

streams



SHAPING

Why science and business cooperate.

→ P. 44

INNOVATION

KSB's approach to global research and development.

→ P. 24

TOGETHER

Why diversity is so important for companies.

→ P. 18

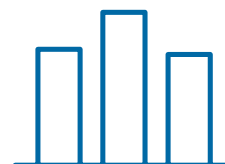
The 2021 Financial Year

Order intake



€ **2,412** m

Sales revenue

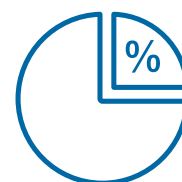


€ **2,344** m

Company profile

KSB is a leading supplier of pumps, valves and related support services. Its reliable, high-efficiency products are used in applications wherever fluids need to be transported or shut off, covering everything from building services, chemicals and petrochemicals, industry and water transport to waste water treatment, power plant processes and mining. Founded in 1871 in Frankenthal, Germany, the company has a presence on all continents with its own sales and marketing organisations and manufacturing facilities. Under the brand name KSB SupremeServ, more than 190 service centres and approximately 3,500 service specialists around the world provide inspection, maintenance and repair services in close proximity to their customers. Innovative technology that is the fruit of KSB's research and development activities forms the basis for the company's success.

EBIT



€ **141.2** m

Earnings before finance income/
expense and income tax

Employees



15,412

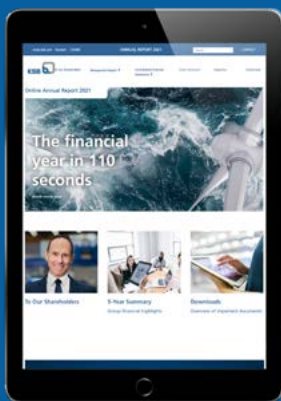
(31 December 2021)



The 2021 financial year
in 110 seconds

<https://annualreport2021.ksb.com/110seconds>

Shaping the innovations of tomorrow – this is what has made KSB so successful for more than 150 years. Guided by the needs of customers, 439 specialists worldwide engage in research and development to continually improve pumps, valves and related services. In-depth expertise, teamwork, curiosity and diversity around the globe are the cornerstones of KSB's worldwide research and development activities.



Download the Annual Report digitally:
<https://annualreport2021.ksb.com>

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Shaping

24



Innovation

18



Together

→ Together we're better

Cooperation with universities, colleges and research institutes drives companies' capacity to innovate.

→ Research worldwide

KSB has more than 400 employees at work developing innovations worldwide.

→ Innovation through diversity

Interview: How companies benefit from mixed teams when developing new products.

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Ground breakers

Innovations are a driving force behind the economy, science and society. For companies, they are a decisive factor for success. The products and solutions developed by KSB not only meet today's needs, but also promise enormous potential for the future.

Powering the shift to renewables



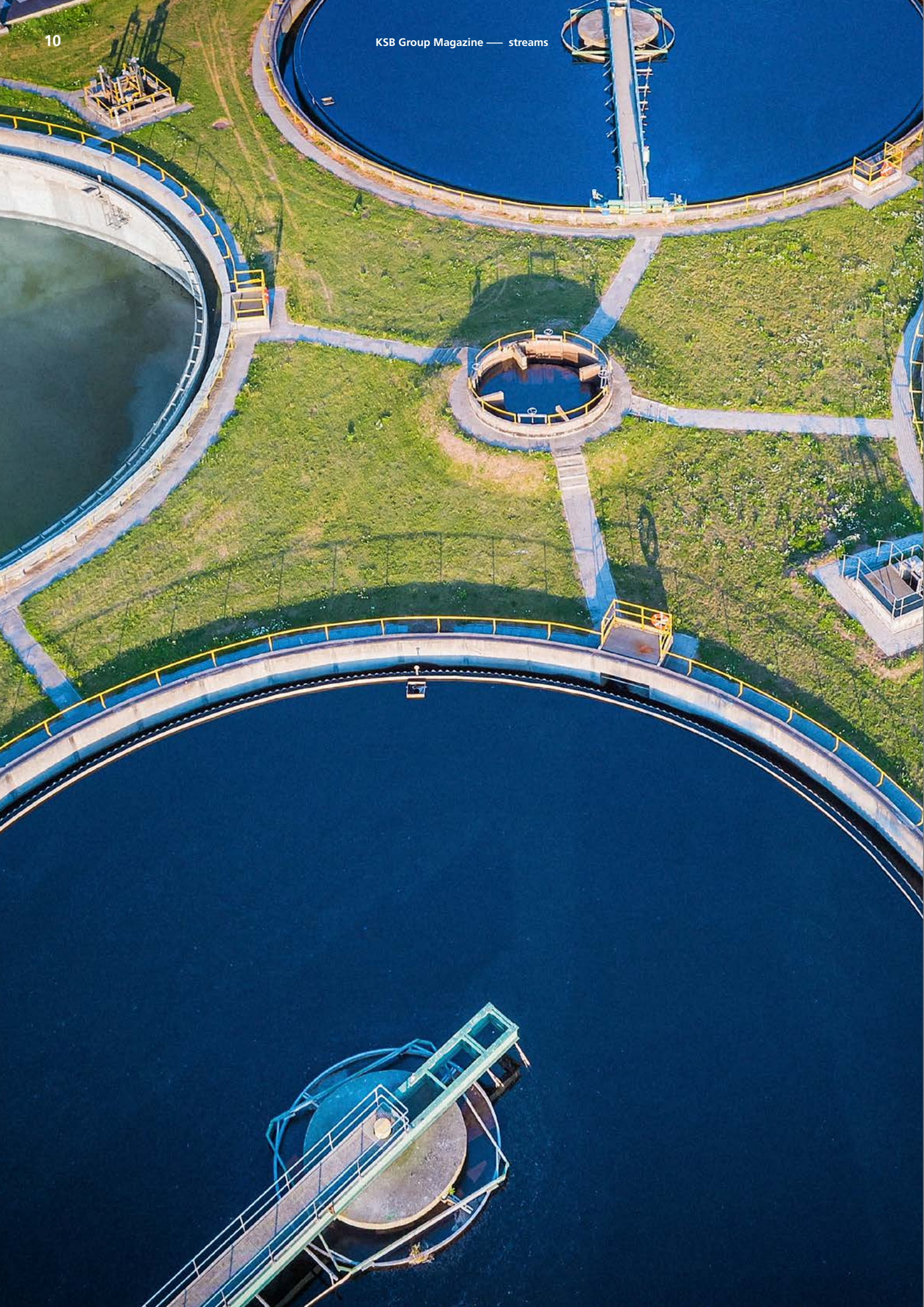


SISTO diaphragm valve

Clean energy from renewable sources

Green hydrogen is produced via the electrolysis of water. The electricity required comes exclusively from renewable energy sources such as wind. SISTO diaphragm valves from KSB help split water into hydrogen and oxygen. A special design means that only the body and diaphragm come into contact with the highly reactive electrolyte.





Treating water

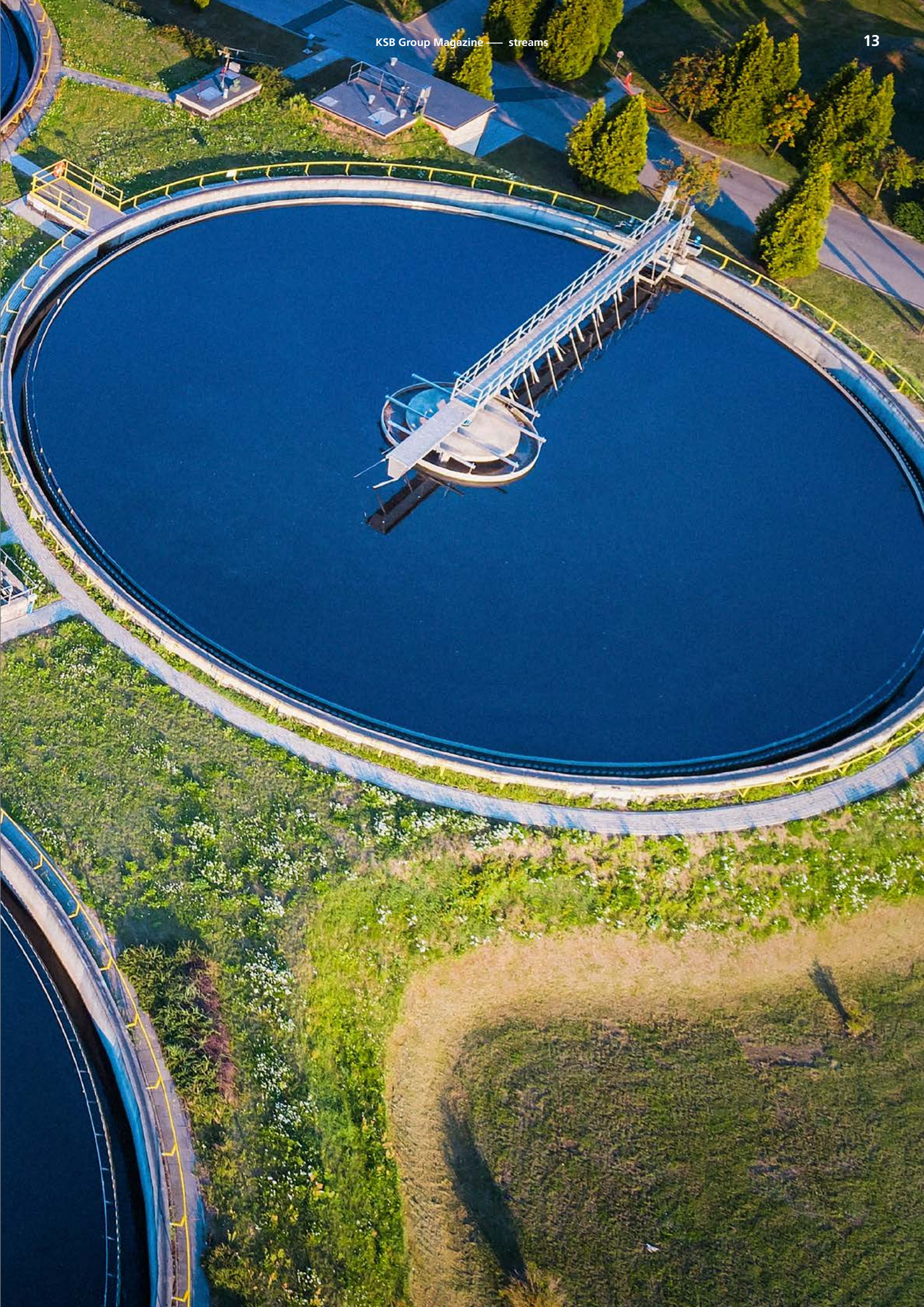




F-max impeller

Ensuring that waste water treatment plants work reliably

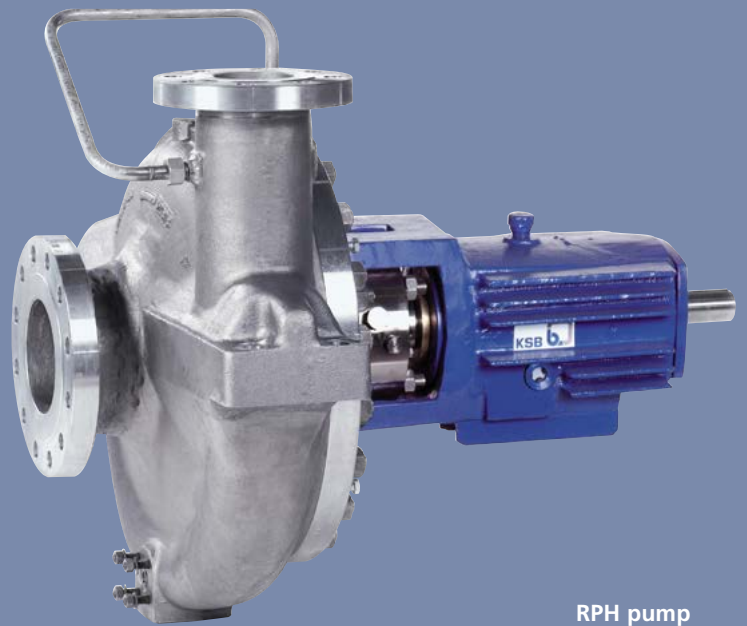
A sustainable water cycle requires waste water processing. But rubbish in waste water can disrupt the operation of treatment plants. KSB has developed the F-max impeller to prevent clogging caused by fibrous solids. Such specially designed impellers ensure the systems' reliable and durable operation.





Storing carbon dioxide





RPH pump

Reducing CO₂ emissions and mitigating climate change

The blue hydrogen production process is designed to prevent the release of carbon dioxide into the atmosphere. Manufacturers filter out and store the climate-critical gas. This is where KSB's RPH process pump comes into play, for example in the CO₂ capturing process. Their robust design is particularly suitable for challenging system conditions.



INNOVATION through DIVERSITY

Companies value diverse teams because they broaden perspectives. KSB is no different. Dr Stephan Timmermann, CEO, and Martina Szautner, Head of Human Resources, explain why diversity is so important for a global company like KSB. Especially when it comes to creating something new.

Diversity is on everyone's lips. What do you understand by this at KSB?

Stephan Timmermann: Plurality. Colourfulness. A modern understanding of society and social change. People are all different in terms of their gender, ethnic origin, nationality, age, sexual orientation and basic attitude. Diversity is implicit to our culture – at KSB we are outward looking and happy to have the world in our company.

Martina Szautner: Every company comprises many distinct individuals with different ways of thinking, experience, perspectives, cultures and lifestyles. This diversity is an asset for any enterprise.

The power of plurality: CEO Dr Stephan Timmermann and Head of Human Resources Martina Szautner value diversity at KSB.



What role does diversity play at KSB?

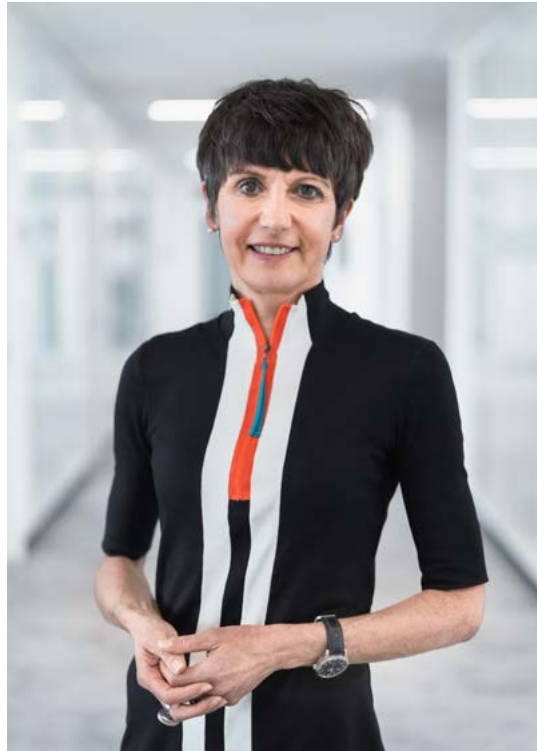
Martina Szautner: Appreciation is one of our core company values. This includes being open-minded towards other people and opinions. We learn from each other and develop together. In a nutshell: We see the value of diversity.

Stephan Timmermann: Different people bring different perspectives to the company. This is particularly important for global companies like KSB. We have more than 80 international companies and employ people from more than 100 nations. We need diversity to understand the world. Because the world is a diverse place! Our work is market-oriented and customer-focused. Our success is based on developing products that bring added value to a wide range of applications and cultures. This is why we want as much diversity as possible at KSB. It is a strength which benefits us all.

Martina Szautner: The same applies to the concept of inclusion. We seek to employ people with different physical and mental skills, because together they have a positive impact on the success of the company. At KSB, we often exceed legal requirements pertaining to topics such as accessibility. This is because we value the voices of women and men with disabilities. They offer a different view of the world.

Mechanical engineering is traditionally a male-dominated discipline.

Martina Szautner: This is reflected in the profile of our more than 15,000 employees. Women make up only 16 percent of our workforce worldwide, and we want to change that. Our internal and external communications consciously seek to break away from traditional role depictions. For example, we feature images of female professionals more often on our social media channels to support our recruitment of women to technical positions – because engineering is not just for men. It is equally important to address prejudices as early as possible: We support projects to spark girls'



More women: Martina Szautner wants to increase the proportion of female managers at KSB. This should increase from 13 percent today to at least 20 percent by 2025.

enthusiasm for science and technology already in nurseries and schools. Women working on the lathe or as design engineers – this must become a given.

Stephan Timmermann: Very important: We need more women in management. This is because they have a different discussion and problem-solving culture than men. Their perspectives are important; their assessments enriching. Every company stands to benefit from these insights. KSB has therefore set itself the goal of increasing the proportion of female managers from the current 13 percent to at least 20 percent by 2025. This is an important step in expanding diversity within our company.

How do you intend to achieve this?

Martina Szautner: For a mechanical engineering company, this is a challenge. But we are taking it on by providing even more targeted support for our female employees. This includes mentoring programmes, round table events with our four Managing Directors and a women's network. Communicating with others facing similar challenges can offer valuable help. When it comes to appointments, we always ask whether there is not a woman who could do this job. This sharpens awareness. Of course, we also offer special training programmes. These aim to prepare women for their career path and offer personal development opportunities.

“Different people bring different perspectives to organisations.”

Dr Stephan Timmermann
CEO of KSB



↑ **Multiple perspectives:** Diversity strengthens KSB's ability to innovate, according to Dr Stephan Timmermann.

“In a constantly changing world, it is an advantage for companies to be able to engage many voices.”

Martina Szautner
Head of Human Resources



A plus point for companies: Martina Szautner values diverse teams.

What are the advantages of teams with different compositions?

Stephan Timmermann: Diverse teams evaluate ideas from fundamentally different perspectives. Women often have different approaches than men, younger people know trends better, older people bring knowledge and experience. When the balance is right, it becomes exciting. Such teams work creatively and flexibly. In comparison with homogeneous groups, everything is slightly better thought out.

Martina Szautner: In a constantly changing world, it is an advantage for companies to be able to engage many voices. Competent managers and project leaders also play a crucial role in optimally managing diversity. After all, diverse teams work differently than homogeneous ones. We therefore offer appropriate training for our managers and experts.

The coronavirus pandemic has affected cooperation in every company. What effects have you noticed?

Stephan Timmermann: Physical meetings are often no longer possible; in many cases we are limited to digital communication. But this brings some advantages: Telephone and video conferences can be arranged much more easily and naturally, there are fewer organisational hurdles. Cooperation can then occur on a more equal footing. Hierarchies play a minimal role in digital communication, making it easier for all participants to get involved. Contributions are made in a more disciplined fashion, everyone listens more carefully. This often leads to better results.

What role does diversity play in innovation?

Stephan Timmermann: It is particularly important in the early phase, for example in the development of a product. Risk can be minimised when ideas are checked by multiple members of diverse teams incorporating different perspectives. Different views give rise to different questions which can more effectively – and above all more quickly – identify potentially expensive developmental missteps.

Countermeasures can then be taken. This 'fail fast' approach is a basis for success.

Martina Szautner: Our diverse development teams also shape our company culture: Agile approaches encourage team members to question everything, correct if necessary, and then swiftly change or adapt their innovations. This is a plus point in international competition.

Can you give an example?

Stephan Timmermann: Our Business Innovation Lab sees colleagues from the most diverse backgrounds working together. Here, experienced engineers collaborate with students who bring a whole new way of thinking. These diverse teams bring ideas to completion. This means generating concepts and then developing them in more detail. The result is a hotbed of ideas, with team members creating innovative digital business models for the needs of tomorrow.

How do you envisage future diversity in practice?

Stephan Timmermann: Diversity is a reflection of the way we interact with each other in the company. In a colourful world, work is much more fun and exciting. Our world can only be understood through dialogue and the exchange of ideas. This is my idea of a working day spent with open-minded people looking to learn from each other.

THE NETHERLANDS

Group member DP industries B.V. develops pumps made of deep-drawn stainless sheet steel and pressure booster systems.

FRANCE

Employees at the research and development centre in Gradignan develop products including actuators for butterfly valves with associated control and automation systems.

SPAIN

Developments by KSB's engineers in Zarautz include marine pumps and products for fire protection.

USA

At GIW, specialists develop customised pumps for the hydraulic transport of solids.

RESEARCH

BRAZIL

Experts in Brazil adapt pumps for the South American market.

SOUTH AFRICA

Pump designs are revised to make them fit for the requirements of the African continent.

LUXEMBOURG

KSB subsidiary SISTO is active in the research and development of diaphragm valves. The company focuses on elastomers alongside monitoring and automation solutions for valves.

GERMANY

In Frankenthal, hydraulics experts optimise the flow behaviour of pumps and valves.

At the Pegnitz-based materials laboratory, experts are working on the development of robust and efficient materials for pumps and valves.

CHINA

In Shanghai, the SEC-KSB joint venture manufactures and tests the latest pumps for state-of-the-art nuclear power plants.

WORLDWIDE

TWELVE EXAMPLES

INDIA

KSB MIL Controls Limited operates a centre for the research and development of control valves in Meladoor.

KSB Tech in Pune works exclusively for KSB worldwide on tasks including design and software development.

Around the globe, more than 400 research staff are at work creating innovations for KSB's customers. The pump and valve manufacturer invests in research and development at its locations in the pursuit of very different goals. Here are some examples.

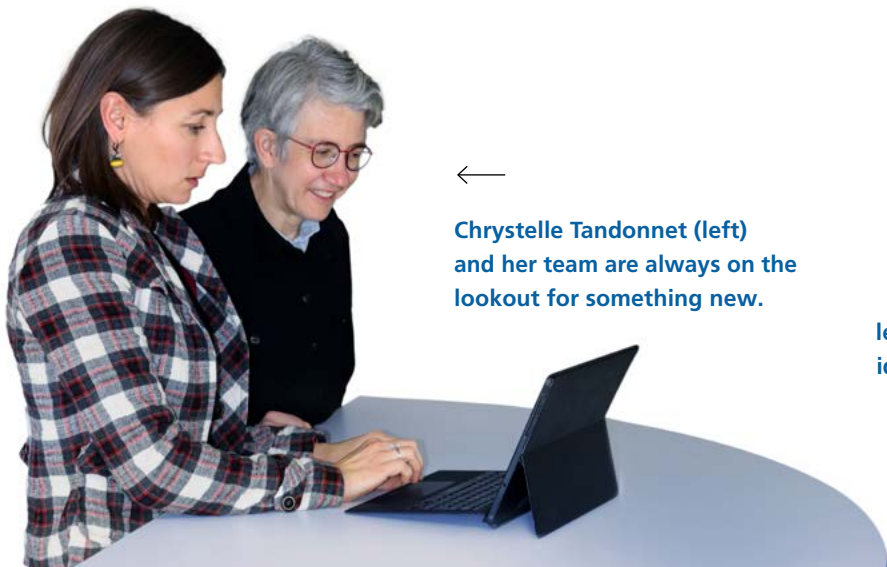


GRADIGNAN | FRANCE
Chrystelle Tandonnet

CURIOSITY AS A DRIVING FORCE

Our tasks and projects are extremely interesting, and even quite gripping. But we are also under pressure, because KSB's future products depend on our ideas. I head the French branch of the KSB Group's valves research and innovation department. We research and test new technologies and develop technical concepts for the valves of tomorrow. 3D printing of polymers, equipping valves with sensors and handling a range of related technological and regulatory tasks are just a few examples. We are exploring interesting fields of application with increasing volumes, such as the hydrogen sector and CO₂ capture. All of this requires a globally functioning network and cooperation with colleagues from different disciplines. I value the mutual exchange of ideas and cooperation – everyone contributes their skills, their experience and their personality. We work closely with our French and German colleagues, as well as with the teams in Luxembourg and India. We are also creating new research capabilities for the KSB Group to develop a global vision of the requirements facing us in the future. In addition, we naturally work together with external working groups and scientists.

We are motivated by curiosity and the drive to create something new. And we keep track of all technologies, market developments, manufacturing processes and applications of our customers. Ultimately, we try to adopt a broader view and consider developments in other sectors, too.



Chrystelle Tandonnet (left)
and her team are always on the
lookout for something new.



FRANKENTHAL | GERMANY
Frank Hafner

HYDRAULICS EXPERTISE FOR THE WORLD

Every application requires a specific set of properties from a pump. Frankenthal's hydraulics experts thus work to modify pumps' characteristic curves with the goal of achieving optimised operating behaviour – from small circulators to power plant pump sets weighing several tonnes. This is not just about efficiency. Our calculations also incorporate pump head and performance profiles as well as cavitation behaviour. To ensure the optimal adjustment of our pumps, we analyse their fluid mechanics on the computer and determine the best solution on a case-by-case basis. Sometimes we also conduct tests on models with different pump impeller types. The development process also sees us working with external research institutes and internal specialists. In future, we want to accelerate our work even more using artificial intelligence. Intensive collaboration with our colleagues from other departments plays an important role for us. We are glad to make our experience and know-how available worldwide.

When it comes to customised solutions, we work particularly closely with the sales departments, who often deliver the impetus for new developments. The people I deal with every day are as diverse as our tasks. I find that particularly enriching.



Frank Hafner and his colleagues determine pumps' ideal operating behaviour.



GROVETOWN | USA

Dr Harry Tian

FULLY COMMITTED TO LONG PUMP SERVICE LIVES

Since the mid-1990s, I have been heading the materials research and development department at GIW Industries, Inc. in the USA, which is part of KSB. Our research focuses on developing and applying materials specifically used in slurry pumps found in the mining industry. In these applications, the pump sets typically experience substantial material loss on those components that come into contact with the fluid handled. This is due to heavy wear, corrosion or erosion. It is thus necessary to ensure ongoing development of new materials for this highly competitive market. Our specially alloyed white cast iron materials and innovative coatings are a good example. Research at KSB also involves evaluating and developing polymer elastomers as well as ceramics and composite materials for extreme applications including hard rock mining and oil sand transport. In addition, I investigate trends in materials engineering and new technologies. I likewise collect customer requirements for the materials we incorporate in our pumps. I then propose research topics and cultivate ideas for potential applications. In ideal cases, these form the basis for successful projects and further development.

Our team carries out frequent experiments to provide material evaluations from scientific and technical standpoints. To conclude research projects successfully, we often collaborate with other departments in the KSB Group around the world on cross-functional activities. We also maintain contact with customers and suppliers, who assist us by providing feedback and other valuable information. Materials engineering is very important for our product range as a specific service life must be achieved for the critical parts used in slurry pumps. New materials are the basis for our success in demanding fields of application. The markets and applications we cater to are highly complex, and competition is extremely intense. We constantly have to face changing challenges due to different materials – it never gets boring. That is what my team and I enjoy every day.



Dr Harry Tian (centre) and his team investigate new technologies and trends in materials engineering.





PEGNITZ | GERMANY
Dr Andrea Kühl

PERFECTION THROUGH TRIAL AND ERROR

KSB's competence centre for materials technology is located in Pegnitz. Experts from various disciplines research and develop new materials to produce components with improved properties. Today, KSB can offer unparalleled global expertise in metals, ceramics, polymers, coatings and composites. This is something our customers appreciate.

Since 2007, I have been working on publicly funded research projects at the materials laboratory. Some exceptional projects saw us developing coatings of diamond and diamond-like carbon on ceramic bearing components – even including integrated temperature sensors – in cooperation with project partners. These coatings help reduce friction and wear in the event of dry running and insufficient pump lubrication. In a nutshell: The pump set offers a longer service life.

We have been researching materials for use in additive manufacturing processes such as 3D printing and laser beam melting for several years. One example is the material-efficient production of pump impellers from high-alloy steels. We are continuously expanding our range of materials for these manufacturing processes.

Our work cannot really be done from home. New ideas and proposed solutions are often found during practical experiments in the laboratory. I greatly appreciate the contributions of all my colleagues because research and development is teamwork. Within KSB, we work across locations and in direct contact with companies as well as with various institutes worldwide. We also make special use of KSB's global network of experts. In addition to regular meetings, workshops also help us to resolve specific issues.

I haven't had a single day of boredom at KSB. What continues to drive us is turning ideas into real innovations. If we can improve the robustness of our pumps and valves, then they will last longer. And if we can simultaneously increase energy efficiency within our value chain, we are supporting sustainability.



Dr Andrea Kühl and her colleagues conduct research into materials for cutting-edge manufacturing processes such as 3D printing.



PUNE | INDIA
Ganesh Devale

CREATING NEW PRODUCTS, IMPROVING EXISTING ONES

In order to remain competitive on today's market, companies need to develop new products and continuously improve existing ones. As Head of Valves at KSB Tech, I am responsible for the development of gate, globe and check valves in India. Our company is an engineering and IT service provider that works exclusively for KSB worldwide. Our task is to fulfil the requirements of the Group's production plants around the globe.

Together with my team, I am responsible for the design and development of valves, primarily for the manufacturing plants in India and China. We also work closely with valve development in Germany. We undertake projects for new valve designs, adapt designs to the latest versions of standards and codes, provide technical expertise in preparing quotations, supply design solutions for operations and support our service colleagues in analysing and resolving complaints. Not only do we improve existing designs, we also improve the associated processes. This is how we contribute towards increasing efficiency in the company.

Teamwork is extremely important in every step of our work – whether internally within the department, across departments or in collaboration with different KSB locations. In addition, we are creating a worldwide network. Everyone involved benefits from long-term cooperation. We are continuously expanding our capacity and expertise to support other locations. One example is our collaboration with colleagues in Pegnitz. We compile and update KSB's technical documentation and product literature – an important task within the Group.

We are closely involved in the development of new products. For example, we are developing new design tools to minimise the time needed for calculations. We also carry out CAD work for our internal customers, supporting the further development of KSB's portfolio and products.

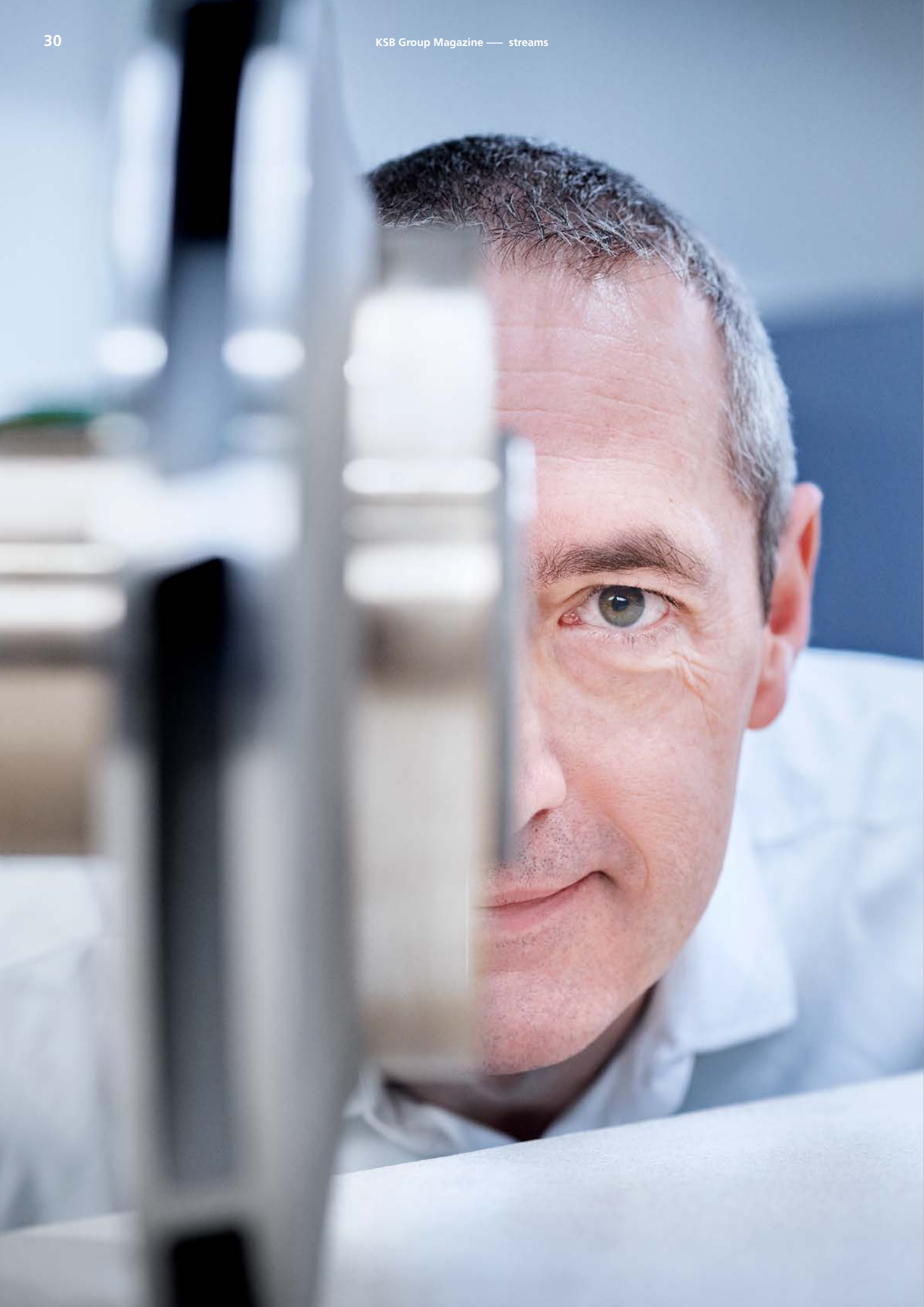
I am particularly proud of one of my employees' projects. Our valves team has developed various design processes and tools in order to quickly respond to new requirements in product development. This allows us to offer optimal product solutions while streamlining workload. Using minimal resources gives us a competitive edge. Our department has even applied for two patents for optimal design concepts in this area.

Developing new products and improving existing ones has been my passion since day one of my career. What I especially enjoy about my work is the perfect synergy between our team of highly experienced product experts and our colleagues around the world.



Ganesh Devale designs and develops various valves with his team.





Put to the test

A technical solution's quality can only be demonstrated by pushing it to its limits. KSB therefore puts all products through their paces via challenging test scenarios before launching them to market and shipping them to customers. With customers around the globe placing their trust in KSB's reliable quality, the company ensures that testing is carried out to the same high standards at all test facilities worldwide. Some 28,000 pump tests are carried out every year at 50 test facilities KSB-wide.

Andreas Karsch,
Head of Testing Engineering



Two KSB Shanghai Pump Co., Ltd. employees at the test stand

1 CHINA

“Pump performance testing is the most important phase in ensuring the quality of the final processes, including materials, machining and installation. It also plays a fundamental role in demonstrating KSB’s technology and product quality to our customers,” says Hongwu Zhu, who heads the test facility at KSB Shanghai Pump Co., Ltd.

The facility’s 16 specialists and cutting-edge test stand ensure that performance testing of KSB pumps is carried out in accordance with international standards. Online acceptance tests have now become routine.

“Performance testing is a core process within pump manufacturing. The provision of performance-tested pumps is not just a customer requirement, it is part of KSB’s obligation to deliver consistently high product quality to our customers,” confirms Zhu.

Our SEC-KSB plant in China is also home to one of the KSB Group’s largest test facilities, built for testing reactor coolant pumps of all generations. This test stand can simulate the complete life cycle of such a pump – a process which has already taken place several times, including when testing the RUV series for Chinese nuclear power plants.

2 SOUTH AFRICA

Based in Germiston, KSB Pumps and Valves (Pty) Ltd. operates several test facilities including a test stand in Pretoria for large pumps which is run in partnership with the South African Bureau of Standards (SABS).

At the test facilities in Johannesburg, seven employees are responsible for operating two test stands and – as in almost all KSB test facilities – online acceptance testing in accordance with specified KSB standards is part of the routine.

Certain parts of the old test facility, which was built in the early 1970s and has a nine-metre-deep underground storage tank, are still used today on the modern test stand. Tests tailored to customer requirements, especially those using customer motors at different voltages, are very much in demand here.

Test stands are also available for standard tests, which are fully automated and equipped with multiple test loops.





↑ **Dr Vanessa Romero Segovia from Model-based Product Development at the Frankenthal development test stand**

3

GERMANY

↓ **Remote acceptance testing is part of the routine at KSB Pumps and Valves (Pty) Ltd.**

In Germany, KSB's largest test facility for dry-installed water transport pumps is situated at our Halle location, and the largest test facility for boiler feed pumps is located in Frankenthal. Both of these test stands offer variable speed tests with and without the customer's motor and with all necessary auxiliary units.

Frankenthal is also home to the central development test facility with more than 60 test stands able to test products from all production locations. "Throughout KSB, we have the unique ability to implement time-intensive and application-specific tests such as hot water and hot oil tests, or low-temperature tests down to minus 20 °C," explains Andreas Karsch, Head of Testing Engineering.

"We want to get the most out of our pumps," says Karsch. "We are essentially the competence centre for KSB's test stand technology. We design and build test stands, create central KSB standards – for online acceptance tests for example – and develop KSB's in-house software for data acquisition on all KSB test stands worldwide." Continuous, cutting-edge development of testing options and thus of KSB products is ensured thanks to the work of more than 30 staff and numerous students who always bring fresh ideas, as well as cooperations with multiple universities. "This is what we stand for. And our know-how is available to the entire KSB Group," underlines Karsch.





KSB's Brazilian factory in Várzea Paulista is home to one of the largest and most versatile test facilities in Latin America. It features nine test stands capable of testing almost every type of KSB pump, as well as pumps repaired by the company's own KSB SupremeServ.

4

BRAZIL

KSB's Brazilian factory in Várzea Paulista is home to one of the largest and most versatile test facilities in Latin America. It features nine test stands which can be configured to test almost every type of KSB pump as well as pumps repaired by our KSB SupremeServ. A further test stand for submersible motor pumps is located at the Jundiá plant.

"The department responsible for the test stands plays a fundamental role in the company, as it can guarantee the quality and functionality of KSB products and thus provide added value for our customers. Services in the field of testing are increasingly requested and purchased by our customers. Key account customers see performance testing as an important and essential requirement," explains Thiago Munhoz, an employee at the test facility in Várzea Paulista. "During the pandemic, our department faced major challenges. A lot of testing normally done in person with the customer had to be performed via video conferencing during this period."



GIW pumps transport highly abrasive slurries. The hydraulics laboratory is globally unique in its capacity to handle pump performance testing and slurry testing.

5

USA

GIW pumps convey highly abrasive solids. "The GIW hydraulics laboratory is globally unique in its capacity to handle pump performance testing and slurry testing. On the one hand, it is able to verify the performance of pumps with impeller diameters of up to 2.87 metres. On the other, it has the expertise to test slurries in pipelines of any size," reports George McCall, who heads the hydraulics laboratory at GIW. Eleven employees ensure that the pumps are put through their paces.

The test stands are primarily intended for testing pumps typically manufactured by GIW Industries, Inc.: end-suction, single-stage centrifugal pumps for slurries. However, they can also be configured to test any pump.



6

INDIA

The Indian locations Shirwal, Chinchwad, Pimpri and Sinnar all have test facilities. "We manufacture a variety of pumps that we subject to a range of tests," says Nitin Patil, who manages the test facility in Chinchwad.

"In recent years, we have successfully developed and tested new pumps," Patil explains. "The key function of the test stands is proving the performance of the final product before we ship it to our customers. They confirm our guaranteed performance to the customer and any discrepancies can be corrected. This strengthens our customers' trust in our quality and reliability."



→
Test stands are operated at the Indian locations in Shirwal, Chinchwad, Pimpri and Sinnar.

¡HOLA BOGOTÁ



Something very special is being created at KSB's factory in Halle: By this summer, six pumps will have been manufactured there for a waste water pumping station in Colombia's capital Bogotá. The water treatment plant, called Canoas, will be the largest in Latin America when it is completed in 2026. Its purpose is to purify 70 percent of the waste water generated by this metropolis of eight million inhabitants, making it viable for agriculture and giving the Bogotá River the opportunity to regenerate. Around one million cubic metres of untreated waste water currently enter the river every day, making it one of the dirtiest in the world.

A great feat of technology

This order represents a highlight in Halle's 150-year company history in two respects: It comprises a volume of eleven million euros, and the waste water pumps being manufactured are the largest and most powerful the factory has ever produced. "Each pump set weighs more than 100 tonnes, has a motor rating of 4.3 megawatts and can pump 6.4 cubic metres of waste water per second to a head of 53 metres. That corresponds to the amount of water in 35 bathtubs," reports Plant Manager Frank Aschenbach. The pumps are four metres tall – and ten metres with their motors. This means they would barely fit into the assembly hall at the Halle location. The motors are being produced by KSB in Brazil and will be mounted onto the pumps on site. Frank Aschenbach is proud of the pump sets' technology: "We have redesigned and adapted numerous pump components to meet the customer's specific requirements."

"We have been involved with this customer project for five years now. During this period we have offered consulting on the planning and optimisation of the water treatment plant."

Henning Look
Sales Engineer, KSB Halle

Excellent cooperation across continents

In order for KSB to land this major contract, it took concerted teamwork across countries and departments. And a long view. "We have been involved with this customer project for five years now. During this period we have offered consulting on the planning and optimisation of the water treatment plant," says Henning Look. As a sales engineer, he was responsible for the technical aspects during project planning. "There was a lot to coordinate for everyone involved," says Look. A key element was keeping site conditions in mind while designing and selecting pump components. We had to make many calculations in advance, both with regard to the pumping station and the pumps themselves." But the elaborate preliminary work and consultation helped to develop the optimal product for the customer.

The fact that KSB has a subsidiary in Colombia proved a local bonus: Close cooperation between KSB's Bogotá office, the consortium of companies responsible for building the waste water treatment plant and KSB Halle allowed the Group to win and further develop the project. "We knew that a project of this scale in Colombia was an important opportunity for KSB," says sales engineer Ricardo Barros. He is in charge of the order at KSB Colombia. Barros emphasises the know-how and wide-ranging expertise offered by KSB's specialists. These were decisive criteria for successfully landing the order. "We were involved in all crucial phases of the project, and we were able to present the client with a customised solution," he explains, further stating that although KSB was already market leader in Colombia for waste water disposal and drinking water supply projects, such a prestigious undertaking promised excellent opportunities for further orders in this country and throughout South America.

100
TONNES
 Weight of each pump

"KSB is active worldwide, and it is always an advantage when native speakers are involved in the projects."

Lina Perez
 Sales Engineer, KSB Halle

What should not be forgotten is the role of linguistic and cultural competence. Project engineer Lina Perez, who has been involved in the project from the start, comes from Colombia but now lives in Halle, so she knows both countries and their customs. She thus took on an important mediation function.



6.4 m³/s

Volume of waste water each pump can deliver to a height of 53 metres

Silvio Kuch uses a crane to lift the motor onto the casing of a waste water pump destined for the Canoas water treatment plant in Bogotá. Its functioning will then be confirmed on the test stand.



↑ Henning Look, Lina Perez and Frank Aschenbach (from left) talking in front of pump models of a large Omega and an RDLP.

“KSB is active worldwide, and it is always an advantage when native speakers are involved in the projects,” Perez is certain. “It simplifies many things: Negotiation and consulting discussions, documentation – and of course knowing what your counterpart values.” As a Colombian, she says she is proud to be involved in such a technically demanding and professionally managed project in her home country. Logistics pose a major challenge. The size and weight of the components make transportation and shipping a daunting task. The transport chain stretches from the factory in Halle to the seaport and from there by ship to South America. Transport then continues on land to Bogotá located at an altitude of 2500 metres.

“We knew that a project of this scale in Colombia was an important opportunity for KSB.”

Ricardo Barros
Sales Engineer, KSB Colombia



4.3 MW

Motor rating of
each pump set

KSB pumps to protect Colombia's environment

It is important to KSB to act as a sustainable, environmentally conscious company. This goal is embodied in the Canoas project. "Our pumps will help treat waste water in this metropolis and thus make an important contribution to protecting and improving the environment in Colombia. That gives you a positive feeling," Perez explains. Her colleague Henning Look agrees: "The Canoas project is sensational because it delivers genuinely sustainable environmental protection."

The pumps produced in Halle will operate in the intake pumping station of the Canoas plant. KSB has already supplied numerous pumps for another waste water treatment plant in Bogotá. The Salitre plant treats the remaining 30 percent of the Colombian capital's waste water. A comparable project in Germany proves that renaturation can succeed. In the mid-twentieth century, the Emscher river in the Ruhr region was considered the most polluted watercourse in Germany. With the help of KSB pumps, it was possible to rehabilitate a 51-kilometre stretch of the river. "If you improve the

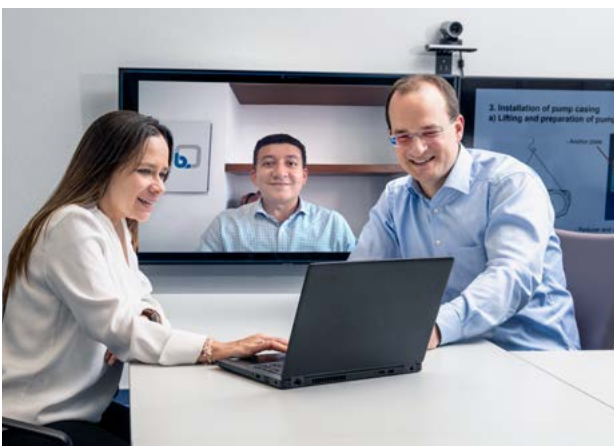
water quality of the Bogotá River, it has an impact on nature, the population and the wildlife. And maybe the tourism industry will also stand to benefit," Perez hopes.

150 years and more

This especially large and complex order comes at a time when the Group and the factory are celebrating their 150th anniversary. With around 500 employees, the Halle plant has been part of the KSB Group since 1991, and is the company's competence centre for water and waste water pumps. More than 80 percent of the pumps manufactured in Halle are exported. "The Canoas contract was a real highlight – especially in the anniversary year. You notice how proud the location's employees are that they work for a company which accepts every challenge and tackles it in the best interests of the customer. So, bring on the next 150 years!" says Plant Manager Frank Aschenbach, looking positively to the future.

"We have redesigned and adapted numerous pump components to meet the customer's specific requirements."

Frank Aschenbach
Plant Manager, KSB Halle



Sales engineers Lina Perez, Ricardo Barros and Henning Look discuss the Canoas project via video link.



Silvio Kuch (left) positions a crane over the pump casing while his colleague Ronny Schmidt attaches it to chains in preparation for a pressure test.

SHANGHAI

TEST FACILITY
WATER TRANS-
PORT PUMPS



90,000 m³/h
VOLUME FLOW RATE

90,000 m³/h can be circulated by the test facility for large water transport pumps – that corresponds to a water volume of around 170 full bathtubs per second.

ENGINEERED

FRANKENTHAL

Component
test facility for
liquid salt

700 °C

To develop components for recirculation pumps that use liquid salt as a coolant, KSB has built a test facility which circulates fluid with a temperature of 700 °C.

WORLDWIDE

439

EMPLOYEES IN
RESEARCH & DEVELOPMENT

The number of employees engaged in research and development in 2021 was 439.

WORLDWIDE

27,800

PUMP TESTS
A YEAR

To ensure and further improve product quality, KSB tests 27,800 pumps a year at its test facilities worldwide.



WORLDWIDE

600,000
Tonnes

CO₂ EQUIVALENT SAVED

Using digital monitoring solutions like the KSB Sonolyzer app and PumpMeter saves a lot of energy. The potential savings are equivalent to 600,000 tonnes of CO₂.

WITH PASSION

LA ROCHE-CHALAIS

Butterfly valve test facility
for liquid nitrogen



-196°C

FLUID TEMPERATURE

KSB tests butterfly valves for use in liquefied natural gas applications at a test facility with liquid nitrogen at a fluid temperature of -196 °C.

FRANKENTHAL

Test facility for
power station pumps:

20,000_{KW}

ELECTRICAL DRIVE RATING



The test facility for power station pumps has an electrical drive rating of 20,000 kW, which corresponds to the power of 250 cars with 80 kW each.

WORLDWIDE

EVERY
1.4th
PUMP
DIFFERENT

Statistics show that having sold 1,250,000 units of the current ETA pump family manufactured since 2013, every 1.4th pump was different.



Together we're better

Companies cooperate with universities, colleges and research institutes to drive innovation. Intensive collaboration can yield benefits for both sides. KSB has thus developed a global network to strengthen its capacity to innovate.

Many companies place innovations at the centre of their strategic vision. KSB defines them as solutions that create added value for customers and have been successfully implemented in the market – in the form of new products, services or business models. The pump and valve manufacturer is currently working intensively on determining what the future holds for fluid handling, i.e. the entire process of fluid transport. The basic operating principles of the products involved will remain unchanged. But in the future, the classic disciplines of mechanics, hydraulics and drive technology will increasingly merge and be supplemented by communication

“Working with us allows university partners to apply their knowledge to practical applications.”

Dr Stephan Bross
Member of KSB Management

A N K I T A
G O U T A M
S A R K A R

DATA SCIENCE

I was very excited to be accepted for a three-month internship in KSB's data science team. My task was to extend a function for creating heat maps from a one-dimensional colour scale to a full three-dimensional colour space and evaluate the results. Heat maps are an important visualisation tool for KSB's data scientists, who use them to create spectrograms of vibration signals for example.

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My supervisors were very supportive as I tackled the task. They encouraged me to do my own research and find solutions to problems. I learned a lot and expanded my expertise.

The sensor data displayed improves error detection and correction. With the extension I created it is now possible to display three-dimensional

vibration data as a compact colour spectrogram.

I am quite proud to have successfully completed this challenge. I now plan to write my master's thesis in the Business Innovation Lab. Here, KSB is developing new digital business models. I look forward to the exciting projects ahead of us.

Companies cooperate with universities, colleges and institutes to drive innovation. Intensive collaboration brings benefits for both sides and thus developed a global network to strengthen its capabilities and innovate.

“Working on a challenging project has boosted my confidence enormously. This will definitely help me in my working life.”

“Working with us allows university partners to apply their knowledge to practical applications.”

Dr Stephan Bross

Member of KSB Management

HERITIER
S A M U E L
N D A Y A M B A J E
N K I N D I

Electrical Engineering
and Information Technology

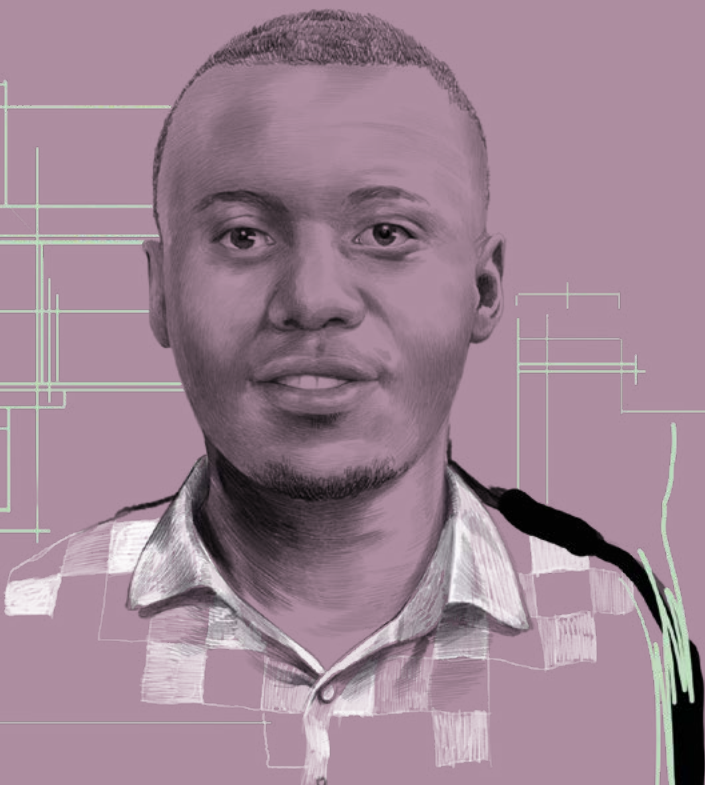
I first got to know KSB on a summer excursion organised by my university. As well as manufacturing optimised products for vital tasks such as fresh water supply, the company is also driving forward their automation. This is also my field of expertise at the Technical University in Kaiserslautern. The company left a lasting impression on me. Which is why I applied directly for a specialist internship position. It allows me to use my theoretical knowledge in practice.

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To we're

Companies cooperate with universities, colleges and institutes to drive innovation. Intensive collaboration benefits for both sides thus developed a global strategy to strengthen its capabilities and innovate.

During my five months of work in KSB's research and development team, I was tasked with designing a microelectronic temperature transducer. I was also involved in KSB's cloud-based solution for monitoring

and directly reporting deviations in pump operation. Today, I work in the team as a student trainee and contribute to various projects in electronics, sensor technology and the Internet of Things.

“The collegial atmosphere supports my professional development, and there is always something new to learn. KSB is not only an attractive company, but also a place full of interesting interaction.”

“Working with us allows university partners to apply their knowledge to practical applications.”

Dr Stephan Bross

Member of KSB Management

between the components and artificial intelligence. By focusing its research and development activities on these trends, KSB can improve the energy efficiency and sustainability of its products. Other central research topics include materials engineering and additive manufacturing processes such as 3D printing. These offer unprecedented opportunities for KSB.

Close cooperation between companies, scientific institutes and development partners enables research and development work to be conducted at a technologically advanced level. The aim here: Laying the foundations for innovative, sustainable solutions for the world of tomorrow.

GLOBAL RESEARCH AND DEVELOPMENT NETWORKS

“Particularly in our early-stage development and basic research work, we rely not only on internal expertise, but also on cooperations with universities,” says Dr Stephan Bross, member of KSB Management responsible for Technology and Digital Transformation. “Universities have a greater degree of creative freedom and an enormous pool of know-how.” KSB thus unites different areas of expertise which expand the company’s knowledge base and can be integrated into its knowledge network.

KSB conducts research and development at various locations around the world in order to achieve accelerated development of new products and services close to their respective markets. The company spent more than 52 million euros on research and development in 2021, and 439 women and men work in this field throughout the Group.

BENEFITS FOR COMPANIES AND UNIVERSITIES

For the pump and valve manufacturer, cooperation with universities offers many advantages. These include gaining KSB access to the latest scientific developments. New concepts, theories and technologies can be tested in practice. “Working with us allows university partners to apply their knowledge to practical applications,” says Bross. “Many students are motivated by the prospect of collaborating with us to solve concrete problems from practice.”

The universities also stand to benefit. “It is an opportunity for us to keep abreast of developments and demands on technological innovations from the industry directly,” reports Professor Shuhong Liu from the Institute of Thermal Engineering at Tsinghua University in China. The university’s department of energy and power engineering has conducted research with KSB on the mechanical stability of boiler recirculation pumps used in power plants.



↑ **Projects and solutions:** At KSB, students work on practical challenges. Dr Stephan Bross (right) appreciates the knowledge young people can offer.

“The cooperation has helped us to expand our knowledge in evaluating the operating reliability of new pump prototypes and refine our research methods,” says Liu. It is thus possible for universities to incorporate more practical elements into their programmes.

INTERDISCIPLINARY TEAMS CREATE INNOVATIONS

For mechanical engineering companies like KSB, cooperation with universities has previously focused on disciplines such as mechanical engineering, hydraulics, materials technology and electrical engineering. Today however, emerging technologies and digitalisation are boosting interest in specialist fields relating to mathematics, information technology, process engineering and physics. Data analysis

and evaluation are playing an increasingly important role across all industries.

“For us, strengthening the capacity to innovate means connecting with experts from different disciplines and bringing them together,” says Bross. Digitalisation and new technologies are making tasks much more interconnected and interdisciplinary.

Cooperating with university spin-offs and start-ups is also becoming more and more attractive for established companies. “These dynamic firms work within a great environment and have innovative ideas,” says Bross.

KSB cooperates with numerous scientific institutes worldwide. Research and development work is often part of publicly funded projects.

OPPORTUNITIES FOR STUDENTS

The company also establishes contact with students directly. KSB offers young academics a wide range of opportunities via internships, thesis topics for various disciplines and jobs as student trainees, enabling them to get involved in projects at a practical level. In addition, young people can apply for dual study

INNOVATIONS FROM THE THINK TANK

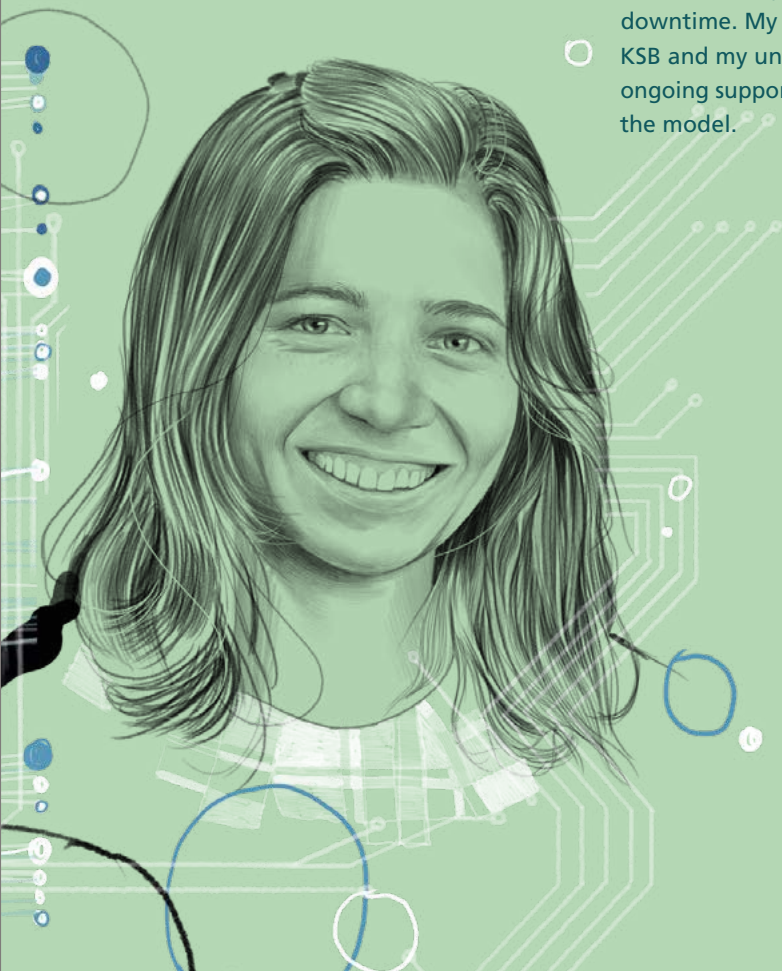
With its Business Innovation Lab, KSB is exploring alternative approaches to traditional research and development processes. It is located away from the company's locations and is not involved in the turbulence of day-to-day business. This think tank sees young and experienced KSB employees working with external innovations.

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JULIA
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DATA SCIENCE

I wrote my master's thesis at KSB over a six-month period. The thesis involved me creating a model using pump process data that recognises whether two pump sets are in direct proximity to each other. This knowledge allows measures such as pump maintenance to be planned more cost-effectively and cause less downtime. My supervisors from KSB and my university offered ongoing support as I was creating the model.



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↑ Projects and solutions:
Dr Stephan Bross (right)

“The cooperation has helped knowledge in evaluating the ability of new pump prototype research methods,” says Liu. for universities to incorporate elements into their program

INTERDISCIPLINARY TEAMS C INNOVATIONS

For mechanical engineering of KSB, cooperation with universities focused on disciplines such as engineering, hydraulics, materials and electrical engineering. To emerging technologies and boosting interest in specialist to mathematics, information process engineering and physics.

“I am pleased that the data model from my master’s thesis is not just gathering dust in a filing cabinet, but might find a useful application in future.”

KSB experts from the fields of mechanical engineering and mathematics also assisted me with different approaches. I found the mixture of theory and practice very interesting. We also had to find solutions for

dealing with erroneous and incomplete data. When presenting my work at KSB, I realised from the questions and the resulting discussion that my results could prove very useful. Overall a great experience!

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INNOVATIONS FROM THE THINK TANK

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A N S G A R
B A C H M A N N

Mechanical Engineering

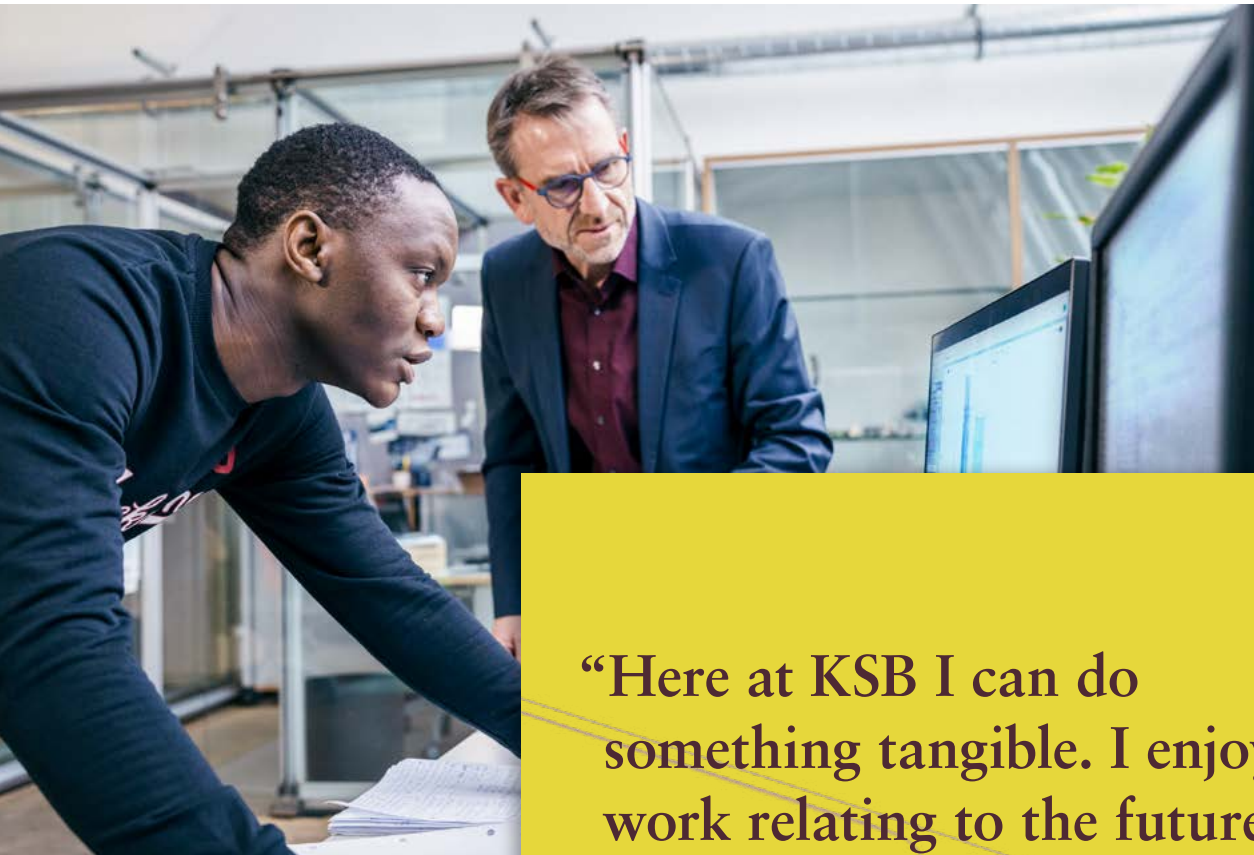
After a four-month internship at KSB, I was offered the opportunity to continue working as a student trainee. I did not need long to think about it. This job has enabled me to work on a range of projects. Carrying out CFD simulations on the computer was especially interesting. These can be used to calculate the flow characteristics of liquids and gases. The focus here was on the aeroacoustic analysis of a fan. Our goal was to reduce the time required for the simulations while being able to completely map the experiments carried out. It was an exciting challenge.



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“Here at KSB I can do something tangible. I enjoy work relating to the future.”

↑ **Projects and solutions:** /
Dr Stephan Bross (right)

“The cooperation has helped knowledge in evaluating the ability of new pump prototype research methods,” says Liu. for universities to incorporate elements into their program

INTERDISCIPLINARY TEAMS C INNOVATIONS

For mechanical engineering of KSB, cooperation with universities focused on disciplines such as engineering, hydraulics, materials and electrical engineering. To emerging technologies and boosting interest in specialist to mathematics, information process engineering and physics.

I am currently working on automating simulations for a prototype. The team is hoping to get more information on aspects such as noise development in a shorter time. But this is not an everyday project and I cannot reveal too much more about it.

I think our loft office is great. It is a workplace for students from different disciplines. Interacting with others helps us to look beyond our own horizons. You can learn an incredible amount like this.

OPPORTUNITIES FOR STUDENTS

The company also establishes contact with students directly. KSB offers young academics a wide range of opportunities via internships, thesis topics for various disciplines and jobs as student trainees, enabling them to get involved in projects at a practical level. In addition, young people can apply for dual study programmes or schemes combining study and apprenticeships – the perfect mix of theory at university and practice in the company.

A positive side effect: Companies that establish contact with young talent early on are rewarded with skilled staff in the future. After all, an early collaboration with KSB can often be the start of a career with the company. Students already know 'their' company, its processes and many of its employees. Human resources departments therefore see universities as an important channel for recruitment.

INNOVATIONS FROM THE THINK TANK

With its Business Innovation Lab, KSB is exploring alternative approaches to traditional research and development processes. It is located away from the company's locations and is not involved in the turbulence of day-to-day business. This think tank sees young and experienced KSB employees working with external experts and students to develop innovations.

The Lab was founded in 2017, and is home to agile, interdisciplinary project teams on a mission to find novel, digital business models and ideas for products and services. Throughout this process they keep their sights firmly set on achieving added value for KSB's customers. This approach facilitates the development of innovations yielding benefits such as increased operating reliability or improved ease of use for pump systems.



↑ **Researching together:** KSB cooperates with numerous universities worldwide, including 15 different research institutions in Germany alone. Kaiserslautern Technical University is one of them.

MORE COOPERATION IN THE FUTURE

The trend is clear: The number of cooperations will continue to increase in the future. Because if you want to produce the best products, you need the best minds. There are still many innovations to develop!

Current KSB job opportunities for students:
www.ksb.com/careers

Providing early inspiration

Education for children and young people is a central theme of KSB's social engagement efforts. The company is a founding member of the initiative Wissensfabrik – Unternehmen für Deutschland e.V. [Knowledge Factory – Companies for Germany]. Since 2005, KSB has been helping awaken children's interest in science and technology through educational partnerships with schools and nurseries. The company provides learning materials for practical experiments and exercises along with support to help teachers and daycare staff use them.

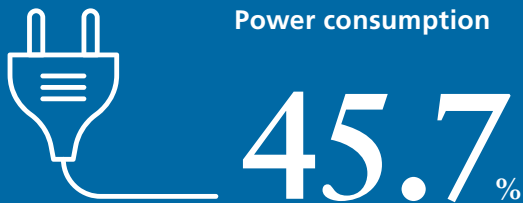
Another Knowledge Factory project supported by KSB promotes early childhood language development. The Knowledge Factory also helps young entrepreneurs set up their own companies. This creates new jobs supporting prosperity and growth. Experienced mentors help the young entrepreneurs take their first steps into the world of self-employment. The initiative brings together new and established companies. This allows both to learn and benefit from each other.

See: www.wissensfabrik.de

↓
Awakening interest: The Knowledge Factory introduces children and young people to technology in a fun and engaging manner.



Sustainability at KSB



Share of renewable energy in Group-wide electricity consumption; percentage in Germany: 63.6 %



Number of working days lost due to occupational accidents per employee per year in 2021 worldwide

Social activities

110 charitable initiatives and projects supported by KSB in 2021



KSB has set itself nine sustainability goals to be achieved by 2025. More information can be found in the Sustainability Magazine.
www.ksb.com/sustainabilitymagazine2021

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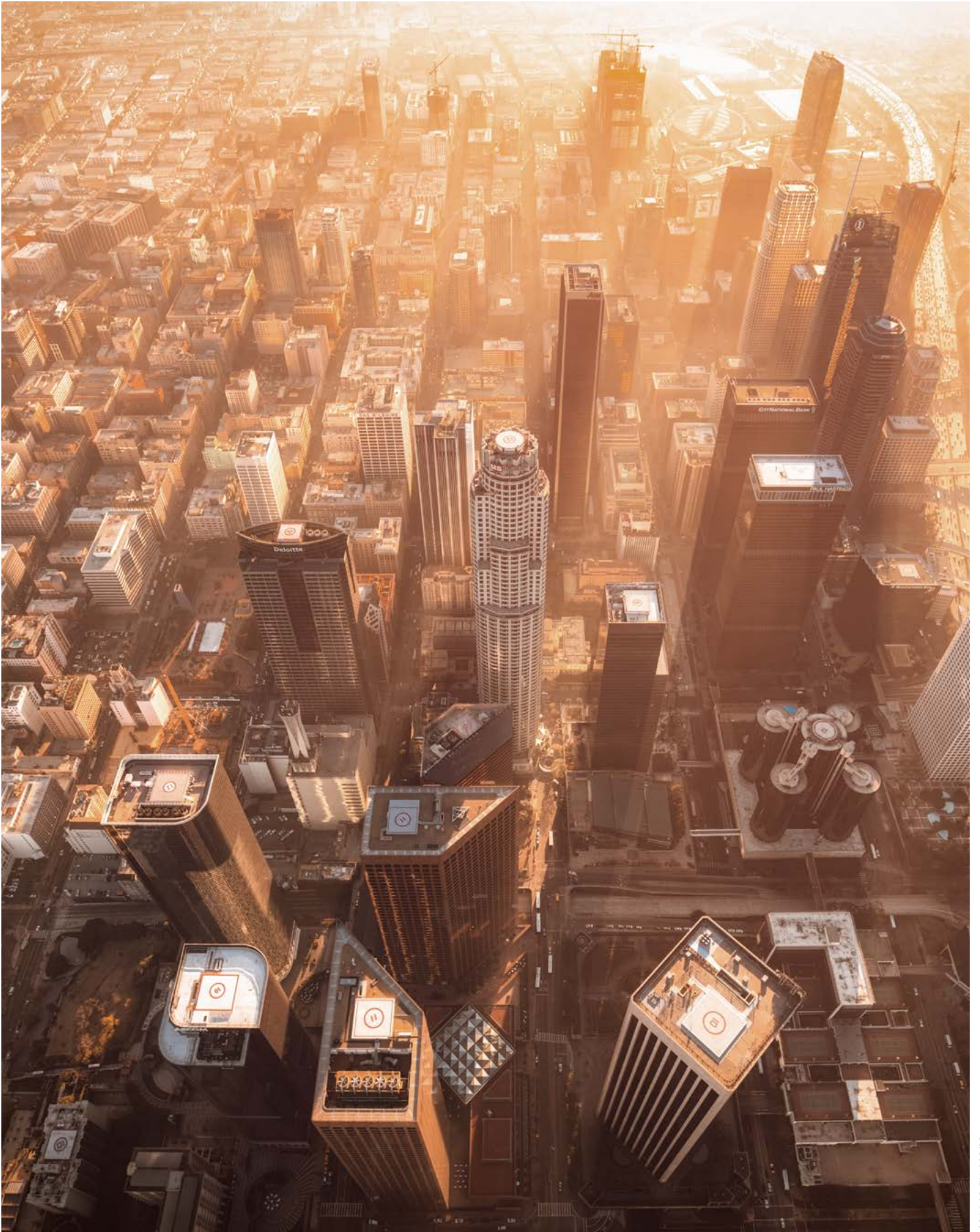
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