

Bundesgesellschaft für Endlagerung mbH (BGE)
Unternehmenskommunikation und Öffentlichkeitsarbeit

Eschenstraße 55
31224 Peine
T 05171 43-0
F 05171 43-1218

www.bge.de
www.einblicke.de

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Concept, layout and texts:
Dagmar Dehmer (dd), Monika Hotopp (mh),
Martina Schwaldat (ms), Ursula Ahlers

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Annual Report 2019



Cover photo: Haulage system for transporting miners during construction of the bunker and for the planned installation of an inner lining

Dear Employees,

In the past fiscal year, we all worked together at our construction sites and on our projects, site selection, and product control. We also used this time to reorganise ourselves, and our plan is to continue modernising and developing our company in the future. Innovation is an important driver of progress, change, and acceleration. Let us use our creativity to continue moving BGE forward! We thank you for your commitment and loyalty.

Glück auf!

The management board

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Report of the supervisory board

In 2019, the BGE supervisory board received oral and written reports from the management board, informing of all the essential business transactions. The supervisory board held three meetings to discuss the business performance and major projects and to deal with the transactions submitted for examination and approval in accordance with the law and articles of association.

On 19 June 2019, the supervisory board visited the company headquarters in Peine and, in its meeting there, accepted the financial statement for 2018, informed the general assembly in writing of its appraisal, and proposed its approval. As discussed in the supervisory board on 25 November 2019, the public auditing company PricewaterhouseCoopers GmbH was commissioned to audit the financial statement for fiscal 2019.

The supervisory board had already adopted rules of procedure on 14 February 2019, which set out in detail the internal organisation of the super-

visory board and its cooperation with the management board. At the subsequent meeting, the supervisory board elected a presidium of four members who can prepare the decisions of the supervisory board.

In a workshop on the rights and obligations of members of the supervisory board, organised by BGE mbH and held on 15 May 2019, the supervisory board received further training on its duties, due diligence, liability issues, and other matters. The supervisory board expresses its thanks and appreciation to the management board and all employees of BGE mbH for their performance in 2019.

Peine, 30 June 2020

Jochen Flasbarth
Chairman of the Supervisory Board



The members of the presidium
(from left to right):
Dr. Holle Jakob, Jochen Flasbarth,
Gregor van Beesel, and Gabriele Theisen

Members

Jochen Flasbarth

Chairman of the Supervisory Board
State Secretary, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin

Gregor van Beesel

Deputy Chairman of the Supervisory Board
Dipl.-Ing. Cartography, Bundesgesellschaft für Endlagerung mbH, Peine (Employee Representative)

Dirk Alvermann

Foreman
Bundesgesellschaft für Endlagerung mbH, Morsleben (Employee Representative)

Ursula Borak

Head of International Affairs,
Fossil Fuels and Nuclear Energy Division at the Federal
Ministry of Economics and Energy, Berlin

Dr. Wolfgang Cloosters

Head of Department Nuclear Safety, Radiation Protection, Federal Ministry for the Environment, Nature Conservation
and Nuclear Safety, Berlin

Sabine Diehr

Head of Unit, FhG (Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung), MPG (Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.), in the Federal Ministry for Education and Research, Berlin

Leonie Gebers

State Secretary
at the Federal Ministry of Labour and Social Affairs, Berlin

Prof. Dr. Karin Holm-Müller

Head of the Chair of Resource and Environmental Economics at the Rhenish Friedrich Wilhelm University, Bonn

Franz-Gerhard Hörnschemeyer

Secretary Energy Sustainability of the Mining, Chemical and Energy Industries Union, Hanover

Dr. Holle Jakob

Head of Division Fundamental Issues
Participations in the the Federal Ministry of Finance, Berlin

Dr. Andreas Kerst

Speaker in Division
Participation in Deutsche Telekom AG, Bundesdruckerei and Toll Collect in the Federal Ministry of Finance, Berlin

Sylvia Kotting-Uhl

MP (Bündnis 90/DIE GRÜNEN)
and Chairwoman of the Committee on the Environment, Nature Conservation and Nuclear Safety of the German Bundestag, Berlin

Jens Lindner

Shift Supervisor
Bundesgesellschaft für Endlagerung mbH, Salzgitter (Employee Representative)

Gabriele Theisen

Head of Finance and Accounting
Bundesgesellschaft für Endlagerung mbH, Remlingen (Employee Representative)

Peter Wolff

System Administrator
Bundesgesellschaft für Endlagerung mbH, Remlingen (Employee Representative)

There is no progress without innovation

A large part of the workforce of the Bundesgesellschaft für Endlagerung (BGE) works in four mines: the Konrad repository, the Asse II mine, the Morsleben repository, and the Gorleben mine. The handling of radioactive waste is heavily regulated for good reason. The safety culture in BGE, combined with a strict legal framework, has spawned hundreds of operational rules. At first glance, it might not look like a place that spawns new innovations.

In fact, BGE is a veritable hotbed of innovation: a closer look reveals inventions, creative problem solving, the development of new processes, social innovations such as the sustainability project group, and even patents held by the subsidiary BGE TECHNOLOGY GmbH. The entire company is furthermore in the process of digitalisation, which will continually bring its own innovations with it. In other words, the drivers of innovation are many and varied. In the case of the Site Selection Act (Standortauswahlgesetz, StandAG), for example, it is law itself that is innovative – and is driving innovation in site selection. Sometimes, the tightening of limits forces our colleagues to get creative. Sometimes there are conditions that prohibit the use of “normal” machinery, construction methods, or materials – and we can say that is especially true for the Asse mine. External factors like ‘big data’ are driving innovation in geoinformation as well: without new developments, the colleagues would drown in the ocean of data before they could draw any real benefit from it.

Often, however, there is also a direct desire to bring about change in order to boost efficiency or achieve more productive collaboration. In 2019, in a group of 30 employees from all sites and hierarchy levels, BGE developed a mission statement that will now guide operations such as modernising the administration of BGE, placing greater emphasis on environmental and climate protection, and making the workforce more diverse – developments that are being promoted, among other places, in a sustainability workgroup.

Over the following pages, we present innovations that might surprise you, like baking soda in Sorel concrete, innovations that you might expect, like the move towards e-mobility, and innovations that cannot be achieved by technology alone.



Stefan Studt
Beate Kallenbach-Herbert
Dr. Thomas Lautsch
Steffen Kanitz

"We make the safe final disposal of radioactive waste possible"

How BGE came to its mission statement

The first sentence of the mission statement says it all: "We make the safe final disposal of radioactive waste possible." It is the reason and purpose for having established the Bundesgesellschaft für Endlagerung (BGE) in the first place. It was also the sentence that required the least discussion among the roughly 30 people who formed mission statement development team.

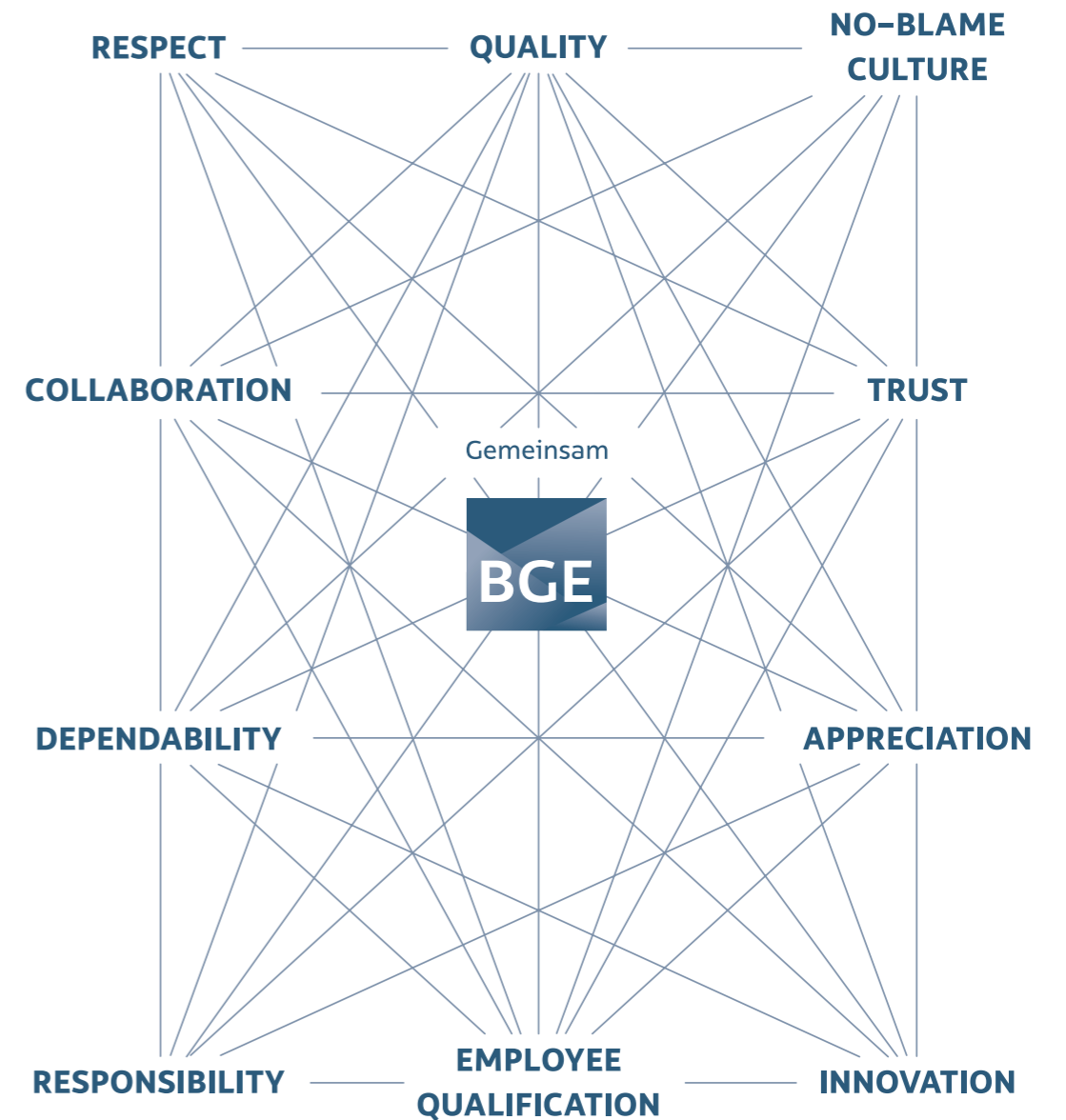
Although BGE already had enough on its plate with its restructuring in early 2019, we mutually agreed that it was worth accepting the additional challenge of developing a mission statement for our "new BGE". The purpose of this mission statement is to help the three original organisations – the Endlagerabteilung des Bundesamts für Strahlenschutz (BfS), Asse-GmbH, and the Deutsche Gesellschaft für den Bau und Betrieb von Endlagern für Abfälle (DBE) – to form a new, powerful and efficient company. Above all, it is a way to provide a sense of identity to a workforce that may be leaving its past behind but is also ready to make a brave new start.

Working on the mission statement has shown on a very real level how this can be accomplished. The statement was drafted by a group of employees from all sites and all hierarchy levels in four workshops. In addition to the entire management team, there were specialists representing all BGE projects: miners, drivers, secretaries, engineers, business people, and plant managers. In small and large groups, we approached the task with role plays, keyword collections, and sometimes even heated debates. We all experienced "victories" and "defeats" in voting on every single sentence of this mission statement – until the decisions were acceptable to all. It was a new and good experience for many in the workforce.

In defining this mission statement, BGE has adopted values and overarching goals that shall now guide us in our daily activities – alongside those that admittedly should have been guiding us from the start. We want this mission statement, developed with such strong spirit, to reach every part of the company. We will now take the time to ensure just that – by sharing information, undergoing training, and coming up with practical ideas that might even surprise ourselves. The BGE mission statement cannot end up as just a piece of paper in a drawer, rather it must provide the motivation for our daily work – internally and externally.



Stefan Studt
Chairman of the BGE Management Board



Our mission statement

Julia Kutscher, 33, Industrial Clerk,
IT Department, Peine

We need a no-blame culture that is actually lived.
We must be able to admit our mistakes and not
look for them in others.

Frank Nocht, 64, Engineering, Organisation,
Liaison Office, Berlin

Every single employee must internalise the con-
tent of the mission statement. It will not be easy.

Dr. Wilhelm Hund, 62, Head of Department
R & D / Knowledge Management, Salzgitter

The mission statement is an important means to
provide us with orientation, develop a common
corporate culture and get everyone connected.
In order to implement it, we will need stamina,
determination, tenacity, and respect.

Gabriele Seidner, 54, Clerk
Documentation, Site Selection, Peine

I find it a very important aspect of our mission
statement that we want to create a motivating,
appreciative and family-friendly company.

Toni Hollekamp, 30, Heavy Equipment Operator,
Konrad Mine

Appreciation is the lynchpin. It is all-important,
in my view. Everything else hangs upon it!

Urban Regenauer, 57, Geologist, Salzgitter

Cultivating respectful and appreciative relations
between everyone is very important. Therein lies
the key to a harmonious coexistence.

Peter Neumann, 63, Electrical Engineer,
Quality Management, Peine

The mission statement provides orientation and strategic direction. We want to live a no-blame culture. Employees in managerial positions are looked to as role models.

Annette Parlitz, 48,
Public Relations Asse

Trust is very important because none of us can take on all tasks alone. So we all trust that others do their part of the job to the best of their abilities.

Dr. Antje Carstensen, 51, Geologist,
Decommissioning Measures Morsleben, Peine
Successful cooperation and thus the achievement of common goals only become possible by anchoring the code of conduct at all levels of the company.

Dagmar Dehmer, 54, Head of Department
Corporate Communication and Public Relations

The mission statement will not drop from the sky like manna from heaven. Each and every one of us is called upon to turn our mission statement into a guideline for all of our actions. I look forward to this shared learning process.

“Digitalisation helps us to be – or to become – innovative” Christian Wilkens, Diplom-Informatiker

Where does BGE stand? We asked Christian Wilkens for a situation analysis. The 45-year-old computer scientist and head of the digitisation group in the engineering department is working with colleagues Judith Nettelroth, business informatician, and David Horner, industrial engineer specialised in mining technology, on the issues of repository technology 4.0 and process-supporting IT tools.

How do you see digitalisation in relation to the BGE environment?

We always see digitalisation from two perspectives. One is about linking vehicles, mobile machines, and systems more tightly at the level of mining technology. The other is about digitalising our collaborative work processes. This applies not only to the processes within BGE, but also to our cooperation with suppliers, service providers, and authorities.

Where does BGE currently stand when it comes to digitalisation?

BGE is in the thick of it! There are good ideas in some areas and initiatives have been launched to replace analogue processes. We hope digitalisation will bring about great improvements.

Does that mean digitalisation makes everything better?

Ultimately, digitalisation is really just a tool, like IT. It is never complete; rather it will always accompany us as an ongoing process. Digitalisation doesn't make problems suddenly go away. The important thing is for our colleagues to be active-

ly involved in it, because innovation only works from within.

With our technical engineering projects, we want to lay the foundation for the use of sustainable technologies and, at the same time, provide a nucleus for further innovations.

The new BGE mission statement was created with a great deal of commitment last year. We asked ourselves what contribution we can make with our work so that we really do live the values described in it. This gave rise to the idea of a network of proponents of digitalisation. We will assemble and build this network from the various departments.



From left to right:
Christian Wilkens,
Judith Nettelroth,
David Horner
Photo: BGE, Cornelia Gonet

What are you working on, specifically?

We are currently modernising the first galleries of the Asse and Konrad mines with a latest-generation wireless LAN. This WLAN will serve as the basic infrastructure for technologies relating to mobile data transfer, such as secure and non-proprietary communications between existing and future systems and machines. We need mobile data transfer for all further underground digitalisation scenarios that will hopefully help us achieve our vision for 2035, which is autonomous repository operation.

Autonomous repository operation – can that work?

Definitely! I am firmly convinced that we will have the first fully autonomous vehicles on Germany's roads within five years. That will increase the fundamental trust in this technology because, by then, it will be a normal part of life. The heavy machinery manufacturers have already been gathering experience in this area for years. In Sweden, autonomous vehicles have been in productive use in mines for a long time. The next generation of mining vehicles will operate autonomously here in Germany, too.

Doesn't that mean jobs will be lost in the end?

No! That is a common misconception! New areas of expertise will emerge and the jobs will evolve.

What things are you addressing to improve the collaborative culture?

We want to introduce so-called "Building Information Modelling (BIM)" as a central building management method. The essence of this method is to bring all information in the lifecycle of a building – from the first draft to its demolition – together in a single, central system. All stakeholders in the project will have access to the information they require for their tasks at all times.

What do you expect from applying this method?

We expect better cooperation between the commercial and technical divisions, higher planning quality, and improved workflows for our construction projects.

Where do you see BGE in five years?

I hope that our digital nucleus bears fruit and that, with committed colleagues, we will put many innovative ideas into practice! (ms)

Digitalisation 4.0

What BGE's plans are for now or how maintenance can be better planned

30,000 is a magic number for the maintenance workers at the Konrad mine. What is behind this number?

The Konrad mine, and indeed every other BGE mine site now, has thousands of pieces of equipment on site, each one a maintenance part in itself. All of them require some degree of maintenance during their life cycle. Examples include stationary and mobile facilities, systems and components such as fire extinguishers, ventilation systems, vehicles above and below ground, heavy mining machinery such as so-called roadheaders, and of course the man-haulage systems. Maintenance is an integral duty of the machine department, electrical operations, materials management, and maintenance planning and control. There are a total of 146 maintenance employees at the Konrad mine.

146 employees who are responsible for the maintenance, repair, inspection, and improvement of 30,000 pieces of equipment. That's a lot. Furthermore, legal requirements are becoming ever tighter, for example for maintenance intervals and tests. This will also affect the facilities, systems, and components of emplacement technology in the coming years. In order to cope with this in the long term and to be able to manage it sustainably, we need to rethink.

Dennis Neumann, Head of Maintenance, has been aware of this for some time: "The idea of modernising maintenance is not new. We were becoming more and more busy with administrative things, which was time consuming. The actual work started to take a back seat. That had to change. We had to question the way we did things. How could we manage maintenance better?"

The magic word here is digitalisation. While SAP is currently used, most see it as merely a means to an end rather than as a useful tool. "That is our starting point. The system that is to be used must genuinely help and support us in our daily work as well as in planning, implementation, and traceability," Neumann continues.

Project Manager Ronny Müller will have his hands full with this. The mechanical engineer understands the topic of maintenance from multiple BGE sites and can assess how complex the project is and what things have to be considered. "The project is divided into several steps. We are still in the analysis phase and first have to reduce the concept of maintenance to a common denominator. For historical reasons, we have different structures in SAP at our respective sites. Our goal is for everyone to use the same system and for the sections to be uniformly structured. We call that harmonisation of maintenance."

Neumann and Müller know there are other companies that are already ahead of them. They talk wistfully about all the possibilities available for controlling and planning maintenance. But they also know that the conditions in mines can hardly be compared with the requirements in other companies. If they want to modernise BGE in this respect, they occasionally have to think outside the box and perhaps use functions that things speed up, such as fault analysis, which is a prerequisite for implementing condition-based and predictive maintenance. If the oil quality in a compressor drops, for example, a networked system with intelligent sensors will help by suggesting solutions as to where the fault could be. At the same time, an automatic check will be carried out to determine whether the necessary spare parts are in stock. If not, the system will immediately initiate



From left to right: Project Manager Ronny Müller and Dennis Neumann, Head of Maintenance

an order for them. All that, however, is still far off. Nevertheless, Neumann and Müller are confident.

Their goal: maximum safety and reliability in the repository. This could include, for example, a system that automatically transmits measurements from machinery and thus reports a potential need for maintenance. Sensors would analyse a vehicle's situation along its route. Some colleagues are working on the digital recording of operating hours for vehicles below ground. This will be used to steer maintenance plans and automatically schedule maintenance intervals. It should also allow better personnel deployment planning.

A pilot project is to be launched at the Gorleben and Konrad sites to equip the underground galleries with Wi-Fi or, alternatively, 5G radio technol-

ogy. This has to work if automated maintenance control is to work. All in all, this innovation project will take more than three years. (ms)

Make the invisible visible

How data gets onto glasses

Stand up very slowly, because the VR glasses over your eyes are a real challenge for your balance. Your gaze now sweeps over the Asse hill range – as you stand in the middle of an office in Peine. As you sit down, a different picture appears: you now are on a virtual tour of the Asse mine. Depending on which way you look, you can see passages, junctions, or the way down to even greater depths. These images are generated in the Geoinformation department – from the wealth of data that has accumulated over the years.

For many years, maps were the only visual form of geographic information for documenting spatially related objects and features on the earth's surface, and thus for making more complex information from below ground more visually relatable – they were the state of the art of mine surveying. A spectacular change has now taken place with the appearance of computer-assisted processes and high-performance data storage. At BGE, above all the geoinformation experts were instrumental in their introduction.

Department Head Volker Busse is especially proud of the development of a 3D information portal. It can show 3D visualisations in a web browser without requiring special software. Only a few months old, a lot of the data available to BGE have already been incorporated into this portal. It is now paying off that the Markscheiders – the guild of mining surveyors – were early to adopt databases as a means of storage for geoinformation. The aim is to amalgamate all geometric, geological, and geotechnical data. Users can then create whatever kind of view they need from the existing data pool. Ideally, this will even one day be possible in real time.

VR glasses have been used for geoinformation for quite some time. So far, the technology has

been used for presentations, for giving the viewer a three-dimensional impression of the complex spatial structures of the Asse mine, for example. Experts are also interested in using it for the convenient visualisation of geotechnical measuring points in mine cavities. For boreholes, it can visualise not only the geology, but also the geotechnical instruments such as extensometers. Being mounted in boreholes, these are not visible on site. Busse can also well imagine that, in a few years' time, VR glasses will be worn for assistance while driving in areas requiring geomechanical surveillance. In other words, precisely where the stability of a mine is in question.

The use of 3D laser scanners has long been common practice for geoinformation, and is in fact already standard. However, Busse can still remember the times, only a few years ago, when this was far from the case. That is why innovations are so important to the 55-year-old mine surveyor: "Without innovations, we stand still and can't complete tasks or solve problems. Without continual advancement, it would be impossible to use the current flood of data."

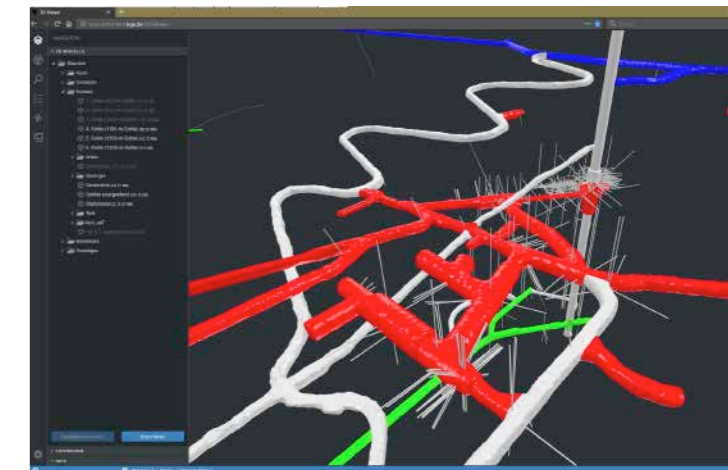
Where is the trend in geoinformation heading? Busse has a clear picture in mind for this, too: "VR applications will be a part of regular operations, and there will be all kinds of geoinformation apps on mobile devices. Presenting exploration results will be easy."

He also feels it is important to clarify once more what his field of expertise is all about. Geoinformation is any information that contains an indication of location, be it structures above or below ground, parcels, estates, boreholes, or cavities in a mine. In essence, it is always about the analysis and preparation of spatial data.



Laser strain measurement using video tacheometers for stability calculations

150 employees at all BGE sites help to survey mine areas, collect geological information about the subsoil/subsurface, ensure the operational safety and stability of cavities, or identify faults, cracks, and damp areas using geophysical methods. Nothing would be possible without these things at BGE. (ms)



3D information portal

The visualisation in VR glasses is created by displaying two slightly different images in front of the eyes. A computer program simulates this difference such that the brain creates a three-dimensional impression from the two images, which ultimately creates the illusion of three-dimensional vision with practically no discernible boundaries, and offers a particularly realistic sensation. The fact that you can move and look around in the virtual environment reinforces the impression of being right in the middle of the action.



Volker Busse, Head of Geoinformation, explains the principle of VR glasses

In search of new ways

There were several reasons for breaking new ground – both metaphorically and literally – in the construction of the side rooms and the future emplacement chambers at the Konrad mine. Site Managers Andreas Graupner and Moritz Kellner are not overly keen to use the word innovation, but they will tell you that, sometimes, you have to try new things and leave the old ways behind.

Time is always an important factor on construction sites. How do you stay on schedule? Can all sections be organised in a way that prevents downtimes? Are the choices of technical approaches the right ones? Graupner and Kellner agree that these questions have to be asked time and again, for every project, especially on complex construction sites. The two mining engineers had a clear division of tasks: one dealt with the technology, while the other dealt with the finances and contractual arrangements with contractors.

The cavities built for the repository infrastructure are impressively huge. So huge that the machinery reached its limits to build them. The engineers therefore changed and continuously adapted the driving method – in such a way that the so-called drive cross-section would be divided into multiple smaller sections.

In mining, it is standard to use anchors to secure the rock. When it became clear that the originally planned sliding head anchors – up to 18 meters long – were now unsuitable for producing the desired result, namely influencing the movement behaviour in the resulting cavity, multiple BGE departments started looking for alternatives.

The narrower conditions in the mine had made this necessary.

Now, shorter anchors would also have to be used that work differently from the sliding head anchors. While they would take less technical effort to install, they would fulfil the requirements much better. Another positive effect: more anchors could be installed per shift. They amounted to almost 4,000 pieces in total.

But the engineers not only had a brainwave in the choice of technology; they also came up with a new way of organising the work. In the first step, for example, they drove longer route sections, or drilling rounds, than are usually driven, so that other work steps could follow with little delay, thus making optimum use of the limited space available below ground.

The underground construction situation was therefore more than challenging: four working groups had to work sometimes all together in the same, cramped space. Any changes made to the construction cycle at one site meant having to assess the effects on other sites. Not to mention the working conditions resulting from the generation of heat and dust.



Konrad mine: Future site for pre-shredding, 2nd level, view of the 3-rope system

The particular challenge when later driving the emplacement chambers – six in all – was that the driving produced a large amount of debris, in the form of loose rock, in very short time. To dispose of it, existing cavities had to be found and used throughout the entire mine and even throughout other construction sites. Good teamwork and agreement between all those involved was not just necessary; it was all-important. This is one of the most important findings by Graupner and Kellner. Complex construction sites involving many external companies only work if there is constant dialogue and sharing of information.

Their conclusion: "Many associate mining and even BGE with conservative thinking and action. We cannot attest to that. On the contrary: we are able to contribute our own ideas and creativity. They are more than in demand!" And: this kind of close cooperation may be somewhat uncommon, but it delivers the desired results. (ms)



From left to right:
Andreas Graupner and
Moritz Kellner in an interview
with Martina Schwaldat



Watertight? Absolutely!

What happens in the Morsleben repository has nothing to do with trial and error. This is because BGE uses a demonstration structure to determine special properties of planned waterproofing structures and to demonstrate how these can be built to quality requirements. No more – and no less.

Dr. Antje Carstensen is so enthusiastic about "her" demonstration structure that, once she starts talking about it, she can hardly stop. Shortly before the contact restrictions were enforced due to the coronavirus, she presented the preparations in the Morsleben repository to BGE management. She pointed to two round holes in the ground in a section of the route where a test was to take place. The holes had been drilled to determine additional material properties of a newly developed building material. In the walls around them, there were still a number of facilities that had already been used in the planning and test phase. At a depth of around 460 meters, the gallery has been driven into fissured rock. This rock is anhydrite. The miners are not fans of it. It is very hard and, due to its cracks, unpredictable in terms of the safety of the galleries.

Dr. Antje Carstensen heads the decommissioning group in the Morsleben project. She is enthusiastic because "the job is so great" and "because the cooperation with the miners in Morsleben and also with the colleagues from a large number of specialist groups works so well". Dr. Antje Carstensen's group has one of the central tasks in the Morsleben decommissioning project. The purpose of the demonstration structures is to determine how it is possible to achieve safe sealing – as tight and permanent as possible – of galleries (horizontal passages) even in anhydrite. Whether in the end there will be multiple structures, for optimising different construction methods or materials

and determining various properties, will be seen after discussions with experts and the approval authority. One thing is certain for Dr. Antje Carstensen: "I could not imagine anything more interesting and motivating as a profession."

Some of the radioactive waste in Morsleben was emplaced in the remote Ostfeld between 1997



Test holes: Material parameters for a new building material are determined here. It's all about confirming laboratory results.

and 1998. This area is only connected to the rest of the mine by two connecting galleries, one of which resides in the fissured, i.e. cracked, anhydrite.

For optimal safety after decommissioning, these galleries are being sealed with geotechnical barriers. The technical measures involved in decommissioning (shaft sealing, structural sealing, back-fill measures, and borehole sealing) must work under diverse conditions that could conceivably, no matter how unlikely that is, exist in the future. These seals are intended to prevent a potential ingress of solutions into the wastes in Ostfeld and a subsequent dispersion of radionuclides out of those wastes. Like others, this decommissioning measure is performed "to be on the safe side".

Morsleben repository: Demonstration structure for the permanent sealing of galleries



From left to right: Dr. Antje Carstensen spoke with Dagmar Dehmer

But that in itself does not make it any easier to prove that it will work in all possible scenarios. It is therefore important to recognise that there are uncertainties to be dealt with in a system as complex as a repository. Uncertainties are either accounted for in the safety assessments or they can be reduced by performing further realistic tests that improve the quality of the forecast.

In 2010, there had already been a large-scale test to seal a section of anhydrite at another site outside the Morsleben repository. However, that attempt was unsuccessful. The building material, a so-called magnesia binder, did not hold up in the large-scale test to the characteristics it had seemed to promise in laboratory trials, and which had therefore been assumed as given when

Philipp Wilke in the process of drilling core holes



planning the construction. It did not permanently 'swell' to create a tight seal for all time. "At least this gave us the chance to learn a lot about the magnesia binder as a material," Antje Carstensen says. This provides a good example of what it means in practice to furnish proof for a state of the art damage prevention solution as demanded by the Atomic Energy Act. It speaks of "science and technology". Safety and reliability increase, but so do the risks for scheduling.

Dr. Antje Carstensen can handle it – she is a scientist. "It is important to keep learning and to implement what you have learnt – even if it sometimes costs time. We see what we're doing here as a self-learning process," she says. In the meantime, she has had various smaller material tests carried out. And she has learned a lot about the different material compositions. An institute of Freiberg University of Mining and Technology collaborated. "The colleagues from Asse were also very helpful," she reports. They have many years of experience in practical use with a variant of the magnesia binder, called Sorel concrete. The colleagues also provided much practical help. They provided a magnesium chloride solution from the Sorel concrete production at Asse as a mixing solution for the material development. Also val-

uable was the experience of the colleagues from BGE TEC in the development of building materials, which they had gained from various projects.

The group has since moved onto other things. With the help of the mine operator, she selected galleries in the Morsleben repository where the raw materials for the demonstration structure could be stored. These practicalities are also part of it. "I don't want materials to have to be moved back and forth during the concreting work," Dr. Antje Carstensen reports. The building material components will therefore be stored in the immediate vicinity of the future mixing machine. "The material is a bit tricky," she says. The building material must exhibit good thixotropic behaviour and be processable for a long time. Furthermore, it ought to bind well to the rock and ultimately achieve the required strength as a result of its initial increase in volume during hardening.

This type of contact joint is at the centre of this demonstration structure. Yet, the list of relevant properties is even longer: permeability, strength, and long-term stability are merely the most important of them. Accordingly, further tests may still be necessary, depending on the acceptance of remaining uncertainties.

In order for the gallery to be optimally prepared for the experiment, the miners must first create the precisely defined cross-section. Precise and clean re-cutting with a roadheader is not easy in the extremely hard and cracked anhydrite. "It will take practice," Dr. Antje Carstensen believes. "Nobody can do it just like that, even though the miners here do fantastic work and are highly trained." This is because such work "is after all not part of the normal routine" of keeping the mine open. Dr. Antje Carstensen is delighted that so many miners "are genuinely keen to do this work". And, she adds, "We can really feel how well supported we are." The miners continued working on the demonstration structure even during the coronavirus-related restrictions. Dr. Antje Carstensen is therefore confident that the schedule can still be upheld. Before the gallery can actually be concreted, "we still have to test a few things,"

she says. From the first demonstration structure, she had namely learned that the path from the laboratory to large-scale application is not just a question of upscaling, or resizing, but that some materials behave differently at the construction site. "It's really exciting," Antje Carstensen says with satisfaction – and has already discovered another new detail that she absolutely has to report to management. (dd)

Matthias Bösche creating the backfill site for testing the mixing facility



Innovations in the Asse project

“With sleds and baking soda”

Advancements in Sorel concrete formulas and their areas of application

Asse emergency planning seems to be a think tank. No less than two innovations have been launched here. One is a system developed by Bernd Radau for lining large boreholes. In carnalite salt rock, boreholes must be secured because otherwise they would become deformed by the creep behaviour of the salt. “It must be noted that absolutely no gas-forming foreign matter such as wood, plastic, or metal is allowed remain in the material used to line the holes. Sorel concrete, for example, meets these requirements,” explains Emergency Preparedness Group Leader Matthias Heydorn. Of himself, he would say he is respon-



Matthias Heydorn, emergency preparedness group leader

sible for almost everything that has to do with Sorel concrete. Sorel concrete is a building material that was developed in the middle of the 19th century and has been successfully used in potash and rock salt mining for more than 100 years. It is the most frequently used building material at Asse.

For vertical boreholes and boreholes that are not particularly long, the first bore is lined by filling with Sorel concrete. Once hardened, a new bore of a smaller diameter is drilled into the centre of the first bore. This leaves behind a Sorel concrete ring that protects the borehole. With long and

inclined bores, it is not possible to create a second bore precisely in the centre of the concrete body because the drill string will inevitably deviate in its direction. And this is where Bernd Radau’s idea comes in. When asked how he came up with the idea, he answers flatly: “I thought about it.” He has now developed a system designed to ensure that a new bore in a long borehole stays in the dead centre when re-drilled. For it to work, a cavity must be created. The drill always follows the cavity. This is created by an empty plastic pipe. In order to get this plastic pipe centred in the large borehole, the pipe is attached onto approximately 1.5 metre long pieces of precast concrete, shaped a lot like sleds, which are inserted into the hole. This plastic part always stays in the centre, even if the concrete part twists a little. Once you have an entire chain of these finished parts inside a long borehole, you also have a chain of plastic pipes that is consistently in the centre of the borehole. Then the rest of the cavity of the large borehole, which is still hollow around the prefabricated Sorel concrete parts and plastic pipe, is filled with concrete.

From left to right: Kerstin Pflug (IT/Drawings), Matthias Heydorn (Group Leader), Bernd Radau (Planning), Alexander Scheller (Formwork Construction)



The precast elements thus form a single body with the Sorel concrete. In the centre is the plastic pipe. Through this chain of plastic pipes, after a suitable curing time, the hole is then drilled to the required diameter and the plastic pipe removed in the process. Then only a jacket of Sorel concrete remains. This process developed by Bernd Radau can be used over several hundred meters. “You can’t develop such a process on your own,” Bernd Radau says. “It only works if all departments involved play a part and contribute to the success.” He particularly mentions the training workshop that built the formwork for the prefab parts and the drilling department that was responsible for installing the prefab parts.

Matthias Heydorn praises his colleague: “Bernd Radau thought the system out cleverly. It is used for boreholes that are at such an incline that the prefab part slides in under its own weight, but cannot tip over if it’s in a steep hole!” And then he describes the next problem. “I was concerned about how the installation of the heavy prefab parts would go.” Because if you lowered the part down into the borehole with a hook, the hook would remain in the borehole. Bernd Radau also solved this problem. With the help of two rope systems combined with a suitably dimensioned steel needle, a system for inserting the finished parts was developed in which no foreign material remains in the borehole.

In 2019, Bernd Radau’s method proved its worth in a pilot test in a large borehole drilled between the 800 m level and 850 m level; now it is to be used in a longer borehole in excess of 150 meters.

“Asse is full of holes like Swiss cheese,” is a description one often hears from people talking about the Asse mine. But that is no longer really

true. Salt was mined from Asse on a large scale, but, through the former Asse GmbH, BGE and the former operator, the Federal Office for Radiation Protection introduced an enormous amount of concrete into selected mine areas as a stabilisation measure for the mine. Of course, using the Sorel concrete we already mentioned. But Sorel concrete in its original formula is not the right building material for everywhere. There are places in the mine, such as the so-called cross-cuts, where the requirements for concrete are different, for example in terms of flowability. These are short connections between two mining series that are no longer accessible. A building material was required that is characterised by an increase in volume and a slow flow rate. Two young geoscientists from Matthias Heydorn’s team tackled this question: Marcus Tresper and Dr. Jonas Weber. Since no gas-forming materials may be introduced here either, a plastic-based building material was ruled out. “Our approach was to use the approved Sorel-based building materials available at the Asse mine as the base material and add sodium bicarbonate – or more simply baking soda – to achieve gas formation and thus an increase in volume,” Marcus Tresper describes the process.

After initial tests in the building materials laboratory at Clausthal University of Technology, where Jonas Weber was still doing his doctorate, it became apparent that the building material not only exhibited the necessary large porosity and volume increase, but also hardened significantly faster than conventional Sorel concrete.

After the laboratory tests, in which an apparently suitable formula was developed, it was time to try it in the mine. Several in-situ tests with different mixing ratios were carried out below ground. It was important that the building material could definitely be processed using the existing tech-

Reusable steel formwork for the production of Sorel concrete prefabricated parts



A prefabricated part made from Sorel concrete



nology. "What use to me is the best building material if I can't process it with the existing equipment below ground," Dr. Jonas Weber asks. In the last tests, several cubic meters were produced in a slightly larger gallery. "The trial showed that we have to play around with the equipment in order to produce larger batches but, in principle, the construction material is now ready for application," he reports in summary of the results. The practical testing can now begin. "I was impressed by the initiative of the two young colleagues. It was exciting to see how, out of the laboratory scale, the in-situ scale was achieved," says Matthias Heydorn. This project once again depended on good cooperation with the mine operation, which gave the two colleagues its support. Matthias Heydorn praises the collaboration: "The short coordination paths here at Asse especially make work easier, so, alongside the daily business, you can try out something application-related at short notice." Marcus Tresper and Dr. Jonas Weber accepted the challenge of working at Asse. "You can't just use off-the-shelf things here; different

requirements apply. You have to come up with something new," Marcus Tresper says, describing his tasks. Dr. Jonas Weber adds: "We had plenty of freedom to approach the task and carry out tests. Not every company has that." (mh)

Dr. Jonas Weber with a sample from the 3rd pilot test project



Another sample in the hands of Marcus Tresper. It shows the layered structure of the individual concreted batches.



E-mobility goes underground

How BGE wants to meet the new limits for nitrogen oxide pollution

Sebastian Voigt could hardly have imagined a better start. "Through the measurement campaigns, I got to know all the systems," reports the speaker for the technical management, who started at BGE in the engineering department. He had come from Kali & Salz GmbH, where he had already gained experience in measuring nitrogen oxides below ground. He was perfectly prepared for his new job: a planned innovation, made necessary by new limits.

The use of diesel-powered machines below ground was examined in an extensive monitoring programme in 2018 and 2019. Potential protective measures were subsequently derived from the results.

The Lower Saxony State Office for Mining gave recommendations for the monitoring programme, and the Bochum Institute for Hazardous Substance Research (IGF) of the Berufsgenossenschaft Rohstoffe und chemische Industrie (BGRCI) advised BGE on the choice of measurement technology and evaluation system. Since 2016, it has been clear that compliance with the limits for nitrogen oxide (NO) and nitrogen dioxide (NO₂) below ground will become considerably more challenging starting from the end of 2021. The permissible eight-hour mean NO value is being reduced from 25 ppm (parts per million, or one particle per million particles) to 2 ppm, and the limit for NO₂ from 5 ppm to 0.5 ppm. On top of this, maximum values have been set for short-term pollutant peaks. Furthermore, the limit for soot emissions will drop significantly further from 300 µg/m³ (micrograms per cubic meter) to 50 µg/m³ by the end of 2022. Since 2018, a working group of experts from all four mines has been taking stock and looking for solutions.

The extremely different operating conditions at

the respective BGE mines have required individual monitoring programmes. For choosing the measurement tasks, typical operating situations were monitored in the daily workflow.

From the results of these measurements, it can be stated that no or very few violations of the future limits were detected at any of the sites when using inspection vehicles and small to medium-sized machines. The problem can be solved by purchasing new machines that meet the new limits in the scope of replacement investments that had already been planned. There is need for action in the use of loaders at the Asse, Konrad, and Morsleben sites. These predominantly older vehicles no longer meet the requirements. No violations of the existing limits for mining were detected. However, there were violations of the future limits, most cases being short-term limit exceedances and the next most common being exceedances of the maximum peak limit. The rarest cases were exceedances of the 8-hour mean shift values.

In the Konrad mine, violations of the future limits were measured during tunnelling, even though the vehicles used there are fitted with a working filter system. These exceedances could not be attributed to the vehicles. So, what was the plausible source? The logical conclusion was that organic carbon was the cause – which was confirmed through research. The roadheader happened to be driving in a clay rock horizon that contains up to three percent organic carbon. Given the cutting work and the resulting dust, it appears very likely that the measurement results were affected by geogenic influences.

In principle, there are several approaches to solving this: either significantly reduce the NOx emissions of the machines and vehicles below



Sebastian Voigt, Speaker For Technical Management

ground, or supply the mines with more fresh air. Neither is easy. It would also be conceivable to replace the machines in use with other technologies. In the Konrad repository, the fresh air inflow is already supposed to be increased in the future with a mine ventilator. But that will be long after the new limits come into force. At the Asse mine and Morsleben repository, as well, this approach has proved to be impracticable for licensing and energy efficiency reasons. Only in the Gorleben mine would it be possible to increase the fresh air supply without difficulty.

In light of all this, it was only natural to start thinking more about electric vehicles below ground. That would not be easy, either. After all, the electricity for operating the machines has to come from somewhere. That means there has to be a charging infrastructure in the mines. And the mine operations have another problem with electric vehicles: there are still many open questions about fighting fires should a battery ever catch fire. And there is also much to consider for the approval of batteries for use in mines. These are not trivial tasks; it is all new territory.

That is why practical tests with battery-powered e-loaders should start now. Some battery-powered electric vehicles have even been in use for

some time already, for example at the Morsleben repository and the Asse mine. Before the first e-loader can be used in mines, the manufacturer must furnish a series of documents as a burden of proof.

"The e-loader in Morsleben will then become a prototype in German mining," reports Matthias Gimpel, who is pursuing the project in the Engineering department. Three small battery-powered wheel loaders have already been procured for the Asse mine. These are still undergoing the adaptation work necessary to guarantee that they can operate efficiently under the local conditions. A battery-powered 10 ton electric loader is being procured for the Konrad repository. Another solution for Asse is the use of pneumatic conveyance: air pressure would be used to convey salt piles vertically from the lower levels of the mine over an elevation of around 100 meters to the building material facility on the 700 meter level.

For many other vehicles, there are currently no solutions available for going electric. Although there is movement in the market, the technology for many machines is not yet fully mature. Until suitable technology becomes available, BGE will continue to rely on clean diesel with a working exhaust gas cleaning system. The use of elec-

tromobility can be a significant component in reducing emissions. For this reason, a variety of electrical machine types are being and have been introduced in the BGE mine operations. The future will surely see more solutions for using this technology appearing on the market. Until then, the existing mobile measurement technology shall continue to be used routinely for measurement of workplace limit values and success control as duties of self-monitoring.

All in all, Sebastian Voigt and Matthias Gimpel think that, with the knowledge gained and the different solutions that can be adopted, coping with the future limits will be a "manageable challenge" for BGE. (dd)

Electromobility in the Morsleben repository: Harald Schmidt charging an inspection vehicle



Green roof on the Asse mine

Sustainability management at BGE – future task and challenge at the same time

An interview with Elena Bartsch, Head of the Sustainability Team

“We make the safe final disposal of radioactive waste possible. In this way, we contribute to the protection of man and environment. Thus, we make a decisive contribution to solving a socio-political problem.” This quote comes from the BGE mission statement and describes the motivation for the company’s actions.

BGE accepts its responsibility not only to protect the environment from radioactive waste. It also sees it as its duty to accomplish its tasks with as little environmental harm as possible. And in that respect, there is much to do. The most obvious issues are the energy consumption and traffic caused by BGE.

But there are also environmental concerns that are less obvious, such as working conditions in the mines.

Since September 2019, the company has a Sustainability Team, headed by Elena Bartsch. In an interview with the 32-year-old bio- and environmental engineer, it quickly becomes clear that the team discussions do not all revolve around energy issues, but extend to other important aspects as well.

Who are the members of the Sustainability Team?

The BGE Sustainability Team has nine members. We want to look at the issues we deal with from different angles. For that, we need an interdisciplinary team. It’s best to get many different areas of the company involved.

And we mustn’t forget our energy teams at the sites. They record and evaluate the energy consumption on site, and raise the colleagues’ awareness of potential energy savings. The ventilation,

that is the fresh air supply below ground, or the man-haulage, meaning the elevator down, are good examples of this. The fresh air supply can be reduced to suit requirements. Of course, the limits below ground must be observed. The number of man-haulage trips is reduced by introducing fixed times, and it is no longer possible to enter at arbitrary times.

How are we supposed to measure sustainability at BGE?

We need to make sustainability measurable in order to make successes visible and to give us verifiable goals. One of the main issues is, of course, environmental protection. That is obvious. Key indicators are energy and material efficiency, water, waste, the state of biodiversity at our sites, and emissions of all kinds. We want to record and, of course, reduce our fresh water consumption and resulting wastewater. We have to collect all waste for the EMAS certification. This goes as much for waste from the office sites as for the industrial waste from the mines.

We are planning to convert to e-mobility for our vehicle fleet. And we are already using exclusively renewably generated electricity. The certification of our environmental and energy management system also plays an important role and is planned for the next two years.

We also want to become certified in the area of work-life balance. We have learned a lot during the coronavirus outbreak. And we also want the company and everyone in it to economise sustainably. Therefore, social aspects such as occupational safety, equal opportunities, qualification, and the attractiveness of BGE as an employer are important starting points.

What are you working on, specifically?

We want to introduce an environmental management system and have it certified according to EMAS. For this, we are taking part in the “EMAS convoy”, which is a support platform offered by the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety for the introduction of an environmental management system. At its core, it’s about intelligently saving resources. This is done in a continuous improvement process, in which the participation of employees and their suggestions play an important role. Sustainability needs the creativity of everyone. BGE can make ideas that seems odd at first more sustainable.

Why is certification so important to BGE?

The certifications are a measure of our environmental friendliness. Certifications also increase the transparency and credibility of BGE to the public. That helps to make the successes of BGE more transparent. (ms)



Elena Bartsch heads the Sustainability Team

The sustainability team answers the following questions:

1. Why is it important for a company to get involved in sustainability?
2. Which area or what topic seems especially important to you?
3. Where is the greatest need for action?



Sonja Reinecke, 36, Political Scientist, Head of Administration, Management Office

"As a company in the portfolio of the Federal Ministry for the Environment, it goes without saying that BGE is committed to sustainability. It is hardly conceivable for me that we, as federal companies, would not fulfil our social responsibility in this respect. It is particularly important to me that we not only think about sustainability in the ecological dimension, but also take economic and social aspects into consideration. And that colleagues can contribute their creativity. Ultimately, as indeed with most things, the successful implementation will also depend on whether we succeed in getting people enthusiastic about the topic."



Dr. Stefanie Oberle-Plümpe, 52, Molecular Biologist, Operational Safety Analysis

"Sustainable, entrepreneurial action is becoming increasingly important in the context of climate change. Sustainable corporate management is a "win-win-win situation": the environment, society and the company itself will all benefit from it. Sustainable companies with socially responsible management can reduce their costs by using resources sparingly. They are coveted employers and are perceived more positively by the public. In addition to the big and most pressing topic "Reduction of CO₂ emissions", I also find the small, quickly implementable things, like the use of microplastic-free hand soap and a functioning waste separation system, to be particularly important."

Sebastian Voigt, 37, Mining Engineer, Speaker for Technical Management

Sustainability means staying on the ball and up to date. It is important to think things through from beginning to end and to be aware of what influences my decisions have on other company areas or the outside."

The greatest consumption of energy and resources occurs in the technical area of BGE. Procurements and processes should be coordinated such that security, efficiency, and economy are in harmony and do not in conflict with one another."

The hardest part is not the implementation. Sustainability starts in the head."



Laura Ude, 25, Industrial Clerk, Assistant in the General Services Department

Because a company has great influence and acts as a role model, it is important to take a responsible attitude towards our society and the environment."

The main topic in my field of work is e-mobility. The plan is to convert the entire BGE fleet to e-mobility by 2025. To do this, the charging infrastructure must be created at all sites first. This will be followed by scheduled replacement of the existing vehicles with electric vehicles."

We all should take responsibility for ourselves and our surroundings, become aware of the consequences of our actions and be willing to change our own actions accordingly."

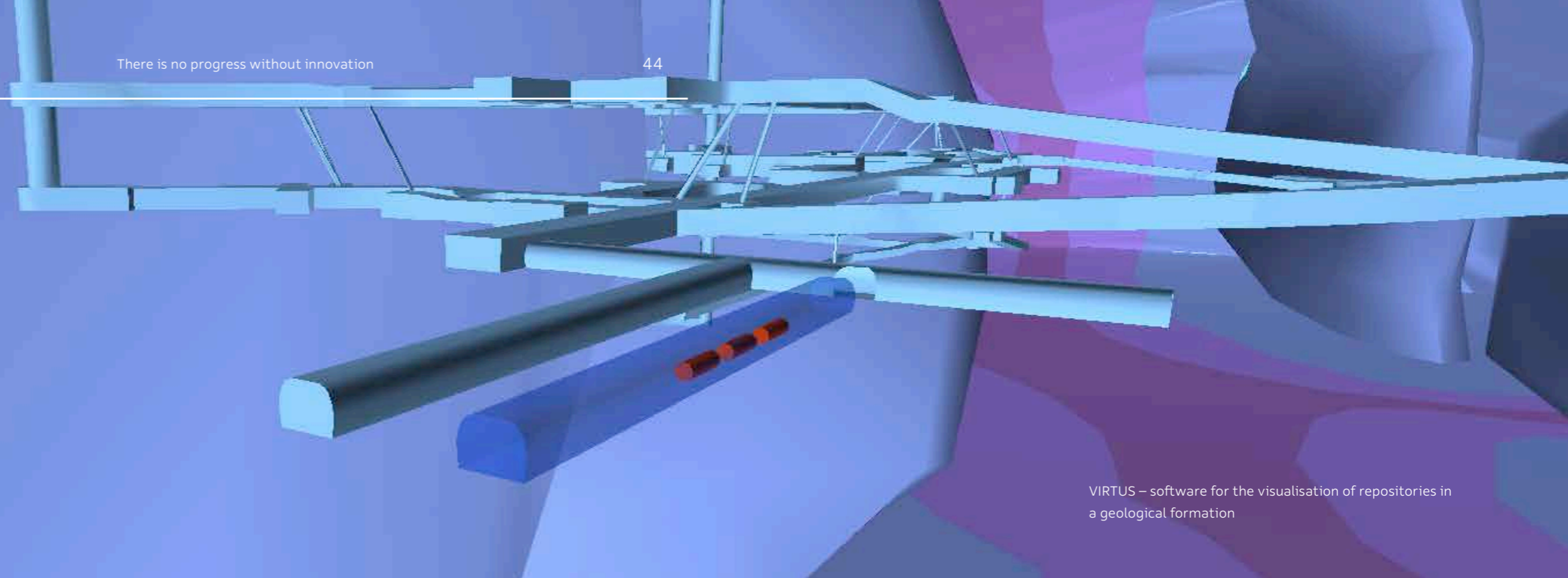


Michael Kaczmarek, 53, Diploma Business Administration, Personnel Services for Sites

"It is the duty and obligation of our generation to treat the environment in such a way that it is liveable for future generations as well. Everyone is called upon to contribute their share to sustainability. In a globalised environment, this can only be achieved through the interaction between society, business, and politics."

Other team members: Oliver Kugelstadt, Antonia Aulbert, and Michael Cloth.

Always out in front The mission of BGE TECHNOLOGY GmbH is innovation, research and development



VIRTUS – software for the visualisation of repositories in a geological formation

Dr. Nina Müller-Hoeppe always feels a certain satisfaction "when someone came up with the idea themselves" to do something different. "It doesn't work any other way with the miners – not as a woman," she says with a laugh. She often sees herself as a coach; she asks questions and uses those questions to open up spaces of possibility and, often enough, those who enter these spaces are not the kind of people who describe themselves as researchers, developers or innovators. Nina Müller-Hoeppe is Head of Repository Safety at BGE TECHNOLOGY, the subsidiary of BGE, whose job is to be close to research at all times when it comes to the state of the art in science and technology. "Repository security is about damage prevention: you have to know the state of the art in science and technology, but you also have to know what is technologically feasible." Nina Müller-Hoeppe sees BGE TECHNOLOGY at exactly this interface, and her colleague Wilhelm Bollingerfehr, Head of Research and Development, agrees without hesitation.

In many respects a pioneer in the repository business, Nina Müller-Hoeppe believes BGE TECHNOLOGY is "at its best" whenever it works directly with BGE. That is also the difference between BGE TECHNOLOGY and a research institute. "We know from experience what is needed and what is possible under real mining conditions." The interface between basic research, development projects,



Dr. Nina Müller-Hoeppe, Repository Security

and real action interests her the most. Because "You have to do that too." Nina Müller-Hoeppe has gained experience especially in the Asse II mine, an almost impossible project. BGE TECHNOLOGY even holds patents for some of the processes that make sealing structures truly tight. But it seems even more important to her to think through and test "the process chain from start to finish". In her experience, "complex systems organise themselves". She is an advocate of self-organisation. But once that organisation has been found, it is important to write the processes down and work on the efficiency of those processes. "Because, otherwise, newcomers can never find their way around." The weak points for safety in final disposal, she states, are the interfaces in the process chains, especially when an attempt is made to shift weak points from one responsibility to an-



Wilhelm Bollingerfehr, Research & Development

other. "Then a problem will never be solved."

Wilhelm Bollingerfehr, in turn, likes to think about problems that not many have considered yet. For example, about what container concepts would be possible in a crystalline repository, or what building materials can be used for sealing, or the technical concepts of emplacement. This may seem a little early for a site that won't be found before 2031. But anyone who has ever had to carry out a large-scale project knows that you can never start too early. Wilhelm Bollingerfehr is all about "gaining an early view of everything that is necessary for safety verification and asking the right research questions in good time". An example of this is work on behalf of the Federal Ministry for Economic Affairs and Energy, the result of which is to be published in the summer of 2020. The aim

is to systematically derive the requirements for potential repository containers in different host rocks.

The containers should not only be adapted to their rock environment – crystalline, clay, or rock salt – but should also last 500 years so that they can be retrieved if there ever appears to be a need. This is the strictest requirement out of the 2010 BMU security requirements. It is high time, Wilhelm Bollingerfehr advises, to think seriously and to develop solutions. (dd)

How innovative is the Site Selection Act?

apl. Prof. Dr. Ulrich Smeddinck
 Institute for Technology Assessment and Systems Analysis (ITAS)

Professor Ulrich Smeddinck has published the first General Comment on the Site Selection Act. He was a co-speaker for the ENTRIA Research Network and is now co-working on the follow-up project TRANSENS (Transdisciplinary research on the disposal of highly radioactive waste in Germany). He heads the subproject DIPRO (Dialogue and process design in the interplay between law, justice and governance). He works at the Institute for Technology Assessment and Systems Analysis (ITAS) at the Karlsruhe Institute of Technology (KIT).

Fresh start or politics as usual?

Can a law with a progressive policy design be innovative even if it was more or less passed in the classical legislative process? The Site Selection Act was praised in politics as a fresh start. It introduced a complex, innovative approval procedure to replace the conventional plan-approval procedure. This was the result of the legislators taking into account the experience gained from the Stuttgart 21 underground station project, as well as suggestions from the Working Group on the Selection Process for a Nuclear Disposal Location (AKEnd) from 2004. They could proudly boast to having found a compromise across old trenches between the parties. Except, the left ventured off course. Critics from society were disappointed that they had been cut out of the equation and were not granted deeper involvement. Accusations floated about that the State had learned nothing.

However, in Section 1 of the Act, the legislators commit themselves to a site selection process that is above all learning and self-questioning. And inevitably, the 2013 legislative text was not the final word. Following the deliberations of the Repository Commission – and with the participation and influence of social actors – the law was extensively revised. Demands were met to regulate public participation more transparently.

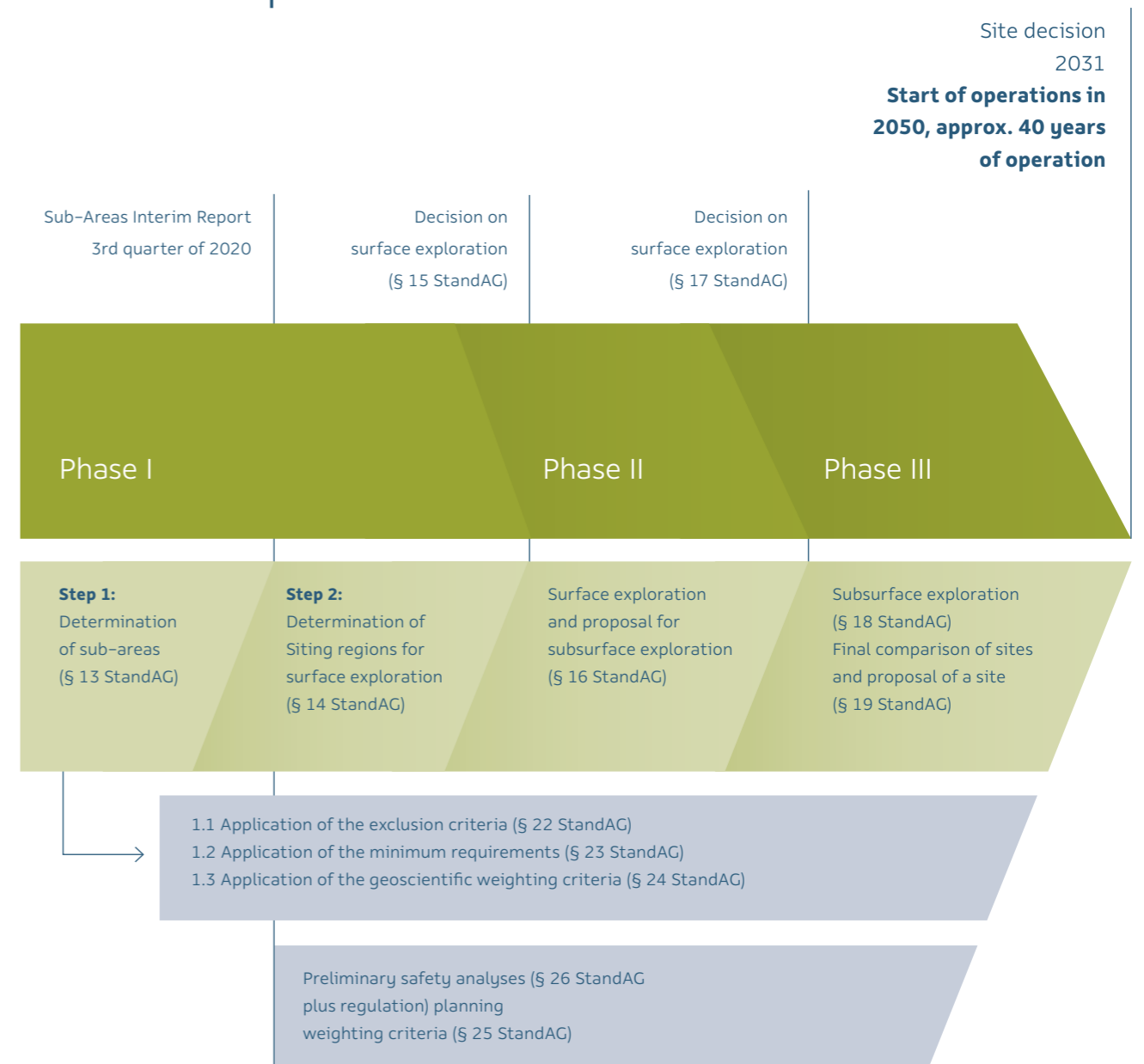
The legislators committed themselves to a dialogue-oriented process of participation, the likes of which had never been seen before. It meant there had to be not only one-directional communication of strategies and goals but rather, and above all, listening and being open to persuasion – an immense challenge for the State in the site selection process. Furthermore, the forms of participation would have to be reviewed at appropriate intervals to keep track of their suitability.

Between consensus and conflict – more participation, less legal control

The Site Selection Act places the focus of conflict management and resolution on participative forms of settlement. On the one hand, this limits the degree of legal protection: the first instance for monitoring the process for legal errors is the Federal Administrative Court. On the other hand, it also escalates the number of parties entitled to litigate. Many who were not entitled before, now have a newfound litigative power. So, does that mean: more public participation, less legal protection?

Normally, controversial large-scale projects are attacked through instances before the Administrative Court and the Higher Administrative Court over many years before the Federal Administra-

General outline of the site selection process



tive Court is ever called upon. However, and perhaps more importantly, there has been a change in legal sentiment over the past few decades towards preferring to resolve conflicts outside of, or at least prior to, court proceedings. This way, the conflict issue can be dealt with more comprehensively. More participants can be included in the search for solutions. In court cases, by contrast, only the plaintiff and defendant state can put in an appearance in order to resolve two, three, or more legal errors.

The legislator strives to leverage the potentials for out-of-court resolution, without forfeiting the necessary legal protection. The *raison d'être* of public participation is to find a solution that enjoys broad social consensus and can therefore be tolerated even by those affected. New – and a certain compromise – is, for example, the right to submit a re-examination request to a regional conference as stipulated in Section 10, paragraph 5, sentence 1 of the Act. Regional conferences are formed as soon as the search for a repository has been narrowed down to a few siting regions.

Between trust and distrust: the National Citizens' Oversight Committee

Perhaps the most striking innovation in the Site Selection Act – in its original form since 2013 – is the National Citizens' Oversight Committee. The classical actors, the project operators and control authorities, are accompanied by a third player: a "watchdog" representing society. The duty of the pluralistically composed National Citizens' Oversight Committee is to provide mediation and independent support in the site selection process, in particular public participation, with the aim of enabling trust in how the process is carried out. The turn of trust into distrust, and the gradual

growing of trust as distrust fades, is a phenomenon that plays a major role in the site selection process. Many have lost their trust throughout debates over the peaceful use of nuclear energy and react accordingly waspishly when asked to start trusting. They are sceptical. But trust is not the only value or objective out there. The theory of democracy (as described by Pierre Rosanvallon, for example) very much emphasises the value of distrust for the good of a community.

It was out of this spirit that the Oversight Committee was born. Its task is not to simply nod along and follow the other actors' activities and suggestions with blind trust; rather it is to reveal weaknesses and errors. If it performs this duty with credibility, then – so meekly the legislators word it – it could raise confidence in the site selection process.

Not perfect, but still satisfied?

The site selection process ought to be participatory, science-based, transparent, self-questioning and learning – some, like Eckhard Reh binder, call that ambitious. In more cases than not, lawmakers are unable to make good on all of the promises made when a new law is introduced. After all, regulations are always products of compromise in the political process – doctrine of the mean; a little bit of everything. The democratic lawmaker can accept that. Yet, it leaves many experts in specific fields and positions of authority feeling disappointed. Once enacted, it is uncertain whether the political bodies can ever find the effort again to revise a law to any effect.

There is no question that the Site Selection Act is innovative in the light of progressive environmental regulation. And, in light of that, we can still ask: Is it possible – as in real life – to work well with someone, achieve good results, and even be satisfied, without that person (the law) being perfect in every way?

From left to right: Melvin Schniedermeier and Heiko Ruppe at the Konrad mine



Management report for the fiscal year 2019

Company basics

The Bundes-Gesellschaft für Endlagerung mbH (BGE) was established as a third party in the sense of § 9a (3) sentence 2 of the German Atomic Energy Act (AtG) by resolution of the German Bundestag of 23 June 2016 on the Act to reform the organisational structure in the field of disposing of nuclear waste (Gesetz zur Neuordnung der Organisationsstruktur im Bereich der Endlagerung). The sole shareholder is the Federal Republic of Germany, represented by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). BGE's articles of association were first notarised on 19 July 2016.

The objective of BGE is to fulfil the duties of nuclear waste disposal according to the Atomic Energy Act and the Site Selection Act (StandAG) as a federal enterprise (§ 9a (3) sentence 2 AtG).

Upon the decision of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety dated 24 April 2017, amended by the decision of 27 June 2019, the duties of the federal government pursuant to § 9a (3) sentence 1 AtG and the necessary governmental powers pursuant to § 9a (3) sentence 3 AtG, were conferred upon BGE with effect from 25 April 2017.

Duties conferred include:

1. the construction, operation and decommissioning of repositories as well as the operation and decommissioning of the Asse II mine in accordance with § 57b AtG with all associated

2. the sovereign powers to issue administrative acts in accordance with
 - a) § 3 (1) sentence 2 of the Nuclear Waste Disposal Regulation (AtEV),
 - b) § 2 (5) sentence 1 No. 1 ICW sentences 2 and 3 of the Waste Management Transfer Act (EntsorgÜG),
 - c) § 7 (2) AtEV,
3. the role of project developer pursuant to § 9a (3) sentence 1 AtG as defined in StandAG.

On 1 July 2017, the company took over the operational activities of DBE and Asse-GmbH through a merger by absorption.

BGE employs personnel who have been appointed or provided by the Federal Office for Radiation Protection (BfS).

The company's contracts with third parties are awarded in accordance with public procurement law.

Control system

BGE's mission is to make the safe disposal of radioactive waste possible. In this way, it contributes to the protection of man and environment and makes a decisive contribution to solving a socio-political problem.

Another objective is the responsible and transparent implementation of projects. These include construction and operation of the Konrad repository, retrieval of radioactive waste from and decommissioning the Asse II mine, keeping open and

decommissioning the Morsleben repository, and keeping open the Gorleben mine. Further duties of BGE include product control, which ensures that only approved waste containers are employed in the Konrad repository, and selection of the site that guarantees the best possible safety for final disposal of highly radioactive waste. Safety comes first for BGE. This applies as much to occupational health and safety as it does to safe operation and safety in the long term.

BGE is equally committed to the responsible use of the financial resources made available to it for these duties, and to compliance with all legal requirements and burdens of proof relating to the award of contracts and the use of funds by a public-sector enterprise. In particular, the principles of economy and efficiency must be observed. Profitmaking is not the goal of the company. BGE is furthermore subject to special guidelines for action under nuclear and mining law.

The mission statement drawn up in 2019 and the corporate goals form the guidelines for carrying out the corporate duties. These guidelines are supplemented by the statute on economic management and financial and asset management within BGE (Financial Statute) set out by the shareholder, the internal regulations based on this statute, and the economic plan approved by the shareholder as well as the schedules and work-flows of the projects.

Key performance indicators are the costs of the projects and the associated overheads (general). The 2019 budget anticipated net costs of € 538.034 million. In contrast to this, the actual costs amounted to € 388.203 million.

Beatrix Seifert, Head of Bookkeeping



Responsible for the financial statement: Marion Mrozek, Director of Finance and Accounting

Project costs

in thousands of euros	1st 2018	1st 2019	Budget 2019	Deviation 2019	Forecast 2020
Konrad project	211,315	215,538	293,816	-78,278	282,217
Decommissioning Asse mine	84,181	101,689	146,050	-44,361	175,344
Decommissioning of the Morsleben repository for radioactive waste	37,467	40,051	50,823	-10,772	59,940
Gorleben project	17,268	15,096	19,769	-4,673	17,479
Site selection procedure	3,830	5,973	17,106	-11,133	25,148
Product control activities	7,586	9,856	10,470	-614	15,751
Total	361,647	388,203	538,034	-149,831	575,877

The difference between costs in the amount of € 388.203 million and revenues in the amount of € 387.800 million declared in the profit and loss account results from the transfer of bills to the subsidiary BGE TECHNOLOGY GmbH (BGE TEC) and from revenues that were booked in the BMU projects with a cost-reducing effect (reclassifications due to the Accounting Directive Implementation Act (BilRUG) and the Asse canteen business).

Other performance indicators relate to the milestones achieved in 2019. Select milestones and other activities as well as major reasons for the deviations of actual costs from planned costs are described in the 'Business development' section.

Essentially, the reasons for not achieving performance indicators in the project areas and overarching areas can be summarised as follows: There were deviations in deadlines and costs resulting from procurement-related delays, longer delivery times, inadequate and late services from sub-contractors, and approval-related issues. There were also lower personnel costs due to a lack of suitable and available applicants and delays in the recruitment process – also owing to the organisational change. Maintenance costs were lower due to the plants, systems, and components being in good condition.

Upon the release of BGE from the BMU on the planned date, the insurance costs for damage risks were eliminated. Priorities were changed and plans had to be corrected as a result of new knowledge and for the purpose of risk management.

The budget forecasts net costs of € 575.877 million for 2020. The corresponding milestones and tasks to be achieved are presented in the forecast report.

Regarding occupational health and safety, the performance indicator relating to accidents at work is included in the 'Personnel and social report' section.

The company's activities are under the scrutiny and supervision of the shareholder, the supervisory board, the Federal Office for the Safety of Nuclear Waste Management (BASE) as well as other authorities, and equally importantly in the focus of the public.

BGE therefore provides regular, event-related information about its projects and seeks professional dialogue with experts and the specialist public. The decisions made for the projects are documented and made public as a rule.

Research and Development

The company coordinates and processes research and development (R&D) tasks for the conferred duties itself or commissions researchers and external service providers. The subsidiary BGE TEC additionally carries out research and development on behalf of third parties. For site selection, BGE gathered the R&D requirements it considers necessary. For the preparation of representative preliminary safety investigations in the site selection process, BGE is supported by the research project RESUS on basic development for representative preliminary safety investigations and for the safety-based consideration of sub-areas with particularly favourable geological requirements for the safe final disposal of heat-generating radioactive waste.

There are further research projects on quaternary volcanism in Germany and the corresponding safety distances to be applied in the scope

of safety verifications, as well as on the thermal integrity of clay and clay rock with experiments and coupled thermal-hydraulic-mechanical-chemical simulations (THMC).

Expenses in 2019 for research and development activities in connection with site selection amounted to € 1.400 million (previous year: € 3.824 million). In other active areas of BGE, there is ongoing research and development, for example, in the construction of sealing structures in the Morsleben repository and in the planning and development of retrieval technology (salvage equipment) in the Asse area.

In the scope of international cooperative efforts, BGE participates in joint R&D projects, in

the exchange of knowledge and experience with other EU member states, and in the International Atomic Energy Agency (IAEA). As the waste management organisation for Germany, BGE is involved in the European Radioactive Waste Management Programme (EURAD) and in the international research project Development of coupled models and their validation against experiments (DECOVALEX). Furthermore, BGE was included as a full member in the executive group of the Implementing Geological Disposal of Radioactive Waste Technology Platform (IGD-TP), and has gained membership in the Salt, Clay, and Crystalline Clubs of the Nuclear Energy Agency (NEA)/Organisation for Economic Cooperation and Development (OECD).



Keeping the Gorleben mine open



Gorleben mine – modelling of the site after removal of the enclosing wall (photo: Geoinformation)

Business development

The articles of association, the transfer of exercise of duties, the budget, and the resolutions of the supervisory board and the shareholder form the basis for the business management of BGE. The details of economic management are regulated in the Financial Statute.

General

The transformation phase was concluded at the end of June 2019, when the new organisational structure came into force. The organisational changes and the filling of positions were essentially completed by the end of 2019 for all but the fourth management level.

Further key company guidelines have been put into effect, such as those for data protection, internal auditing, compliance, and anti-corruption.

The use of SAP has been introduced company-wide and the payroll system has been standardised. A competence model has been adopted as the basis for future personnel development and recruitment. BGE has also developed a mission statement, which was formulated by a dedicated mission statement development team that spanned across all locations, departments, and hierarchy levels. The use of social media has been started along the lines of a social media strategy. As part of its corporate image presentation to the outside, BGE actively promoted dialogue-oriented communication about its projects and tasks.

Room capacities were expanded in Peine by building an office module, and in Salzgitter by renting additional office space.

Construction of the Konrad repository

The Konrad mine is being converted into a repository for low- and intermediate-level waste. Once complete, up to 303,000 cubic meters of low- and intermediate-level radioactive waste will be emplaced in it. It is the first repository in Germany approved under nuclear law. Approval for the construction and operation of the repository was given in 2002.

In the reporting year, alongside safe operation, the construction of the Konrad repository was characterised by extensive construction measures. The Konrad project consists of the subprojects Konrad Shaft 1, Konrad Shaft 2 and Pit.

Konrad Shaft 1

There are two phases to the construction of the office and social building. After completion of the first construction phase in 2018, focus shifted to the second construction phase in 2019. Demolition work on the old building was completed and structural work on the new parts of the building began. Currently, the plumbing and interior finishing work are being done.

Essentially, sandblasting, corrosion protection, and painting work are being done to ensure that the building structure of the shaft hall can be preserved as planned. Additional fire protection measures and heating installations were part of the work done in 2019.

The shell of the new north hoist building was completed and the roof was covered in 2019. Currently, the building is having its interior finished.

In addition to construction of the new hoisting system for Shaft 2, extensive work is also being done in the shaft itself. This has included, for example, extraction of the timbering of the old shaft hoisting installations to a depth of 970 meters, in order to reduce the fire load in the intake ventilation shaft on the one hand and to make room to install the new hoisting installations on the other.

Konrad Shaft 2

The planning work for all major buildings at Konrad 2 continued intensively in 2019. Thus, among other things, the review was completed of the execution plan for the ventilator building that serves to ventilate the mine openings.

The first construction measures on the Konrad 2 minesite were excavation of the foundation pit for the ventilator building, with a special submerged concrete floor, and relocation of the media facilities of the mine water transfer station. Commencement of further cost-intensive construction measures planned for buildings in the future control area above ground depends on the execution plans. These have yet to be completed, due to additional work made necessary by changes in regulations and due to performance limitations imposed on the contractor.

The piping of Konrad Shaft 2 must be renovated before the shaft hoisting system can be built. The award of the Konrad Shaft 2 hoisting system, scheduled for the first half of the year, was delayed by nine months due to a re-examination procedure. Given that the Konrad Shaft 2 hoisting system is a critical determinant in the project timing, this delay leads to an increased risk in meeting the commissioning deadline of the repository in 2027.

The focus in 2019 was on structurally supporting the filling site. This filling site is the area of the future repository where the waste will arrive at the shaft and then be reloaded onto vehicles that will then transport it to the emplacement chambers via the emplacement transport routes.

Pit

The below-ground work in the first structural supporting stage for the future infrastructure area of the Konrad repository (outer support lining of two linings in total) was almost completed in 2019. This included the actual driving of the mine openings, securing with anchors, and creating the structural support with a first outer shotcrete lining. This first structural supporting step forms part of the so-called yielding support system, which allows the hills to relieve ground stresses and redistribute pressure through movement, and thus to relax (so-called convergence).

Since the start of the renovation work on the repository, the emplacement routes of the first of five emplacement fields and the infrastructure routes have been navigable. This was accomplished, among other measures, by anchoring many tens of thousands of rock anchors of various types. The current focus for the repository infrastructure rooms is, in particular, on the installation of the shotcrete inner lining. Installation of the technical facilities is to follow afterwards.

Overarching measures

The planning and pretesting of emplacement vehicles and equipment, as required by nuclear law, and the execution plans for various infrastructural

measures, fire protection, central energy supply systems, building power supply optimisation, control technology, communications technology etc. were continued. For the stackers and side stackers, for example, further revisions to the planning documents were made as part of the preliminary review process that has been ongoing since March 2018.

Decommissioning of the Asse II mine

Between 1967 and 1978, some 47,000 cubic meters of low- and intermediate-level radioactive waste were emplaced in the mine. Retrieval has been a statutory order since 2013.

Tasks involved in the decommissioning of the Asse II mine include measures for retrieving the radioactive waste, implementing the precautionary measures stated in the emergency plan, and safe operation.

Retrieval

Seismic surveys were carried out in 2019. These serve to obtain reliable data on the structure of the overburden and the geological structure of the Asse hill range. They are an important step along the way to retrieving radioactive waste. Only with the help of the data obtained can the approval documents for the retrieval and subsequent decommissioning be created with the necessary accuracy.

The preparation of 3D seismic measurements to explore the overburden and the boundary between the salt dome and overburden (salt envelope) were started in autumn. Prior to this, the rights of access to the 37.5 square kilometres

required for this were obtained from the property owners and users. By the end of the year, almost all preparatory work had been completed, with more than 6,000 drillings of excitation points and placement of the measured excitation and reception points.

The retrieval is currently being planned as a tiered process. The retrieval of radioactive waste from three levels is being considered simultaneously, yet separately from one another. The reason for this is the different level of knowledge about the individual emplacement chambers and their different conditions. The concept plans for retrieving the radioactive waste from the first two chambers were completed and concept development continued for retrieving the waste from the other chambers.

In developing the retrieval plan, a summarised description of the overall retrieval project was created. The retrieval plan covers all process steps from retrieval of the radioactive waste to waste treatment and interim storage. The planning status of the retrieval mine, of the new Shaft 5, and of the retrieval procedures was presented in detail. Planning of the retrieval will require further exploration measures. For this purpose, among other things, the drilling equipment was tested with additional safety equipment as required for exploring the emplacement chambers.

As a part of the preliminary investigation for Shaft 5 to the area east of the existing mine, two drilling machines were set up, the standpipes were sealed, and the drilling work commenced. For the construction of the new Shaft 5 and the above-ground infrastructure for the waste treatment plant and interim storage facility required for retrieval, the necessary land areas (parcels) that are yet to be acquired were identified.

There is no need for a concept plan to prepare Shaft 2 for retrieval since, according to the plan in its present status, the Asse 5 shaft will be available.

Emergency planning and precautionary measures

As an emergency and precautionary measure in 2019, approximately 27,700 cubic meters of Sorel concrete were introduced primarily into three levels in order to fill the remaining voids and to erect geotechnical structures (flow barriers). This undercut the planned backfill volume by approx. 4,300 cubic meters. Other measures included filling the remaining cavities on two levels and filling those cavities that are no longer required on another level.

In addition, the system for storing and conveying solutions is being built with a capacity of more than 4,000 cubic metres as an essential part of the infrastructure required for counter-flooding. Work commenced on the central sections. Due to the termination of the previous contractor owing to the termination of services, there have been delays and the measure has had to be restructured.

The technical readiness for acceptance was established for the introduction of uncontaminated influent solutions into the Bergmannsseggen Hugo mine. Currently, a lawsuit regarding the discharge permit is still pending against the State Office for Mining, Energy and Geology (LBEG) as the responsible licensing authority, which means that there is still no regular option for introducing influent solutions as an emergency contingency.

Decommissioning of the Morsleben radioactive waste repository and keeping the Gorleben mine open

Between 1971 and 1991 and from 1994 to 1998, a total of around 37,000 cubic meters of low- and intermediate-level radioactive waste was disposed of finally in the Morsleben repository. Radioactive waste was also temporarily stored.

The tasks in connection with the Morsleben repository for radioactive waste include the plan approval procedure for decommissioning and maintaining readiness for decommissioning of the plant.

Plan approval procedure

The plan approval procedure for decommissioning continued with the processing of recommendations from the Waste Disposal Commission (ESK), the preparation of proof of route seal tightness, the adaptation of the project structure and resources to meet the burden of proof, and the reflection of the changed state of science and technology in the ongoing planning and approval process. In addition, matters were coordinated with the approval authority in terms of organisation and information (e.g. document structure, processing of receivables, and burden of proof). The project workflow for the horizontal sealing structures was adapted on the basis of new knowledge. Accordingly, services will only be carried out later.

Maintaining readiness for decommissioning

The work involved in keeping the mine open is aimed at safe and proper operation, preparation for decommissioning, and maintaining readiness for decommissioning. Given that the mining work for decommissioning the repository, which requires planning approval, is not expected to start before 2028, various measures (such as renewal of the waste water and rainwater pipe in Bartenleben, conversion of the pithead and associated functional areas, and renewal of the ventilation gates) became necessary and other planned measures had to be postponed.

Gorleben

When the Site Selection Act was passed in 2013, the exploratory work in Gorleben was discontinued. In site selection processes, Gorleben will continue to be treated like any other potential site in Germany.

The Gorleben mine is being kept open in accordance with § 36 StandAG while ensuring all legal requirements and the necessary maintenance work. In accordance with the agreement between the Federal Government and the State of Lower Saxony on 29 July 2014, the "overall concept for keeping Gorleben open" was formulated in 2015, defining the framework for a significant downsizing of the systems both above and below ground as well as the general economic conditions.

For transitioning the mine to the state of being merely kept open, dismantling work had to be carried out above ground in addition to necessary construction and conversion measures to reduce the size of the minesite. Traffic areas and media lines that are no longer required are to be dis-

mantled, as is the surrounding wall, except for a segment of wall that is to be preserved as a monument. As a replacement for the pithead, office and social building, preparations were made for erecting modules in 2020. The planned completion date has had to be postponed due to further documentation requests from the competent building authority. The firefighting water network was adapted to the needs of the new infrastructure and the fire protection measures below ground were adapted for the campaign operation.

Site selection process

The search for a site for a repository for highly radioactive waste recommenced with the first Site Selection Act (StandAG). Following the amendment to StandAG in 2017, BGE received the order to locate a site by 2031 that would offer the best possible safety for the containment of highly radioactive waste for a million years.

In the context of site selection, the year 2019 was characterised by method development for the application of the exclusion criteria, minimum requirements, and geoscientific weighting criteria pursuant to § 13 StandAG, and by preparation for the publication of the Sub-Areas Interim Report at the end of September 2020. For this purpose, in addition to the data queries on the exclusion criteria initiated in August 2017, data were supplied by the federal and state authorities by the end of 2019. The plans had envisaged mid-2019. The digitalisation of existing analogue data commenced in three federal states.

The criteria-related application methods were developed further throughout 2019. They were finally presented and discussed publicly in December 2019.

In order to apply the geoscientific weighting criteria to the identified areas, another data query was made with the federal and state authorities in the 3rd quarter of 2019. The development of a first method for the application of the geoscientific weighting criteria was successfully completed by the end of 2019. With a view to publishing the Sub-Areas Interim Report at the end of September 2020, a report concept has been in development since mid-2019.

BASE and the National Monitoring Committee (NBG) are other important actors in the selection of sites. BGE regularly informs BASE and NGB in quarterly reports about the current status of work.

Product control measures

The following primary duties were carried out in 2019:

- Qualification of conditioning measures
- Preparation and approval of schedules
- Preparation and approval of change requests for already approved schedules
- Type testing of repository containers
- Testing and approval of waste containers

As a result of the reform on the final disposal of radioactive waste, the energy supply companies submitted many applications for product control measures in 2019. In addition, BGE intensified its activities in container type testing. The assessment of radioactive waste

product control is done with the inclusion of experts for their technical opinion.

The implementation of incidental provisions relating to water law is greatly important for ensuring suitability as a final repository according to the Konrad Plan-Approval Decision (PFB). This takes into account the amendment of the Groundwater Ordinance (GrwV). The adaptation to updates in the derivation of insignificance thresholds for groundwater made by the Federal/State Working Group on Water Issues (LAWA) is not yet complete.

For the targeted coordination of work in the complex matters of product control, type testing, and water law – in relation to the Konrad repository – regular technical discussions were held in 2019, moderated by the BMU. On these occasions, with the participation of the energy supply companies, container manufacturers, experts, and supervisory authorities, current issues were discussed, time-critical tasks were worked out and scheduled, and their execution was monitored.

Furthermore, the product control department took part in specific technical and status discussions with the waste producers and experts.

Earnings, financial position, and net assets

Earnings

The company's revenues increased compared to the previous year (€ 361.728 million) to € 387.800 million. Of this, € 387.378 million (previous year: € 361.144 million) is mainly attributable to the shareholder due to the transfer of all expenses for the current fiscal year. In addition, revenues include the invoicing of services to the subsidiary BGE TEC in the amount of € 336,000 (previous year: € 500,000) as part of the agency and service agreement.

Other operating income of € 9.690 million (previous year: € 10.645 million) mainly results from the reimbursement of contributions by the German Social Accident Insurance Institution for the Raw Materials and Chemical Industry (BG RCI) for 2018 (€ 8.111 million; previous year: € 6.658 million) and from the reversal of provisions for expected settlements for services in 2018 (€ 0.887 million; previous year € 2.587 million).

The costs of operational management in the amount of € 397.645 million (previous year: € 372.542 million) break down as follows:

Costs of operational management

in thousands of euros	2019	2018
Material expenses	216,553	207,782
Cost of raw materials, consumables, and supplies	25,006	27,225
Cost of purchased services	191,547	180,557
Personnel costs	146,829	142,486
Other operating expenses	23,413	19,873
Interest and similar expenses	9,059	1,403
Taxes on income and earnings	1,737	957
Other taxes	54	41

The cost of purchased services mainly includes work contracts and other services, temporary employment, energy, maintenance, and cleaning and security services.

Personnel costs include all wages and salaries, social security contributions, and costs for pension schemes.

Other operating expenses in the amount of € 23.413 million (previous year: € 19.873 million) mainly comprise expert and consulting services, rental and leasing costs, incidental personnel expenses, and procedural costs recorded as a provision for decommissioning the Asse II mine.

Assets and financial situation

The total assets increased by € 20.797 million compared to the previous year and now amount to € 118.697 million (previous year: € 97.900 million). This is mainly attributable to the increase in receivables from the shareholder for provisions that have yet to become effective as well as trade payables as of the balance sheet date.

The fixed assets of € 5.623 million are attributable exclusively to financial assets.

Current assets mainly comprise receivables from the shareholder amounting to € 103.030 million (previous year: € 83.288 million) and advance payments made to contractors (€ 3.905 million; previous year: € 4.207 million).

On the liabilities side, current assets are mainly offset by debt capital in the form of project-related trade payables and provisions.

Provisions increased to € 59.784 million (previous year: € 44.162 million) and mainly comprise pension provisions (€ 15.771 million; previous year: € 14.782 million), provisions for outstanding invoices (€ 19.064 million; previous year: € 12.621 million), provisions for the procedural costs of decommissioning the Morsleben repository for radioactive waste (€ 7.609 million; previous year: € 7.552 million) and for decommissioning the Asse II mine (€ 3.408 million; previous year: € 0 million), provision for VAT risks (€ 5.800 million; previous year: € 0 million) and other provisions for personnel obligations (€ 7.062 million; previous year: € 7.128 million).

Within liabilities (€ 54.109 million; previous year € 48.383 million), trade payables predominate at € 34.941 million (previous year € 27.879 million). Other liabilities (€ 14.757 million; previous year € 16.628 million) essentially comprise value-added tax (VAT) and wage tax payable.

Equity decreased to € 4.804 million due to the distribution of € 551,000 in profits from 2016 and 2017 that were not taken into account in the course of the merger. The equity ratio is 4.0 % (previous year 5.4 %).

The financial situation is secured at all times through financing from federal budget funds in the scope of the commissioning by the shareholder. For this reason, separate lines of credit from banks are not required and are therefore not held.

Personnel and social report

As of 31 December 2019, BGE employed a total of 1,960 employees at 8 locations, divided into 1,703 company employees (annual average 1,515), 127 BfS-appointed civil servants and TVöD em-

ployees, and 130 temporary workers. A total of 54 trainees were employed.

The year 2019 was marked by numerous recruitment procedures and the conversion of employment relationships into in-house personnel.

In 2019, approximately 150 temporary workers were taken on in predominantly fixed-term contracts; 76 employees were transitioned from a temporary to a permanent contract. As of 31 December 2019, there were a total of 293 fixed-term contracts.

The concept for transferring interested BfS officials and TVöD employees to BGE was introduced and implemented.

In 2019, more than 440 jobs were advertised, of which 329 were newly filled. The total number of applications received was over 3,800.

As a result of the collective wage agreement negotiated with the IG BCE on 9 December 2019, which came retroactively into force as of 1 December 2019, the collective wages were increased by 3 % and the training allowances were also adjusted. In addition, the training allowance system was modified as of 1 January 2020; by reducing the previous vacation allowance to the amount of the monthly training allowance and evenly distributing the excess amount over the monthly training allowance, this has increased significantly. The wage agreement has a term of 15 months until 28 February 2021.

In the course of the new BGE organisation that came into force on 1 July 2019 and the associated completion of the transformation, the HR department filled all new positions at the second and third management levels (51 department heads

and 86 group heads); the only exceptions to this are a few positions in the organisational units still being built up.

BGE, as a corporation with employee representation and more than 500 employees, fulfils the requirements for setting targets and deadlines for the proportion of women in management positions in companies subject to co-determination. BGE works towards the corresponding application of the Federal Gender Equality Act (BGleG).

Seven of the fifteen seats on the BGE supervisory board are currently held by women (46.7 %). The proportion of women in management is 25 %. The target percentage of women at management level in BGE, of 25 % in head of department positions, is to be achieved by 2023. At the end of the year, this proportion was 21.4 %. The proportion of women in head of department positions was 19.1 % and thus exceeded the target proportion of 8 %.

The developed BGE competency model came into force in mid 2019. It consists of the three components: core competencies, specialist competencies, and management competencies, and serves as the basis for targeted personnel planning and development. The model is based on the HR strategy of BGE and builds on the mission statement of the company and its values.

Numerous general works and company agreements were negotiated and concluded with the works councils, addressing important issues such as mobile working, standardised payrolls, hourly records, data processing, and the social plan for compensating disadvantages resulting from a change of location.

Initial and continuing education

As part of the internal training measures, more than 2,650 training measures were organised for the company in 2019, which essentially served to maintain or to develop/expand the specialist knowledge and qualifications of the employees. An employee successfully completed his qualification as a state-certified technician in the reporting period. As of 31 December 2019, 54 trainees were employed at four locations. 15 trainees successfully passed their exam in 2019, of which 10 trainees were taken on in fixed-term contracts, and two trainees in permanent contracts.

Occupational health and safety

The framework directive on occupational health and safety has been extensively revised and is now called "Occupational Health and Safety Management".

Participation in the BG RCI trainee competition was extremely successful. Good placements were achieved. Campaigns on occupational health and safety were held at almost all locations.

The main goals and measures from the specifications of the Safety Steering Committee to optimise occupational health and safety have been implemented. Measures to promote occupational health were carried out at the locations and flu vaccinations were offered.

In the fiscal year, three reportable accidents occurred among BGE's own personnel and nine at external companies. The goal for 2020 is to reduce the number of accidents.

Forecast, opportunity, and risk report

Opportunity and risk report

Internal reporting and comprehensive controlling ensure that the management is promptly informed about possible opportunities and risks and can initiate appropriate countermeasures.

There are no existential financial risks for BGE, since the costs of economic management are reimbursed by the BMU upon notification of resource requirements through the call-for-funds procedure. The BMU reimburses the costs incurred at cost price.

Forecast report

The coronavirus pandemic is affecting BGE operations in 2020 to varying degrees. BGE will furthermore always endeavour to continue its operations to the best of its capabilities under the given conditions. Due to the applicable hygiene measures and distancing rules, operations have been significantly slowed down at the above- and below-ground construction sites in all projects. The number of employees working per shift has been reduced and mining work has been reduced. The time-critical planning and approval procedures in all projects are affected to varying degrees. Employees at the office locations alternate between front and home office.

Effects on the target dates cannot currently be quantified conclusively. The foreseeable extensions of construction times will result in an increase in total costs. If there is a need to continue operation under the current level of restriction for several months, this will lead to more significant effects.

General

Further development and optimisation of process organisation is a part of corporate development. The control and operational processes in the specialist concepts of the areas of finance and accounting and financial planning and controlling will be further developed and implemented in accordance with the Financial Statute.

For cross-divisional corporate management, key performance indicator control is being expanded and the existing control instruments will be transferred to an integrated management system in the medium term.

The corporate communication department is planning an extensive relaunch of its digital services. In addition, the department is closely involved in the communication of the retrieval plan for Asse and of the Sub-Areas Interim Report in site selection.

The homogenisation and consolidation of the various IT systems and IT applications will continue in the area of information and communications technology. An integrated document management system is to be introduced as of 2020.

The room capacities at the Peine site are to be expanded to accommodate the current require-

ments. A second module is being built and office space is being rented.

Construction of the Konrad repository

In the Konrad project, the construction work on the Konrad 1 mine that started in 2019 will be completed in 2020. These include the north hoist building and the administration and social building.

The activities in Konrad Shaft 1 (conversion of the shaft hoisting system Konrad 1 north) are continuing. This will be followed by the work to renew the shaft areas.

At the Konrad 2 mine, the planning services, the administrative acts under building law, and the awards of contracts are being pushed ahead. The construction work on the depot will be done at the beginning of 2020. The construction of the mine water transfer station is also scheduled to begin.

In Konrad Shaft 2, the work in the filling site on the 2nd level has advanced a long way with the creation of the outer linings, and will be completed with the driving of the level in 2020. Subsequent activities will commence in 2020 in the filling site on the 3rd level.

In the Pit, the infrastructure of the repository is continuing to be built at five operating points. The final element of the routes below ground is the installation of the inner linings (turning point ramp 380, connection of the 2nd and 3rd levels, and in areas of backfill preparation).

The procurement, production, and assembly of the emplacement technology are continuing.

Asse II mine

The planning for the retrieval mine at the Asse II mine is continuing. After completion of the 3D seismic measurements in the first quarter of 2020, evaluations and accompanying investigation programmes will follow. The emplacement-specific exploration for drilling, measurements and analyses, and the conceptual planning of the retrieval of the waste are continuing. For 2020, the aim is to enter into the approval process for the construction of the new shaft and the driving of the new retrieval mine.

The technical/organisational precautionary measures for emergency planning are continuing. This includes improvements to the design and maintenance of the functionality of solution management, backfilling of routes and selected mine areas, as well as sealing and stabilisation measures. In addition, the construction of the acceptance point for a counter-flood solution is to be completed in 2020. This liquid will come into use if there is ever a beyond-design ingress of solution. For this purpose, it is planned to contractually bind a contractor for the provision of the counter-flood solution.

Morsleben repository

For the decommissioning of the Morsleben repository for radioactive waste, further extensive measures are planned for reducing the above-ground control area. Due to the extended phase of keeping it open, investments are necessary to maintain readiness for decommissioning the repository, and these will continue in 2020. In addition to working off further ESK recommendations, approval documents are being created.

For 2020, preparations are underway for the development of and application for a large-scale trial, with the aim of testing how a tight, secure sealing structure can be built in anhydrite that meets the requirements in the plan approval process for decommissioning.

Gorleben

The Gorleben site is to be kept open, where the plans for 2020 include completing the replacement for the pithead, office and social building, as well as modelling the terrain for dune-like profiling of the embankments for the company site. Planning will commence for releasing parts of the company premises from mining authority control. Additional work priorities are the organisational merging of the Gorleben and Morsleben operations as well as further coordination with supervisory authorities regarding the operational and safety concepts.

Site selection

The main milestones for 2020 in the site selection project relate to the publication of the Sub-Areas Interim Report pursuant to § 13 StandAG. For this, the method development and application of the exclusion criteria were to be concluded in the first quarter. The development of methods for applying the minimum requirements and weighting criteria will be concluded in the first half of the year. This will be followed by the application of the criteria. Up until the end of May, further data will continue to be procured from the federal and state authorities, and analogue data digitalised. After that, extensive support is expected in the form of the Expert Conference on Sub-Areas held by BASE. Subsequently, the work for determining

sub-areas shall be completed and the preparatory work for determining siting regions shall commence with site-specific, open-ended exploration programmes.

In a letter from the BMU dated 13 September 2019, responsibility for developing the repository for highly radioactive waste was transferred to BGE as the project developer. The first preparatory work regarding the development of the repository is to begin in 2020.

Product control measures

Since the product control department expects a further increase in applications for product control measures in 2020, the requisite human resources for this will be created.

In the product control department, the current plan for 2020 provides for accelerating the processing of application procedures for qualifying waste containers as part of the product control measures.

Ongoing research projects and memberships will continue.

Regarding the forecast costs, please refer to the table in the 'Control system' section.

Peine, 31 March 2020

Financial statement for the fiscal year from 1 January to 31 December 2019

Balance as of 31/12/2019

Assets

in thousands of euros	As of 31/12/2019	As of 31/12/2018
A. Fixed assets		
I. Financial assets	5,623	6,119
	5,623	6,119
B. Current assets		
I. Stock		
1. Advance payments	3,905	4,207
	3,905	4,207
II. Receivables and other assets		
1. Accounts receivable	0	0
2. Receivables from shareholder	103,030	83,288
3. Receivables from affiliated companies	10	58
4. Other assets	5,661	3,633
	108,701	86,979
III. Cash on hand, bank balances	117	43
	112,723	91,229
C. Accruals and deferrals	351	552
	118,697	97,900
Trust property	3,431	3,445

Liabilities

in thousands of euros	As of 31/12/2019	As of 31/12/2018
Equity		
I. Subscribed capital	2,825	2,825
II. Capital reserve	37	37
III. Retained earnings	1,942	1,942
IV. Profit carried forward	0	551
	4,804	5,355
B. Provisions		
1. Provisions for pensions	15,771	14,782
2. Tax provisions	1,021	1,991
3. Other provisions	42,992	27,389
	59,784	44,162
C. Liabilities		
1. Payments received	1	0
2. Trade payables	34,941	27,879
3. Liabilities towards the shareholder	3,563	3,133
4. Liabilities towards affiliated companies	0,847	743
5. Other liabilities	14,757	16,628
	54,109	48,383
	118,697	97,900
Trust property	3,431	3,445

Profit and loss account for the period from 1 January to 31 December 2019

in thousands of euros	As of 31/12/2019	As of 31/12/2018
1. Revenue	387,800	361,728
2. Other operating income	9,690	10,645
	397,490	372,373
3. Material expenses		
a) Cost of raw materials, consumables, supplies and purchased goods	25,006	27,225
b) Cost of purchased services	191,547	180,557
	216,553	207,782
4. Personnel costs		
a) Salaries and wages	117,194	107,641
b) Social security contributions and expenditure on pensions and other benefits	29,635	34,845
	146,829	142,486
5. Other operating expenses	23,413	19,873
	386,795	370,141
	10,695	2,232
6. Income from loans under financial assets	155	169
7. Other interest and similar income	0	0
8. Interest and similar expenses	9,059	1,403
9. Taxes on income and earnings	1,737	957
10. Profit after taxes	54	41
11. Other taxes	54	41
12. Net annual profit	0	0



View of the north hoist building, Konrad 1 mine

Annex for the fiscal year 2019

General information

The financial statement of Bundesgesellschaft für Endlagerung mbH (BGE) for the fiscal year from 1 January 2019 to 31 December 2019 was prepared on the basis of the accounting provisions in the German Commercial Code (HGB). In addition to these regulations, the provisions of the GmbH Act and the articles of association were observed. According to the size classes specified in § 267 HGB, BGE is a large corporation.

The profit and loss account was prepared in accordance with the total cost method pursuant to § 275 (2) HGB.

BGE is entered in the Commercial Register of the Hildesheim Local Court under HRB 204918. The sole shareholder is the Federal Republic of Germany, represented by the Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU). The company's registered office is located in Peine.

Information on accounting and valuation methods

BGE does not own any tangible fixed assets to be capitalised, since BGE transfers to the BMU ownership or rights to movable assets procured for the purpose of operation and financed by the BMU at the time when BGE itself acquires these rights.

Shares in affiliated companies are shown under financial assets and valued at acquisition cost. Loans are shown at their nominal value. Advance payments are stated at their nominal value.

Receivables and other assets are valued at their nominal value. Value adjustments are made where necessary.

Cash and cash equivalents are stated at their nominal value.

Prepaid expenses relate to expenses prior to the balance sheet date, representing expenses for a specific period after that date; the item is reversed over time.

Subscribed capital is carried at nominal value.

Provisions are recognised at the amount required to settle the obligation in accordance with reasonable commercial judgement.

Provisions with a remaining term of more than one year are discounted at the average market interest rate of the past seven years corresponding to their remaining term.

Provisions for pensions are measured on the basis of actuarial calculations using the projected unit credit method taking into account the "2018 G Mortality Tables" of Prof. Dr. Klaus Heubeck, Cologne. The pension obligations carried as liabilities are based exclusively on the benefit regulations and the defined contribution pension plan of Bochumer Verband for individual commitments. Provisions for pensions are measured at the average market interest rate of the past ten years published by the Deutsche Bundesbank (§ 253 (2) HGB). With an assumed duration of 15 years, this corresponds to 2.72 % (previous year 3.21 %). The salary trend remains unchanged at 2.5 %, the pension trend unchanged at 2.0 % and 1.0 % for commitments with an adjustment guarantee. Age- and gender-dependent probabilities are used for the expected employee development (fluctuation).

The difference resulting from the different valuation of pension provisions at the 7-year or 10-year discount rate (€ 1.375 million) is not subject to a distribution block in accordance with § 253 (6) sentence 2 HGB due to sufficient free reserves.

In addition, provisions were formed for uncertain liabilities from pension claims. The provisions are generally discounted in accordance with their term (§ 253 (2) HGB). As the remaining term is less than one year, the provisions were not discounted.

Provisions for anniversary bonuses within other provisions are also measured on the basis of actuarial calculations using the projected unit credit method, taking into account the "2018 G Mortality Tables" of Prof. Dr. Klaus Heubeck, Cologne. The current discount rate is 1.97 % (previous year 2.3 %).

Provisions have been made for social plan costs in connection with the transition to "purely keeping the Morsleben mine open" and the associated personnel reduction measures. Other provisions include amounts payable for services rendered by subcontractors, fees for the ongoing application process for decommissioning the Morsleben radioactive waste repository and decommissioning the Asse II mine, and provision for VAT risks. The other provisions also take into account all identifiable risks and contingent liabilities.

Liabilities are stated at the settlement amount.

The excess of deferred tax assets over liabilities is not reported. The valuation of deferred taxes is based on a tax rate of 29.3 % (15.82 % for corporation tax, including solidarity surcharge, and 13.48 % for trade tax). Differences between commercial law and tax law arise in particular with

regard to pension provisions and procedural costs for decommissioning the Morsleben repository and the Asse II mine.

The accounting and valuation methods have not changed compared to the previous year and have been applied consistently.

Notes on the balance sheet

Fixed assets relate exclusively to financial assets and include the tenant loan with PALEA Grundstücks-Verwaltungsgesellschaft mbH for the Peine administration building. For information on developments in the reporting year, please refer to the statement of changes.

The receivables from the shareholder (€ 103.030 million; previous year € 83.288 million) result from the settlement of BGE's provision of services in 2019. Receivables from affiliated companies (€ 10,000; previous year € 58,000) relate exclusively to BGE TEC and result from the invoicing of services in the scope of the agency and service agreement. All receivables and other assets have a remaining term of up to one year.

Other assets (€ 5.661 million; previous year: € 3.633 million) primarily relate to claims from product control claims against energy supply

companies and have a remaining term of up to one year.

Cash and cash equivalents (€ 117,000; previous year: € 43,000) mainly consist of short-term bank balances.

The capital reserve in the amount of € 37,000 is made up of capital shares of DBE and Asse-GmbH that were not used to increase the subscribed capital.

The profits of € 551,000 (profit carried forward from 2016 and 2017) that were not distributed in the course of the merger were distributed in accordance with the resolution of the shareholders' meeting on 27 June 2019.

BGE has made use of the option under Art. 67 (1) sentence 1 EGHGB to distribute the conversion expenses from the introduction of the Accounting Law Modernisation Act (BilMoG) on 1 January 2010 on a straight-line basis over a maximum period of up to 15 years. The annual amount of € 214,000 is reported under other operating expenses. As of the balance sheet date, the shortfall in pension provisions thus amounted to € 1.072 million.

Provisions for corporation tax (€ 151,000) and trade tax (€ 870,000) are shown in the tax provisions. The high anticipated trade tax back-payments essentially result from previously very low advance payments.

Other provisions essentially include the following items:

Other significant provisions

in thousands of euros	As of 31/12/2019	As of 31/12/2018
Provisions for personnel obligations	7,062	7,128
Provisions for outstanding invoices	19,064	12,627
Provision for procedural costs for decommissioning of the Morsleben repository for radioactive waste	7,609	7,552
Provision for procedural costs for decommissioning of the Asse II mine	3,408	0
Value-added tax (VAT) risks	5,800	0

The personnel-related provisions include in particular costs for the Gorleben social plan as well as obligations from vacation and time credits.

Liabilities to affiliated companies result entirely from the service relationships with BGE TEC. Liabilities to the shareholder consist entirely of trade accounts payable.

Other liabilities in the amount of € 14.757 million mainly comprise obligations from VAT and wage tax payable (€ 14.413 million; previous year € 16.597 million) for the months of November and December 2019. The item furthermore includes liabilities under social security in the amount of € 55,000 (previous year: € 6,000).

All liabilities have a remaining term of up to one year.

There are no liabilities secured by liens or similar rights.

The € 3.431 million reported in the balance sheet relates to security deposits held in trust for obligations under the Lower Saxony Nature Conservation Act for compensation and replacement measures in the Gorleben area. The trust assets are accordingly matched by trust obligations in the same amount.

Other financial obligations and other contingent liabilities not shown in the balance sheet

The company conducts its business in an administration building rented in Peine. This results in future payment obligations of € 3.484 million, based on a contract term of approximately 1.5 years. A further € 3.031 million relates to the rental of parts of the building and storage space. Financial obligations from other existing rental, tenancy, or leasing contracts amount to € 1.151 million for the agreed terms on the balance sheet date. Altogether, the existing contracts result in financial obligations totalling € 7.666 million.

To secure existing and future claims of Volksbank e.G. Braunschweig Wolfsburg, there is a "guarantee for individual claims" for BGE TEC in the amount of 2 750,000. It is not assumed that this will be used because BGE TEC has sufficient liquidity.

Notes on the profit and loss account

In the year under review, revenues are broken down by activity as follows:

Revenue

in thousands of euros	As of 31/12/2019	As of 31/12/2018
Konrad	215,712	210,993
Asse	100,691	84,181
Morsleben	40,051	37,410
Gorleben	15,096	17,242
Product control	9,856	7,574
Site selection	5,973	3,824
Other revenue	421	504
Total	387,800	361,728

Other revenue essentially comprises services for the subsidiary BGE TEC. All revenue is generated domestically in Germany.

Other operating income (€ 9.690 million; previous year: € 10.645 million) includes income from other periods in the amount of € 9.033 million (previous year: € 10.280 million). These are essentially the reimbursement of contributions from the Berufsgenossenschaft Rohstoffe und chemische Industrie (BG RCI) in the amount of € 8.111 million (previous year: € 6.658 million) for 2018 as well as unused provisions for contractor service invoices in the amount of € 0.887 million (€ 2.587 million).

The reported cost of materials includes in particular the cost of raw materials, consumables and supplies (€ 25.006 million; previous year € 27.255 million) and the cost of purchased services (€ 191.547 million; previous year € 180.557 million), mainly for work contracts and other services, temporary employment, energy, maintenance, and cleaning and guard services.

Costs of pensions amounting to € 1.690 million (previous year: € 1.644 million) are shown under personnel costs.

The € 23.413 million (previous year: € 19.873 million) in other operating expenses mainly comprise general administrative expenses, including expert opinion and external consulting services, rental costs, incidental personnel expenses, and procedural costs for the decommissioning of the Asse II mine. This item also includes the annual pro rata conversion expense in the amount of € 214,000 from the introduction of the BilMoG relating to the underfunding of pension provisions as of 1 January 2010.

Income from loans from financial assets in the amount of € 155,000 mainly results from the tenant loan to PALEA.

Interest expenses of € 9.059 million (previous year: € 1.403 million) mainly relate to expenses from provisions for VAT risks (€ 5.800 million) and the compounding of provisions (€ 1.209 million).

Taxes on income and earnings comprise € 0.592 million in corporation tax including solidarity surcharge and € 1.145 million in trade tax.



Dennis Hoffmann, Machine Operation Supervisor in the Morsleben repository, Mine Rescue

Other Information

Members

Management board

The company was founded in 2019 by the following managing directors:

Stefan Studt, Rickert,
Chairman of the Management Board

Steffen Kanitz, Dortmund,
Deputy Chairman of the
Management Board

Beate Kallenbach-Herbert, Einhausen,
Commercial Managing Director

Dr. Thomas Lautsch, Peine,
Chief Technical Officer

Notwithstanding para. 5.1.2 PCGK, no age limit has been set for occupying a position in BGE management. The contracts of the current management are fixed in term such that no member of the management will reach the legal retirement age before the end of the term.

Management remuneration in the 2019 reporting year comprises fixed salary payments including fringe benefits. Performance-related remuneration components are not paid.

Management Board remuneration in 2019

in thousands of euros

Manager	Base salary	Pension scheme	Other	Total 2019
Stefan Studt	295	0	9	304
Steffen Kanitz	275	0	20	295
Beate Kallenbach-Herbert	275	0	2	277
Dr. Thomas Lautsch	275	30	8	313
Total amount	1,120	30	39	1,189

A total of € 7.705 million was set aside to cover pension obligations to former members of the management of a merged legal entity; their current emoluments amounted to € 577,000 in 2019.

Supervisory board

The following are members of the supervisory board:

Jochen Flasbarth
State Secretary, BMU (Chairman)

Gregor van Beesel
BGE (Employee Representative, Deputy Chairman)

Dirk Alvermann
BGE (Employee Representative)

Ursula Borak
Head of Division, Federal Ministry for Economic Affairs and Energy

Dr. Wolfgang Cloosters
Head of Department, BMU

Sabine Diehr
Head of Division, Federal Ministry of Education and Research

Leonie Gebers
State Secretary, Federal Ministry of Labour and Social Affairs

Prof. Dr. Karin Holm-Müller
Chair of Resource and Environmental Economics at the Rheinische Friedrich-Wilhelms-Universität Bonn

Franz-Gerhard Hörnschemeyer
Industry Group Secretary for Energy Sustainability, IG BCE

Dr. Holle Jakob
Head of Division, Federal Ministry of Finance (BMF)

Dr. Andreas Kerst
Speaker in the BMF

Sylvia Kotting-Uhl
Member of the Bundestag (Bündnis 90/Die Grünen)

Jens Lindner
BGE (Employee Representative)

Gabriele Theisen
BGE (employee representative)

Peter Wolff
BGE (Employee Representative)

Notwithstanding para. 5.2.2 PCGK, no age limit has been set for occupying a member seat on the BGE supervisory board, in order to ensure that additional specific skills and experience can be introduced to the benefit of the company.

Management reports to the supervisory board in accordance with § 90 of the German Stock Corporation Act (AktG). In addition, reservations of approval in favour of the supervisory board are laid down in BGE's articles of association for transactions of fundamental importance. These are, in particular, decisions and measures that could lead to a significant change in the business activity within the framework of the articles of association or to a fundamental change in the Company's net assets, financial position, operational results, or risk structure.

By resolution of the shareholders' meeting on 23 August 2017, the attendance fee for supervisory board members who are neither members of the German Bundestag or the German Federal Government, nor are in a service or employment

relationship with the Federal Republic of Germany, was set at € 4,000 per year. The following members of the supervisory board received this attendance fee in 2019:

Dirk Alvermann
Gregor van Beesel
Professor Dr. Karin Holm-Müller
Franz-Gerhard Hörnschemeyer
Jens Lindner
Gabriele Theisen
Peter Wolff

The supervisory board has formed a presidium made up of four supervisory board members who can prepare supervisory board decisions; the final decision is the responsibility of the supervisory board.

Auditor's fee

The total fee for the auditor calculated for the fiscal year is shown in the BGE consolidated financial statements.



Morsleben repository, supporting structure for the new man-haulage bridge

Number of people employed

On an annual average, there were 1,515 people in the company's employ in the sense of § 267 (5) HGB:

Sites	Employees/ annual average	Of which women
Salzgitter	30	12
Wolfenbüttel/Remlingen	477	95
Peine/Berlin	483	191
Gorleben	29	1
Morsleben	151	23
Konrad	345	24
Total employees	1,515	346

Shareholding

One shareholder owns 100 % of the interest in BGE TECHNOLOGY GmbH, Peine.

As of 31 December 2019, the equity of BGE TECHNOLOGY GmbH amounted to € 2.810 million. In fiscal 2019, the company generated a net profit of € 174,000.

Supplementary report

The coronavirus pandemic is affecting BGE operations to varying degrees.

Nevertheless, BGE will endeavour to continue its operations to the best of its capabilities under the given conditions. Due to the applicable hygiene measures and distancing rules, operations have been significantly slowed down at the above- and below-ground construction sites in all BGE projects. The number of employees working per shift has been reduced and mining work has been reduced. The time-critical planning and approval procedures in all projects are affected to varying degrees. Employees at the BGE office locations alternate between front and home office.

Effects on the target dates cannot currently be quantified conclusively. The foreseeable extensions of construction times will result in an increase in total costs. If there is a need to continue operation under the current level of restriction for several months, this will lead to more significant effects.

Public Corporate Governance Code

The company has issued a declaration of conformity in accordance with the Federal Public Corporate Governance Code and published it on the company's website.

Peine, 31 March 2020

Development of fixed assets

1 January 2019 to 31 December 2019

Acquisition and manufacturing costs

in thousands of euros	As at 01/01/2019	Additions	Retirements	Transfers	As at 31/12/2019
Financial assets					
1. Shares in affiliated companies	690	0	0	0	690
2. Other loans	5,429	0	496	0	4,933
	6,119	0	496	0	5,623
Total fixed assets	6,119	0	496	0	5,623

Value adjustments

Accumulated depreciations 01/01/2019	Additions	Retirements	Transfers	Accumulated depreciations 31/12/2019	As at 31/12/2019	As at 31/12/2018
0	0	0	0	0	690	690
0	0	0	0	0	4,933	5,429
0	0	0	0	0	5,623	6,119
0	0	0	0	0	5,623	6,119

Carrying amounts



Konrad 2 mine, foundation of the depot building, workshop with locomotive shed, warehouse, and friction winch hall