

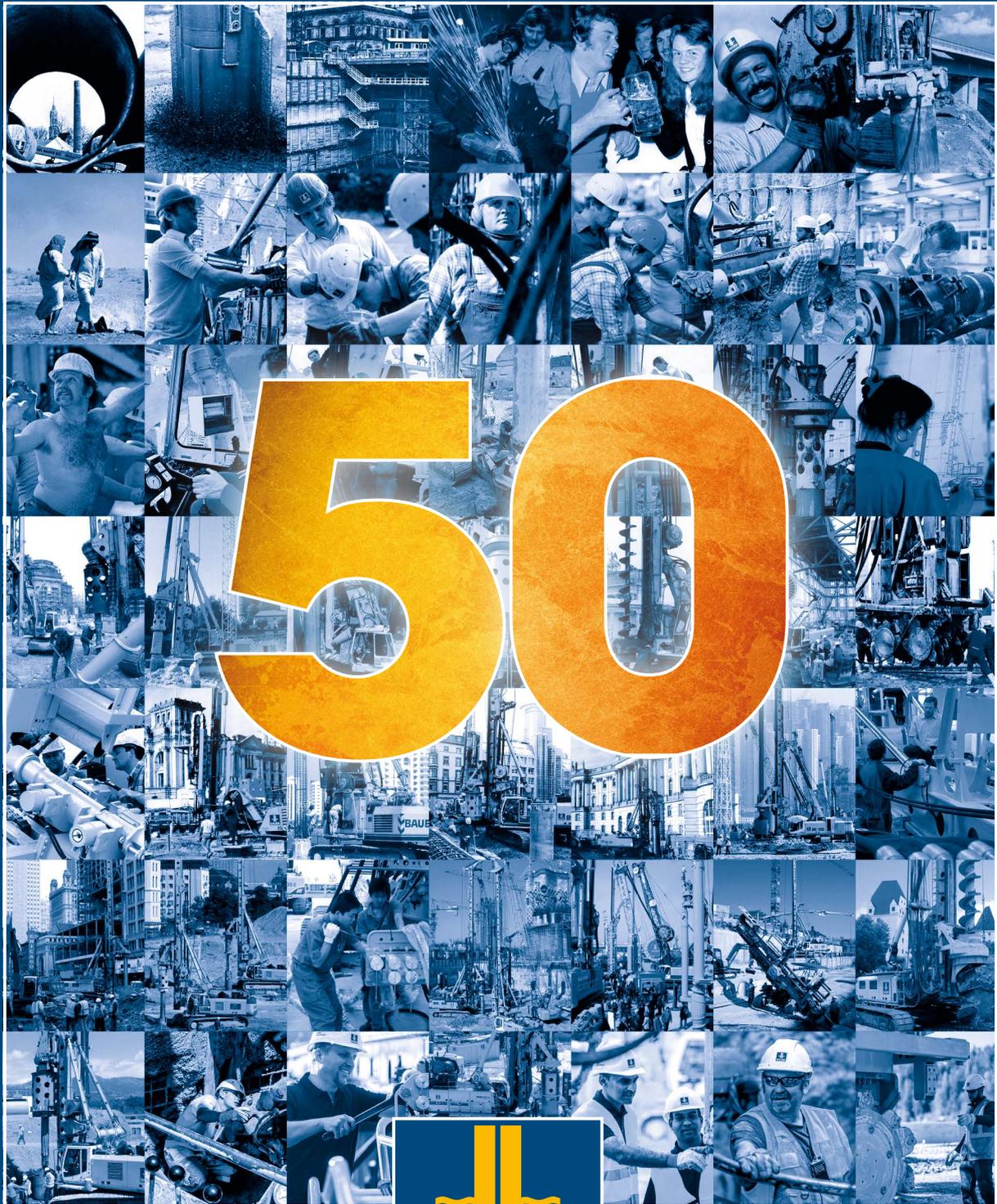
BAUER REVIEW

FOR EMPLOYEES AND FRIENDS OF THE

BAUER GROUP COMPANIES

2020

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An RTG RG 19T was used during work on the QHTrack project in Berlin. The excavation pit was horizontally sealed, using an environmentally compatible and sustainable LWS silicate gel base.

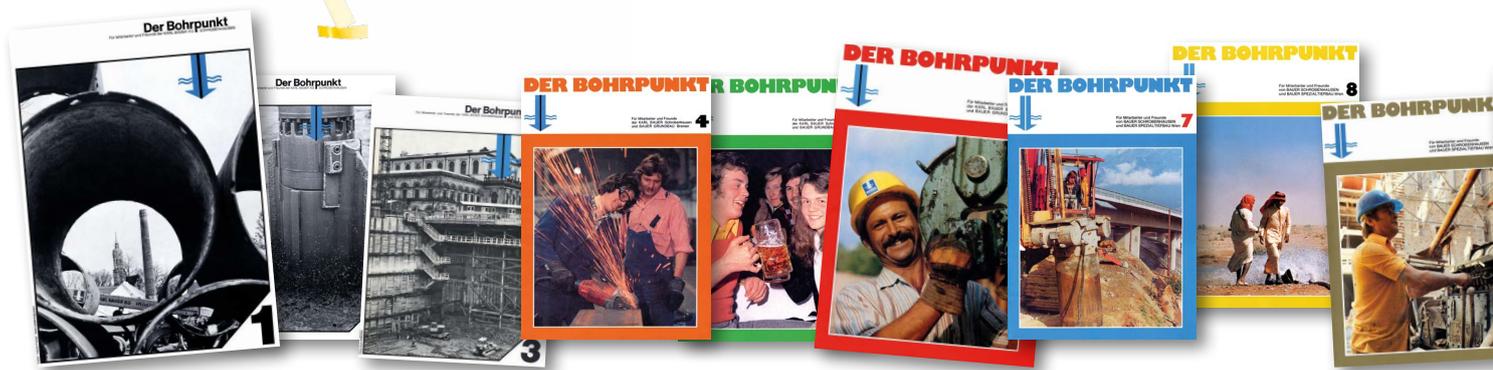
Internal news

Around the world, the year 2020 will be remembered for a long time due to the coronavirus pandemic and the restrictions, problems, and changes that occurred as a result. Despite all the difficulties and challenges we have faced, there are also positive aspects to look back on this year. For instance, we are celebrating a very special success story with this year's issue of the BAUER Review: The first issue of the company magazine left the print shop in May 1972. Over the years, the BAUER Review has become an institution and even a piece of the company's history in its own right.

Alongside numerous successful projects and completed construction

works, this issue of the Bauer Review is also dedicated to an overarching topic that will gain increasing importance in the future: sustainability.

This concept is defined as the principle "of no longer using more than can be regrown, regenerated, and supplied again in the future". In other words, the entrepreneurial decisions of today must also be responsible for the world of tomorrow. Across its various segments, the BAUER Group relies on resource-efficient, environmentally compatible methods, sustainable machine technology, progressive ideas, and innovative approaches to face the global challenges of the future.



Happy Birthday

BAUER Review

1972 was an eventful year: Willy Brandt was the Chancellor of Germany and the Watergate scandal and Vietnam War shook the US government, under the leadership of President Richard Nixon. The Olympic Games in Munich were overshadowed by a terrorist attack, Germany's soccer team won the European Championship for the first time, and the first episode of the cult sci-fi series "Star Trek" flickered on TV screens in living rooms across Germany. This turbulent time also marks the birth of the BAUER Review: The first issue of Bauer's magazine "For employees and friends" left the print shop in May 1972. Today, 50 issues later, the BAUER Review still documents a valuable facet of the company's history.

The BAUER Review began when the company was still Karl Bauer KG, generating an annual revenue of 68 million DM with 875 employees. Founded and published by Marlies Bauer and her small team, all the new company magazine needed was a name. Then came the idea: a competition to come up with

the name. Ultimately, Franz Steuringer's suggestion was chosen: The magazine would be known in German as "Bohrpunkt", a reference to the drilling location on the construction site used by Bauer employees to sink a pile or start anchor drilling. At the same time, the proposal "Bohrwurm" (drilling worm) was given a consolation prize. While the first three issues were printed in black and white, color was used starting with the fourth issue: The cover featured four colors and one highlight color was used on the inside of each issue. Inside pages with four colors appeared starting with issue 7, and the definitive switch to four colors took place for issue 9 in 1979. The company's increasing international focus finally made it necessary

» ... for employees and friends ... «



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to produce two versions of the BAUER Review starting in 1986: a German version and an English version. Three years later with issue 19, the layout was given another distinctive touch: the "blue line" that is still featured on the cover of the BAUER Review.

A status report for the company has been included since the first issue and continues to appear at the start of each issue. Alongside important central topics, reports on current construction sites, and the latest innovations, the BAUER Review still focuses on people. From company celebrations to participatory campaigns or honoring employees. Apart from the technical aspects of the BAUER Group, people and their per-

sonal stories are what truly make the BAUER Review special. Today, nearly half a century after the publication of the first issue, more than 11,500 employees work at the different companies in the BAUER Group, generating total Group revenues of 1.6 billion euros. Over the years, the BAUER Review has discussed the reunification of Germany, the challenges of the global financial crisis in the late 2000s, and now the unanticipated consequences of the coronavirus pandemic. Along the way it has also addressed numerous celebrations, successful in-house exhibitions and Bauma

trade fairs, the Schrobenhausener Tage symposium, award ceremonies, spectacular construction sites, novel machinery, and innovations. In this way, the BAUER Review has become an institution over the years, an integral component of the annual rhythm within the BAUER Group, and a piece of company history in its own right.

Happy Birthday BAUER Review!



For a hydroelectric power plant in the upper Inn region along the Swiss-Austrian border, a BG 36 H and a BG 36 V were used to construct reinforced piles using the Kelly method.

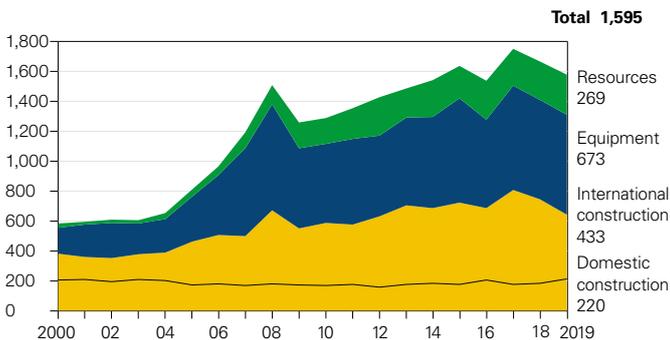
Status report

The BAUER Group has faced unprecedented challenges during the "year of Covid". Companies in many industries are struggling or even on the point of closing down, for instance in the tourism or airline industries – there have been very few winners, most of them in IT or the digital sector. The negative impact has been very strongly felt in the construction and equipment sectors. But first let's take a look back at the 2019 business year.

With total Group revenues of EUR 1.59 billion, 5.4% below the previous year's values, and markedly negative earnings after tax at EUR -36.2 million, 2019 unfortunately did not turn out as we had hoped. Political changes in the Middle East brought the construction market to a standstill in some countries. Due to project postponements, we struggled with underutilization in the Construction segment as a result. Our earnings situation was also significantly affected by unfavorable interest developments in provisions for pensions and interest rate hedging. But the largest impact came from a ruling that we simply do not understand in response to an appeal against an arbitration court verdict from 2018 concerning a construction project in Hong Kong in the years 2011 and 2012. As a result of this ruling, we were forced to make a valuation allowance of approximately EUR 40 million.

Development of total Group revenues by segment

in million EUR (segments after deducting Other/Consolidation)



Looking at our three segments in detail, total Group revenues in Construction fell by 12.9% to EUR 668.8 million. Earnings after taxes amounted to EUR -52.7 million. Nearly all the factors described above had an impact on the Construction segment. Unfortunately, these figures do not demonstrate the fact that we were able to manage our projects successfully overall.

The Equipment segment had a very good business year, once again due to the solid markets in Europe and China. Total Group revenues remained high and virtually unchanged at EUR 713.7 million, and earnings after tax fell slightly to EUR 39.5 million.

Although we hoped for significant improvements in the Resources segment, this was not possible due to sustained losses in our business with brewery and beverage technology, underutilization at our subsidiary in Jordan, and restructuring expenses. While total Group revenues increased by 5.5% to EUR 274.9 million, earnings after tax were again markedly negative at EUR -13.7 million.

After a difficult 2019, we started off the new business year optimistically with a clear action plan and new goals. But the spread of coronavirus, resulting in a global pandemic, quickly showed us that 2020 had more serious challenges in store.

We introduced hygiene and distancing rules very early on, as well as separation of similar activities – first at our plant in China, then at our location in Italy, and finally at our German and international locations, construction sites, and production facilities. As a result, we have succeeded in minimizing case numbers, as well as the negative impact on our internal business operations. We did have a few infections internationally, primarily on our construction sites, though all our employees have now fully recovered. Working from home has also been very successful, which demonstrates us that our IT infrastructure is robust.

Nevertheless, we are clearly experiencing the economic consequences of the pandemic. In many countries, curfews and travel restrictions complicated logistics and supply at construction sites in terms of equipment, materials and personnel, sometimes even making operations impossible. Numerous employees have had to endure week-long quarantines in order to reach their work sites. Many of them worked on international projects for months without being able to travel home as usual. In the Equipment segment, we felt a clear reluctance to invest among our customers, due to the uncertain situation, which also caused our sales to fall. Only our Resources segment has been able to perform quite well so far this year, even though we are still in the process of restructuring.

As a result of all these factors, we had to introduce short-time working arrangements starting in April for many areas and postponed some of our investments. Independently of this, we continue to proceed consistently with our reorganization measures: closing the Prakla location in Peine, ending our joint venture with Schlumberger in deep drilling technology, or selling our Resources company that offers brewery and beverage technology. In the future, we want to reinforce our commitment to the core business and make use of our opportunities for growth in that area.

We would like to particularly thank all employees who are dedicated to driving business forward every day – whether chartering flights to bring employees and materials to construction sites, submitting to quarantine measures, working to maintain virtual contact with customers in sales, or organizing the first virtual employee information event to keep their colleagues up to date. All our employees are striving to get us through this difficult year in good shape. And I would also like to warmly thank you, our trusted partners, customers, and friends of the company. We hope you will continue to accompany us through these extraordinary times and let us stay in touch – in whatever form that may be!

Yours sincerely
Michael Stomberg



Innovative methods

Focus on resource-efficient and environmentally compatible methods
See more on p. 18



Sustainable equipment

Shaping the future of machine development
See more on p. 26





Assuming responsibility

Sustainability – a multifaceted topic

Whether in fashion, technology, or nutrition, some trends fade away nearly as quickly as they arrive. But others deeply take root and change the way we think, live, work, or consume for a long time. Sustainability is one of these trends.

This now widespread term can be traced back to the early 18th century, when it was first introduced by Hans Carl von Carlowitz, though his ideas were confined to the context of forestry. The term remained dormant for a long time afterwards, only to emerge in the collective consciousness again more than two and a half centuries later. Particularly over the last 20 years, sustainability has increasingly become a guiding principle for political and commercial activity. At the very latest, the Sustainable Development Goals passed by the UN in 2016 have made it clear: Sustainability concerns us all.

Sustainability as a driving force for innovation

If you look up sustainability in the dictionary, it is defined in part as the principle "of no longer using more than can be regrown, regenerated, and supplied again in the future". Or as phrased by the UN's World Commission for Environment and Development, sustainable development "meets the needs of the present without compromising the ability of future generations to meet their own needs." A more concrete explanation is the three-pillar model, according to which sustainable development depends on equal implementation and consideration of environmental (ecological), commercial (economical), and social goals. Sustainability according to this model does not mean making income that is then invested in environmental or social projects, but rather generating income in a way that is environmentally sound and socially responsible. "In short, the question is how we take on responsibility for tomorrow, with the entrepreneurial decisions we make today," summarizes Michael Stomberg, CEO of BAUER AG.

Green technologies

Innovative approaches
for global challenges
See more on p. 34



Progressive ideas

Sustainability in all
areas of the
SCHACHTBAU Group
See more on p. 38



Assuming responsibility and taking action for the good of society: Once again, Schachtbau Nordhausen supports the Children's Hospice of Central Germany with its Christmas donation (right) while employees of Bauer Technologies South Africa bring joy to children with personal Christmas gifts, as part of the charity project "Spread the Kindness" (bottom).



"As a family business with a long tradition, our orientation should never favor short-term results at the expense of the long-term development of our company and our society."

Sustainability offers major opportunities for inspiring improvements and producing innovations that can be assessed in terms of their environmental and social responsibility. For instance, research and development activities at Bauer focus on bringing innovative methods and products onto the market in a way that optimizes performance and efficiency while minimizing the negative ecological impact. Existing construction methods and equipment are continually optimized. Bauer also offers numerous sustainable methods and solutions to face the challenges of the future – starting from brownfield remediation and biological water treatment methods all the way to the rehabilitation of existing structures.

Long-term solutions rather than short-term optimization

Alongside environmental protection, the sustainable policy of the BAUER Group centers on entrepreneurial performance, quality, and safety. "Sustainability has many dimensions for us," says Michael Stomberg. "We are committed to applying this word in its strict sense to the overall development of the Group: As a family business with a history spanning more than 230 years, we aim to develop solutions that are viable over the long term rather than risky short-term optimizations. This philosophy is reflected in our equipment and services: after all, sustainability also means future viability."

Two major topics for the construction industry of the future are electrification and digitalization. In spring 2019, visitors at the Bauma in Munich were able to witness our first electrically powered Bauer cutter unit. The machine

has since been successfully launched on the Chinese market, where a keen interest in electrified equipment is evident. But the electrification of construction equipment will become even more important in Europe and other markets in the future. "For this reason, electrification is and will remain a central component of our road map for development," emphasizes Michael Stomberg. "We want to actively shape future trends and develop equipment and processes for meaningful and beneficial use in our sector." Another focus is the continuous optimization of conventionally powered equipment with the aim of improving their efficiency. Bauer's energy-efficient power (EEP) has become firmly established in drilling rigs and also represents our state of the art for the MC duty-cycle cranes and RTG pile driving equipment. Not only does the EEP reduce fuel consumption, it also reduces noise emission. In addition,

numerous smart assistance systems aid equipment operators in their daily work. These enhance safety and long-term productivity on the site, thereby contributing to sustainability.

"Digitalization has been a focus of our activity for some time now," says Michael Stomberg. "As an equipment manufacturer and operator, we work on digitalization solutions that offer real added value for us and our industry, and we demonstrate their effectiveness in practice. Here I would like to emphasize: Digitalization is not just about new IT. Instead, when we talk about digitalization we mean the creativity to identify new solutions using the resources of modern IT. This creativity could come from any area of the company. That's why we motivate our employees and work together to generate ideas." This could involve using new control systems in production, using IoT sensors on site for process improvement, and monitoring or actually creating an IT product in the form of software. One example is the Bauer project management tool "b-project", which is used to centrally manage and connect all information and production data for a construction project on a single platform – a key component for the digital twin of the site that makes it possible to monitor all planned services against the actual execution in real time. But a universal concept of sustainability extends beyond the environmental aspects of equipment and construction sites and touches on social considerations. In a similar way, Bauer has supported social projects worldwide at our different locations for a number of years. We are also engaged in close

and continuous dialog with research institutions and universities to promote two-way knowledge transfer, not only with research projects and scientific lectures but also through teaching engagements.

Sustainable business development based on self-regulation

"Ultimately, sustainability is also reflected in the way we interact with our various stakeholders – apart from partners, customers, suppliers, and society, this particularly means our employees," explains the CEO. "Our company culture is characterized by team spirit and solidarity – values more urgently needed in these times than ever before. These values and our sustainable actions make me proud and optimistic – even in difficult times."

It is crucially important to consider not only "What" – in other words, products and services – but also "How", that is, the way we work together and interact. "I believe that self-regulation is the most modern form of business organization. In my opinion, this is the best fit for us and for the future-oriented, sustainable development of the Group." The advantages: Encouraging autonomy at Bauer locations worldwide increases motivation and streamlines the decision-making process. However, this requires significant effort in communication, training, and exchanges of experience – and especially shared values that bring all units together. "Local companies within the Group already have a great deal of freedom for self-regulation in line with our strategies, requirements, and values."

But how does governance work in a self-regulating organization? "Self-regulation does not go against the binding requirements that describe how we work, how we handle specific issues, and which values we promote," asserts Michael Stomberg. "One task of management is to outline specific requirements that prescribe the basic framework for business activity. On the other hand, management has to take care of employees, for instance by ensuring a fair system in which prescribed rules are observed in a reasonable manner, and above all that employees understand the purpose of their work." This purpose does not primarily involve profit for the company, however. "Of course, we need sufficient income to maintain the company in business over the long term. Naturally, our goal is to make a profit in line with fair market conditions. But profit is like the air we breathe: We have to breathe to live, but we don't live merely to breathe." So what is the purpose of a company? Michael Stomberg: "I believe this has a lot to do with satisfaction – the satisfaction of achieving a goal and doing one's best even when that may have taken a great deal of effort. Think about a mountaineer who struggles to climb a peak and then enjoys the view from the summit, exhausted but content. Of course it would have been easier to fly to the summit in a helicopter – but I'm pretty sure this wouldn't give the mountaineer the same feeling of satisfaction and pride in his achievement."



Instead of sending christmas gifts to customers and business partners, BAUER AG makes donations to social institutions in the Neuburg-Schrobenhausen region every year.

Specialist foundation engineering on all continents

USA An existing levee system is receiving an upgrade on the east bank of the Mississippi. To restore the existing dike, Bauer uses a combination of grab and cutter technology to create a single-phase cut-off wall by adding a self-hardening slurry. A total of approx. 53,000 m² cut-off wall will be created over a length of 1.4 km up to a depth of approx. 43.5 m. **right**



Australia About 900 km north of Brisbane, a new aeration shaft was constructed for an existing mine, up to approx. 70 m and stabilized and secured using concrete. **top**

Canada An old bridge structure from the year 1909 is being replaced by a new bridge to better connect the center of Calgary in the future. To create the foundation, cased piles were installed to a depth of 18 m. **right**





USA The Teller Dam is located within the U.S. army base Fort Carson near Colorado Springs. Bauer was contracted to seal the dam and will construct approx. 1,160 m² of secant pile wall as well as approx. 1,760 m² of grout curtains for this purpose. **top**

Saudi Arabia With the construction of a new international airport, a large project is taking shape in the desert outside the city of Jazan. Over an area of 500,000 m², ground improvement measures have been carried out up to a depth of 11 m. **bottom**



Burkina Faso A secant pile wall created using the Kelly drilling method up to a depth of 23 m forms the foundation for a new mine ventilation shaft. **top**

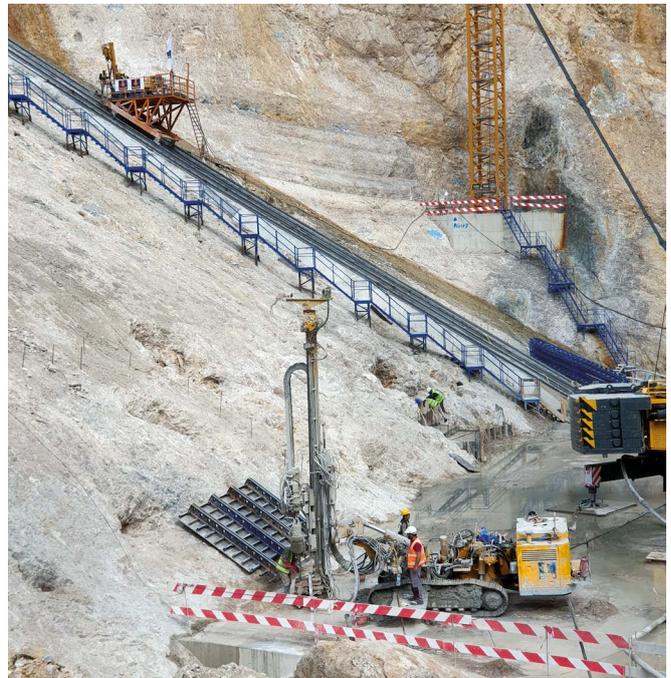
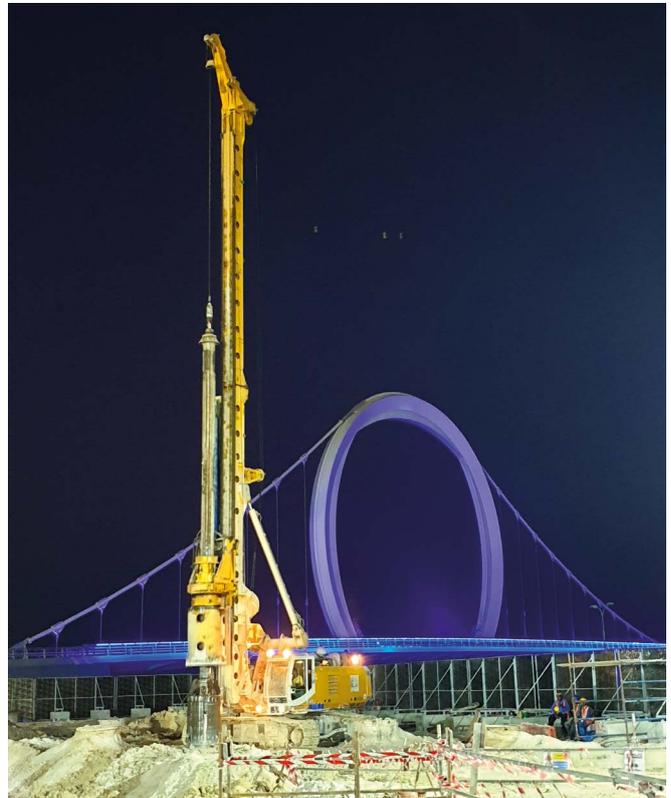
Jordan 112,000 m² of cut-off wall is being created for a salt water basin to extract potash. What makes this project unique: Because of its unusual location right next to the Dead Sea, the cut-off wall with a length of 4.2 km and a depth of between 18 and 30 m is being installed directly into a soil predominantly made up of salt. **right**





Qatar Using a BG 40 and a BG 28, a secant pile wall with a total of 112 piles was created for a pedestrian underpass in Doha. **left**

Qatar A BG 40 and a BG 28 were used to create piles for a total of eight residential buildings on four plots. **bottom**



Lebanon The Jannah Dam northeast of Beirut serves as a reservoir for the region. To seal the dam and grout the rock in sections of the foundation that are subjected to high pressure, Bauer carried out approx. 25,650 m of injections. **top**



Malaysia For the new Setiawangsa-Pantai Expressway under construction to improve the traffic situation in Kuala Lumpur, 56 foundation piles were constructed using a BG 40 and BG 45. **top**

Vietnam In the city of Nha Trang, Bauer constructed a total of 16 piles, up to a depth of 44 m as foundations for additional pylons for a cable car. **right**





Philippines As part of a large investment program, drilling for a geothermal power plant was carried out on the island of Leyte. Over four months, multiple slurry stabilized drilling operations were carried out using a BG 40, up to a depth of 150 m. **left**

Philippines A new highway is being constructed with the Metro Manila Skyway, to improve the traffic situation in the metropolitan area of Manila. Bauer created 188 piles, up to a maximum depth of 30 m, and installed 226 ductile piles with a length of 16 m. **bottom**







Specialist foundation engineering

Innovative methods for the projects of the future

The development of resource-efficient, environmentally compatible innovations and technologies has been a clear focus at BAUER Spezialtiefbau GmbH for some years now. The aim is to reduce the environmental strain caused by specialist foundation engineering, to use raw materials more efficiently and strategically, and to sustainably manage projects in an environmentally compatible way.

Resource-efficient methods

The Mixed-in-Place method (MIP) patented by Bauer, has been used successfully for more than 25 years to create retaining structures for foundation measures and for flood control. So far, approximately 650 construction sites have been outfitted with more than 2.6 million m² of MIP walls. The name of the method describes the process: "Mixed-in-Place" method refers to on-site mixing of the existing soil with a binding agent. Using a triple auger, the existing soil is broken up and the binder slurry is inserted. During the subsequent homogenization process, the direction of rotation for the individual augers is varied in order to circulate material in the trench and optimally mix the soil material with the binding agent. What makes this method unique: In contrast to conventional specialist foundation engineering methods that require soil removal, the MIP method involves producing the construction material on-site using the existing soil, which takes on the role of the aggregate material. This significantly reduces the quantity of construction material delivered, while also cutting back on the quantity of excavation material removed from the site. Due to high productivity levels, this method also results in relatively fast execution times – another advantage of the Mixed-in-Place method.

Reduction of greenhouse gas emissions

The upshot of all these advantages is not just a commercial benefit: the system is also impressive from an ecological perspective. In order to scientifically demonstrate the sustainability of the MIP method, the "Product Carbon Footprint" (PCF) was calculated using the CO₂e calculator of the European Federation of Foundation Contractors (EFFC). CO₂e is a unit used to compare the effect of all different greenhouse gases on climate. Since different greenhouse gases – for instance, methane or nitrous oxide – each have a different impact on the climate, they are converted to CO₂ equivalents (CO₂e). Using this method, the total amount of greenhouse gas emissions generated by the MIP method can be determined based on a sample construction site in Berlin. This CO₂e footprint takes into account all emission factors on the site, from the production of construction materials to the construction equipment used, required fuel, and power consumption, all the way to the required transport routes for construction materials, equipment and personnel, as well as production waste that is generated. The construction of a typical excavated diaphragm wall was used as a reference. The result: The MIP method was able to save 330 t of CO₂e in comparison, which corresponds to a value of 30%. "The method offers various advantages," explains Andre Seidel, Head of MIP Core Technology at Bauer Spezialtiefbau. "Apart from resource efficiency and low-vibration production, the Mixed-in-Place method is extremely flexible and productive, and it also involves lower noise and exhaust emissions. Last but not least, it is cheaper than conventional specialist foundation engineering methods."

With the Mixed-in-Place method, the construction material is produced on-site using the existing soil. This significantly reduces the quantity of construction material delivered while also cutting back on the quantity of excavation material removed.

Redesigning a tried-and-trusted system

Due to the continuous ongoing development of drilling and mixing equipment, the MIP method can now be carried out in nearly all soil formations. Apart from large-scale infrastructure projects or dam projects, the technique is also used in residential construction. In this context, the MIP method can also be used for near-surface geothermal heat. The highly profiled surface of the MIP wall generates a broad interlocking effect with the surrounding soil, enabling an efficient exchange of energy. For this purpose, geothermal probes can be



The system of geothermally activated mixed soil walls received the Innovation Award from the Bavarian construction industry in 2019.

mounted on the reinforcement cages for MIP retaining walls. This geothermal activation is also possible for foundation elements or sealing walls that are not reinforced. Using roof collectors, energy can be obtained in the summer months, fed into the ground via the installed geothermal probes and stored. In the winter, this energy is extracted from the ground again and used to heat the building. This method has already been used for a single-family home in the Bavarian town of Füssen. In this project, 1 kW of electricity was successfully used to

generate 5.5 kW of heat. "This could also be an innovative way to use renewable energy for private construction projects," explains Dr. Patrik Wenzl, employee in the Technical Services Department. "The system is now patent-pending and received the Innovation Award from the Bavarian construction industry in 2019."

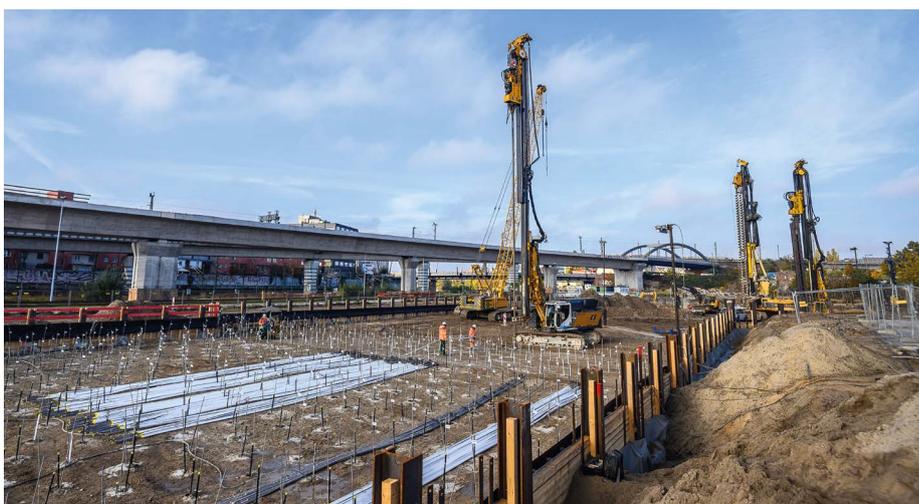
Ecological injection base

The environmentally-friendly, resource efficient MIP method is frequently used for the creation of impermeable excavation pits in combination with another innovative Bauer method: the LWS silicate gel base. While the MIP method can be used for the vertical encompassment and sealing of an excavation pit, the silicate gel base seals off the bottom of the excavation pit, preventing ground water from seeping in. The silicate gel base is installed in the ground by means of pore injection. For this purpose, grout pipes with valves in a grid spacing are inserted into the ground, using vibration or installed in drill holes. The grout is pressed through these grout pipes with valves, sealing off the pores in the soil and forming a seamless base with the grout body that is generated. In contrast to conventional soft gel blankets, which release compounds and elements that are bound in the adjacent ground due to their composition and may negatively impact the ground water, the composition of the injected silicate gel for the LWS method is optimized to cause a harmless increase in the pH value of the ground water. The excavation pit water that is transported through dewatering systems can also be directly diverted without additional cleaning. The LWS silicate gel base is used as an alternative to a jet grouting base (high-pressure injection base). Compared with the highly energy-intensive production of the bentonite used for the HPI method, production of the LWS construction material requires significantly less energy and resources. While the HPI method predominantly involves

removing and replacing the existing soil, and the emerging bentonite-soil mixture must be transported away from the construction site, resulting in higher transport expenses along with noise and exhaust emissions, the LWS method produces almost no backflow. Compared with the HPI method, this makes it possible to reduce CO₂e emissions by approximately 87% per m², while the energy consumption in kWh per m² is reduced by approximately 83%. Bauer's LWS method is an extremely reliable option for installing horizontal ground water barriers, that generally fall well below the official limits in relation to permitted residual water quantities. This prevents an unnecessary impact on the local ground water system near the site, as well as an excessive strain on the community's waste water system. Low emissions during production help to protect the environment and resources, as do rapid execution times and short transport routes. "Bauer's LWS silicate gel base is far superior to other base techniques when it comes to environmental compatibility and sustainability, and it is also very robust and reliable," says Dirk Beier, who is responsible for pore injection at Bauer Spezialtiefbau.

Wind energy thanks to offshore foundations

Oceans offer considerable potential for the generation of renewable energies from wind, waves, and tidal currents. Over the long term, wind energy is probably the most important and economically efficient renewable energy source in the power sector. Many of the wind farms in Europe that are already constructed, planned, or currently under construction, are situated in the North Sea and the Baltic Sea – a secure anchoring of the rotors or turbines in the ocean floor is essential for such projects. In 2011, the company BAUER Renewables Ltd., a subsidiary of BAUER Spezialtiefbau GmbH, took a first step in this field and successfully carried



An environmentally sound and sustainable LWS silicate gel base was used for the horizontal seal of the excavation pit for the QHTrack project in Berlin, comprising around 16,000 m².



A Mixed-in-Place wall was constructed for the remediation of a dike along the Rhone in Provence. The transport of construction materials was kept to a minimum thanks to the use of this method.

out the foundation work for a tidal turbine off the coast of Scotland, near Orkney. This was followed by an order for the Beatrice Offshore Windfarm Ltd (BOWL) project off the northeastern coast of Scotland in 2017. Each of the 84 turbines in total required four foundation piles, each with a diameter of 2.2 m and lengths between 32 and 54 m. All the piles were constructed by the client Seaway Heavy Lifting (SHL), using the pile driving method. In the event that the ground conditions turned out to be overly problematic, Bauer was on board as a reliable partner to carry out relief drilling to reduce friction using a specially constructed drilling rig from BAUER Maschinen GmbH, the BAUER Dive Drill C40. On July 29, 2019, Beatrice was officially opened.

In France, the harnessing of offshore wind energy is still in its infancy. But over the next few years that will change: According to a report from the International Economic Forum for Renewable Energies (IWR), the French government plans to build up offshore capacities with a total output of more than 5,000 MW by the year 2030. One of these projects is an offshore wind park in the bay of Saint-Brieuc in north-western France, for which construction is planned in 2021/22. For this planned wind park, BAUER Spezialtiefbau GmbH was commissioned in 2018 to plan and execute a total of 14 onshore test piles, including load tests to obtain findings for the dimensioning of the offshore foundation.

The test piles were installed in an active quarry near Cape Frehel in Brittany.

The greatest challenge in this project: extremely hard stone with a strength of more than 180 MPa, 60 MPa more than anticipated. Nevertheless, test drilling was successfully executed, in part thanks to innovative measuring technology, such as a laser scanner to determine the roughness of the rock or an automatic geo-laser system to test for ground uplift.

"This successful project established the foundation for developing a special drilling method, in which cased offshore drill holes can be installed using a Dive Drill and a casing oscillator. Structurally functional pile shafts are then lifted into these drill holes and then grouted with a special mortar," explains Thorsten Sprunk, head of the Offshore Foundations Division at Bauer Spezialtiefbau. Then in early June 2020, Bauer was contracted by the Dutch company Van Oord with the construction of 190 piles, for the tripod foundations of turbines at 62 locations. "This is the first commercial application of this new drilling technology worldwide. Another important step towards the future market for renewable energies," concludes Thorsten Sprunk. In August 2020, the Dive Drill began a six-week test phase in the bay of Saint-Brieuc, starting from the Dutch port of IJmuiden, and the actual foundation work with three Bauer Dive Drill rigs is planned to start in March 2021.

Outlook

"Thanks to our innovations in the area of Mixed-in-Place method, LWS, and offshore drilling, we are already well equipped for the requirements of environ-

mentally conscious and resource-efficient construction," summarizes Gebhard Dausch, Managing Director of BAUER Spezialtiefbau GmbH. "Our goal for the future is to further promote the topic of sustainability for other methods, as a way of establishing long-term innovative approaches in specialist foundation engineering."

Renewable energy generated from wind is an important area of sustainable energy supply. Bauer was commissioned to construct the underwater foundation for an offshore wind park off the coast of France.



Machinery in customer operations



Czech Republic When carrying out ground improvements for a dual-track railway embankment, our customer Firesta-Fiser opted for a BG 20 H and the SCM method. **top**

Switzerland For a micro tunneling drive in Geneva, the company Smet-Tunneling nv used a BE 275-60 with GS 425-V and BDS 250-20 K as well as a BD 90 from MAT in Immenstadt. **bottom**



Norway The customer Keller Grundbau executed a bridge construction site with a BG 36 using the Kelly drilling method. **top**



Netherlands For a new attraction on the coast of the North Sea, the company BodemBouw B.V. used an RTG RG 21 T for the execution of a CSM wall. **bottom**



Sweden To secure a sheet pile wall with self-drilling anchors, our customer NCC in Gothenborg relied on a KLEMM KR 806-5G. **top**



Russia To drill ventilation shafts for coal mining, our customer OAO SUEK Kuzbass used a PRAKLA RB-T 135. **bottom**



United Kingdom In London, Southern Piling UK carried out a micropile installation with hollow stem augers using a KLEMM KR 709-3G, up to a drilling depth of approx. 11 m. **top**

Italy For a project in the harbor of Trieste, I.CO.P. S.p.A. used a BG 24 H to manufacture a cut-off wall, using the SCM method. **bottom**



Germany GbE Grundbau Essen GmbH successfully carried out fill drilling and exploratory drilling in Bochum, using a KLEMM KR 801-3GS. **top**

Monaco The construction of piles in the harbor of Monaco was successfully concluded by the company Fondamenta S.r.l. using a BG 55 and a BG 45. **bottom**



Italy Our customer Brenelli Costruzioni S.r.l. installed micropiles in the ground of a basement, using a KLEMM KR 702-2 and a KR 802-3S. **top**

Greece In Thessaloniki, Xanthakis S.A. used a RTG RG 16T to construct a second central waste water pipeline. **bottom**



USA In order to reach a drilling depth of 44 m with the duty-cycle crane MC 128, we designed a special jib in collaboration with the company Berminghammer. After just two months, the MC 128 was used in Hawaii for the first time. **top**

Greece For the pile foundation of an industrial complex, our customer Triantafillakis Foundation Works used a BG 24 H as well as a BG 20 H. **bottom**



USA In Wilmington, Malcom Drilling Company used a BE 550 desanding plant for trench cutters. **top**

Democratic Republic of the Congo For well drilling in Central Africa, Bauer Technologies South Africa relied on a PRAKLA RB 40. **bottom**



Mozambique In southern Africa, our customer Vale relied on a BG 30 for the test drilling of a coal mine. **right**



USA Bauer Equipment America carried out various test runs on the company premises in Conroe, Texas, with a BG 33 using the Kelly drilling method. **bottom**



China Shanghai Tunnel Engineering Co. Ltd. used a BC 40 cutter on a MC 96 duty-cycle crane, as well as a BC 50 cutter on a MC 128 duty-cycle crane, in the Chinese metropolis of Shanghai. **top**

China On the Xin River, Jiangxi Bingxin constructed a cut-off wall with a BG 38, using the CSM method and an eccentric screw pump EP 14-400 from MAT. **bottom**



Sri Lanka On a construction site for a bridge in Kelaniya, San Piling (pvt) Ltd. used a BG 30 from Bauer. **top**

Singapore In Singapore, our customer Dongah Geological Engineering Co., Ltd relied on a total of four Bauer grabs: three GB 80 and one GB 50. **right**





With the energy-efficient power system (EEP), Bauer set the course for energy savings for drives or pumps ten years ago.

Energy-Efficient
POWER EEP



Equipment

On the path towards sustainable equipment

From energy and climate technology to electromobility, water supply, building technology, and medical technology – intelligent solutions and technical innovations are already delivering answers for the most critical issues of our time: Globalization, urbanization, mobility, and demographic shifts. Along with quality optimization, machine development has always focused on improving efficiency in terms of time, materials, or energy. Over time, however, priorities have changed when it comes to efficiency: Energy was largely much cheaper 20 years ago and customers were not so concerned with increasing energy efficiency, but the circumstances have fundamentally changed since then – though energy prices are currently far from their peak rates as a result of the coronavirus crisis. "Our customers view sustainability and economic efficiency as two sides of the same coin. That's why we share the same perspective," explains Dr. Rüdiger Kaub, Chairman of the Management Board of BAUER Maschinen GmbH. "If we build equipment that is more powerful and faster, while consuming less energy, the equipment will save resources in multiple ways and also reduce costs in the process."

The possibilities can be demonstrated by looking at the area of energy. Energy demand is increasing worldwide, but this rise can be curbed using innovative technologies, such as energy savings achieved with drives or pumps. By developing energy-efficient power (EEP), BAUER Maschinen GmbH set the course for energy savings around ten years ago. In addition to optimizing conventional equipment, the company continually works on advanced technologies, ranging from smart assistance systems to alternative drive concepts.

Sustainability means future viability

Visitors to Bauma 2019 in Munich were able to witness an electrically powered cutting unit with MC 96 duty-cycle crane from BAUER Maschinen GmbH. The electric duty-cycle crane was successfully launched into the Chinese market, where customers have demonstrated a growing demand for electrified equipment. Electrification in the construction industry is gaining importance, not only in Asia but in other regions around the world. For this reason, electrification is and will remain a central component of our road map for development. As a manufacturer and operator, Bauer actively shapes future trends and develops products and processes that offer added value for the long term. Bauer also continues to work on its electric drive technology. An electrically powered hydraulic power pack HD 1400 Electric Drive was recently introduced for special applications relating to diaphragm wall equipment, for example in confined spaces.

5G technology – not just a vision

Previous models that combined equipment with the mobile radio standard were not very complex: conventional mobile radio technologies essentially recreated a smartphone in the machine. This is no longer sufficient for machine communication, where broader reach is a decisive factor: Equipment operators, machines and equipment, site processes all need to speak the same "language" in order to understand one another.

Using 5G wireless technology, Bauer is currently developing a drilling rig that is able to recognize its environment and communicate data securely via interfaces. BAUER Maschinen GmbH is researching the technology behind networked sites, together with engineers



Wireless remote control allows for convenient and safe execution of many service tasks as well as telescoping the undercarriage or moving the drilling equipment, regardless of the equipment operator's position.

from the TU Dresden and more than 20 other partners. This innovative research project focuses on the further development of construction machinery to enable it to operate automatically or semi-automatically. Partially automated Kelly drilling is currently the most important area of development at Bauer. This requires the development of multiple systems, as well as their implementation on a demonstrator: An environment recognition system that can recognize both process interfaces and also possible dangers, a finite-state machine that is able to automatically capture its current process data; an equipment database and an equipment management system that automatically recognizes and manages tools and attachments, and corresponding assistance systems. 5G will enable extensive machine communication in the future. Even today, the Bauer equipment management software WEB-BGM acts as a central system for telematics – telecommunications and IT – supporting the transmission of data from equipment. This allows relevant machine data (such as

run-time, position, fuel level) or wear data and logistics data to be accessible remotely at any time.

Increased efficiency thanks to predictive drilling

BAUER Maschinen GmbH already offers many assistance systems to its customers for added convenience and safety. This includes adaptive Kelly speed assistance which automatically regulate the optimal hoist speed when extending and retracting the Kelly bar. As a result, crucial components of the highly complex and challenging Kelly drilling process have already been automated. The long-term goal of these developments is a machine that operates autonomously. Over time, equipment operators can benefit from a wide range of additional assistance systems that help them in their work, take on tasks, and make the drilling process more convenient. Thanks to the patented automated pile positioning system, it is already possible to hoist piles and position them rapidly. In the process, the shake-out and one-directional spoil discharge assistant helps to empty

the drilling tool quickly and efficiently. This saves time, while also positively influencing productivity. In addition, assistance systems can save fuel by assisting equipment operators with optimized fuel consumption, identifying defects, ensuring good drilling quality, and reducing wear. Ultimately, however, the responsibility lies with the equipment operator.

Focusing on equipment operators

Sustainability also means keeping an eye on rig operation. To be precise, this means offering equipment operators exactly what they need to optimally operate their equipment, such as a graphic user interface with a clear display that makes it easy to process information rapidly and a flat menu structure that is easy to understand. This is precisely the operating approach BAUER Maschinen GmbH aims for with the high-resolution B-Tronic touch screen, which provides an optimal visualization of all data collected in the cab, offering clear added value for the equipment operator. The optimized



The B-Tronic system offers customers a clear leading edge in terms of equipment efficiency and process optimization on site (top). The BAUER Foundation Simulator reproduces the reality of a construction site for the purpose of training (right).



display of various work processes demonstrates the versatility and flexibility of the B-Tronic system. A screen display for Kelly drilling, equipped with Kelly visualization and torque display enables the operator to work the machine with minimal wear. A display of the trench cutter's current position and deviations in the x and y direction allow the equipment operator to intervene at any time (if necessary) to correct the position. In addition, a screen display for the hydraulic grab shows the direction of rotation, inclination and deviations, as well as the last reached depth and the progress per cycle. In pile driving mode with an accelerated hammer, the operator can see at a glance when a pile has reached its level of strength. Other equipment benefits: The option to activate night mode and change the screen brightness and color scheme with assist the equipment operator in a wide range of working situations.

BAUER Foundation Simulator – the site goes virtual

Develop, test, train: The BAUER Foundation Simulator reproduces the reality of a construction site to a high degree of precision. It primarily consists of a cab with original hardware. A 55-inch flat screen and high-quality speakers produce images and noises that convey the atmosphere of a construction site. This allows Bauer engineers to assess the behavior of Bauer equipment from the very beginnings of the development process. To do so, they can "feed" all relevant machine data into the simulator along with circumstances that exist in reality, such as soil or environmental conditions. This also makes the BAUER Foundation Simulator part of an extensive virtual training method that confers valuable knowledge to beginners as well as trained equipment operators without any safety risks. In real operation, skill training with the BAUER Foundation Simulator – which is also available in a compact, easily transportable configuration – leads to clear improvements in safety and productivity.

Energy-efficient power is firmly established

Increased productivity and reduced consumption – a goal that BAUER Maschinen GmbH has been pursuing for some time now. Yet it can still be quite surprising how much progress can be made in technologies that seem to be fully developed. When the research project TEAM established suitable methods

for assessing the energy efficiency of mobile work equipment from 2012 to 2015, this represented a major step forward in the implementation of energy-efficient and economical mobile hydraulics. At the time, there was no other process model of its kind. After test drilling and determining consumption values and energy flows, significant savings were achieved with a demonstrator in 2013 and validation trials were conducted during on-site operation. Along with improvements to hydraulics and engine control, dieselsavings of between 20 and 30% were achieved. The concrete outcome of the TEAM project was EEP, which brings together various measures to improve energy efficiency. Efficiency improvements included reworking the drive system of the main hoist, which represents a significant share of energy consumption especially in Kelly drilling. The new system makes it possible to recapture energy released during the lowering process. Particularly with deep drilling operations, this allows for significant reductions in fuel consumption. Furthermore, all auxiliary equipment such as fan drives and pressure supplies were optimized for energy efficiency. This lowers both energy consumption and noise emissions. The control of the diesel engine was also improved in several aspects. For example, the rotational speed of the engine is now dynamically adjusted during the operation of auxiliary functions such as the auxiliary hoist or in standby mode. This makes the equipment significantly quieter during operation.



At Bauma 2019 in Munich, BAUER Maschinen GmbH presented the first electrically driven cutter based on a Bauer duty-cycle crane.

By developing the EEP, BAUER Maschinen GmbH created the prerequisites that allowed this technology to become established in much of the equipment for specialist foundation engineering: EEP has become firmly established in Bauer drilling rigs. More than 500 drilling rigs with EEP are currently in use worldwide. Thanks to the achieved improvements in efficiency, more than 1.2 million liters of diesel fuel have already been saved. The relevance of this technology is also evident beyond the extensive range of products in specialist foundation engineering: EEP also represents our state of the art for the MC duty-cycle cranes and RTG equipment.



United Kingdom To increase traffic capacity between London and Edinburgh on the East Coast Main Line, the train route was expanded at Werrington. This project included the installation of piles in the immediate vicinity of the tracks, which required special measures to be taken to continue work without interrupting train traffic. **top**





Bauer Spezialtiefbau all over Europe

Denmark For the "Operaparken" project in Copenhagen, an underground garage will be constructed directly adjacent to the Royal Opera as well as a park with a connection to the harbor. Using an MC 96 duty-cycle crane equipped with a BC 48 cutter, a total of 6,600 m² of a two-layer anchored diaphragm wall will be created to serve as the permanent exterior wall of the underground garage. **left**



Netherlands For a new motorway link in Rotterdam, around 10,000 t of material were installed in the second-largest city in the Netherlands. A total of 4,500 GEWI® thread bar piles, that is, micro piles with threads, were required for the "Blankenburg connection" and executed by a total of eleven teams using eleven KLEMM KR 806 rigs. **top**



Austria A seven-floor IKEA furniture store is due to be built by 2021 at the Westbahnhof in Vienna. In a period of around eleven weeks, Bauer created around 5,100 lin.m. of in-situ concrete piles and around 5,400 lin.m. of drillings for the king pile wall. The deepest drillings went down to a depth of 36 m. **left**

Georgia The construction of the Batumi Riviera will establish a new hotel and commercial complex including a yacht club, a new port, casino, shopping center, restaurants, and convention center. For the foundation, Bauer created various piles with lengths between 18 and 60 m, and a total of 2,000 m of temporary anchors were also installed. **right**



Bulgaria Good planning and organization was required for the execution of large-diameter bored piles for the Zhelezniitsa Tunnel, which will be the longest tunnel in Bulgaria when it is completed. Piles with a diameter of 1,500 mm and 1,800 mm were installed up to a depth of 25 m. **top**

Slovakia Directly on the banks of the Danube, the EUROVEA 2 project is creating a new residential and business district in the Slovakian capital of Bratislava. The specialist foundation engineering works for the 14 m-deep excavation pit included the installation of retaining structures and sealing walls as secant pile walls, the execution of high-pressure injection columns, and temporary anchors as well as foundation piles. **right**





Hungary For a new company headquarters in the center of Budapest, 7,900 m² of diaphragm wall were installed up to a depth of 22 m and secured with 489 anchors in three rows. In addition, 135 piles were installed. **bottom**



Russia For a new ocean engineering center in the Russian city of Murmansk, Bauer created a total of 2,540 lin.m. of piles with a length of up to 32 m. Construction was completed after 50 days of work. **top**



With more than 2 million reed plants, the site for cleaning process water at the Nimr oil field in Oman provides a habitat for more than 140 animal species, including numerous birds, fish, and reptiles.



Resources

Green technologies move the world

The world is changing, and nothing stays the same. This also applies to technologies: "Green tech" is one of the new catchwords in all industries. This refers not to a short-lived trend but to a crucial necessity: Using innovative and sustainable technology to successfully confront global challenges such as climate change, resource consumption, or environmental pollution. Companies that want to help shape this transformation and overcome these challenges have to plan for the future, act sustainably, and develop resourcefully. This is why Bauer Resources is committed to researching innovative and green technologies that not only make water treatment more sustainable, for example, but also save resources or reduce emissions to protect the environment.

Turning old into new

The biological method EcoVert® developed by Bauer Umwelt is used to clean contaminated ground water at brownfield sites such as refineries, former gas works, gas stations, tank farms, or contaminated deposits. The technology is based on a biofilm sorption method that originated in sewage treatment technology. This method has been established for decades to clean organically contaminated waste water in sewage treatment plants. And that's what makes it unique: It had never been used for brownfield remediation before. Bauer Umwelt recognized the method's potential for ground water treatment at contaminated sites and further developed the method for this application.

Bauer now offers an equipment solution consisting of at least four successive layers of filters through which the polluted water is conducted in surges using an integrated distributor system. Specifically, the equipment consists of a biologically activated preliminary filter usually for deferrization of the water, a coarse filter and after-filter for the biological decomposition of organic compounds, and a sorption filter to remove residual organic and inorganic

contamination before reintroduction. Through a pulsing feed-in, the ground water is passively enriched with oxygen from the air, stimulating aerobic decomposition processes. The method is relatively simple but effective: The biological filter layers break down up to 99% of the organic materials, and the residual quantity is removed from the ground water by the downstream sorption unit if necessary.

Although conventional methods can achieve a similarly high cleaning effect using activated carbon adsorption and stripping, these techniques have considerable weaknesses in terms of efficiency: High operating costs due to the technical equipment as well as very long run-times. In comparison, the EcoVert® method is significantly more efficient: Due to the low use of components and degree of wear, maintenance and repair costs are reduced to a minimum, cutting down on personnel costs and favorably influencing the equipment run-time. This also makes it possible to achieve sufficient savings in operating costs, which makes the method attractive in view of its economic benefits. But the greatest advantage is ecological: Contaminated water can be safely treated entirely without the use of chemicals or energy-intensive aeration equipment. In this way, the associated CO₂ emissions can be reduced by approx. 255,000 kg per year at a throughput of approx. 20 m³/h.

This green and sustainable technology has already been used successfully in multiple pilot projects across northern and eastern Germany, and it debuted in a modified form in the city of Leuna in Saxony-Anhalt: A large-scale plant has been operating continuously since 2014 to clean approx. 22 m³ per hour of ground water from an old refinery polluted with hydrocarbons, aromatic hydrocarbons, and MTBE. The on-site success of this method compared with conventional equipment speaks for itself: Operating costs have been reduced by approx. 30 to 35%



After a third expansion, the reed bed treatment plant in Oman not only cleans 175,000 m³ contaminated water daily, but the reduction in CO₂ emissions also meant that emission certificates for 114,000 t of CO₂ could be sold in 2019.

and power savings of approx. 70% have been achieved. "With EcoVert[®] we have developed a technology that is not only economically beneficial but also significantly reduces the negative environmental impact of conventional methods," says Jens Gross, Head of Sales for the northern region of the Bauer Umwelt environmental division of BAUER Resources GmbH. "As service providers in environmental business, this is particularly important to us, since our top priority is protecting the environment for the benefit of humans and nature."

Ground water treatment on a small scale

Due to the growing demand for a flexible approach to smaller quantities of contaminants and applications with

limited space – particularly for inner city remediation – EcoVert[®] Compact was developed with a mobile and modular design. A basic module has a cleaning capacity of approx. 2 to 4 m³/h of polluted water. The required connections, filter materials, and distribution systems are integrated into a standard vessel system and can be expanded as needed. To reduce the costs and time spent on pilot projects, a micro-scale system was developed: The EcoVert[®] laboratory container, a true novelty from Bauer Umwelt. In the future, this will be used cost-effectively at polluted sites in order to test the fundamental applicability of the EcoVert[®] method under actual conditions in the field. "This micro-scale system enables us to design a powerful large-scale or compact solution in

line with our customer's project based on the laboratory findings collected under field conditions and to meet all the requirements of the site," explains Dr. Frank Tidden, Head of Sales for Bauer Umwelt at BAUER Resources GmbH. "The development of small-scale equipment is an important step for us as we become further established in the field of biological ground water treatment."

Harnessing the power of nature

Bauer Resources also uses a unique biological method in Oman: Here, a reed bed treatment plant cleans polluted water from oil production at the Nimr oil field using a purely biological method. With an area of 13.5 km², this is the largest reed bed treatment plant



Where ground water is polluted due to industry, the green and sustainable EcoVert[®] technology helps with cleaning.



in the world – roughly the size of 1,230 football fields. At its peak, approx. 175,000 m³ of polluted water runs through the equipment every day with an excellent cleaning performance: At the end of the process, a hydrocarbon content of less than 0.5 mg/l is achieved.

What makes the equipment one-of-a-kind is not only its remarkable cleaning performance, but also the new standards it sets for sustainability: By treating contaminated water using natural flow processes in the form of graduated filter beds and reusing the purified waste water on the surface, it is no longer necessary to use energy-intensive pumps for circulation or disposal of waste water or for re-infiltration of the purified water. "After nine years of operation, a total of approx. 1.06 million tons in CO₂ emissions were saved – according to estimates, by the end of operations in 2044 it will save 4.5 million tons of CO₂," explains Dr. Roman Breuer, Managing Director of BAUER Resources GmbH.

In order to reliably document the savings achieved compared with the conventional practice of deep well disposal, a certification process was carried out in accordance with ISO 14064.2. The goal: To trade the saved emissions and sell them to interested parties looking to offset their own emissions. "This opens up new opportunities for us and allows us to positively assist the CO₂ balance of our customers in the oil and gas sector by selling certificates," says Roman Breuer. With its entry into the emissions trade, Bauer Resources has already secured three transactions to offset carbon emissions. "In 2019 we sold certificates for 114,000 t CO₂ and in 2020 we anticipate an increase of up to 225,000 t," asserts Dennis Kronborg Alexander, International Business Development Manager of BAUER Resources GmbH. "We are currently trading our saved emissions with European oil and gas companies that aim to comply with the upstream emissions reduction program of the European Commission. It is a remarkable achievement to be the first company to register a project with the German Emissions Trading Authority."

From plants to organic airplane fuel

Together with the Sustainable Bioenergy Research Consortium (SBRC), an institution at the Khalifa University of Science and Technology in Abu



A large-scale plant has been operating since 2014 based on the EcoVert® method to clean approx. 22 m³ per hour of highly contaminated ground water from a former refinery location.

Dhabi, Bauer Resources is researching ecological and sustainable methods for reusing waste water from the plant-based purification facility in Oman to obtain biofuel from salt-tolerant plants for the aerospace industry. Over an area of approximately 2 ha, the oil-rich saltwater plant salicornia is being cultivated for the sustainable exploitation of biomass. The plant only requires sand and waste water in order to sprout. To produce this novel biofuel, the oil is pressed from the plants, purified, and refined after harvest. Bauer Resources participated in this project for more than three years with great success: Last year, the airline Etihad Airways flew its first Boeing 787 with this new biofuel extracted from the salicornia plant. The world premiere was a 5,000 km journey from the airline's home airport in Abu Dhabi all the way to Amsterdam. The project contributes to the sustain-

Etihad's first passenger flight using biofuel from the saltwater plant salicornia developed by Bauer Resources and the Sustainable Bioenergy Research Consortium (SBRC).



able reuse of waste water while also greatly helping to protect the environment and climate. Particularly when it comes to air travel, considerable growth rates are anticipated over the next few years. Before the coronavirus pandemic, more than 730,000 international flights take off from German commercial airports to 400 airports across more than 110 countries. But the critical dimension of pollution was often neglected in this context: Approximately 380 g of CO₂ was emitted per kilometer flown per person. Using biofuels, it has been demonstrated that air travel could cut back up to 80% of carbon dioxide emissions per ton compared with fossil fuels. Another crucial advantage: Biofuel can be directly mixed with airplane fuel and does not require any modifications to the aircraft, the airport fueling systems, or the engines.

"With our participation in the SBRC, we have already achieved a considerable milestone in sustainability and regenerative airplane fuel," says Marcus Schmölling, Managing Director of Bauer Emirates Environment in Abu Dhabi. "We continue to see a great deal of potential in the future for the production of sustainable biomass to manufacture biofuel."





SCHACHTBAU Group Sustainability in all areas

During pump installation in the Oberhausen pumping station, every step of work is closely monitored and controlled.

The United Nations formulated 17 goals in its 2030 agenda for sustainable development, including topics such as "clean water", "decent work" and "sustainable production and economic growth". Of course, this sustainable development is a continuous process for every individual as well as society as a whole – always expandable and never entirely completed. When looking at measures for improved sustainability, the results are always preliminary and subject to continual growth. Sustainability is multifaceted in the SCHACHTBAU Group. It is the sum of numerous major and minor components in daily work processes, from converting hall lighting to energy-saving LED technology to selling regionally grown vegetables to employees and avoiding plastic by installing drinking water dispensers in all buildings on the company premises. Sustainability is also reflected in the support for local employees in Kazakhstan: In Chromtau, 115 Kazakh employees have been trained and hired for permanent positions at TOO SCHACHTBAU Kazakhstan. All these activities with a long-term focus require continual adjustment in large and small steps to ensure the company's sustainable development. Further components on the journey towards sustainable development include health care and improved working conditions thanks to automated manufacturing processes, innovative safety precautions, project efficiency and lean production, as well as handling increasingly challenging tasks related to the topic of water. With its Mining, Systems Engineering, and Equipment segments in particular, the SCHACHTBAU Group is making significant contributions to sustainability.

Sustainability in mechanical engineering – automated manufacturing processes

One of the first crucial aspects of sustainability can be found at the Bauer equipment plant Schachtbau Nordhausen where an enormous range of machine components, from undercarriages

to masts and hoists, are manufactured for the BAUER Group and other subsidiaries. Production methods are continually optimized using "lean production", that is, a production system which aims to eliminate all kinds of waste. The goal is to use materials and time as efficiently as possible, prevent waste, and continually review processes to sound out and exploit any potential for improvement. For some time now, the Bauer equipment plant has increasingly relied on automated manufacturing methods. Since early 2019, a welding arm has been used in Nordhausen, and a second, larger welding robot was added in May 2020. For material provision, an automated grinder and brusher was introduced in January 2020 to assist employees with the previously laborious task of grinding the welded sheets. These automated manufacturing methods contribute a significant increase in efficiency. For example, the welding of a round – a round sheet – normally occurs in three layers. The robotic arm can carry out welding in one layer while ensuring process reliability and deep penetration. For this work step, a human requires 11.3 minutes on average, while the robot accomplishes the task in just 2.4 minutes, less than a quarter of the time. While the small robotic arm primarily assists with round welding, the new robot features seven axes for improved mobility, enabling greater flexibility and a wider variety of applications. It can be used to process construction components up to a length of 2 m and a weight of 2 t. However, despite their precision and efficiency, these collaborating robots or "cobots" cannot work without the employees who operate them. Even before implementation began, skilled workers from within the company were integrated in the process. During this innovation process, Schachtbau intentionally refrained from involving programmers or engineers: Instead, they relied on qualified welders who had already been working with the company for many years. Using a tablet, they

are now in charge of programming and controlling the robot: It is necessary to have someone involved in the process who can navigate the highly complex, highly digitalized system and intervene if necessary. This integration and the associated qualification measures generated acceptance among the workforce. More than anything, this new technology offered added benefits for the welders, since operating a robot is much simpler and more pleasant than welding in physically demanding positions. Since this technology helps everyone, the employees in the workshop christened their new colleague Hilmar. "When the staff actually give the robot a name, that makes it part of their team. There's no better proof of their acceptance," says Managing Di-

rector André Ponndorf enthusiastically about its successful implementation in the production process.

The Schachtbau team enjoys machine assistance for more than just welding. The material provision team led by Master Stefan Berner has a new "member" since the start of the year: This automated grinder and brusher is the response to a need for automated methods that expand on the deburring and edge breaking process for sheets. After comprehensive preliminary tests, an automated grinder with a unique configuration arrived at the halls in Schachtbau. It also contains a system of hammers to remove residue from the sheets in two process steps. The new automated machine replaces hand grinding of small parts and is used in the Bauer production system for materials with a thickness of up to 30 mm and a width of up to 1.3 m. The sheet lengths are flexible and unlimited, since the construction components pass through the automated machine on a conveyor belt. But this machine is not capable of operating entirely without human assistance: Operation requires trained and skilled workers, so that the grinder becomes the equipment operator. Before processing the sheets, employees first set the corresponding material

thickness using a monitor and place the sheets on a conveyor belt using a crane. The sheet is automatically brought in and passes through the hammer system in the first work step, where up to 95% of the slag is removed. In the second step, the remaining burnt residue is removed using a grinding belt. Then a multi-rotating unit consisting of eight brushes moves across the sheet. This removes oxide layers on the inner and outer contours of the sheet and deburrs the edges evenly. An optional rounding radius of up to 2 mm can be created in this process. The processed sheets are finally fed back to the equipment operator on a conveyor belt. This eliminates unnecessary travel and zones for incoming and outgoing delivery are clearly defined.

"This example also demonstrates that automation processes do not replace employees: Instead, they offer additional qualification," says André Ponndorf, emphasizing the importance and above all the reality that humans and machines do not compete with one another. The material provision team values the considerable facilitation of work offered by the automated grinder or "Mega Machine", as operator Marco Steinmetz likes to call it. Work is carried out from an optimally ergonomic



In the 10 x 10 m robotic cell, construction components can be welded with a length of up to 2 m and a weight of up to 2 t (top), while the welding robot is programmed and controlled by tablet (right).





In the manufacturing hall, the individual components are assembled to form hoists (left). The hoist SBN FH-55 can be transported using a modular trailer (bottom).

position and the machine predominantly takes over the difficult task of moving the construction components, which are often quite large. The monotonous and strenuous physical exertion involved in conventional grinding and deburring is no longer required. And these are far from the only advantages of working with the automatic grinder. Compared with conventional grinding methods, noise pollution is also reduced from 100 db to 76 db. Furthermore, due to the closed cleaning and filter unit, wearing separate ventilation helmets is no longer necessary. Recent time recordings and feedback on work processes from SAP have detected 50% time savings. So the Schachtbau team is already enjoying the benefits of this sustainable investment in terms of economics, ergonomics, and quality. In this way, Schachtbau has made a considerable contribution towards UN sustainability goal no. 8, "sustained, inclusive and sustainable economic growth" along with appropriate, safe working conditions that do not endanger health.

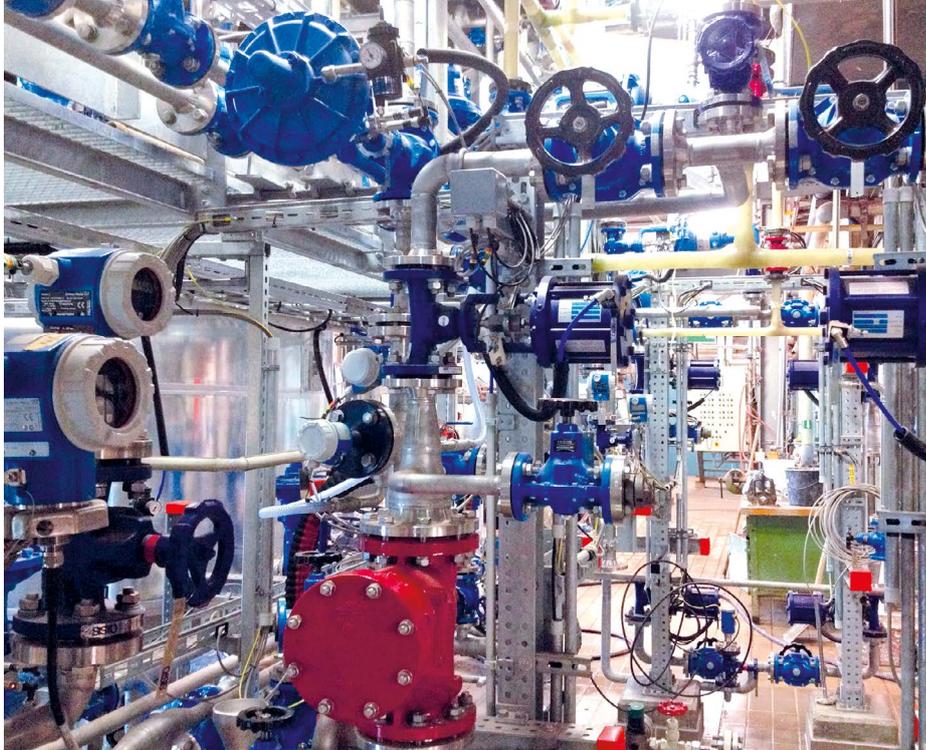
Sustainability in mining – mine rescue services and auxiliary hoisting system SBN FH-55

Safe working conditions are a fundamental component of a sustainable corporate policy, whether in mechanical engineering or mining. "Smart mining, sustainability in mining, mining 4.0 – these are all terms that have become widespread in the sector over the last few years in connection with raw material extraction. They all share the



goal of mining operations that do not endanger the life and health of employees, that are environmentally sound, and that duly consider the needs of the public," explains editor-in-chief Andreas-Peter Sitte in the editorial of the Mining Report Glückauf 1/2020 Edition concerning the future of mining. Given this background, SCHACHTBAU NORDHAUSEN GmbH developed a new winch for mining rescues that is also suitable for mobile use and presented this product at a specialist conference in Leipzig in November 2019. The semi-mobile auxiliary hoisting system, which weighs 20 t, meets all the technical requirements for shaft and slope conveyor systems and can therefore be used with haulage systems as well as trolley systems. Based on the SBN FH-55 auxiliary hoisting system, Schachtbau Nordhausen developed a mobile variant that operates using a modular trailer. As a result, the hoist is no longer stationary and can be moved rapidly with little effort to the

site of deployment whenever needed. The mobile auxiliary hoisting system is authorized for road use according to the German Road Vehicle Registration Regulation (Straßenverkehrs-zulassungsverordnung, StVZO) and can be transported at a speed of up to 80 km/h. A standard Euro tractor head serves as a towing vehicle, which means that the equipment can be transported using a standard truck, allowing for extremely flexible and easy use of the hoist. The main application of the mobile auxiliary hoisting system is the recovery of persons from the shaft in the event of an emergency. For this purpose, the mobile winch with a drive power of 110 kW and nominal tractive force of 55 kN can be transported rapidly to the site of deployment and used in emergencies to convey persons with a hoisting speed of up to 2 m/s. This significantly improves and shortens the process for rescue services. A major advantage of the mobile auxiliary hoisting system is that it can guarantee



Smoke exhaust cleaning in the Ruhleben sewage treatment plant

the viability of the rescue concept at multiple shaft facilities. If these facilities are previously equipped with a suitable location and an appropriate run-off point on the headframe or shaft tower, the mobile auxiliary hoisting system can be used in the event of an emergency. This means it is not necessary to reserve an individual, permanently installed hoist for mining measures in each shaft facility – a single mobile auxiliary hoisting system can serve multiple shaft facilities in a given area. This hoist can be rapidly transported to the relevant shaft as needed. Strict occupational safety precautions and accident prevention are of course the top priority in occupational safety. But rapid, innovative, and especially well-prepared rescue services are just as indispensable. The mobile hoist is an example of how the principle of sustainability not only inspires improvements but also gives rise to innovative new developments.

Sustainability in systems engineering – Renaturation and clean water

These continuous innovations provide a constant boost for sustainable development. Looking back on the development of water management and especially systems engineering as a whole since the 1950s, continual changes are evident. The availability of water as a limited resource worldwide, the management of water and proper waste water disposal and treatment are of elementary importance for all human beings. An entire business division of the SCHACHTBAU Group is dedicated to this task: Systems Engineering. Its

core competences include design and installation as well as all services related to water management and environmental service projects. Based on this expertise, SCHACHTBAU NORDHAUSEN GmbH is participating in a construction project aimed at renaturation of the Emscher River that is globally unique. In the Ruhr area, Europe's longest waste water canal is gradually being moved deeper and the Emscher River is being renaturalized since 2009. In the future, the underground waste water canal with a total length of 51 km will serve as the principal artery for waste water in the Ruhr area. The transformation of the region includes the construction of the Emscher waste water canal (AKE) and the construction of three pumping stations in Bottrop, Gelsenkirchen, and Oberhausen with a total output of 125,000 m³/h.

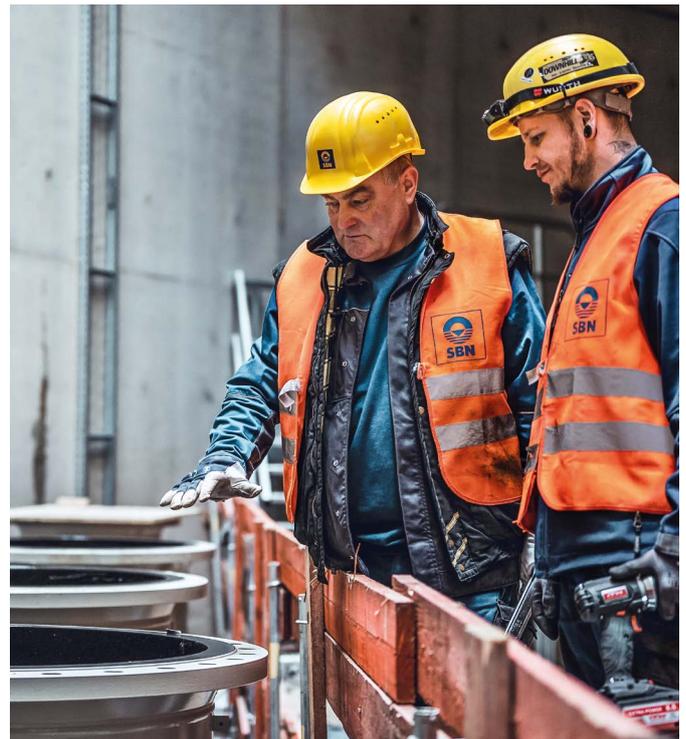
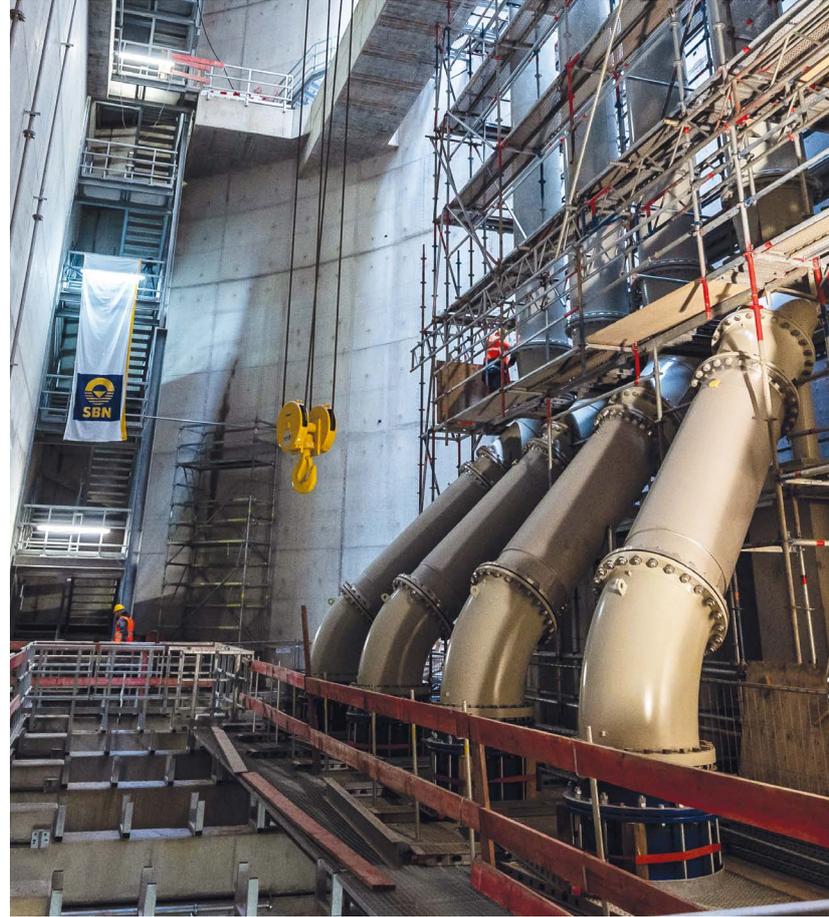
The waste water canal starts in Dortmund at a depth of approx. 8 m below the ground surface and lowers into the ground at a steady gradient of 1.5 m per km up to a depth of 40 m. For this reason, it was essential to interpose pumping stations that convey the waste water upwards at three points. Without these pumping stations, the canal would have reached a depth of around 80 m at Dinslaken. For the construction of these three pumping stations, the Emschergenossenschaft water management organization constructed excavation pits with a diameter of 50 m starting in 2009. The technology, equipment and systems subsequently provided by Schachtbau will ensure high availability and safety of the system in the future along with high energy efficiency and low operating material

requirements. The usage period of the pumping stations is planned for 100 years. For these systems, Schachtbau developed and implemented future-oriented, detailed solutions to provide the owner with equipment from one source for long-term productivity and a high degree of safety. "The AKE and the pumping stations are masterpieces of engineering," remarked Dr. Emanuel Grün, Technical Director of the Emschergenossenschaft, in 2018 upon the commissioning of the pumping stations in Bottrop and Gelsenkirchen. In spring 2021, the Oberhausen pumping station will also be handed over and begin operation as the last of the three stations. The AKE system ensures that the Emscher river is clean and free of waste water, improving the quality of life and attractiveness of spaces along the river. For good reason, the reconstruction of the Emscher has become a symbolic project for sustainable structural changes and ecological modernization in the entire region. The constant alteration of statutory requirements for system operators will be a major challenge for Schachtbau in the future. New technical issues concerning the elimination of trace substances, microplastics, and antibacterial germs – not to mention climate change – are also increasingly gaining focus. In the future, these elements of sustainable social life will be crucial topics for the business division of Systems Engineering, which will continually work alongside and together with the four other business divisions to gradually expand and foster the growth of sustainability in the SCHACHTBAU Group.



The previously installed construction components are continually inspected and the next installation steps are planned (right).

The installation of pipe work on the pressure side in the Oberhausen pumping station requires the utmost precision (left), as does pipeline installation with heat exchangers (bottom).



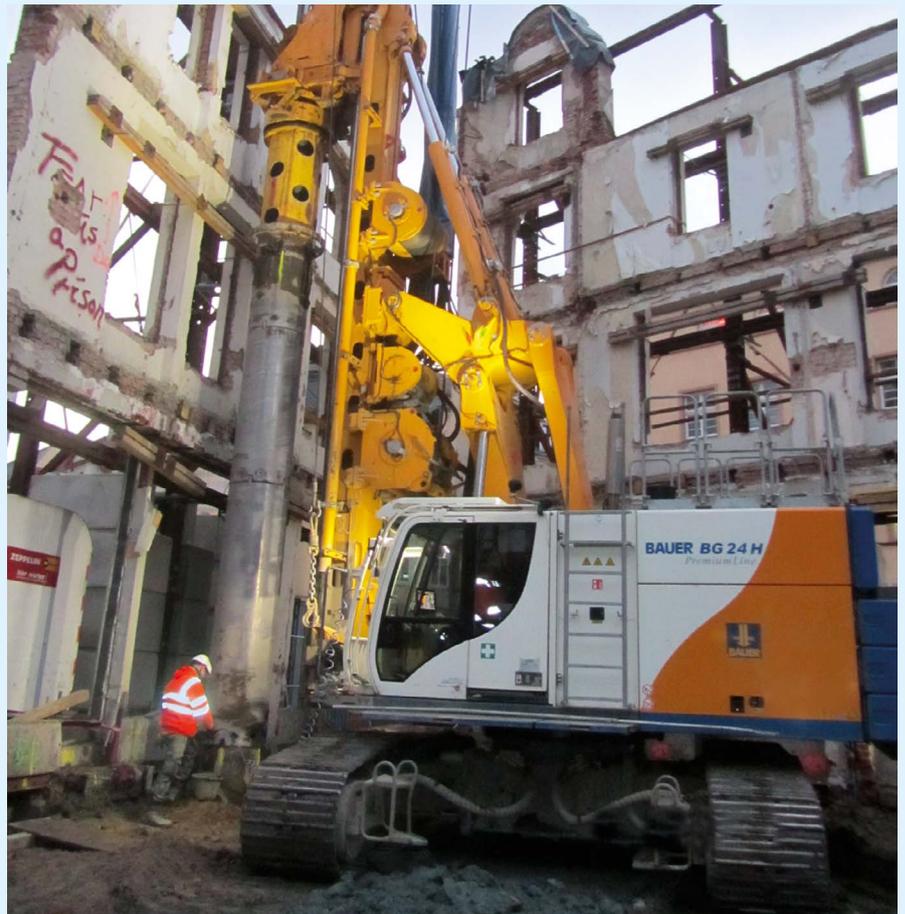
Specialist foundation engineering all over Germany

For the new construction of a gas power plant in **Chemnitz**, a subsoil investigation was carried out along with around 5,000 m² of MIP wall as a cut-off wall and static element up to a depth of 8 m. **right**



530 m long and up to 50 m wide: The excavation pit for the "QH Track" project in **Berlin** extends over an area of 16,000 m². As part of the huge project "Quartier Heidestrasse" and in the immediate vicinity of the central station, a completely new district will be created here. For the encompassment of the excavation pit, approximately 23,000 m² of MIP wall was created along with a LWS base for horizontal sealing. **top**

Ruins make way for a new hotel in the center of **Weimar**: A pile wall, a Berlin wall, and anchoring works were carried out for the Schillerhof. The major challenge: The facade of the building, which is a protected monument, could not be damaged. **right**





To permanently protect the banks of the Rhein against flood, Bauer Spezialtiefbau constructed a new cut-off wall for dike relocation near the district of **Mündelheim** in Duisburg. Over a length of 1.6 km, a total of approx. 28,000 m² of cut-off wall was constructed up to a depth of 20 m using the Mixed-in-Place method. **left**

For the foundation of a new high-bay warehouse in **Amerang**, 552 micropiles were commissioned with a diameter of 27 cm. What makes this project unique: The micropiles were constructed using the CFA method and concreted from the bottom up after reaching the final depth. In addition, GEWI® thread bars were installed for uplift prevention. **right**

In **Emmerting**, approx. 10,500 m² of static MIP cut-off wall was constructed to protect against flood. Over a dam length of 2.3 km, the cut-off wall was constructed using an RG 16 T as a sawtooth profile in order to prevent disruptions to the prevailing ground water flow. **bottom**





The new construction of a residential and commercial building in **Munich** will establish 164 apartments, a day-care center, and an underground garage. Bauer Spezialtiefbau was commissioned to construct 6,900 m² of static MIP wall as well as 650 running meters of anchors with five to six strands.

bottom



Near the Ostbahnhof station in **Munich** on the former premises of the Optimol company, a new office building will be constructed as a high-rise with three underground floors. For the execution of the excavation pit, a total of approx. 7,400 m² MIP retaining structures were constructed and secured with 330 anchors in one to two layers. In addition, foundation piles were constructed up to a drilling depth of 29 m. **left**



In **Schrobenhausen**, the home-town of Bauer, a new residential complex with two houses and a total of 2,400 m² living space will be created by 2021. To seal against ground water, the excavation pit was made impermeable before excavation with a retaining wall using a combination of sheet pile wall construction and the Mixed-in-Place method. **top**

The federal motorway A9 is an important north-south connection across different regions in Germany. Maintenance and replacement construction activities will be carried out by 2022 on the section between **Langenbruck** and the Holledau triangle. Bauer will carry out foundation work for this purpose. **right**



Using a BG 30, an excavation pit was created in **Mainz** for a residential building and hotel. First, 370 foundation piles were installed using the CFA method with drilling depths of up to 20 m, followed by retrofitting for the Kelly drilling method. **right**

For the execution of a turnkey excavation pit for the new exhibition hall 5 in **Frankfurt am Main**, Bauer Spezialtiefbau was commissioned to manufacture a cut-off wall with installed prefabricated steel concrete elements, micropiles up to a depth of 30 m, and for the construction of large-diameter bored piles up to a depth of 36 m. **bottom**



GWE Colloquium and 100-year company anniversary

On January 9th and 10th 2020, the GERMAN WATER and ENERGY Group (GWE) belonging to the BAUER Resources Group held its sixth "Well Drilling and Geothermal Heat" colloquium in Braunlage. Numerous well-drilling experts, specialists in geothermal heat, designers and engineers, operators and industry professionals came together in the packed conference hall. With 14 specialist lectures, the colloquium addressed a wide range of current topics. Alongside practical projects concerning project experience, the focus of the event was the

new development of ATV DIN 18327, developments in rinsing technology, well service, and digitalization of borehole pump equipment. Prof. Dr. habil. Christoph Treskatis expertly guided the

event as moderator and lecturer. Member of the GWE Management Board Christoph Harms expressed his satisfaction with the colloquium: "Apart from the truly top-level lectures and wonderful atmosphere, we were also able to show participants our production in the Nordhausen plant. The plant visit was very well received. In particular, the manufacture of the DN 1.200 stainless steel wire-wrapped screens generated a great deal of interest among all participants." The event concluded with a celebration of the GWE company anniversary.



Alongside specialist lectures about practical experience on projects, new developments, and digitalization (top, bottom right), the plant visit was also met with a great deal of interest (right).



ry, to which all colloquium participants were invited to celebrate the company's 100 years of operation. There as well, the atmosphere was fantastic and there were lively discussions about countless topics.

The GWE celebration for the company's 100th anniversary was the crowning conclusion of the colloquium (bottom).



GWE

Expansion of the water supply for Las Vegas

The supply of drinking water for the approximately 2.2 million inhabitants of southern Nevada with its major city of Las Vegas is 90% dependent on water reserves obtained from Lake Mead. This reservoir, which was built up above the Hoover Dam constructed in 1936, is fed by the Colorado River. With an area of 640 km² and a reservoir volume of max. 35 billion m³, this is the largest artificial lake in the United States. In order to guarantee the population's drinking water supply over the long term, two pumping stations were constructed in the early 1980s to which water was conveyed through an underground tunnel system from various depths of the lake. Due to the worst drought of all

time in Las Vegas and the falling water table in reservoirs throughout the entire Colorado River Basin area – the water level of Lake Mead has fallen by more than 40 m since 2000 – the Southern Nevada Water Authority constructed an additional low-water pumping station for which GWE materials were installed. The pumps themselves came from Indar, while GWE delivered the accompanying uptakes and wellheads with a diameter of 800 mm and wall thicknesses of 10 mm (low-pressure pumps) or 12 mm (high-pressure pumps). Installation began in spring 2019, and a total of 32 pump systems were installed by January 2020.

A total of 32 pump systems were successfully installed at the Hoover Dam in the USA by January 2020, in part using GWE materials.



Schachtbau Nordhausen

New build winding tower Konrad 2

On the grounds of the Konrad 2 shaft (bottom), a new winding tower with a ground area of 20 x 23 m and an external height of 42 m will be constructed (bottom right).



Given its huge importance, the fire safety of the winding tower is subject to the most stringent of requirements, which means that the engineering and execution of fire protection measures are of high priority. This part of the work is also engineered by Schachtbau in co-operation with expert external planners and will later be implemented by them. The contract signed by SBN Managing Director Michael Seifert is one of the largest single orders in recent shaft construction history.

steel frame-work that has been designed to use hydraulic presses to offset subsidence that may occur during the operating cycle, so the tower can remain perfectly level at all times. The winding tower forms the centerpiece of the prospective permanent disposal site "Schacht Konrad," where low and medium-level radioactive materials are to be stored underground following its scheduled completion in 2027. In addition to the supply and construction of the steel frame, the order also includes the creation of the structural shell, including the roof and facade and the associated inspection units. Inside, the building will be fitted with a 40 m high stairway and elevator shaft with integrated media duct and an electric and machine platform on which the hoist is positioned. Then there is the engineering and installation of the ventilation systems, the entire electrics, the rain water disposal system and disposal system for water in the control areas, and the lightning protection system.

At the end of March, SCHACHTBAU NORDHAUSEN GmbH got the go-ahead from the Bundesgesellschaft für Endlagerung (BGE), – the federal company for radioactive waste disposal – for their construction project "Errichtung Förder-turm Schachtförderanlage Konrad 2" to build a shaft hoisting plant. In a negotiation process that lasted over a year with prequalification for bidding, the shaft constructors came out on top with the best project concept. The project comprises the engineering and execution of a winding tower over an area of 20 x 23 m and with an exterior height of 42 m. The building consists of a 1,200 t



Bauer Umwelt

Three decades of environmental technology in the BAUER Group

Over the past 30 years, what is now the Bauer Umwelt environmental division of BAUER Resources GmbH has developed from a two-person operation into a leading company for environmental technology with 177 employees. This successful trajectory began by tackling a challenge in specialist foundation engineering: how to handle contaminated areas on construction sites. The idea to also provide cleaning services for the ground, soil vapor, and groundwater in contaminated areas as part of specialist foundation engineering projects gave rise to an interplay between specialist foundation engineering and environmental services. The company BAUER und MOURIK Umwelttechnik GmbH und Co. KG was founded in 1990 and later renamed BAUER Umwelt GmbH. Finally, the merger with BAUER Resources



GmbH took place in 2016. Today, the environmental division Bauer Umwelt, under the management of Samer Hijazi, is one of the leading remediators of contaminated sites both domestically and internationally. Its services include remediation of contaminated sites, disposal of contaminated waste from construction and industry, and purification of groundwater and site water. One of the most successful projects in ground water treatment was the remediation of a gas works site in

southern Germany. Using a biological cleaning method known as "funnel and gate technology", the plant cleaned 90 liters of contaminated groundwater per second in a pipe system extending over several kilometers. In the area of brownfield remediation, BAUER Resources GmbH and BAUER Spezialtiefbau GmbH, together with a partner, are currently carrying out extensive soil remediation works at the Schwarze Pumpe industrial park in eastern Germany on behalf of LMBV. More than 286,000 t of contaminated soil will be moved and cleaned there by 2022.



The funnel and gate project in Munich's Moosach district is one of the largest projects of its kind in Germany. This ground water treatment plant cleaned 90 liters of contaminated water per second (top). On the grounds of the Schwarze Pumpe industrial park, large-scale soil replacement work is being carried out to eliminate traces of the former gas combine plant (left).

BAUER MAT

A 30-year success story

Bauer MAT Slurry Handling Systems is the specialist in the BAUER Group when it comes to mixing, materials handling, and separation technology. 30 years ago in May 1990, MAT was founded by Josef Soier, then Head of Mechanical Engineering at Bauer Spezialtiefbau and later Managing Director of the Bauer Equipment segment, experienced mechanical engineer Manfred Kleimeier, and a third partner, E. W. Blaschke. The initial aim was to develop and build easily transportable batch mixing plants for the preparation of slurries on construction sites in specialist foundation engineering. The mixing technology available up to that point met neither the economic nor technological requirements. In the first years after the company was established, it not only developed and produced mixers and equipment for the preparation of slurries, it was also involved in various special projects. Eventually, all the activities for slurry handling in specialist foundation engineering, tunnel construction, deep drilling technology, and the



building material industry were combined in MAT Mischanlagentechnik GmbH. Both direct customers and affiliated companies within the BAUER Group still benefit from this today: A package solution with a matching injection plant can still be offered for every KLEMM drilling rig, as well as customized separation and mixing technology for every drill and cutting unit. In 2015, MAT Mischanlagentechnik GmbH became a subsidiary of BAUER Maschinen GmbH. "The resulting synergies put MAT in the position of being able to offer optimal service as a globally active major company," says Timo Seidenfuss, Head of Sales at BAUER MAT Slurry Handling Systems. Entry into the mechanical tunnel

boring market in 2017 was marked by the construction of the largest separation plant ever built by MAT, the BE 2550. Consisting of six individual units, this plant set new standards when it came to performance: It moves 2,400 m³ of drilling fluid per hour. This large-scale plant was first used as part of the major Eppenbergr Tunnel project in Switzerland. Since April 2018, the name change to BAUER MAT Slurry Handling Systems has underlined the subsidiary's affiliation with the BAUER Group. Finally in 2019, a desanding plant BE 500-C was assigned the significant serial number of 1,000. At the Bauma in Munich, BAUER MAT Slurry Handling Systems used the opportunity to present and introduce the CMS mixers in a compact container design that were newly developed over the past year. Since April 2019, more than 20 units of this new equipment series have already been delivered to customers around the world. With a product range that includes injection and grout pumps, mixers, and HDI pumps, the former



30 years of MAT: A reason to celebrate in spring 2020 – for employees as well (top). Whether separation plants, bentonite mixers, or pumps: BAUER MAT Slurry Handling Systems delivers it all from one source, as can be seen here on a construction site in England (right).



Klemm Bohrtechnik

New mini drilling rig

Mühlhäuser-Obermann GmbH became part of the BAUER Group on November 1, 2019. Since then, the company has been operating under the name Obermann MAT GmbH, ideally complementing the MAT product range. In the 2019 financial year, BAUER MAT Slurry Handling Systems ultimately exceeded the sales mark of EUR 20 million for the first time in its history. With innovative engineering, detailed workmanship, and practice-oriented expertise, BAUER MAT Slurry Handling Systems still plays a decisive role in the development of mixing and separation technology.

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MC 96 duty-cycle crane equipped with a BC 48 cutter for the Operaparken project in Copenhagen.

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Important notice

All group photos that were taken after the coronavirus preventive measures entered into force were photographed in compliance with the relevant hygiene and distancing rules.



With the KR 704-3G, KLEMM Bohrtechnik GmbH recently introduced a newly developed mini drilling rig that represents the latest generation of the tried-and-trusted KR 704 series. Designed for challenging drilling tasks in urban environments and inside existing buildings, the new model features high performance, compact dimensions, and light weight. It is powered by a 55 kW diesel engine that corresponds to the latest EU and US standards. The option of using extendable feeds and a low base machine width of 950 mm offer ideal prerequisites for drilling tasks under challenging site conditions, for example tight door openings or low ceiling heights. The kinematics of the feed allow for lateral swing of the

drilling axis (+/-45°), improving maneuverability and making it possible to reach drilling locations in building corners. Special foundation engineering tasks, in particular micropiles for foundations and underpinning existing foundations with high-pressure injection columns, can therefore be carried out under difficult conditions. Other features include the hydraulic system with a load-sensing pump and a load-independent volume flow control, standard equipment of all functions with wireless remote control, and equipment with energy-efficient power (EEP) as is the case for almost all Klemm drilling rigs. The first KR 704-3G was handed over to a long-established Klemm customer in June.

