

PROFOUND

Innovation by Bauer

N°1
2022

BAUER Cube System

New. Innovative. Unique.

EcoVert®

Sustainable. Energy-efficient.
Low-emission.

Digitization

Groundbreaking. Effective.
Progressive.





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Dear Readers,

At the BAUER Group, it's the people who drive innovations. Teams pull together and achieve what is possible. In our company, this drive to improve and develop our products is a firmly anchored component of our culture.

The BAUER Cube System demonstrates how diaphragm walls can be constructed in areas where this would not have been thought possible before. Digitalization in specialist foundation engineering is constantly advancing. We are working on the digital twin of the site, which will make us more efficient and improve the quality of our products. These are just two examples of our innovative strength.

Expanding the boundaries – This is the challenge that we set for ourselves again and again. This innovation magazine displays how we achieve this guiding principle across all the different areas of the Group, and what groundbreaking and sustainable ideas have been developed here. I hope you enjoy reading our new edition of the "ProFound".

Florian Bauer
Digitalization Manager
Development Coordination | Personnel
Education | Company Culture

> Sensor Technology / IoT

> New Materials

> New Business Models

> New Products

> Automation

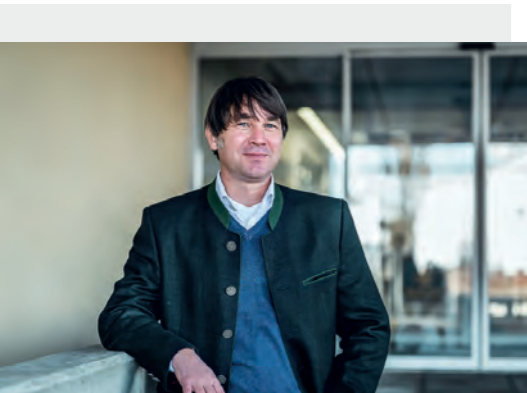
> Electrification

> Sustainability

Bauer Research Community

> The Innovators

Innovation means progress. This is essential in order to remain competitive on the market. At Bauer, we have a special way of developing innovations: every single one of our employees can participate in development. The Bauer Research Community draws on our collective power of innovation.



LISTENING TO >

Dr. Patrik Wenzl

Technical Services Department
BAUER Spezialtiefbau GmbH

Dr. Wenzl, who or what is behind the Bauer Research Community (BRC)?

Since 2008, the Bauer Research Community has been promoting innovative and cross-segment projects. Bauer consciously made the decision not to set up a central development department with the BRC. We want to expand the knowledge and skills of the entire Group. After all, "Passion for Progress" is not some empty corporate slogan for us: We view people as the driving force behind innovation. With the BRC, we are pursuing the goal of optimally utilizing the potential of all our employees and creating new innovative products or services in this way. To this end, we scrutinize our methods and processes in order to improve ourselves and continually develop.

What have been the greatest successes of the Bauer Research Community so far?

We have already achieved a great deal – both on a small scale and on a larger scale. By the end

of 2021, 66 Research & Development projects were approved in line with these criteria, and more are sure to follow in the future. Just recently, we actually opened up a new area of business for the BAUER Resources GmbH through the overarching collaboration of the Construction, Equipment and Resources segments, by working out solutions for the treatment and disposal of liquid residues such as sludges and slurries.

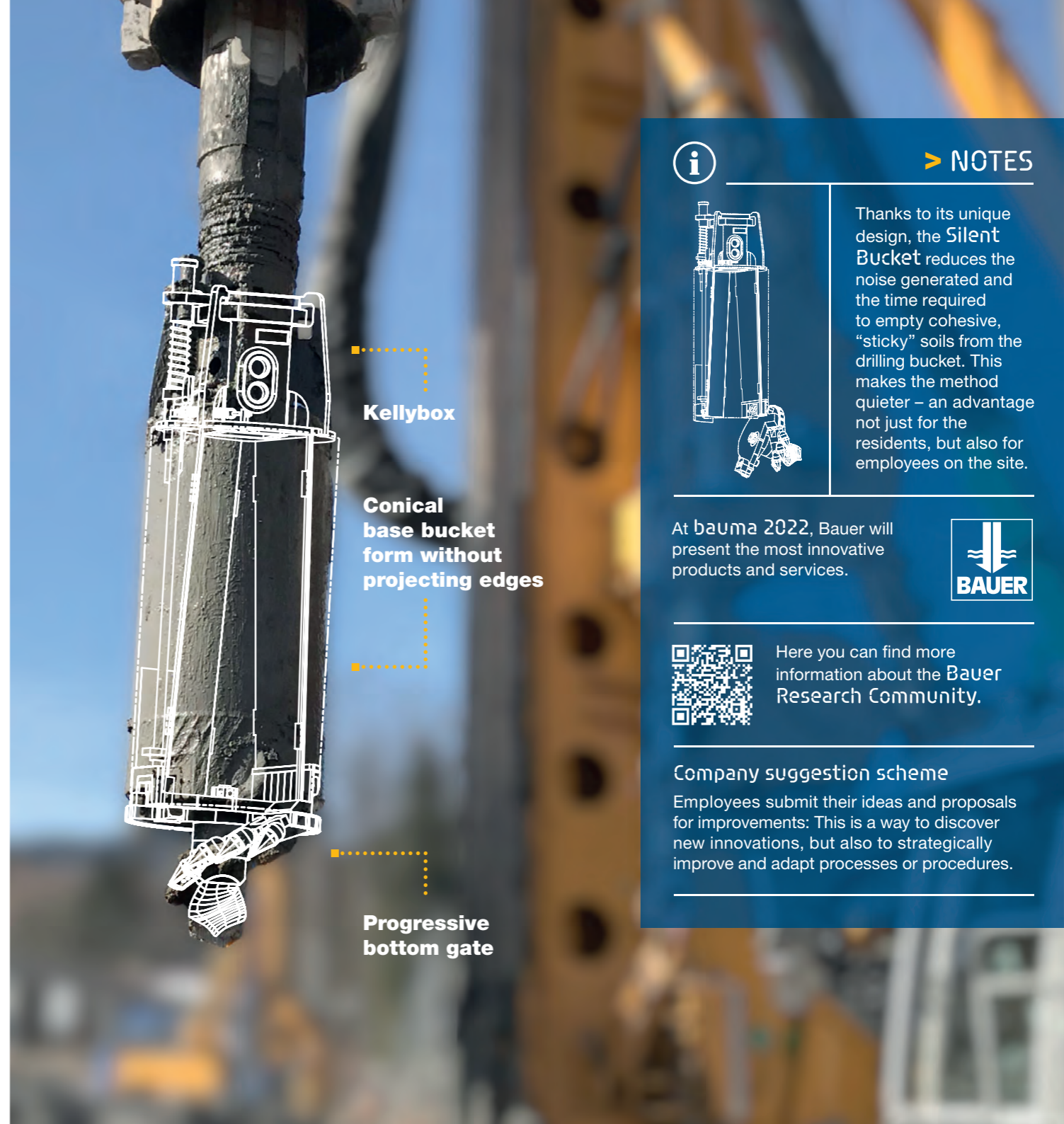
Are there particular focal points in the work of the Bauer Research Community?

One focus, for example, is the area of sustainability and thus the decrease of environmental impacts. Apart from CO₂e reduction, the decrease of noise during execution as well as the conservation of resources are key objectives in our development work. When it comes to CO₂ reduction, it has become clear that the mixed soil walls constructed using our MIP method are excellent for geothermal activation. We even received in 2019 the Bavarian

Innovation Award for this work. It is particularly encouraging to see our work honored like that.

The reduction of noise emissions in specialist foundation engineering is another extremely topical subject. Above all because specialist foundation engineering is and remains enormously important for securing housing and infrastructure. Public acceptance for these measures is also influenced by the noise emissions. We have already introduced many improvements: For instance, drilling rigs are used with noise-diverting flaps, auger cleaners and low-noise Kelly bars.

The new Silent Bucket reduces the effort required to empty a drilling bucket when creating smaller drilling diameters in cohesive, that is, "sticky" soils. Emptying is more efficient due to reduced shake-out procedures, the equipment is protected and we avoid noise. But digitalization is also a focal topic for us.



> NOTES



Thanks to its unique design, the **Silent Bucket** reduces the noise generated and the time required to empty cohesive, "sticky" soils from the drilling bucket. This makes the method quieter – an advantage not just for the residents, but also for employees on the site.

At **bauma 2022**, Bauer will present the most innovative products and services.



Here you can find more information about the **Bauer Research Community**.

Company suggestion scheme

Employees submit their ideas and proposals for improvements: This is a way to discover new innovations, but also to strategically improve and adapt processes or procedures.



EcoVert®

> Because water is life.

EcoVert® >

For clean water



With the EcoVert® technology, Bauer Resources offers biological and sustainable groundwater treatment.

Dr. Frank Tidden
Head of Sales, Technology and Energy
BAUER Resources GmbH

Many people take clean water for granted. But in many places, the groundwater is polluted by former refineries, gas works, gas stations, tank storage facilities or contaminated deposits and can thus endanger people and the environment. With the EcoVert® technology, Bauer Resources is offering a new, innovative and sustainable solution. Depending on the size of the area, the time period for cleaning and the severity of the pollution, EcoVert® can be used for groundwater treatment. What makes this method unique: The EcoVert® technology is based on a purely

biological process.. This allows the groundwater to be cleaned of various contaminants such as naphthalene, PAH, phenols and NSO heterocycles in a manner that is not only energy-efficient and sustainable, but also safe.

Green to the core with unique technology

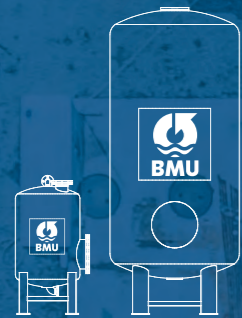
Even though the groundwater treatment plant might not seem particularly spectacular at first glance, there is a one-of-a-kind technology behind it: Two vertical bio filters make up the centerpiece of the EcoVert® method. The contaminated water is

pumped from the ground for treatment and cleared of harmful substances by means of two filters with the aid of millions of microorganisms. More than 97% of the substances are broken down by the biological filter layers. The residual quantity is removed from the groundwater by the downstream sorption unit if necessary. Even complex groundwater can be safely cleaned, and all without the use of any chemicals or energy-intensive aeration systems. Whether long-term rehabilitation or temporary measures – different plant sizes are available to cover the various requirements.



> NOTES

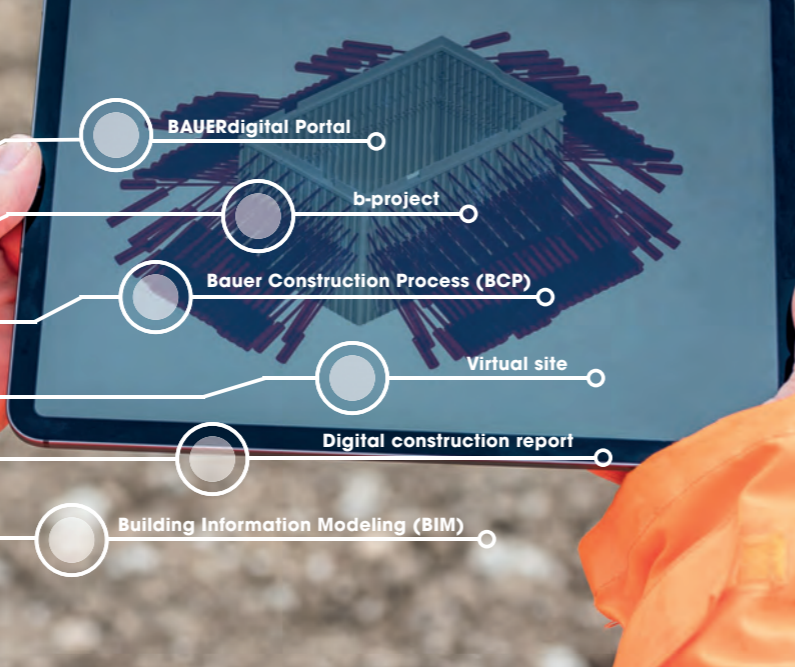
97 % of harmful substances are at least broken down with the help of the biological filter layers.



More information about the EcoVert® technology.



1-40 m³/h of polluted water can be cleaned with EcoVert®.



INTERVIEW WITH >

Marcus Daubner
Head of Digitalization
BAUER Spezialtiefbau GmbH

Digitization at Bauer

> The site of the future

Facilitating the daily work of all employees, more efficient and sustainable working methods as well as cooperative partnerships with customers – this is the foundation on which all innovations in the area of digitalization are developed at BAUER Spezialtiefbau GmbH.

Even on sites, digital work processes and procedures help to manage projects not only more efficiently but also in a sustainable and transparent manner. This prevents waste, saves time and reduces costs. In addition, Bauer Spezialtiefbau supplements the product range with digital services and products, and improves products by means of digital methods and technologies.

The digital site – what’s behind it? We have always collected lots of data on sites, though predominantly in paper form. We want to digitally record this data and lots more to automate processes and achieve a reduction in workload for our colleagues. The process was launched back in 2016, and we are already seeing the benefits of the system today.

What was the approach? First we carried out a status analysis and built on this to further develop our existing systems into a network. A modular structure was important to

us. This allows us to develop various components and combine them together. Working closely with our site managers, that is, coordinating closely with the tasks involved on a site – we develop from the site, for the site, so to speak.

What were the biggest challenges? Digitalization has two sides: On the one hand, it makes work easier. On the other hand, a change process is also required, since the usual process is changed considerably in some areas. We have managed to establish trust by closely assisting with the implementation of processes

and remaining available in case of questions at all times as a contact for employees on site.

What advantages have been achieved with the digitalization measures? With our digital twin of the construction project, we have not only made work easier for our employees, we have also established transparency and traceable quality for our customers – from the very beginning, these were and still remain the top goals for digitalization measures at Bauer.

> BAUERdigital Portal

With the BAUERdigital Portal, BAUER Spezialtiefbau GmbH has created an innovative platform for sites. Supervisors can view general information about a project in a central location. The centerpiece of the BAUERdigital Portal is made up of various application tiles that provide access to various digital tools. With these applications, logs are recorded digitally, data is collected, processed and analyzed automatically and processes are mapped digitally.

> Building Information Modeling

Starting with planning and design all the way to execution: A digital construction site can be designed from beginning to end with Building Information Modeling (BIM). Information such as geographical data and piles and anchors to be installed, can be simulated in exact detail here by the employees in order to find the most economical solution. All project data are saved in a model and the associated database and the structure can be digitally planned in advance.

> Digital construction report

Recording site documentation digitally – this is possible thanks to the digital construction diary. The digital construction report records personnel and equipment as well as working hours, quality information, work completed, and notes on delivered construction materials as well as images for documentation purposes. The information gathered is output in PDF format and can be retrieved by all participants at any time. Available as a desktop application and also as a smartphone or tablet app, this information can now be captured in digital format directly on the site.

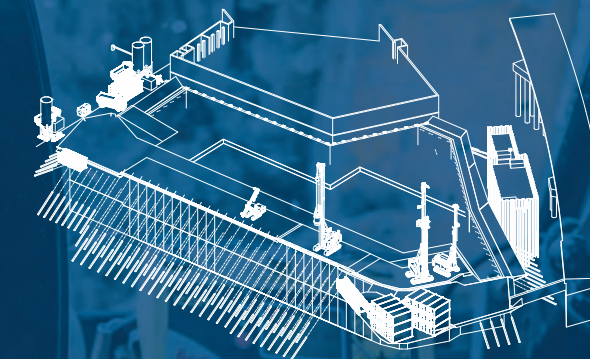
> Digital twin

The digital twin maps the site process by systematically collecting all relevant production data. The data provide the basis for an optimization, for example in the production planning or quality review process. From this depiction, the employees derive automated decision proposals for the site managers using the available site information to increase process security and reduce expenses. In the next expansion stage, Bauer will use artificial intelligence to support these decision-making tools.



> NOTES

Building Information Modeling makes it possible to design a project efficiently and sustainably using precisely detailed models.



More information and videos about the digital construction sites of BAUER Spezialtiefbau GmbH on the website of the ProFound.





> THE WORLD'S FIRST

As a forerunner in cutting technology for specialist foundation engineering, we thought it was time to redefine the limits of what is possible with the new BAUER Cube System. With our fully electrical, compact cutting system, we are now expanding the horizons of specialist foundation engineering.

BAUER CUBE SYSTEM

The BAUER Cube System – an all-round talent. Why? Because we have created a modern and sustainable solution for specialist foundation engineering. This fully electrical equipment is resource-efficient and generates little dust and noise – which benefits the personnel as well as the environment as a whole. In addition, thanks to its compact container format and the reduced need for construction vehicles, it causes less impact on traffic.

The BAUER Cube System was developed for use in extremely tight spaces. Due to its flexible application possibilities, great things can be created below ground, while life on the surface goes about its usual everyday business.

BAUER *CUBE* SYSTEM



IT'S QUIET. IT'S COMPACT. IT'S A COMPLETE SYSTEM.



A FEW QUESTIONS FOR >

Leonhard Weixler

Head of the Diaphragm Wall Division
BAUER Maschinen GmbH

Mr. Weixler, BAUER Maschinen GmbH has introduced an innovation on the market with the BAUER Cube System – what is novel about it?

Cities are becoming increasingly densely populated, growing in height and width, but also when it comes to depth. The Cube System is a cutter unit that allows us to work out of sight – with a greatly reduced impact on residents and traffic.

How did the idea come about? In discussions with the Belgian company Denys, a specialist in the area of micro tunneling, we developed the idea of using specialist foundation engineering methods to optimize wall construction from tunnels. Denys had already developed a prototype for a diaphragm wall robot. But since it was not suitable for the wide range of applications

world-wide, they turned to us. We found the application exciting and our engineering spirit was awakened. Simply making our smallest cutter even smaller was not enough for us. Rather, we wanted to develop something new that would have similar performance capacity to our previous cutters with significantly smaller dimensions.

What was the approach?

I remember as if it were yesterday that I invited five colleagues into my office and said: “I need ideas that would allow us to accommodate a cutter in this office.” We limited the width to 3 m and the height to 2.60 m. For our initial ideas we didn’t care about the length. This resulted in the fundamental principle for the Cube System: We separate the cutter into two parts and put them back together in the trench.

What was the decisive factor that made such an innovative development possible?

Since we are market leaders for the machines for constructing diaphragm walls, we were able to draw on an enormous range of components and knowledge during the development process. So the Cube System is our tried-and-tested technology, just rearranged.

What is the foundation for success at Bauer Maschinen?

Thanks to the structures within the BAUER Group, we have a good and very solid foundation for implementing such innovations and testing their practicality. With this development, we are once again demonstrating the innovative strength to be found within the Group.



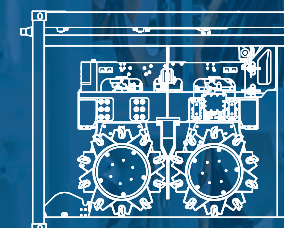
> NOTES

4 patents have now been registered by BAUER Maschinen GmbH in connection with the BAUER Cube System.



More information about our world’s first, the BAUER Cube System.

The development period for the BAUER Cube System was only around **3 years**.



Height	2.90 m
Width	2.44 m
Trench width	640 - 1,000 mm
Trench depth	2,400 mm
Cutting depth	40 m
Weight	50 t



Keep the old – Develop the new

> Shaft towers and headframes

In mining, innovation and tradition are more closely linked than in almost any other sector. The construction and rehabilitation of shaft towers and headframes requires a special and new approach each time, as both structures that have existed for decades and newly constructed structures need to fulfill individual requirements.

In 2017, SCHACHTBAU Group set new standards with the replacement construction of Schacht V shaft tower in Sondershausen. This was followed in 2021 with the structurally identical new construction of the Reiche Zeche headframe in Freiberg, which combined new and rehabilitated components under strict protected monument regulations. Starting in 2023, Schachtbau will construct a one-of-a-kind shaft tower in Salzgitter for a future repository. Engineering for this novel shaft tower has been underway since 2020 and will set new standards.

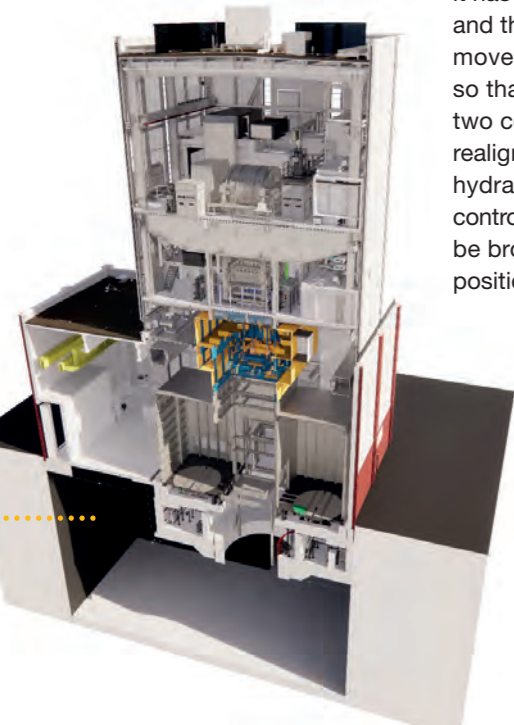


The project in three words: challenging, instructive, unique.

Steven Philipp
Project Manager
SCHACHTBAU NORDHAUSEN GmbH

> Förderturm Konrad 2

Particular requirements apply for construction of the surface installations of the future repository for low and intermediate level radioactive materials in Salzgitter. Here, a shaft tower is being constructed along with a conveyor machine that will transport the waste materials underground along a 1,000 m deep shaft. Although the shaft tower consists of a classic steel framework, it has a particular feature: The tower and the underground shaft ceiling are moved onto 20 flexible elastomers so that, to offset subsidence, these two construction components can be realigned entirely automatically using hydraulic jacks and software-based control. As a result, the tower can always be brought back to a perfectly level position after certain periods of time.



Originally, manual realignment of the tower was planned, but in order to ensure the greatest possible precision, it will now be carried out automatically. In addition, the entire building had to be seismically designed so that even in the event of an earthquake, the components will remain largely functional and the structure of the building will be retained.

Because the shaft tower is part of a mining facility, it is necessary to consider mining law and nuclear law in addition to construction law. Harmonizing all of these different standards is a challenge. But this is a challenge that we overcome with our innovative ideas.



> NOTES



Schacht Reiche Zeche

During rehabilitation of the headframe of the Reiche Zeche shaft from the 1950s, the scaffold parts and the rope pulley platform were replaced to maintain an identical construction, while the diagonal strut supports and the rope pulleys were rehabilitated.

Headframe Schacht V

The dismantling of the old scaffold and the installation of the new steel structuring weighing 250 t was carried out in just 52 days of continuous alternating shift operation.

Förderturm Konrad 2 – Milestones

- Early 2021: Completion of the engineering
- Christmas 2022: Approved audit of engineering
- Late 2023: Completion of steel structure construction
- Mid-2026: Completion of tower incl. all finishing works

Förderturm Konrad 2 – Tower components

Shaft basement, shaft hall with shaft hall extension, electrical platform (+ 19.36 m) with clamping and lifting device above which are the machine platform (+ 27.10 m) with main hoisting installation and mid-sized hoisting installation.

Förderturm Konrad 2 in 3D (left) and further information about the projects of Schachtbau Nordhausen (right).



GeoHeatStorage

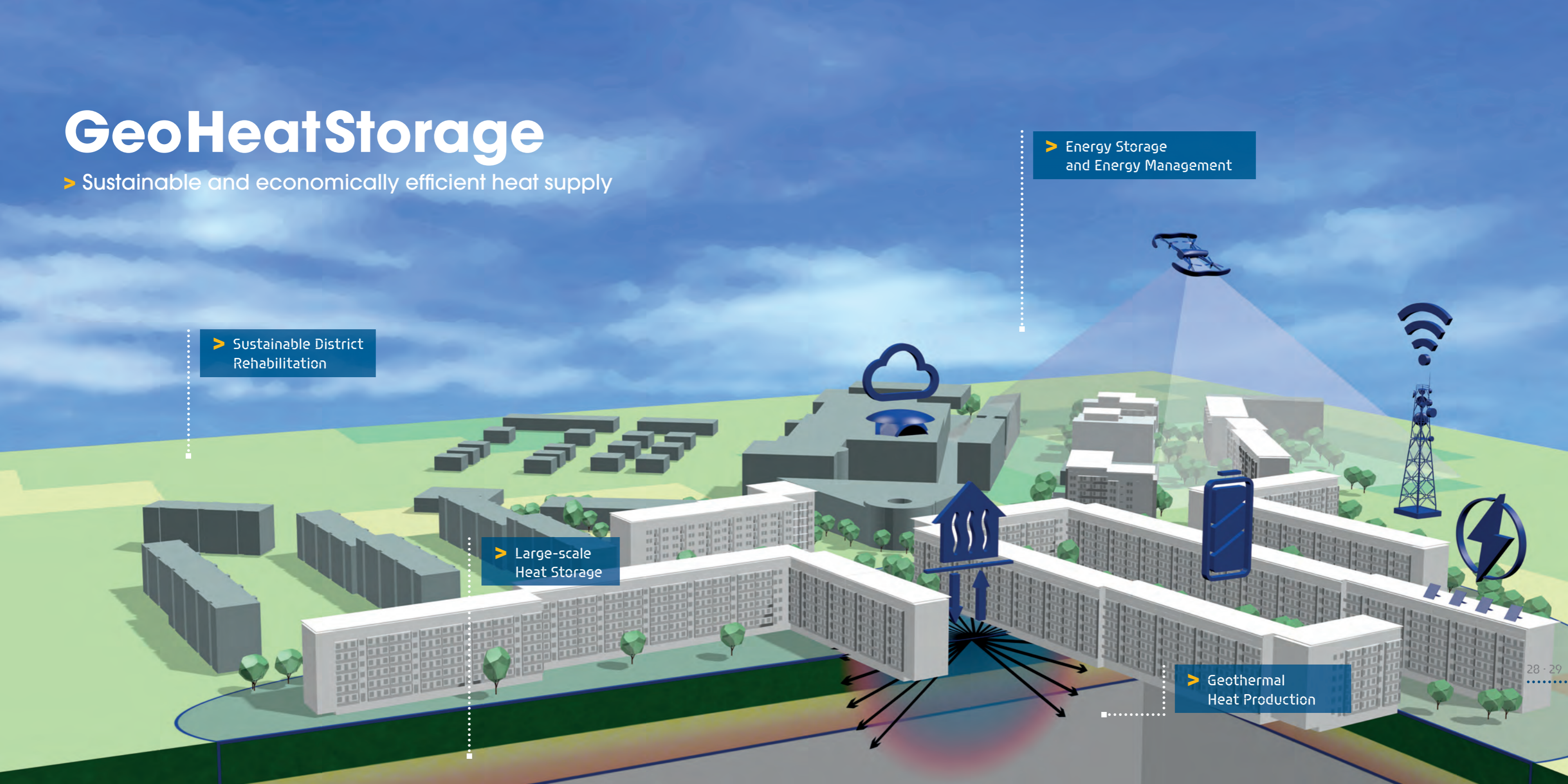
> Sustainable and economically efficient heat supply

> Sustainable District Rehabilitation

> Large-scale Heat Storage

> Energy Storage and Energy Management

> Geothermal Heat Production





> NOTES

smood® – smart neighborhood

The joint projects to which GeoHeatStorage also belongs implement efficient and environmentally-friendly neighborhoods along the entire value chain.

BAUER Resources GmbH is one of 16 companies that are part of the initiative. In addition, four research institutions and an association participate in smood®.



More information about the project GeoHeatStorage.

In 2018, the smood® alliance was launched after successfully passing the Assessment Center in the Federal Research Ministry (BMBF) and was granted funding of €10 million.



INTERVIEW WITH >

Dr. Frank Tidden

Head of Sales, Technology and Energy
BAUER Resources GmbH

Mr. Tidden, what is behind GeoHeatStorage?

The objective of the joint project GeoHeatStorage is to structurally develop gravel aquifers near the surface to provide heat storage for an entire neighborhood. To construct the cut-off wall for geothermal heat storage, the Mixed-in-Place method developed by Bauer is particularly well suited. Aquifers have already been used in the past for heat production and cooling. However, this causes the aquifer to heat up, which can lead to unfavorable changes to the biological and chemical properties. With an underground structure, on the other hand, higher ground water temperatures are also possible without impacts on the environment.

What problems gave rise to the project?

In general, we need to move away from oil and gas towards regenerative energies while still ensuring that people are supplied with heating and cooling. But we also need to protect our groundwater at the same time. With underground geothermal heat storage, seasonal heat storage can be provided for an entire neighborhood and the groundwater can be protected.

What represented a milestone for you?

For me, one clear milestone was seeing that this sustainable heat supply is also economical. Because we wanted a method that was not only resource-efficient, but also one that would be

economically competitive. Thanks to our optimizations in the implementation of Mixed-in-Place walls, we are able to make a significant contribution not only to the energy transformation but also to climate protection. The joint project GeoHeatStorage is the first time a viable option has been put in place for a sustainable and economical heat supply of existing neighborhoods.



Irri360°-AgriSystem

> Smart irrigation for agriculture

”

Getting the right quantity of water at the right time – that is smart irrigation. That is the Irri360°-AgriSystem.

Alexander Franke
 Technical Product Manager
 GWE GmbH



Irri360°-AgriSystem > From the source to the root

Less water but increasing demand and new political regulations: These are the challenges for agriculture in the future. The impacts of climate change are anticipated to cause falling groundwater levels, more periods of drought and thus also crop shortages. The Irri360°-AgriSystem irrigation system counteracts this by increasing efficiency during irrigation, thereby saving water resources.

Whether drums, circle sprinklers, above-ground or below-ground drip hoses – the type of irrigation does not matter when using the Irri360°-AgriSystem: The model-based irrigation system provides a solution adapted to individual needs that increases the prospects of success for crop yields and crop quality.

> NOTES

- Labyrinth in the drip hose features an automated system for regulating the outflow rate
- Durable double-coated tube that resists chemicals and UV damage
- Uniform irrigation of all plants with pressure equalization membrane
- Prevention of blockages thanks to extra-wide outflow channelroot penetration

- Optional: integrated copper protection against

70 % of global fresh water resources are consumed in agriculture worldwide.

In 2020, corn was cultivated on the approx. 1 ha large testing field on the premises of GWE GmbH. The Irri360°-AgriSystem was continuously monitored and analyzed from sowing until harvest.

This way to more information about the innovative and customized solution Irri360°-AgriSystem on the ProFound website.

Thanks to an effective use of hardware and software, the water is delivered directly to the roots of the plant in the right quantity and at the right time. To this end, the sensor and monitoring system records a range of data in the field, such as temperature, soil moisture, conductivity, plant types and weather data, and stores these in a cloud. The data is transferred into the control app and the time for irrigation and the water quantity are controlled autonomously.

In this way, farmers can plan irrigation based on the soil moisture and water needs of the plants – in a time-saving and efficient manner. This has already been successfully demonstrated on multiple test fields in which corn, potatoes, nettles, blueberries and other plants were cultivated.

IMPRINT

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