerequisite for industrial digitalization. "We could consider them to be the 'veins of the digital factory.' And compared to office networks, they are also much more demanding in terms of availability, robustness, flexibility, and security," explains Herbert Wegmann, consultant for Industrial Communication and Identification at Siemens.

Data integration and a functioning industrial network – from sensor/actuator to an ERP system, or to cloud platforms such as MindSphere – are the basis

for digitalization (Industrie 4.0 or IoT, respectively). Industrial communications networks must therefore also meet the future requirements of digitalization solutions. It must be possible to flexibly expand them: for example, in a modular design. Machine-to-machine communications and location-independent availability of all relevant data must be guaranteed to realize operations like cloud-based services in the area of predictive maintenance. This is made possible by a common language that is appropriate for meeting diverse application demands.



Robust

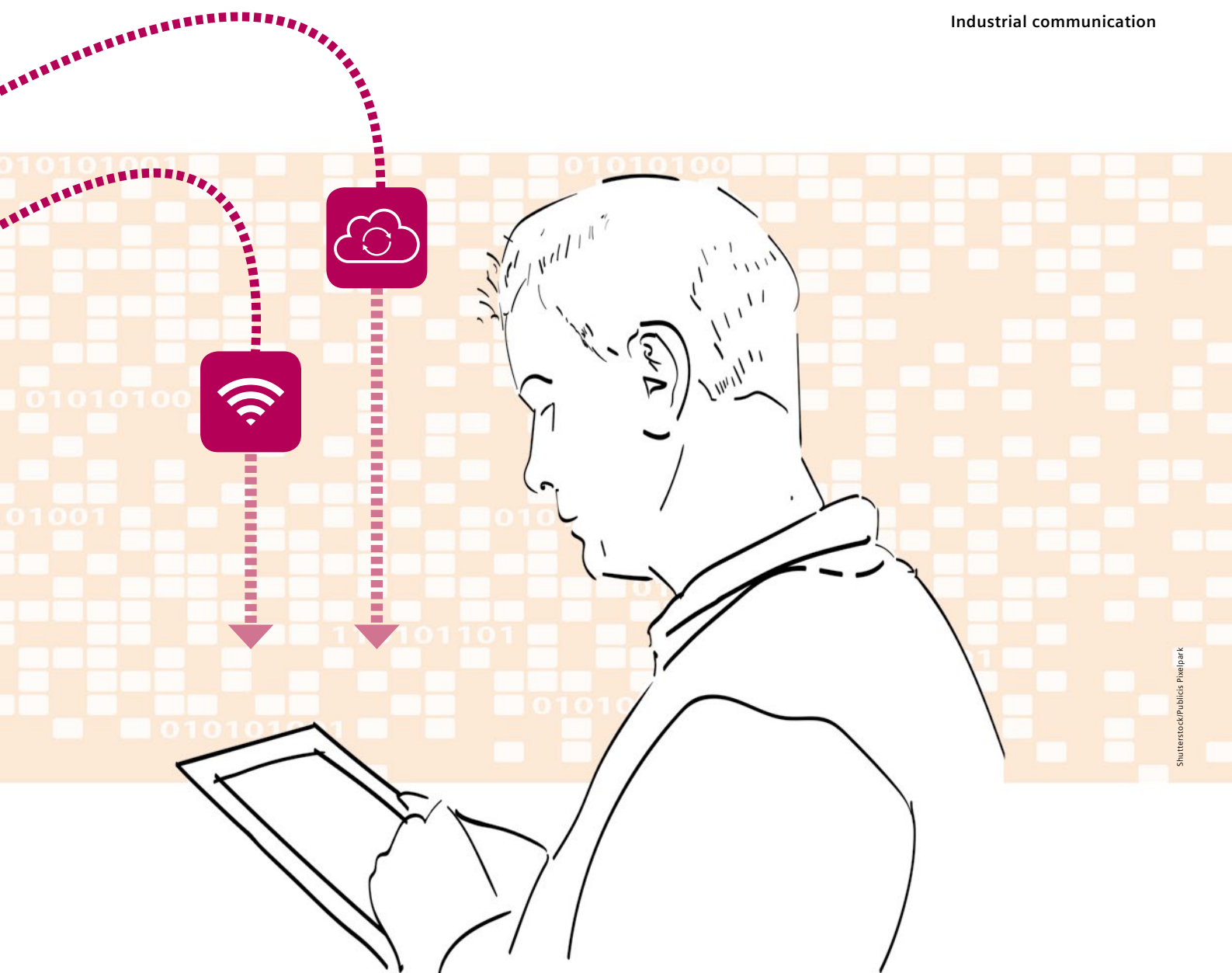
As part of an automation concept, communications networks must be highly available and robust, because downtime costs time and money. In industrial environments, both occasional network problems and prolonged downtime for troubleshooting are unacceptable. It is also essential for users to be able to quickly and easily replace devices in the system. Networks must also meet the requirements of the periodic control processes. Some applications require fast cycle periods, for example the switching over of machines via an emergency button into a safe status.



Flexible

Some industrial plants have long lifecycles, for example, in the chemical industry. When planning and implementing industrial networks, existing systems must therefore be taken into account and integrated. This also applies to a company's IT. "Practical experience has shown that 'one size fits all' does not work for industrial networks. After years of experience in automation and communications technology, we offer special network designs that are tailor-made for applications in a variety of industries," Wegmann says.

Siemens provides extensive services in these areas. As a solution provider, the company is experienced in conceptualizing, planning, and implementing industrial networks. Siemens also offers clients a comprehensive training portfolio and final certifications.



Shutterstock/Publicis Pielpark



Secure

Data security is particularly important. In order to thoroughly protect their industrial plants from both internal and external cyberattacks, companies need solutions for all levels, from the operational level to the field level and from access control to copy protection. Siemens relies on a nested defense – “Defense in Depth” – as overall protection concept, following the recommendations of the leading standards for security in industrial automation ISA99/IEC 62443.



Universal application

In order to meet the goals and requirements of the digital factory, a continuous network topology alone is not enough. A common language is also needed, ideally one that accommodates different vendors. The Unified Architecture Protocol of the Open Platform Communications Foundation (OPC UA) is ideal for this purpose. “OPC UA is an important step for us. It is open and standardized, and it provides adequate semantic information and translation options. It is also simple, extendable, and easily maintained. It offers a high level of security for various manifestations. Thanks to its low memory and processor requirements, it can be implemented on small devices,” Wegmann summarizes. For OPC UA, Siemens offers its clients a comprehensive portfolio of products for all levels, from cloud connectivity to the manufacturing level. ■

The cyber guards

“More potential targets for cyberattacks” is the most frequently cited reason for being very cautious about digitalizing production. Is this a legitimate concern? No, say the security experts at Siemens.

A current statistic published by ICS-CERT, the U.S. authority for protection from cyberattacks, shows that the number of attacks to critical infrastructures is increasing. According to the consulting firm KPMG, twice as many companies fell victim to cyberattacks in 2015 compared with two years before. Neverthe-

less, “The growing number of cyberattacks is a fact we cannot ignore. This, however, must not be a reason to avoid digitalization in industrial production.

We should consider cybersecurity a competitive advantage rather than a cost factor,” emphasizes Helmuth Ludwig, chief information officer at Siemens.

That is why Industrial Security, the comprehensive security concept, is an essential component of the Digital Enterprise, Siemens’ Industrie 4.0 solution. Ensuring industrial security requires continual monitoring and adaptation of new security measures.

Among others, the Computer Emergency Response Team for



“Users only trust providers that deal transparently with vulnerabilities discovered in their products.”

Klaus Lukas,
ProductCERT Leader at Siemens

Products (ProductCERT) is responsible for cybersecurity at Siemens. “Users only trust providers that deal transparently with discovered vulnerabilities in their products,” says ProductCERT leader Klaus Lukas. To safeguard its customers’ digital world, his team has a three-step approach: prevention, early identification, and professional treatment of security vulnerabilities in Siemens products.

Everything for IT security

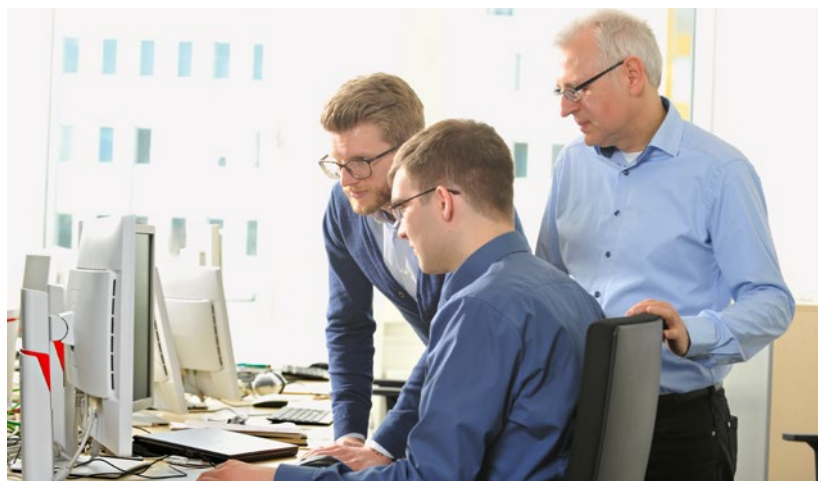
Siemens products and solutions also contain some third-party components. “Attack technologies and methods evolve and improve, meaning the status of a component that had been safe yesterday may change overnight,” explains Oliver Hambörger, security expert at ProductCERT.

That is why he and his colleagues are always on the lookout for new information on security vulnerabilities. They closely check every piece of information: Is the software used in Siemens products, and if so, in which ones? How critical is the security vulnerability? If necessary, updates to the third-party component are immediately implemented in the product or solution.

This is only one of many factors, because the Siemens software portfolio is also growing steadily due to digitalization.

A watchful eye

At the same time, the digital plant must be protected. Updates, patches, and permanent monitoring are indispensable elements of Siemens’ repertoire for its products, and they are more important than ever because the Internet of Things is growing rapidly. “We are always prepared to work on any product security vulnerabilities detected. These are found and reported to us by security researchers, meaning IT experts at universities or IT security providers, but also by customers, national CERT organizations, or internal Siemens sources,” explains ProductCERT security expert Rupert Wimmer.



Rupert Wimmer, Oliver Hambörger, and Klaus Lukas (from left) are responsible for cybersecurity worldwide

Wherever the report comes from, the process is routine: Wimmer and his colleagues communicate intensively with the person reporting the issue in order to understand the observations correctly and completely.

If it becomes evident that a new security gap has been found, a task force is convened with the product manager so that a solution can be developed as soon as possible. The workflow is methodical and very precise. If eliminating a vulnerability requires a product update, the Product CERT colleagues verify its efficiency before publication.

Then a security advisory is published on the ProductCERT website to inform the customer about the security gap and its solution.

Transparent cybersecurity

“Handling vulnerabilities professionally means informing users about their existence and the countermeasures that need to be taken. We set new standards in industrial applications with our security advisories,” explains Lukas. He is convinced that this is a real advantage in the face of increasing digitalization, because only transparency demonstrates our responsibility to the customer. “Transparency is extremely important in the area of cybersecurity.

This goes both ways. It applies to reports we receive as well as to messages we publish,” says Lukas.

The ultimate goal, of course, is to avoid the need to issue any security warnings in the first place. For the Siemens test departments, security tests before delivering the company’s products are therefore an essential step in quality assurance.

Cybersecurity is a daily routine

“We continually work to make it possible for our customers to digitalize their plants so they can compete in the market,” Lukas says. “Monitoring, advisories, and testing are part of our daily routine in the field of cybersecurity response – just as it is a matter of course for operators of chemical plants to handle hazardous substances appropriately. Our team works for our customers 24/7.” ■

➤ siemens.com/industrial-security
➤ siemens.com/cert

Advantages of an intelligent power supply

Over the coming 10 years, electrical power will become the most important source of energy worldwide as a result of the growing share of renewable energy sources. Today, power quality, supply security, and energy efficiency are already essential in the industrial power supply.

Power moves everything: from the industrial sectors — of oil and gas, mining, chemicals, and the automotive industry to data centers and airports. The previous unidirectional power generation and distribution system is increasingly being replaced by multidirectional alternatives. Ralf Christian, CEO of the Energy Management Division at Siemens, explains: “More and more electricity is being generated from renewable energy sources in a decentralized way. This is the basis for a sustainable power supply in industrial plants, buildings, and infrastructures.” A growing number of companies are already generating their own power using renewable energy: for example, to cover peak loads during production-intensive periods.

However, feeding an increasing amount of renewable energy into the grid can result in voltage fluctuations and can therefore disrupt plant operation and even cause downtime. Ensuring plant availability and profitability with new technologies such as digitalization is essential. The answer is to design a holistic, reliable, adjustable, and intelligent power supply system. The following three examples illustrate the practical side of this trend in different industrial sectors.



The intelligent network control platform prevents disruptions, reduces downtime by 60%, and saves considerable costs

Grupo México: Power grid monitoring in real time at Grupo México

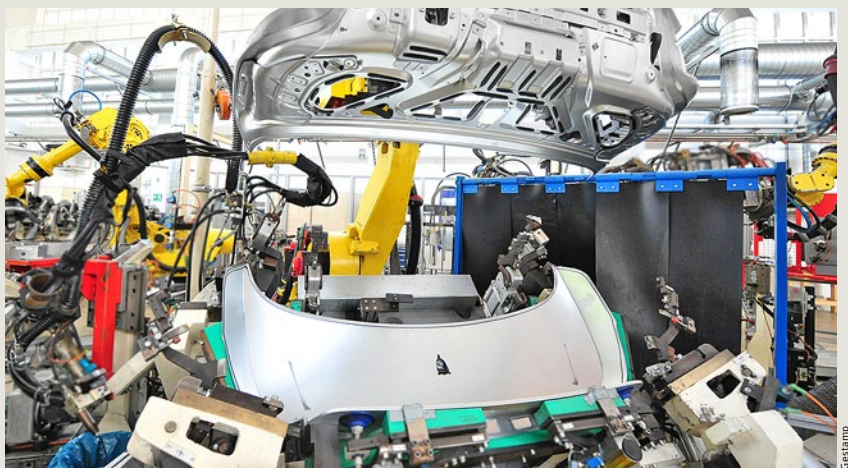
Ensuring a stable power supply for a flexible and efficient production in increasingly complex power grids requires planning and investment security.

This is only possible with a comprehensive energy monitoring system – which also enables companies to remain competitive.

The same goes for Grupo México: For a highly available and market-adjusted production, the Mexican company automated the power supply of its Buenavista del Cobre

copper mine with a predictive maintenance concept and was able to eliminate downtime.

To realize this, Grupo México implemented an intelligent network control platform that is remotely operated from a control room. The new system provides the company with a precise, real-time overview of its power grid. This allows the employees at the control center to quickly assess new situations and make the right decisions. As a result, disruptions are prevented, downtime is reduced by 60%, costs are reduced significantly, and personnel safety is increased.



The rationalization of plant consumption resulting from the data analysis and the solutions offered by this platform has enabled Gestamp to save almost 45 GWh over the past 12 months

Optimizing power consumption at Gestamp

The new and changing mix of power consumers and feeders requires an automated power supply system and results in an increased data volume that needs to be monitored. Because energy costs are a crucial factor for industry, however, maximizing the efficiency of power supply and consumption is of utmost importance. The automotive supplier Gestamp from Bilbao, for example, collects energy data from all power consumers using a complex monitoring system and forwards them to the

Siemens control center in Seville for analysis. Gestamp receives a detailed analysis of all consumer data, including specific suggestions for improvement in real time via a web interface.

“Thanks to a cloud-based efficient energy management platform that uses big data to optimize consumption, Siemens has enabled Gestamp, a multinational company, to reduce energy consumption by up to 15% at 14 of its plants,” says Santiago Esarte, energy efficiency manager at Gestamp, about the energy monitoring system.



Evonik hones its competitive edge with a fully integrated energy management solution for power supply, monitoring, control, and automation in its methionine plant in Singapore

Integrated power management solutions at Evonik

Automation makes power supply and distribution more intelligent. Holistic concepts that ensure a stable and reliable power supply where and when it is needed are in high demand.

Evonik was looking for a reliable partner to provide a fully integrated power management solution for its first plant in Singapore. The plant produces methionine, an amino acid used as feed additive in animal nutrition. A reliable power supply system was needed to keep production up and running and to fulfill the requirements of this process industry. These

included ensuring plant flexibility, high plant availability, and optimal power and resource consumption, while also safeguarding the company's high investment costs. “We were impressed by the product quality, expertise, customer service, and commitment,” says James A. Ledger, project manager at Evonik. ■

➤ Find out more about an intelligent power supply for industry: [siemens.com/magazine/2w0469](https://www.siemens.com/magazine/2w0469)

Ticket to the cloud and back

Increasingly, entire plants and their individual components – including those at field level, complete with drive technology – can be integrated into the Industrial Internet of Things. This opportunity opens up a huge potential to increase productivity and efficiency.

Drives are the core component of nearly every production cycle. In the worst-case scenario, an entire plant might stand idle if there is a failure. However, today intelligent and integrated drive systems can already contribute to accelerating plant engineering, saving energy costs, and increasing plant availability. Detailed digital images are decisive for success when planning, constructing, and operating digitally driven plants. The same is true for the drives as well.

Thanks to sensor technology and digital infrastructure, it is now possible to record vast quantities of service- and process-relevant data from engines and converters. The analysis of these data provides valuable insights into the current and future condition of the plant, as well as valuable information about individual drive components.

In the medium-voltage drive systems in a plant's core processes, every medium-voltage converter records data such as currents, voltages, operating hours, switching operations, and error messages and independently forwards them for analysis.

In high-voltage engines, a motor condition monitoring solution records specific data with the help of specialized sensors and forwards them for cloud-based analysis. The data include information such as vibration, bearings/stator temperature, and motor speed.

Prepared for the future thanks to cloud technology

Once they have been uploaded to the cloud, real readings can be synchronized with simulation models – one example is temperature development in critical motor components. The resulting data indicates not

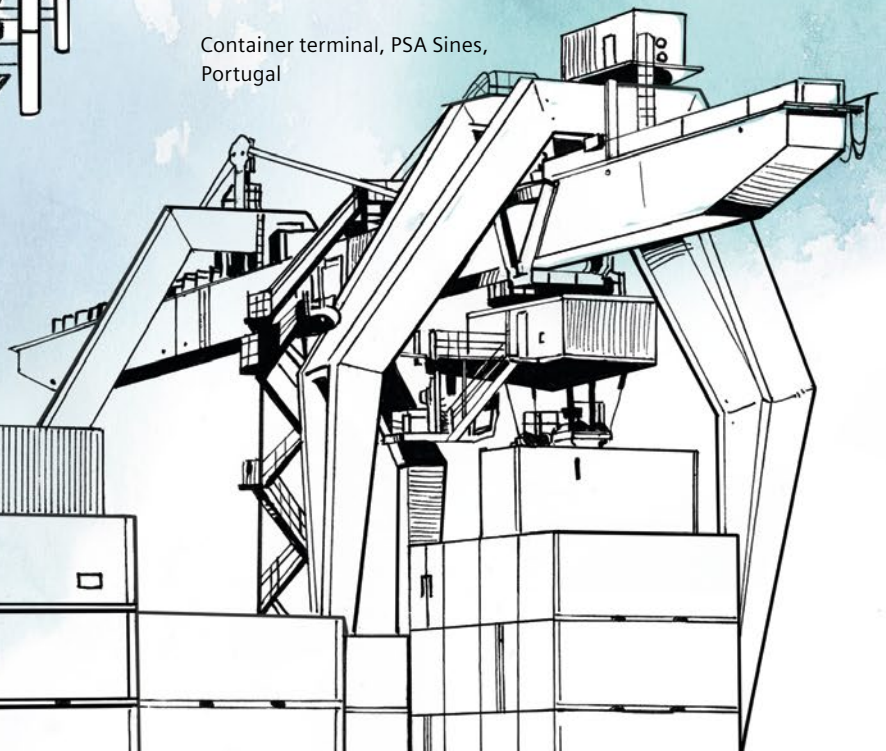


*We were able to reduce our engineering costs by at least **30 percent** and our maintenance costs for the drive system by **15 percent**.*

AUMUND Fördertechnik GmbH,
Germany

*Thanks to modernization and professional technical service, we can save **two million kWh** per year in Terminal XXI.*

Container terminal, PSA Sines,
Portugal



only the precise current condition, but also the future behavior of the component. With respect to temperature development, this means that security buffers that once were required for restarting the motor are no longer needed. This leads to significantly shorter downtime periods for the overall plant.

From now on, all data in low-voltage motors relevant for service and processes will be recorded and analyzed based on the motor's condition. As part of this concept, data relating to the motor's condition such as vibration, cooling status, and energy con-

sumption will be transferred to and analyzed in MindSphere, the cloud-based, open IoT operating system from Siemens.

Digitally supported drive technology therefore enables an entirely new dimension of transparency, resulting in additional opportunities for optimizing processes with added value for the client: shorter time-to-market, more flexible engineering, and greater plant availability and efficiency. ■

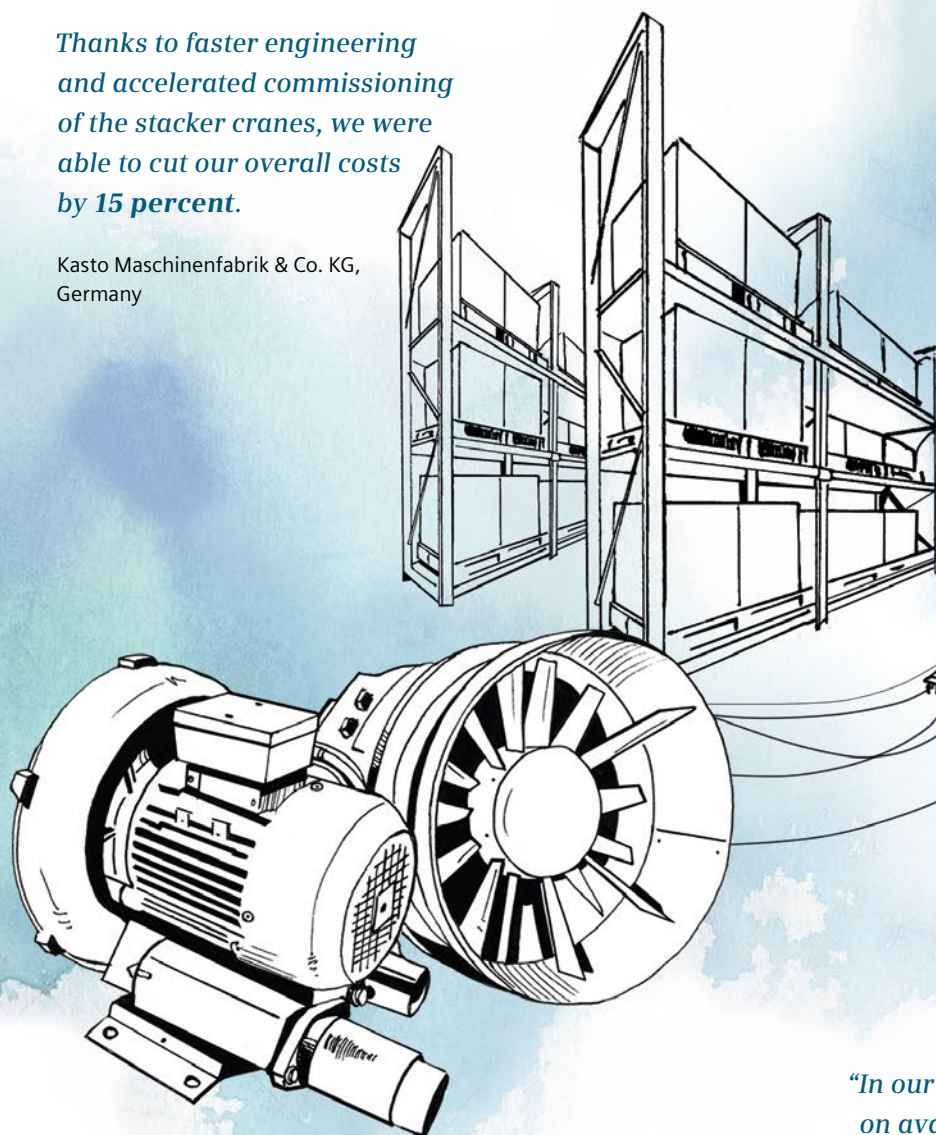
➔ [siemens.com/ids-digitalization](https://www.siemens.com/ids-digitalization)

Thanks to faster engineering and accelerated commissioning of the stacker cranes, we were able to cut our overall costs by 15 percent.

Kasto Maschinenfabrik & Co. KG, Germany

"The Siemens synchronous-reluctance system has withstood the test. We are significantly reducing our energy costs."

Thomas Kroiher, Head of Production, Knauf Integral KG, Germany



A frequency converter on the hydraulic pump of a strip steel cutting system reduces energy consumption by up to 90 percent, because the motor now only runs when it is actually needed.

Norder Lagertechnik GmbH & Co. Maschinenbau KG, Germany

"In our contract, we agreed on availability of 75 percent, but right after commissioning our pilot compression system, it reached a value of nearly 99 percent."

Klaas Bijlsma, Technical Authority
Level 2 Electrical NAM,
Groningen Gas Field, the Netherlands

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