amprion
connects

LEBENS-ADERN

THE
AMPRION
MAGAZINE
VOL. 04

We're here.

“Amprion is paving the way for a climate-neutral energy system. Controlling it demands innovative and powerful technologies. The new System Operation and Control Centre in Brauweiler is setting up the company’s grid management system for the future and will be a core element of this development.”

DR CHRISTOPH SCHNEIDERS
Head of the System Operation and Control Centre in Brauweiler

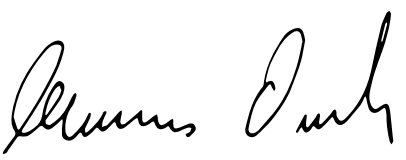
Dear Readers,

We're here. Even if hardly anyone notices us. If we're out of sight, out of mind, it means we're doing a good job. We transport electricity for 29 million people and thousands of companies in our grid area. We at Amprion keep the power grid stable and safe – and are paving the way for a sustainable energy system. Because we're convinced Germany must become climate-neutral by 2050 at the latest. As a next-generation transmission system operator, Amprion will help shape the path to achieve this goal and we will do all we can to build a sustainable energy system.

In this magazine, we tell you what we bring to the table – in terms of technical expertise, enthusiasm and vision. More than 2,000 employees share responsibility for today's electricity system and are helping to develop tomorrow's cross-sector energy system. Our enhanced management team, comprising Dr Hans-Jürgen Brick (CEO), Dr Hendrik Neumann (CTO) and Peter Rüth (CFO), is gearing Amprion towards achieving these goals.

At Amprion, we are committed to playing our part in ensuring the future of mankind, the environment and the economy. It's these feelings of solidarity, of being connected, that lead us to work with others to find the best solutions for a sustainable energy system. Please read this magazine to find out what we are already doing to bring this about and how we are helping to shape the transformation of the energy world.

I hope you enjoy reading it.



THOMAS WIEDE
Head of Corporate Communications and Digital Media

WE'RE HERE.

So that life can thrive.

Amprion's transmission grid carries electricity to 29 million people in an area that extends from Lower Saxony to the Alps. Our power lines are lifelines of society. We keep our network stable and safe – 24 hours a day, seven days a week.

WE'RE HERE.

So the economy never runs out of energy.

Around a third of Germany's economic output is generated in Amprion's grid area. We maintain our grid in a stable and secure condition so the lights never go out. We're helping industry to decarbonise, and want to play our part in converting green electricity into green hydrogen.

WE'RE HERE.

So that renewable energies reach the people.

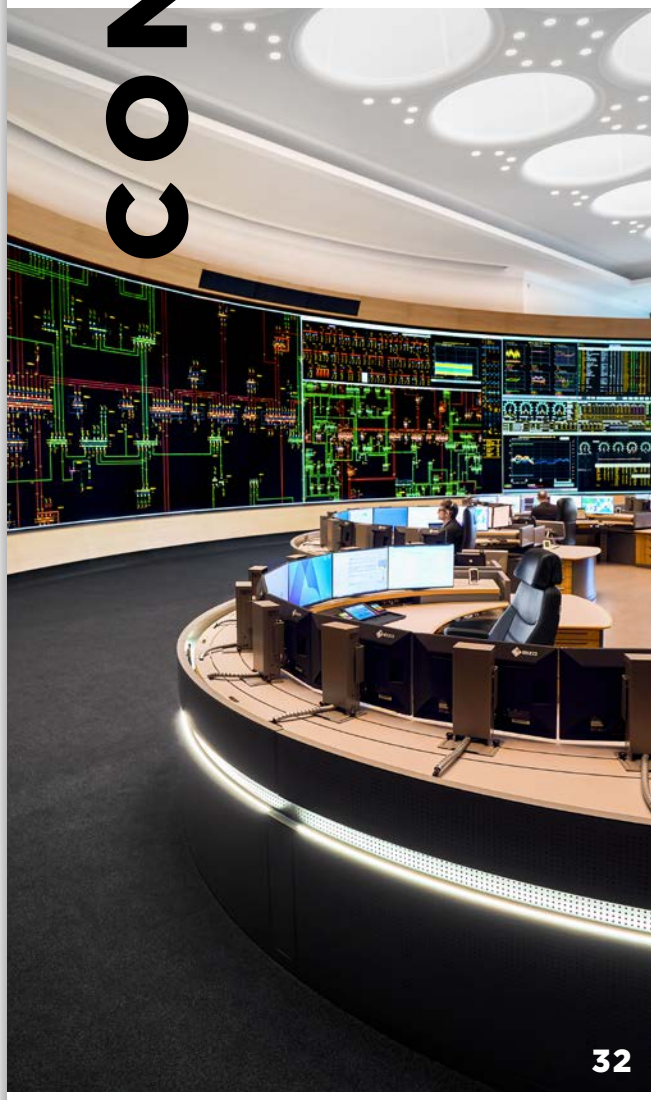
Germany wants to become climate-neutral. Amprion is paving the way for a sustainable energy system: we're extending our transmission grid so that power generated from the wind and sun can get safely and reliably to where it's needed.

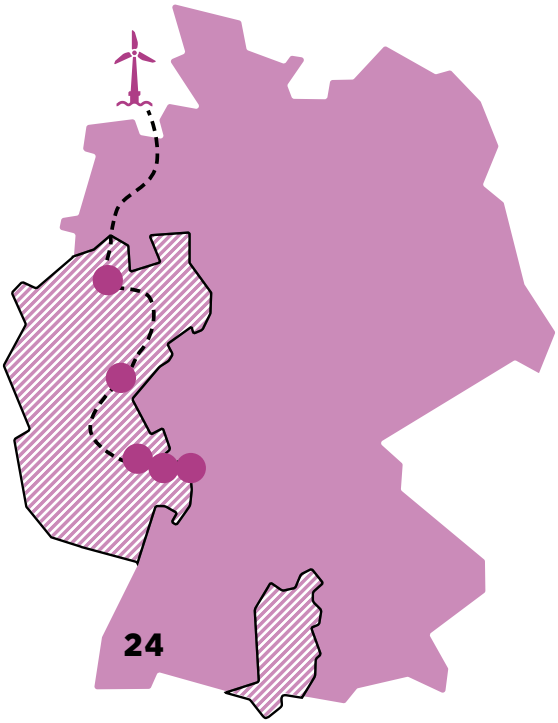
WE'RE HERE.

For a sustainable energy system in Europe.

Amprion is a leading transmission system operator in Europe. We perform key overarching operations for Europe's integrated power grid. We want Europe to grow closer together – and its energy system to become more climate-friendly, more reliable and more efficient.

CONTENTS





All articles in this journal and other exciting insights can be found online at

www.amprion.net/gb2020

MORE THAN ELECTRICITY

The energy world is changing – and Amprion is realigning itself. As a next-generation transmission system operator, it's all about thinking holistically about the energy system in 2050, say Dr Hans-Jürgen Brick (CEO), Dr Hendrik Neumann (CTO) and Peter Rüth (CFO).

Text VOLKER GÖTTSCHE

DR HANS-JÜRGEN BRICK
Chief Executive Officer

PETER RÜTH
Chief Financial Officer

The energy world is changing dramatically. Where are we headed?

PETER RÜTH Electricity will play a key role in this. Decarbonisation, electromobility, digitalisation – wherever you are, the economy and society are totally dependent on electricity.

BRICK That said, we don't yet know exactly to what extent the various energy sources and sectors will shape the energy system in 2050. So far, there's no finalised model for how things will look. But that's what makes it so exciting!

DR HANS-JÜRGEN BRICK Europe is currently embarking on a radical transformation – with the clear goal: we are building a long-term sustainable energy system. Climate-neutral, but also safe and efficient.

DR HENDRIK NEUMANN But electricity is just one part of the system. We need to view the energy system in its entirety, with the energy sources electricity, gas and hydrogen, but also with the sectors industry, mobility and heating. Because everything is connected to everything else.

“I expect the energy system to continue to evolve in a very dynamic way.”

DR HENDRIK NEUMANN

What does this mean for Amprion?

RÜTH Everything is founded on our role as a TSO: we plan, build and operate our grid. But the journey continues: if we at Amprion want to integrate renewable energies in the best possible way, …

NEUMANN I expect the energy system to continue to evolve in a very dynamic way. Our job is to do the best we can to anticipate how. But above all, we at Amprion can help shape this evolution. It’s a great opportunity for us!

BRICK … we need to know our stuff not only in respect of electricity but all energy sources. That’s what we mean when we refer to ourselves as a next-generation TSO. This entails a high level of responsibility for the national economy.

NEUMANN Amprion has what it takes. We are already the ones who think holistically about the system. Take hydrogen, for example: it must be generated from surplus green electricity so that industry can manufacture in a more climate-neutral way. And to keep the cost to the economy low, the electrolysers should be located where lots of green electricity is generated.

RÜTH As a transmission system operator, we keep an eye on both aspects.

NEUMANN And we don’t have to become hydrogen experts for that. But we are experts in integrating hydrogen technology – as well as renewables – into the energy system in the best possible way.

DR HENDRIK NEUMANN
Chief Technical Officer

H_2

SECTOR COUPLING
Amprion wants to integrate hydrogen technology into the energy system in the best possible way.

“We continue to evolve by building on our strengths.”

DR HANS-JÜRGEN BRICK

How will Amprion change while on this journey?

BRICK We continue to evolve by building on our strengths.

NEUMANN One strength is clearly our technical expertise. By building the new System Operation and Control Centre in Brauweiler, we have created the core of a future operating system for the energy transition.

BRICK And we have introduced new tools in recent years to better integrate renewables into the power system.

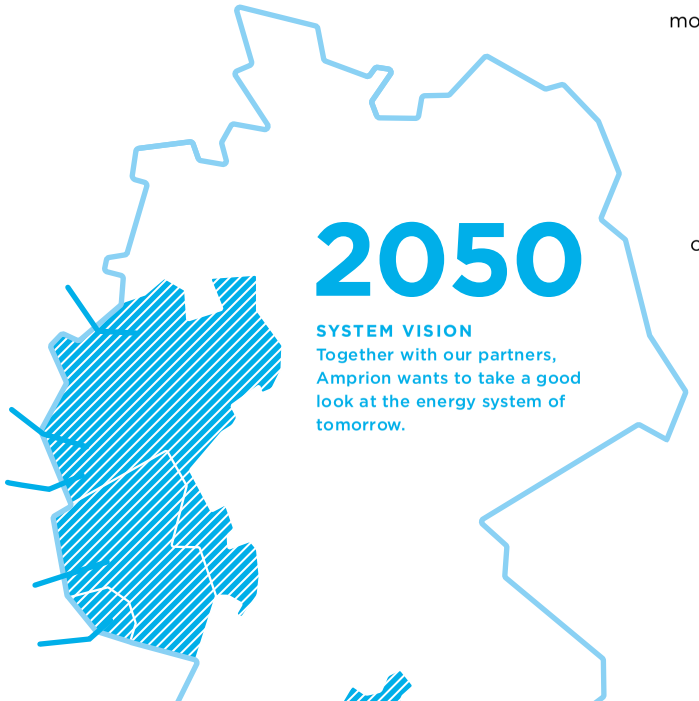
NEUMANN Such as equipment for power factor correction. If conventional power plants are no longer capable of performing this task, we’ll turn to new options – and gain greater flexibility.

BRICK I expect we will see many more innovations of this kind in the coming decade.

NEUMANN And one of our strengths is our ability to model the energy system of the future. This is a quite singular ability. We make our models available to our partners in the “system vision 2050” project – so they can develop their own models …

BRICK … and together we can create a robust model of the 2050 energy system that we still lack today.

RÜTH I see it this way: we by no means know all the answers. Rather, we want – and need – to search for them together with our partners.



2050

SYSTEM VISION
Together with our partners, Amprion wants to take a good look at the energy system of tomorrow.

COLLABORATION
Amprion wants to open up further to partnerships.

“We will continue to open up for partnerships – and for new tasks.”

PETER RÜTH

BRICK This is also reflected in the fact that we are looking beyond our own backyard – at the distribution grids, other sectors and Europe. For example, we are cooperating with E.ON to jointly plan the power grid and further develop storage technologies …

RÜTH We will continue to open up for partnerships – and for new tasks.

NEUMANN … and we have been working together with the gas grid operator OGE to develop plans for testing a power-to-gas plant. We are collaborating in “Eurobar”, the initiative for a European offshore power grid.

Change requires energy. Where does Amprion get it from?

RÜTH From our desire to make a significant contribution towards building a sustainable energy system. It’s what motivates all of us.

BRICK The good mix of experienced and new colleagues certainly contributes to this. My impression is that they all identify with Amprion – and want to play their part in ensuring Amprion becomes the transmission system operator of the next generation.

NEUMANN And founded on a culture that combines values such as safety and stability in all grid-related processes with a willingness to be creative and to look for new solutions.

DECARBONISATION
Amprion wants to make a significant contribution towards building a sustainable energy system.

Braving wind and waves

To bring renewable energies to the people, Amprion is busy connecting wind farms in the North Sea to the power grid on land. If we are to transmit electricity over long distances, we need to install the necessary electrical and ancillary equipment on platforms located on the high seas. And they need to be able to withstand more than just storms.

Text CHRISTINA SCHNEIDER

The North Sea in the German Bight: on normal days, the waves are five to ten metres high. “Once-in-a century waves” – breakers that statistically occur once every 100 years – reach heights of up to 19 metres. “We’re preparing for once-in-a-millennium waves up to 20 metres high,” says Fred Wegener. The 54-year-old mechanical engineer is responsible for the engineering side of one of two projects that feed wind power from the North Sea into the power grid on land. Experts call them “grid connection systems”.

Hundreds of kilometres of power cable will have to be laid – on the bed of the North Sea as well. These cables can only be used to transport electricity as direct current – but the wind farms generate alternating current. Special facilities therefore convert this AC current to DC current while still out at sea. These “converters”, which are built in a steel enclosure (known as the “topside”) for protection, stand on gigantic foundations positioned immediately next to the offshore wind farms – and they, too, need to be able to withstand once-in-a-millennium waves.

The planning team at Amprion consequently has its hands full. “The difficult conditions out on the high seas make planning much more challenging than it is for onshore installations,” Wegener explains. More than 60 men and women at Amprion’s Dortmund and Hamburg sites are working to ensure that Amprion’s first converter platforms will go into service in 2028 and 2029 – as part of the grid connection systems DolWin4 and BorWin4. They are playing their part in making Germany’s energy supply more climate-friendly. Together, these two systems will be able to transmit a capacity of 1,800 megawatts. This corresponds to the needs of a major city such as Hamburg. Completing these systems on time is priority no. 1 for our planners. The energy generated by the wind farms is to be fed into the grid as agreed.

Technical and logistical challenges have to be overcome when planning the converter platforms. As demanding as the planning tasks are, Fred Wegener takes these challenges with typical northern German calmness. Colleagues say there’s not a lot that could ruffle his feathers. Presumably partly because he knows a lot about converter platforms: before joining Amprion, Fred had already planned, built and supervised the installation of platforms while working for a shipyard. “At Amprion, I can use my experience to advance the offshore sector,” he says. “DolWin4 and BorWin4 will not be Amprion’s last grid connection systems.”

“Every cubic metre of extra space not only adds weight, it adds cost, too.”

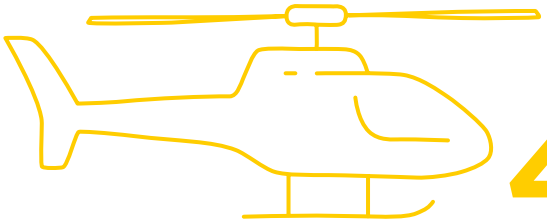
FRED WEGENER
Overall Project Manager Engineering for DolWin4

GIGANTIC DIMENSIONS

The converter platforms for DolWin4 and BorWin4 are being erected around 60 and 125 kilometres from the mainland, respectively, out on the high seas. They are up to 70 metres long, 35 metres wide and 35 metres high. Their footprint is equivalent to the area of ten tennis courts. The substructure of the platform alone – what's called the "jacket" – weighs 5,000 tonnes. That's half what the Eiffel Tower in Paris weighs. The steel piles of the platforms are anchored 60 metres into the seabed. Where exactly this is done depends on the conditions of the seabed on-site. "For example, when we're driving the piles, we want to avoid coming across things like boulders," explains Wegener. To make sure we do, geologists will examine the subsoil by drilling boreholes.

60

metres into the seabed – that's how deep the piles are driven.



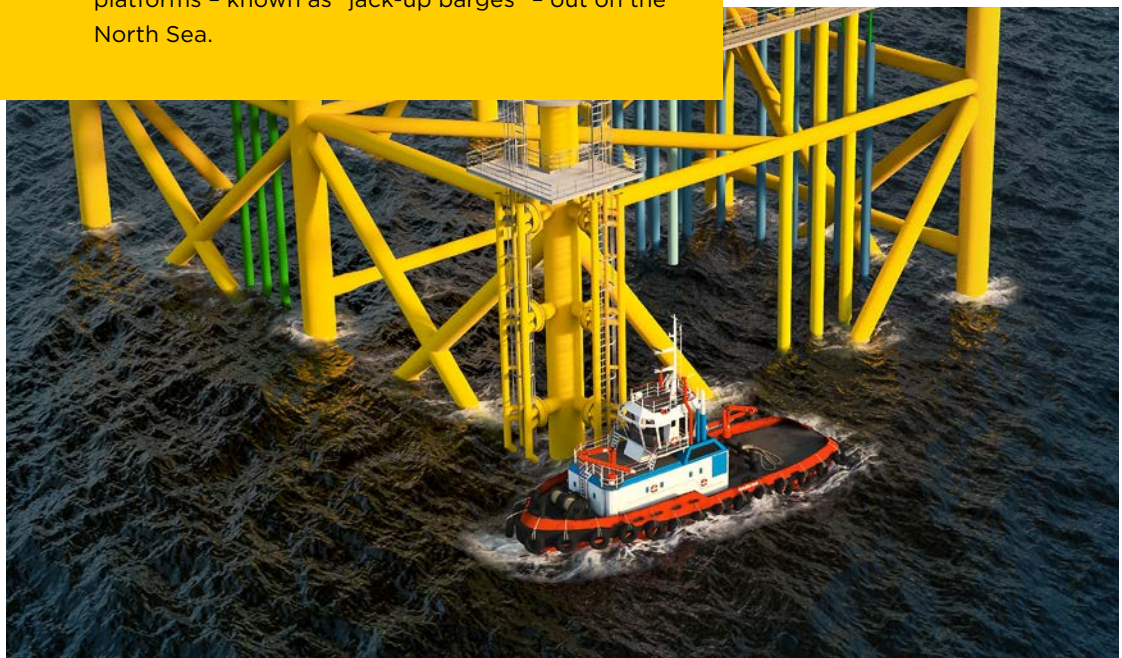
45

minutes to reach the platform by helicopter.

FAR OUT AT SEA

The location on the high seas presents a genuine logistical challenge for the planners. This is because the platforms are manufactured onshore and only then shipped to their installation location. The smaller and lighter they are, the easier they are to transport. “Every cubic metre of extra space not only adds weight, it adds cost,” explains Wegener. Individual components must not exceed a certain size and weight, otherwise ships and cranes will not be able to transport them. “If we forget to pack a certain tool and it’s missing during erection of the platform, that’s a real problem,” says the Overall Project Manager Engineering, because it has to be brought in by helicopter or – if weather conditions are too poor to fly – by ship. “That’s why we have to plan installation meticulously.” To avoid long turnaround times, the fitters stay in rooms provided on accommodation platforms – known as “jack-up barges” – out on the North Sea.

The converter platforms are located 60 and 125 kilometres from the mainland. Each transport run must be planned meticulously.



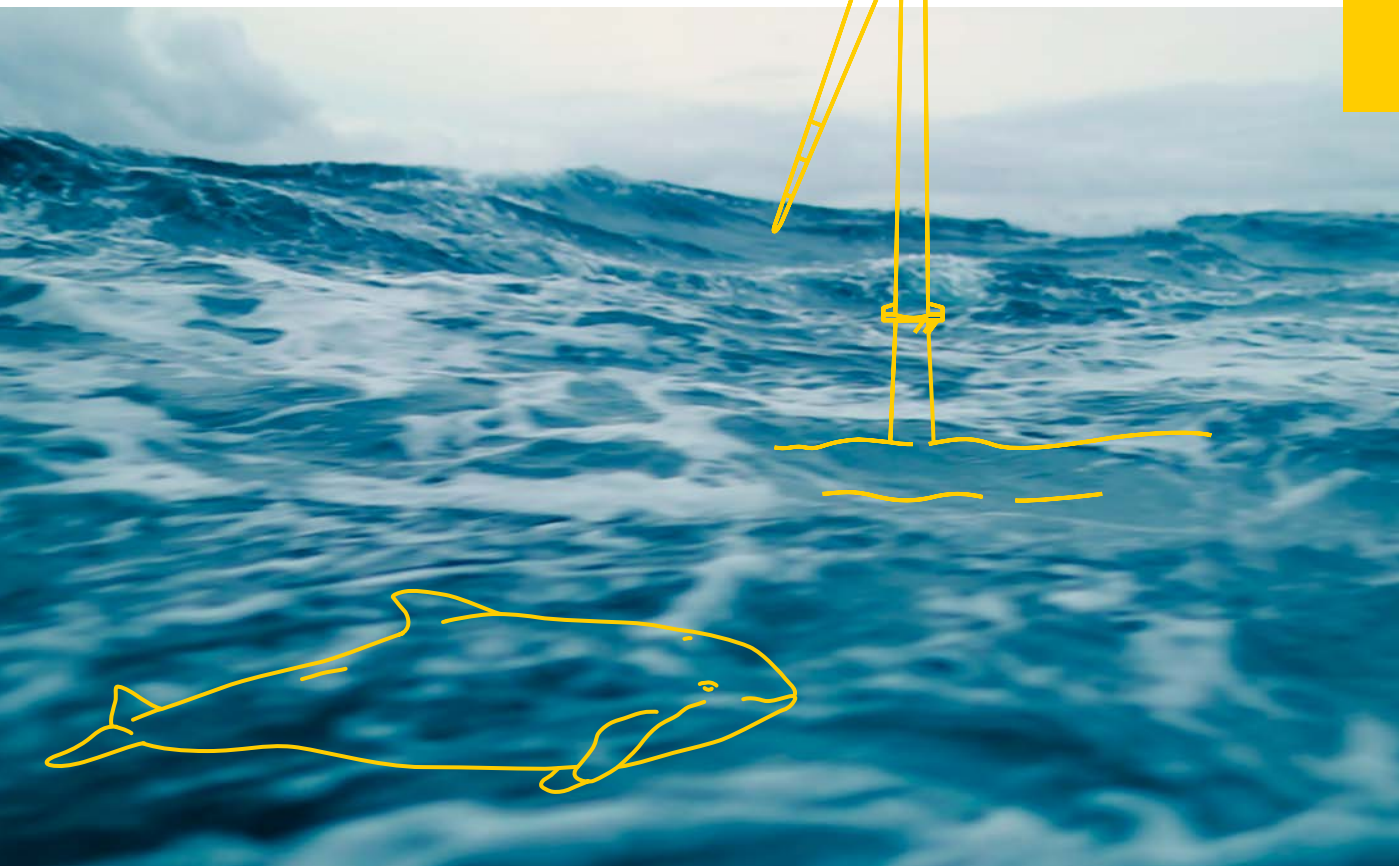
MATERIALS UNDER CONSTANT STRESS

The conditions on the high seas subject the materials of the platform to constant stress. The strength of the waves varies greatly, as do the direction of the waves and current. The Amprion team is also expecting extreme winds of up to 180 kilometres per hour that will put pressure on the materials. And then there's the sea salt, which attacks the steel of the platforms. In order for them to last 32 years, which is the service life the planners are counting on, a sophisticated coating system is needed. Because unlike ships, platforms cannot be brought into port for a "respray". "Unfortunately, we don't have much empirical evidence to work with in terms of corrosion protection for such a long period out at sea," says Fred Wegener. "That's why we avoid large surface areas when planning and keep the number of attachment parts as low as possible. It's also important that the platform is not damaged during construction or maintenance work."

PROTECTING NATURE

In addition to the technical and logistical challenges involved, the planners must also take into account the fact that the converter platforms are located in the middle of a unique natural habitat. Amprion believes in the fundamental necessity of sustainability. Protecting mankind and nature is a top priority for our employees. “This is why we always adhere to the environmental regulations and in some cases even go above and beyond,” says Wegener. For example, common porpoises that live in the North Sea must be protected from excessive noise levels owing to their very acute hearing. We do this by taking special measures when driving the platform piles.

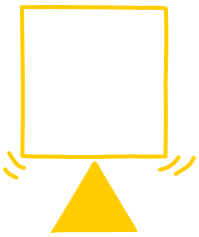
The North Sea is a unique natural habitat. Amprion also pays special consideration to the common porpoises that live there.



SENSITIVE ELECTRONICS

Each converter is made up thousands of transistors, diodes, capacitors and reactors. “The electronics are very sensitive,” says project manager Wegener. The equipment must be installed so high up that even once-in-a-millennium waves cannot touch them. Special ventilation systems run day and night to dehumidify, purify and desalinate the sea air.

But even the most resilient of components will break down at some point and have to be replaced. Other components need to be regularly serviced. This can only be done on-site. This is something the Amprion team must take into account when designing the platforms. The weight of potential components must also be taken into account: “It’s like playing Tetris,” Wegener says. “We go through a thousand replacement variations and constantly face the challenge of keeping the centre of gravity of the platform centred. Only then will the platform be stable.”



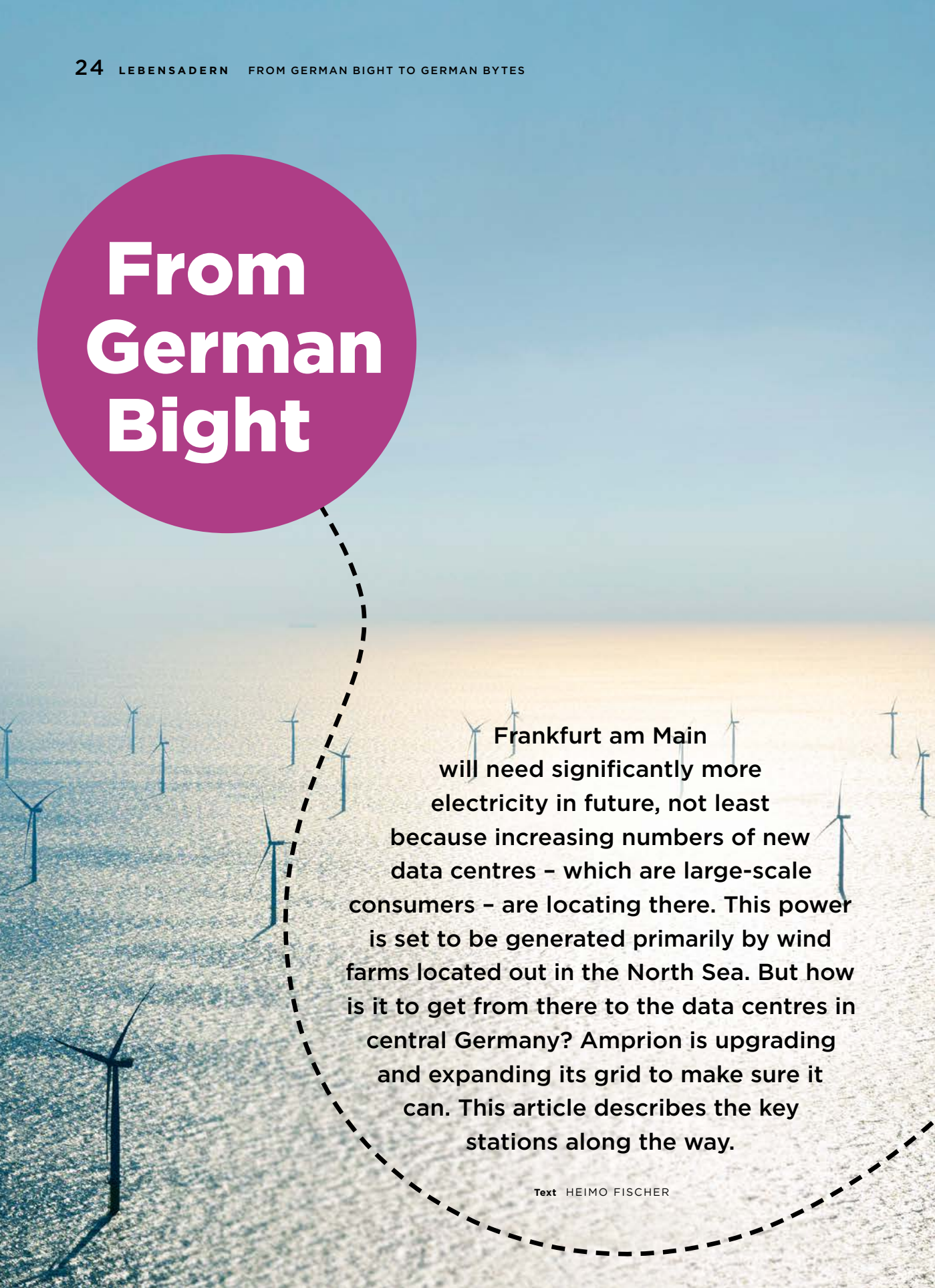
“We’re constantly faced with the challenge of keeping the platform’s centre of gravity centred.”

FRED WEGENER

WHAT DO CONVERTERS DO?

Converters are the key elements of an offshore grid connection system. The wind turbines of an offshore wind farm generate alternating current, which is then converted to direct current on-site by converters. The technology of high-voltage direct-current transmission (HVDC) enables us to transmit large amounts of energy by cable and over long distances with very low losses. This allows the electricity to make the long journey to the mainland. At the point where the grid connection system is connected to the mainland grid, a further converter is required that converts the direct current (DC) back to alternating current (AC). This is because the German power grid operates predominantly with alternating current technology.

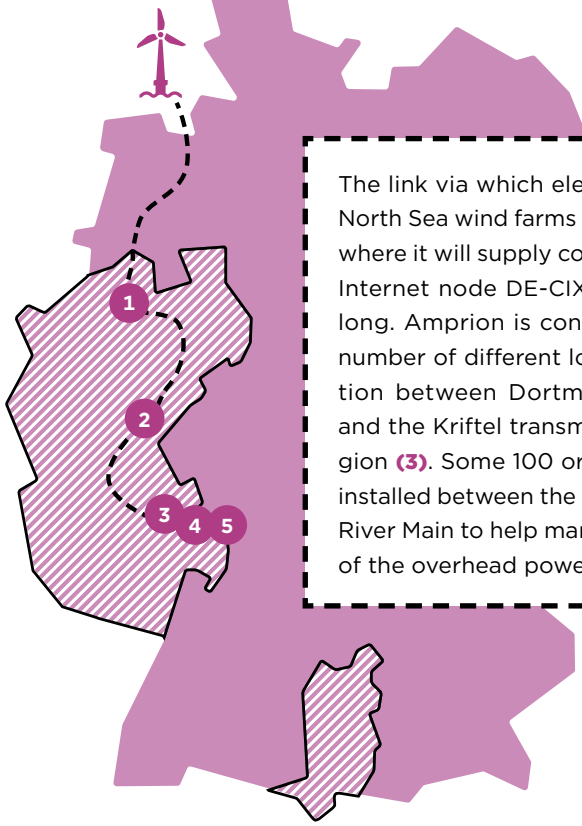
From German Bight



Frankfurt am Main will need significantly more electricity in future, not least because increasing numbers of new data centres – which are large-scale consumers – are locating there. This power is set to be generated primarily by wind farms located out in the North Sea. But how is it to get from there to the data centres in central Germany? Amprion is upgrading and expanding its grid to make sure it can. This article describes the key stations along the way.

Text HEIMO FISCHER


to
German
bytes



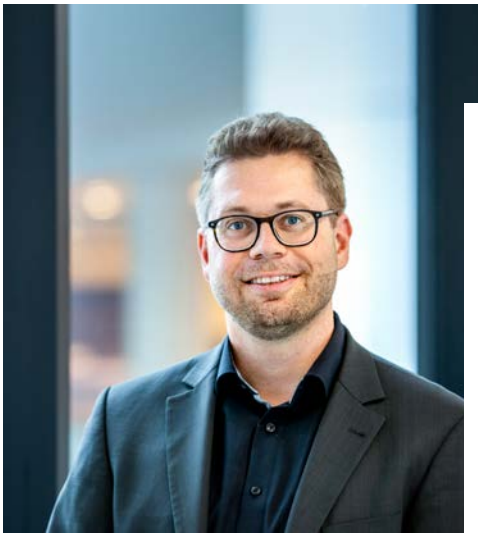
The link via which electricity will flow from the offshore North Sea wind farms via Hanekenfähr **(1)** to Frankfurt **(4)**, where it will supply consumers such as the world's largest Internet node DE-CIX **(5)**, is more than 600 kilometres long. Amprion is consequently upgrading the grid at a number of different locations. This includes the line section between Dortmund-Kruckel and Dauersberg **(2)** and the Kriftel transmission substation in the Taunus region **(3)**. Some 100 or so weather stations are also to be installed between the River Ems in the north-west and the River Main to help manage weather-dependent operation of the overhead power lines.

1

GRID CONNECTION SYSTEM

Welcome, wind power!

Offshore wind power is becoming increasingly important. One of Amprion's responsibilities is to connect new wind farms in the North Sea to the onshore electricity grid. The power will initially flow as direct current through up to 280 kilometres of submarine and underground cables until it reaches the small town of Hanekenfähr in the Emsland region. It's here that Amprion will build the first of two converters by 2028. These are high-tech installations that convert direct current to alternating current, the standard form of electricity on the grid. "There's no more room for them on the site of the existing transformer substation," says grid planner Christian Klein. The new facilities are therefore being built on a plot of land two kilometres away. It's the size of five football pitches. An overhead line that has until now been used to feed power from a nuclear power plant to this transformer substation will connect the converter and the substation. But this nuclear plant will be taken off the grid at the end of 2022. This will free up transmission capacity at this grid node, which will then be able to be redeployed to transmit wind power.



WEATHER MONITORING STATIONS

Natural cooling

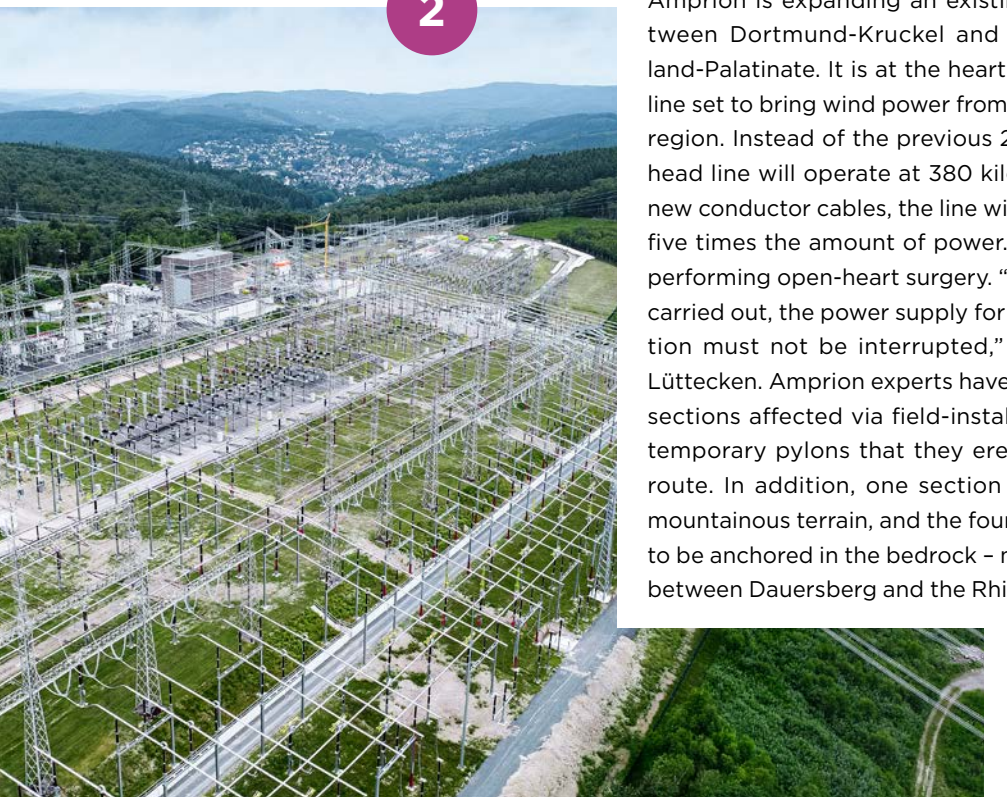
Grid optimisation first, then expansion: this is the principle Amprion is following as it examines the possibilities for transmitting more electricity between Hanekenfähr and Frankfurt using existing lines. One method of achieving this goal is, for example, “weather-dependent operation of overhead lines”. It is founded on the phenomenon that enables conductor cables to carry more current without overheating when outside temperatures are low. Amprion’s grid planners want to take advantage of this natural cooling effect. Around 100 monitoring stations installed between Emsland and the Rhine-Main area are to deliver the necessary weather data. “They are the basis for accurate forecasts that show how much the conductor cables can be loaded under the prevailing weather conditions,” says Lars Henter, Head of Power Circuit Capacity at Amprion. Based on this data, algorithms employed in the Brauweiler System Operation and Control Centre determine at which times more current can flow through the lines. In this way, power surges can be cushioned – and we gain additional time in which to carry out necessary expansion work on various route sections.

2

GRID EXPANSION

New lines with greater capacity

Amprion is expanding an existing 126-kilometre route between Dortmund-Kruckel and Dauersberg in the Rhineland-Palatinate. It is at the heart of the future power supply line set to bring wind power from the north to the Rhine-Main region. Instead of the previous 220 kilovolts, the new overhead line will operate at 380 kilovolts. In combination with new conductor cables, the line will be able to transmit around five times the amount of power. The expansion work is like performing open-heart surgery. “Despite the measures being carried out, the power supply for the Hagen-Siegen conurbation must not be interrupted,” says grid planner Bastian Lüttecken. Amprion experts have to reroute the supply in the sections affected via field-installation cables or run it over temporary pylons that they erect adjacent to the existing route. In addition, one section of the route runs through mountainous terrain, and the foundations for the pylons have to be anchored in the bedrock – no easy feat. The connection between Dauersberg and the Rhine-Main area already exists.

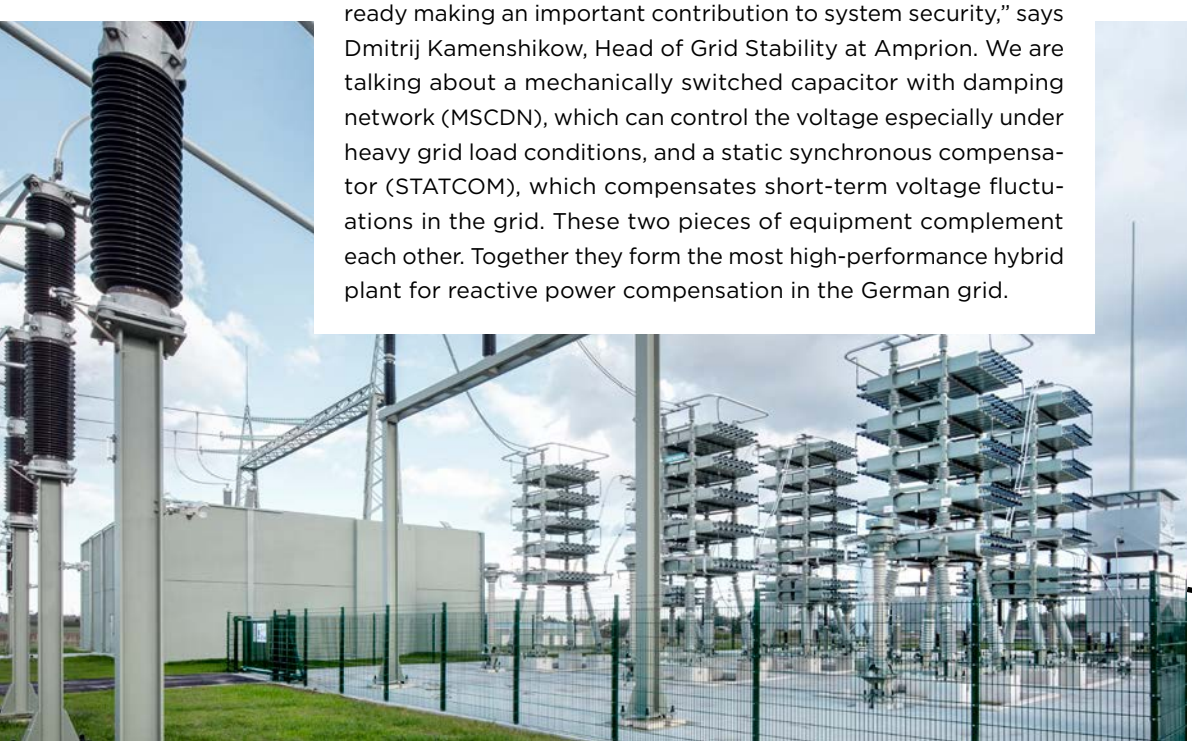


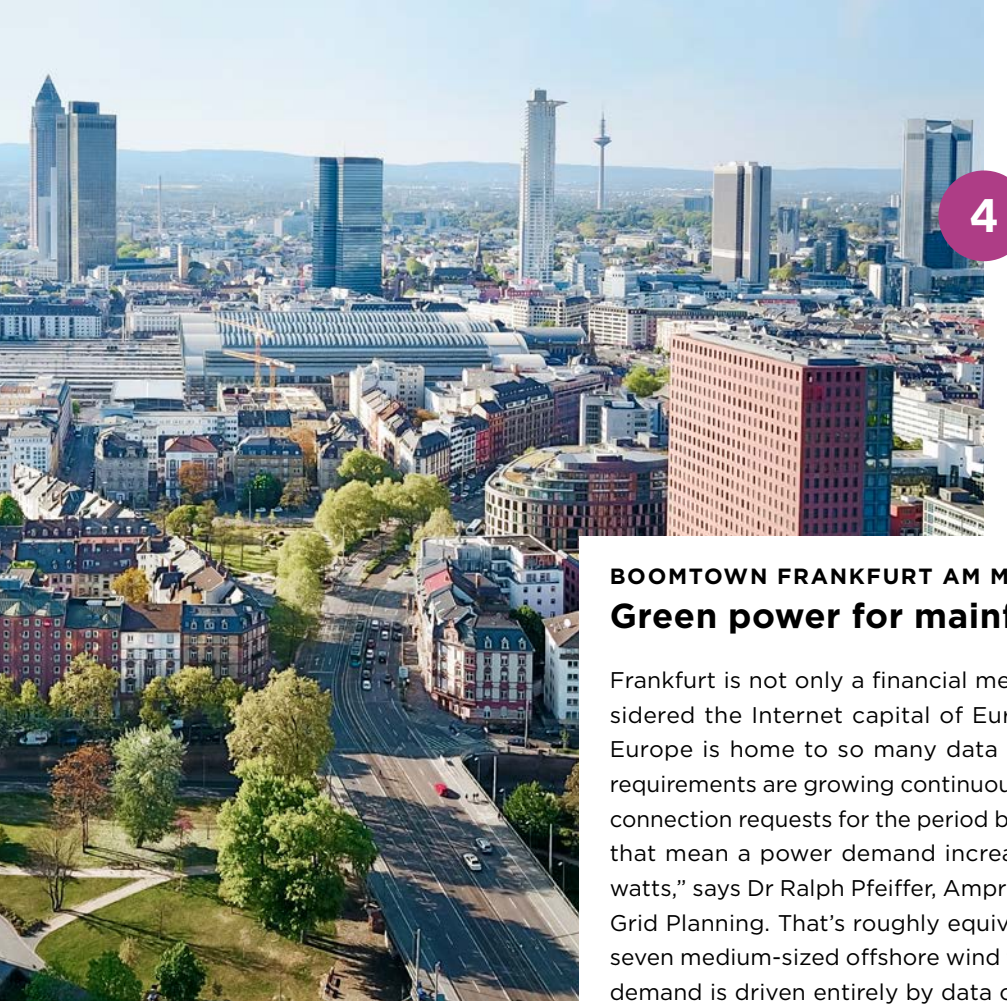
3

KRIFTEL SUBSTATION

Grid nodes with tasks full of tension

The Kriftel transformer substation, located in the Taunus region, is one of the most important grid nodes in the Greater Frankfurt area. It connects the transmission grid – which will in future operate at a voltage of 380 kilovolts – with the 110-kilovolt distribution grids in the region. New transformers perform this task. Another important function of the substation is to provide what's known as "reactive power". With their help, voltage fluctuations in the grid can be compensated. Until now, this has been done by generators in large power plants – but these are being taken off the grid as part of the energy transition. "Our two state-of-the-art reactive-power compensation devices in Kriftel are already making an important contribution to system security," says Dmitrij Kamenshikow, Head of Grid Stability at Amprion. We are talking about a mechanically switched capacitor with damping network (MSCDN), which can control the voltage especially under heavy grid load conditions, and a static synchronous compensator (STATCOM), which compensates short-term voltage fluctuations in the grid. These two pieces of equipment complement each other. Together they form the most high-performance hybrid plant for reactive power compensation in the German grid.





4

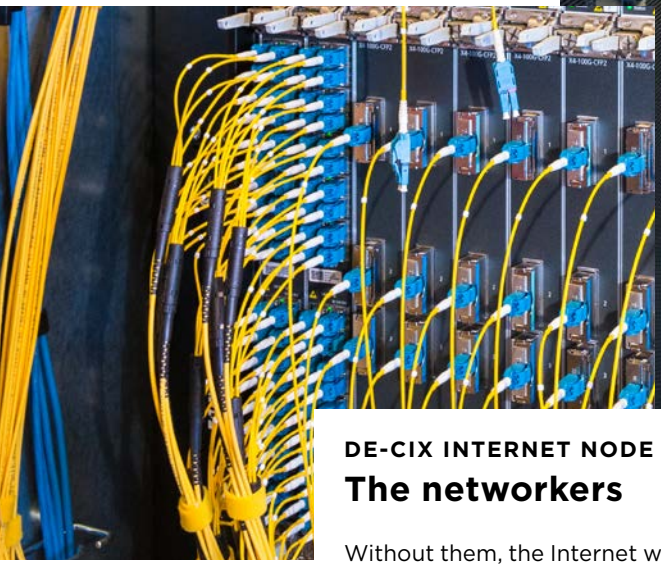
BOOMTOWN FRANKFURT AM MAIN

Green power for mainframes

Frankfurt is not only a financial metropolis; it's also considered the Internet capital of Europe. No other city in Europe is home to so many data centres. Their energy requirements are growing continuously. "We have received connection requests for the period between now and 2028, that mean a power demand increase of up to 3.5 gigawatts," says Dr Ralph Pfeiffer, Amprion's Head of Regional Grid Planning. That's roughly equivalent to the output of seven medium-sized offshore wind farms. "This additional demand is driven entirely by data centres," Pfeiffer adds. In order to process the increasing amounts of data, the performance of mainframe computers is also increasing. Running and cooling these more powerful systems means greater power consumption. And the data centres get this power from local distribution grids, which in turn are connected to the transmission grid. Amprion is currently tracking a dozen projects in the region with the goal of supplying them with green electricity.

New data centres increase power demand, says Dr Ralph Pfeiffer, Head of Regional Grid Planning at Amprion.

5



Winners of digitalisation: the DE-CIX Internet node is where all the different threads of communication come together.

DE-CIX INTERNET NODE

The networkers

Without them, the Internet wouldn't work: DE-CIX operates the largest Internet node in the world in Frankfurt. More than 1,000 network operators, Internet service providers, content providers and company networks link up here to exchange data. "Our equipment is spread across 37 data centres located in Frankfurt," says the company's CEO Harald A. Summa. In addition to DE-CIX, each power system operator has other customers they supply and who also require a lot of energy. The power requirements of data centres are enormous. Summa is certain that the number of such centres in Frankfurt will continue to grow. After all, digitalisation is still in its infancy. "In Frankfurt alone, there are plans to build nigh on ten new data centres in the near future," he reveals. Hundreds of new facilities will be added across Germany in the next few years. This will also increase the need to transmit the electricity required to run these many new data centres around the country.

3 questions for

Harald A. Summa

CEO of the DE-CIX Internet node

Why is the Internet node with the highest data throughput in the world located in Frankfurt of all places?

When we founded DE-CIX in the mid-1990s, Frankfurt was the only city in Germany with a fibre-optic network. Such infrastructure is crucial for transmitting large volumes of data. We exploited what was back then a key asset of Frankfurt to connect clients with us.

How important is a reliable power supply for the computers?

If our Internet node suffered an outage, it could have serious consequences for the entire economy. This is why we place exceedingly high demands on the data centres we work with. They have to guarantee an uninterruptible power supply – comprising several circuits supplied by different power utilities. Of course, all of this presupposes reliable, secure power grids.

How are data traffic volumes developing?

The volume of data being transmitted is growing non-stop. Every year, we invest between four and six million euros to create additional computer capacity. This increases the level of power consumption – even if the latest-generation equipment uses far less electricity than previous generations of IT equipment. And the ongoing Covid-19 pandemic has upped traffic levels even further: video conferencing traffic alone has increased by 50 per cent and led to 10 per cent growth in data throughput in Frankfurt. In 2020, we surpassed the symbolic milestone of 10 terabits per second for the first time here in Frankfurt. This is equivalent to the amount of data needed to stream 2.2 million high-definition videos all at the same time.

Deep dive into the grid

THE NEW SYSTEM OPERATION AND CONTROL CENTRE IN BRAUWEILER

Amprion is paving the way for a climate-neutral energy system. The task of controlling this system demands innovative and powerful technologies. Amprion has made its System Operation and Control Centre in Brauweiler near Cologne fit for the future by completely rebuilding it. Men and women work there in shifts to keep the power grid functioning stably and reliably – and not only in Amprion's control area, but also in Germany and Europe. To this end, they monitor the current flows, voltage and frequency of the grid in real time. The expansion of renewables poses enormous challenges with respect to system operation and control. The new System Operation and Control Centre helps to master them – as an important milestone on Amprion's way to becoming a next-generation transmission system operator.

Text HEIMO FISCHER
Photos MARCUS PIETREK

At the heart of grid management: the video wall in the Brauweiler System Operation and Control Centre is the largest in Europe. At the click of a mouse, not only power lines belonging to Amprion, but also those of neighbouring grid operators in continental Europe's interconnected grid are displayed.

Photo DR MATTHIAS LIVROZET

DR CHRISTOPH SCHNEIDERS
Head of the System Operation and Control Centre in Brauweiler

EXPERT IN VISUALISATION

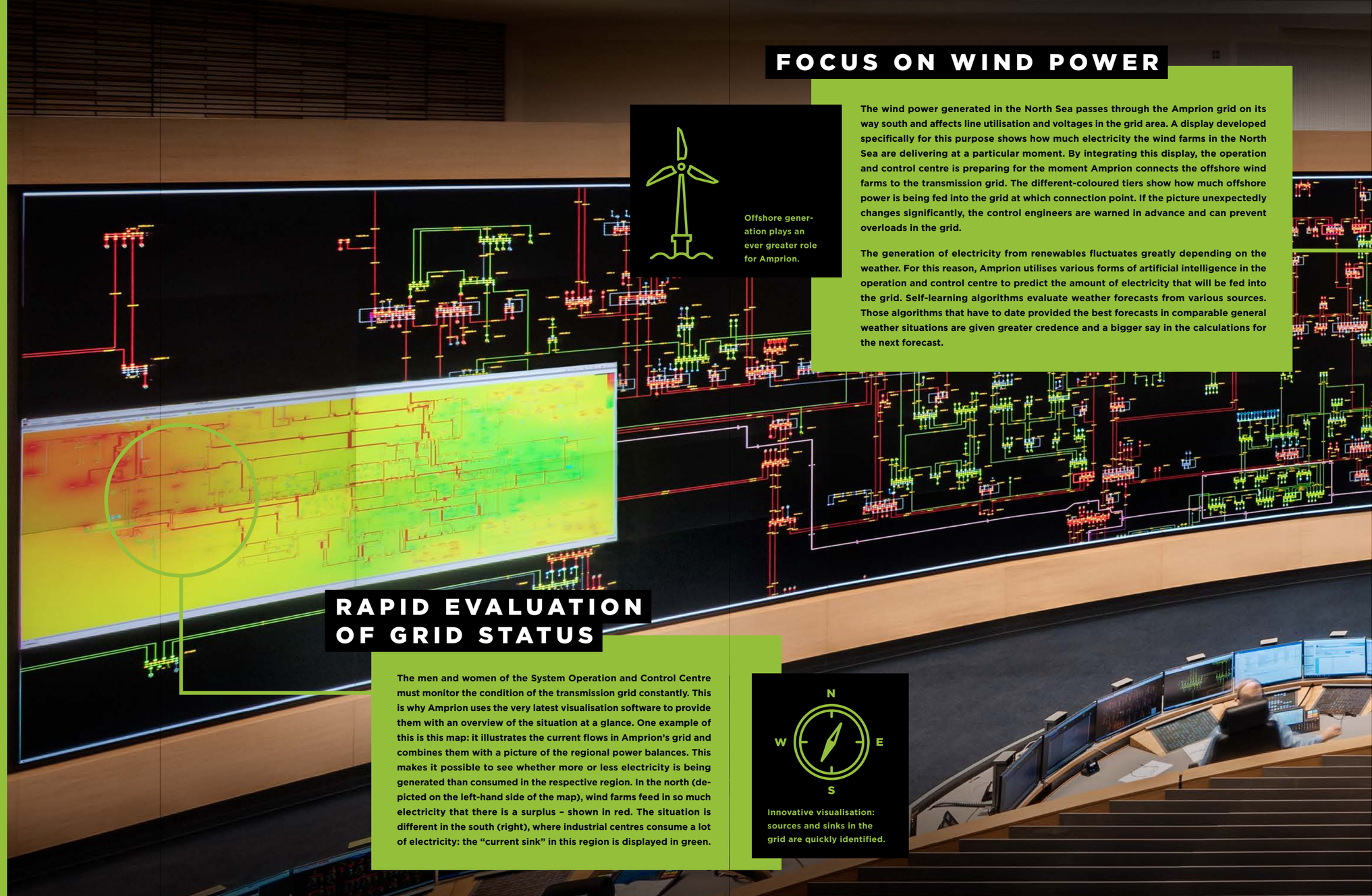
Dr Christoph Schneiders heads up Amprion's System Operation and Control Centre in Brauweiler. "It's the nerve centre of our grid management system," says the 41-year-old electrical engineer. He is one of the people who helped develop the new System Operation and Control Centre. He has a doctorate in the field of visualisation for control systems. How complex situations in transmission networks can be visualised in a comprehensible way was the subject of his doctoral thesis. There's one thing he's absolutely certain about: "The climate goals that Germany and Europe have set themselves can only be achieved if we integrate renewable energies into the power system and also introduce them in other sectors. The new System Operation and Control Centre will play a key role in this development."

WATCHING OVER EUROPE

In the System Operation and Control Centre, our engineers monitor the current flows, voltage and frequency levels of the transmission grid. The most important tool that helps them to carry out this task is a video wall that measures an amazing 108 square metres – one of the largest in the world in the energy sector. "It rightly reflects the degree of system responsibility Amprion holds for the stability of the German and European power grids," notes Dr Christoph Schneiders, boss of the Brauweiler control centre. Among other things, his team also keeps an eye on the transmission grids between northern France and the Czech Republic, as well as between Denmark and northern Italy – and therefore covers the largest monitoring area supported by online information in Europe. "Europe's national power grids have long been interconnected," he says. "If there is a problem in a neighbouring country, this can affect us, too. That's why we monitor such a large area and are also able to offer assistance if needed."

At the click of a mouse, lines of continental Europe's interconnected grid can be displayed on the video wall. Power lines, transformer substations and switchgear are depicted in different colours. Two state-of-the-art data centres process millions of pieces of information from the grid every day. For example, the state of more than 50,000 switchgears in 800 substations and the measured values of around 2,800 lines are recorded every three seconds. These are visualised in the System Operation and Control Centre and combined to form a continuously updated overview of the situation.

Graphics, tables and digital indicators ("needles") complete the image of the power grid. Among other things, they display the voltage, current flows and frequency in Amprion's grid. The expansion of renewable energies and the growth in electricity trading across borders pose increasing challenges to the experts in Brauweiler. The more electricity is generated from wind and the sun (depending on the prevailing weather), the more complex the processes in the transmission grid become. At the same time, electrical energy in Europe's internal electricity market is being transported over ever greater distances to consumers. The voltage, frequency and current must be monitored constantly in order to assess grid and system reliability. In order to regulate the voltage, the control engineers feed in or compensate reactive power as required. To stabilise the frequency, they can deploy balancing energy; that is, instruct power plants to feed more or less electricity into the grid, for example. Current flows can be controlled by switching measures or interventions in power plant schedules – what's called "redispatch".



Offshore generation plays an ever greater role for Amprion.

FOCUS ON WIND POWER

The wind power generated in the North Sea passes through the Amprion grid on its way south and affects line utilisation and voltages in the grid area. A display developed specifically for this purpose shows how much electricity the wind farms in the North Sea are delivering at a particular moment. By integrating this display, the operation and control centre is preparing for the moment Amprion connects the offshore wind farms to the transmission grid. The different-coloured tiers show how much offshore power is being fed into the grid at which connection point. If the picture unexpectedly changes significantly, the control engineers are warned in advance and can prevent overloads in the grid.

The generation of electricity from renewables fluctuates greatly depending on the weather. For this reason, Amprion utilises various forms of artificial intelligence in the operation and control centre to predict the amount of electricity that will be fed into the grid. Self-learning algorithms evaluate weather forecasts from various sources. Those algorithms that have to date provided the best forecasts in comparable general weather situations are given greater credence and a bigger say in the calculations for the next forecast.

RAPID EVALUATION OF GRID STATUS

The men and women of the System Operation and Control Centre must monitor the condition of the transmission grid constantly. This is why Amprion uses the very latest visualisation software to provide them with an overview of the situation at a glance. One example of this is this map: it illustrates the current flows in Amprion's grid and combines them with a picture of the regional power balances. This makes it possible to see whether more or less electricity is being generated than consumed in the respective region. In the north (depicted on the left-hand side of the map), wind farms feed in so much electricity that there is a surplus – shown in red. The situation is different in the south (right), where industrial centres consume a lot of electricity: the "current sink" in this region is displayed in green.

Innovative visualisation: sources and sinks in the grid are quickly identified.

RESPONSIBILITIES FOR EUROPE

Because Amprion's grid is located right at the heart of Europe, it has become the hub of European electricity trading between north and south, east and west. Amprion has taken on far-reaching coordination responsibilities in Europe's EHV grid, without which the European internal electricity market wouldn't function. This is why the video wall in the Brauweiler System Operation and Control Centre also includes a map of Europe that displays system statuses, alarm messages as well as cross-border electricity flows. Countries coloured blue are currently importing electricity, while countries coloured red are exporting electricity. Imbalances can also be easily identified and countermeasures initiated more quickly. To this end, Amprion works closely with the other transmission system operators in Europe and, as "synchronous area monitor" (together with Swissgrid), has a key role in keeping the system frequency stable in the Continental Synchronous Area.

Amprion has far-reaching coordination responsibilities for Europe.

INNOVATIONS IN THE GRID

The energy system is changing not just because of the expansion of renewables. Cross-border exchanges of electricity also continue to increase. This requires high-capacity "power bridges" that connect the national grids. One of them is ALEGrO – the first direct power link between Germany and Belgium. This 90-kilometre-long power line comprises an underground cable between Aachen and Liège and went into service in 2020. ALEGrO is shown in purple on the video wall because it is a DC link. The current flows are easier to control than in the case of AC links. But at the same time, it's a real challenge to coordinate operation of the new DC link in the close-meshed AC transmission grid. Amprion will be able to profit from its experiences with ALEGrO when, for example, the 340-kilometre Ultranet DC link between North Rhine-Westphalia and Baden-Württemberg goes into service.

Graphical symbols: the sine wave stands for alternating current, the double line for direct current.

KEEPING THE GRID IN EQUILIBRIUM

Power generation and consumption must be in equilibrium at all times throughout continental Europe's interconnected grid, aka the Continental Europe Synchronous Area. If it isn't, the frequency will deviate from the specified value of 50 hertz and the system may become unstable. A kind of tachometer on the video wall in Brauweiler displays the frequency deviation at any given moment. If the frequency fluctuates by even a few millihertz, the digital needle deflects. Usually, it's always moving just a bit. But if a deviation in one direction persists over a longer period of time or if the deflections become too great, the control engineers have to take action. They do so by using balancing energy and other instruments. In order to ensure system reliability and availability, they may, in exceptional cases, take comprehensive measures. Here, too, they are supported by state-of-the-art protection and control equipment. Extreme situations and system disturbance scenarios are regularly trained for in the simulator.

50 Hz

Generation and consumption must always be in equilibrium.

HOW MUCH WILL THE FUTURE COST?

Text VOLKER GÖTTSCHE
Photos JULIA SELLMANN

Amprion is set to invest more than 24 billion euros in grid expansion over the next ten years. How does the company intend to finance this? CFO Peter Rüth talks about his financing plans – and what investors like about Amprion.

Mr Rüth, let's talk about money. What will it cost to make Germany's power grid fit for the energy transition?

Germany's four TSOs alone expect a total investment requirement in excess of 100 billion euros between now and 2035. This includes both onshore and offshore grid expansion, as well as linking the offshore wind farms to the power grid. This will see us make a significant contribution towards the goal of decarbonisation and towards the success of the energy transition, too. These investments, which will be spread over many years, will enable us to build a sustainable energy system that will cover the nation's future electricity needs and also help to ensure Germany becomes climate-neutral.

What investments will Amprion have to make?

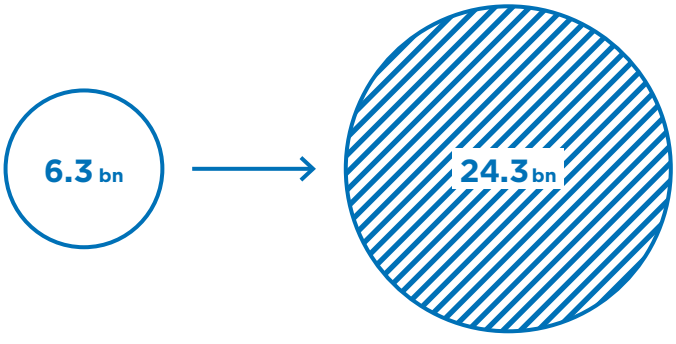
Our current plans for the next ten years detail an investment volume of just over 24 billion euros. The relevant projects are all driven by the energy industry and have been approved by parliament. These include four offshore grid connection systems and two DC links to run from northern to southern Germany, as well as a large number of regional, decentralised measures in the AC grid. Their importance in respect of the energy transition is often underestimated. In addition, we will, among other things, integrate new, innovative operating facilities into our grid that will help to keep the voltage stable. All measures planned will play their part toward creating a climate-neutral energy system by 2050 and keeping it secure and stable. As a next-generation TSO, we want to help shape the transformation in the best possible way, and we are also looking for solutions that span different energy sources.

How do your shareholders contribute to financing your investments?

All of our shareholders are in it for the long term. They provided Amprion with additional equity to the tune of 400 million euros in 2015 and did the same again in 2020. We see this as a great sign of confidence. And our shareholders have also already indicated that they would like to continue to work closely with us on the energy transition in the future. They stand firmly behind our investment programme. However, equity capital is just one important component of our financing strategy. There is also self-financing from net cash flow, which enables us to partially finance investments from liquid assets. At the same time, the company can also use retained earnings for investments. We also make use of various debt instruments. In this case, we have raised finance primarily through debenture and registered bonds, supplemented by loans and development loans. However, this mix of financial instruments will not be sufficient to implement our investment programme over the next ten years. We will have to position ourselves even more broadly if we are to succeed in raising such massive funds.

AMPRION INVESTMENTS IN GRID EXPANSION 2009 TO 2030

Up to 2020, Amprion invested a total of around 6.3 billion euros in the expansion and upgrading of the transmission grid. Between now and 2030, we will be investing a further 24.3 billion euros.



Investments 2009–2020

Investments 2021–2030 (forecast*)

* As at December 2020.

What are you going to do?

In particular, we are considering making greater use of the international capital markets and expanding the circle of debt capital investors through new financial products. One of my tasks as Chief Financial Officer is to make the necessary preparations. It was important to the Supervisory Board at Amprion to strengthen this function within the Management Board. This is why I was brought on board in April 2020. One of my first financing projects was to set up a commercial paper programme in October 2020, with a maximum issue volume of 900 million euros. By introducing this short-term, flexible instrument, we have put the financing structure of our grid business on an even stronger footing. This was followed in November 2020 by the largest debenture and registered-bond transaction to date, with a volume of 350 million euros. We will continue on this path, because we have been receiving some very positive signals from the market.

What do investors like about Amprion?

It may sound obvious, but we do know our business. We know how to plan and implement projects successfully. Despite the coronavirus pandemic, we pushed on with our grid upgrade and expansion work during 2020 at a cost of more than one billion euros – a record investment! As a TSO, we have a robust and secure business model that is independent of economic cycles. Our grid expansion projects are approved by the Federal Network Agency as the relevant regulatory authority. And real physics are behind every project. We invest in cables, facilities and technologies. That is, we

have actual, tangible assets. The whole thing stands on an absolutely sound financial and economic basis, a fact that is acknowledged by external observers. Which is why the rating agencies continue to rank us in the investment grade range.

Amprion scores with stability and safety. What about the prospects for growth?

One thing is clear: a company that is growing profitably is much more appealing to investors than one that has to downsize to return to health. We want to continue to grow at a healthy rate within our existing business model. This includes the offshore sector, too. That said, we will no doubt explore opportunities in neighbouring fields during the course of the energy revolution. One example of this is the matter of hydrogen. Amprion thinks of the energy system in a cross-sectoral way. We are working on the energy transition, not the electricity transition. This is one of the strengths that we want to build on. All this makes us attractive to investors.

What other projects are you working on at the moment?

We have to create conditions that make it easier for international investors to understand what we're about and to appraise us even better. In future, we are therefore going to prepare our accounts in accordance with the International Financial Reporting Standards (IFRS). In this context, we will also be sounding the bell for our move into today's world of SAP HANA. At the same time, we will be focusing Amprion much more strongly on the issue of sustainability. In doing so, we will be guided by the German Sustainability Code, among other things. According to the EU taxonomy for sustainable activities introduced in 2020, we are already considered sustainable with our business model. This is in line with our social responsibility – and is also important to me personally.

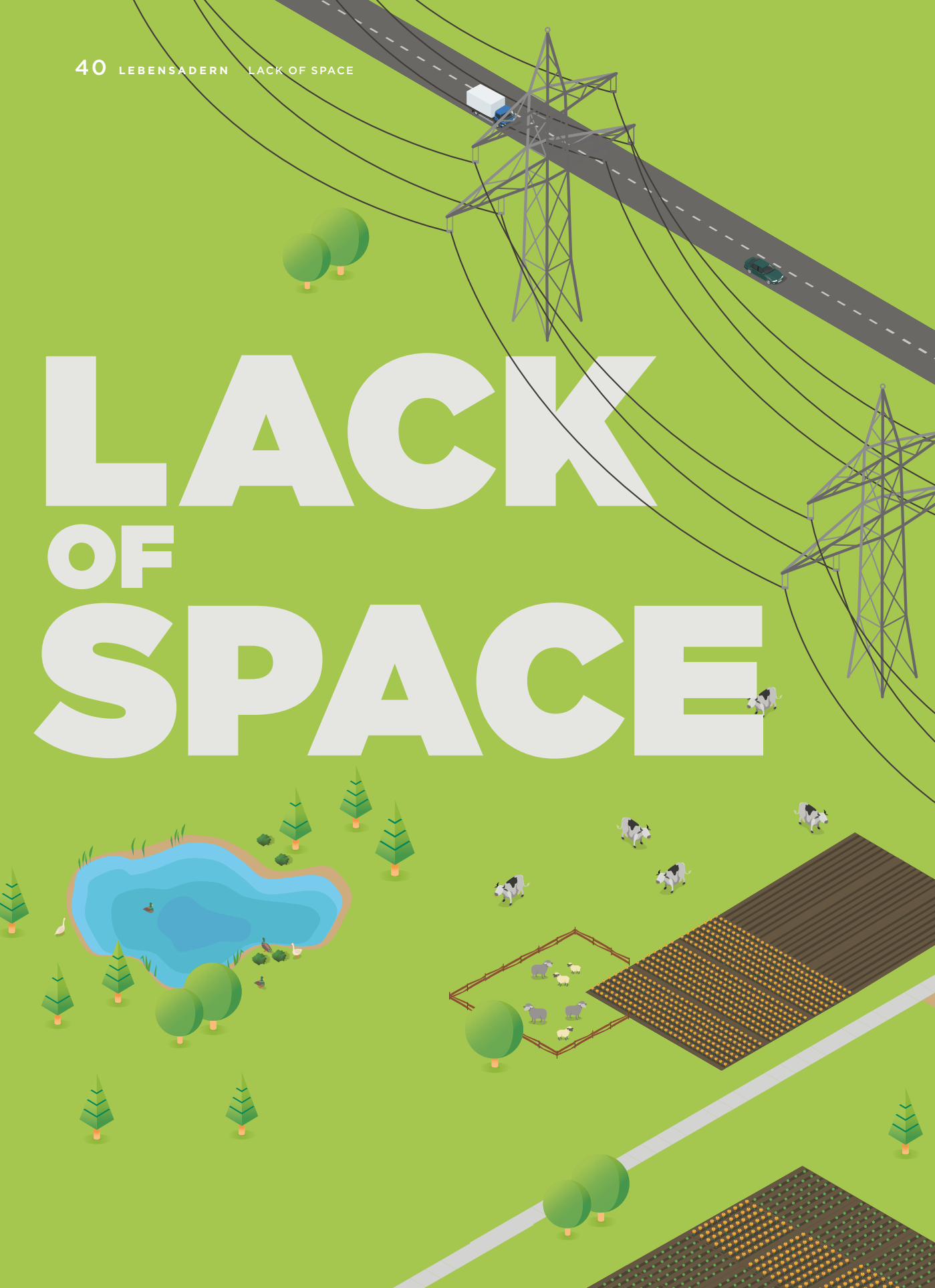
In what way?

No company today can afford to ignore the environmental and social dimensions of its actions. At Amprion, we feel connected to mankind, the environment and the economy. It's part and parcel of our corporate identity: Amprion connects. It's these feelings of solidarity, of being connected, that lead us to act – and to pave the way for a climate-neutral, safe and efficient energy system. At the same time, more and more institutional investors are looking for companies that operate along sustainable lines. These interests find each other in the equity market. And we want to take full advantage of this opportunity.

“No company today can afford to ignore the environmental and social dimensions of its actions.”

ABOUT PETER RÜTH

Peter Rüth has been a member of the Management Board of Amprion since April 2020. As Chief Financial Officer (CFO), he is responsible for the following areas: Finance, Controlling, Investment Management, Accounting, Taxes, Insurance, Regulation Management and Purchasing.



LACK OF SPACE

Amprion is expanding the power grid so that renewable energies reach the people. But space for new lines and facilities, such as substations, is at a premium. Suitable sites are a scarce commodity. Urban developer Tim Tröger and communications expert Katrin Schirrmacher are in agreement: this makes it all the more important to communicate with the people on the ground.

Text ALEXANDRA BRANDT

Mr Tröger, how does this stand with regard to land consumption in Germany?

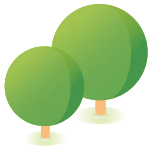
TIM TRÖGER Over the last 60 years, the amount of land in Germany taken up by settlements and transport infrastructure has more than doubled. Presently, the rate at which land is being turned over to such usages averages 56 hectares per day. This equates to around 78 football pitches, and includes new development land and sites or routes for infrastructure such as roads and power lines. With a view to future generations, this cannot continue, because agricultural land and fertile soil are in limited supply. For this reason, and within the framework of Germany's Sustainability Development Strategy, the Federal Government has set itself a target of reducing new land use for settlements and transport infrastructure to less than 30 hectares per day by 2030.

Ms Schirrmacher, what does this development mean for Amprion?

KATRIN SCHIRRMACHER It poses major challenges for us. As a grid operator, we have to find ways of constructing planned power lines that are both legal and take the interests of all those affected into account as much as possible. Legislation stipulates that new power lines may cut across built-up areas or nature conservation areas only in exceptional cases. What's more, technical standards must be complied with so that the future lines can be operated safely. When land becomes scarce, this also leads to conflicts of interest with local communities and authorities. Wherever new settlements or industrial estates are set to be built, there's no way we can plan new power lines. Moreover, farmers want to preserve farmland, because very often the redesignation of land is at the expense of agriculture. In the end, we're often left with very few options for where we can build the power lines that are so urgently needed to realise the energy transition.

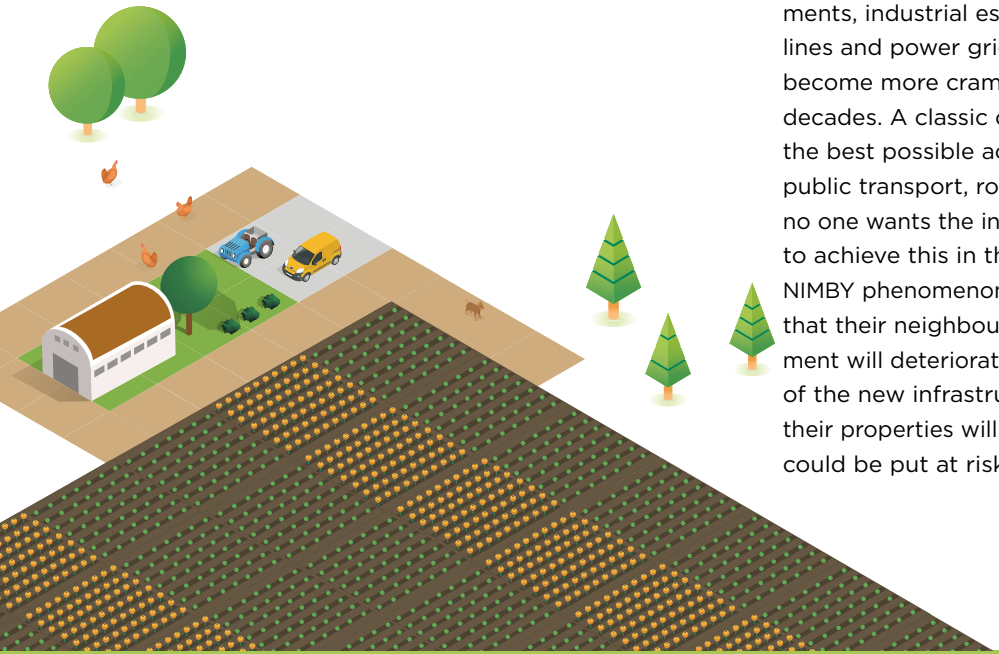
TIM TRÖGER

is a trained architect and since 1997 co-owner of the planning agency StadtLabor based in Leipzig. Urban planning and traffic concepts are among the focal points of his work.



How can infrastructures be planned under these conditions?

TRÖGER Wherever possible, existing infrastructure corridors should be used so that we don't encroach on ever more plots of "virginal" land. High-speed-railway lines or power lines often run alongside motorways for good reason. However, even the decision to renew or upgrade infrastructure along existing corridors often causes problems. Particularly in densely populated Federal states such as North Rhine-Westphalia, settlements, industrial estates, roads, railway lines and power grids have expanded and become more crammed together over decades. A classic conflict: everyone wants the best possible access to the Internet, public transport, roads and electricity. But no one wants the infrastructure necessary to achieve this in their own back yard – the NIMBY phenomenon. Local residents fear that their neighbourhood and living environment will deteriorate due to the proximity of the new infrastructure, that the value of their properties will fall or that their health could be put at risk by noise or emissions.



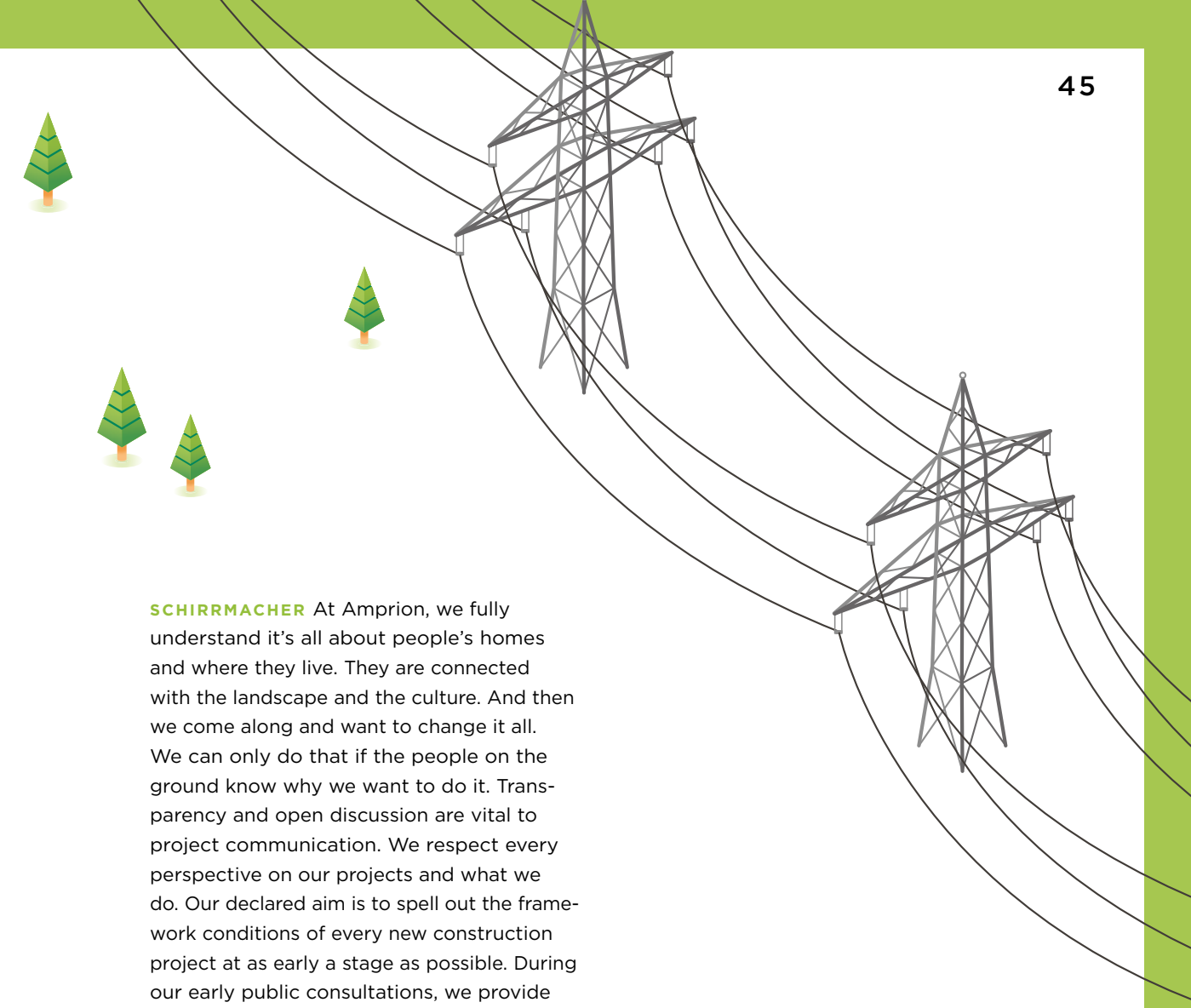
SCHIRRMACHER We encounter this conflict in many projects. And, as you correctly point out, this conflict had often evolved over time owing to the fact that cities, towns and villages have yearned for and approved new residential and industrial zones throughout the past 60 years. In Moers, for example, the neighbourhood of Utfort has over the last few decades expanded ever closer to the transformer station located there and the power lines that lead to it. This urban development has already been sharply criticised by local politicians, among others. Now, in the course of a project in what is known as the "Rheinschiene" – one of our key north-south arteries – we have to modify the transformer station and upgrade the incoming and outgoing power lines. This has led to massive resistance from the locals. What's more, owing to the lack of space that has arisen as a result of this historical development, there is no alternative site available locally on which to "rehouse" our power infrastructure.

How can the various concerns and interests be reconciled?

TRÖGER Transparency and dialogue are important; they can lead to solutions being found. Nothing is worse than when those affected feel that decisions have been made over their heads. All parties involved should be honest, be open with one another, disclose their interests, take opposing views on board – even above and beyond legally prescribed procedures. Comprehending a zoning plan is an art in itself. Laymen very quickly feel left out of the loop. I always recommend approaching the public with clear images and easy-to-read plans and models. And to continually communicate exactly why our society needs this infrastructure.

KATRIN SCHIRRMACHER

is Head of Project Communication at Amprion. Together with her team, she informs citizens about the company's grid expansion projects and answers questions from associations, politicians and the press.



SCHIRRMACHER At Amprion, we fully understand it's all about people's homes and where they live. They are connected with the landscape and the culture. And then we come along and want to change it all. We can only do that if the people on the ground know why we want to do it. Transparency and open discussion are vital to project communication. We respect every perspective on our projects and what we do. Our declared aim is to spell out the framework conditions of every new construction project at as early a stage as possible. During our early public consultations, we provide information before the official approval process even begins. We explain what we plan to do – and why we plan things the way we do. This also provides clarity on where and how citizens can get involved in the subsequent approval procedures.

TRÖGER That all adds up to several thousand kilometres on business trips every year …

SCHIRRMACHER That's for sure. Before Covid-19, we used to organise more than 600 dialogue events in some years. Basically, it's important that we are personally out and about in the respective project regions. It's the only way to build up trust. Last year, it was almost impossible to meet people in person due to the pandemic. That has presented us with completely new challenges. But even under the difficult circumstances, we did the best we could to listen to and understand locals' concerns. For the most part, we have managed to keep talking with one another online or over the phone. Where possible, we check to see if we can incorporate their comments into our planning. Sometimes there are ways to, for example, optimise the route of an existing line or to use a different type of pylon. However, especially where space is limited, there's often no option. We also have to communicate this honestly to the locals, however difficult it may be at times.


Achtung!
Wärmebehandlung (Schweißen oder Richten)
ist an tragenden Bauteilen nur mit
schriftlicher Genehmigung der ÖBB erlaubt!
4,50m
4,50m

Dirk th

e Great

Transformers in Amprion's power grid provide millions of people with a secure and reliable supply of electricity. If these machines – which weigh more than just a few tonnes – need to be replaced, the new unit travels to the installation site by rail. This is why Amprion has had the largest rail vehicle in Germany built. The story of a giant.

Text HEIMO FISCHER

Photos RAPHAEL FOIDL

Its nickname is Dirk – and there's no missing it. Not just because of its sheer size. This matt grey leviathan is 52 metres long, weighs 220,000 kilos and pulls 500-tonne loads. Thanks to its curved, beak-shaped steel arms, it's also known in German as a "Tragschnabelwagen" (Schnabel = bird's beak), or "Schnabel car" in English. It's also known as the TSW 500, for short. Dirk is the latest member of the family of heavy-duty railcars Amprion uses to transport huge transformers. Among trainspotters, Dirk the Great is already quite a sensation. "That's because it's the heaviest rail vehicle in Germany," says Felix Mangold.

"It's the heaviest rail vehicle in Germany."

FELIX MANGOLD
Mechanical engineer at Kübler

The qualified mechatronics and mechanical engineer knows Dirk better than almost anyone else. He works for the Swabian company Kübler, which built the TSW 500 for Amprion. Mangold spent several years working on the car. He planned, calculated and kept checking the calendar to make sure Dirk would be completed on time. September 2020 saw it all come together – and Dirk was handed over to Amprion. At the brief ceremony held at Kübler's heavy-cargo terminal at the Port of Mannheim, the 31-year-old had mixed feelings. "It hurts a little to let go," Mangold admits. But it's also great to see the car actually go into service.

Long search for a manufacturer

Amprion has big plans for Dirk: over the coming 40 years – that's how long the TSW 500 is intended to be in service – more than 500 transformer transport assignments are scheduled. Transformers are located in substations, where they help to secure the power supply for millions of people. Amprion regularly replaces them or brings new machines to their installation site. "Every year we add a few transformers to our grid," explains Henrik Kastner, rail operations manager at Amprion. As part of the energy transition, Amprion is expanding its grid in order to transmit more wind power from the north to the consumption centres in the south of Germany. This also includes upgrading the substations in the grid with more powerful transformers.

But heavy-duty Schnabel cars for transporting these machines are hard to come by. "We searched for a long time for a company that makes them," Kastner says. To no avail. Kübler had previously had the same problem. The heavy-cargo specialist had themselves needed new Schnabel cars, but were also unable to find a supplier. For this reason, in 2015 the forwarding company decided to design their own Schnabel car, to have the parts made to order and to assemble them themselves. "Kübler was the ideal partner for us," says Kastner and also explains where the nickname Dirk comes from: an Amprion executive whose first name is Dirk had championed the purchase. His grateful colleagues consequently named the new vehicle after him.

Schnabel cars are extraordinary vehicles. They split into two halves when in use. The transformer is then suspended in the space in-between. Thanks to the cars' smart design, the forces are transferred and distributed in such a way that the vehicles can transport the heaviest loads imaginable. As the train is allowed to travel no faster than 40 miles per hour, journeys sometimes take weeks. That's why an accommodation carriage is hooked up behind the diesel locomotive, in which the crew cooks and sleeps. The work is exhausting. During the journey, the massive load has to be adjusted again and again with the help of hydraulics to prevent it from hitting obstacles.

In their previous Schnabel cars, the men from Amprion had to stand outside to do this. "The new Schnabel car has two heated cabins," says Felix Mangold. And the technical features are also more convenient and modern now. During the handover, the mechanical engineer patiently explains the digital control system and demonstrates the joysticks and coloured buttons on the control panel. He then deftly shimmies along the massive steel girders, explaining the purpose of the many cables and pipes that run through the TSW 500.

Critical look: Felix Mangold makes sure the car functions properly (top). The height of the load can be raised and lowered remotely (right).

Family get-together: on the day of the handover, a smaller Schnabel car, which Kübler uses to transport large and heavy materials, was parked on the track to the right of Dirk.

Photo: SPEDITION KÜBLER

Long and strong: Dirk already bears the company logo (top). "He" had previously been assembled in Halle with the aid of a heavy-duty crane (right).

Vehicle completed and ready to go, mood good: Kübler boss Heinz Rößler talking to Ludger Meier, Head of Grid Projects at Amprion.

Keeping track

In mid-2019, Amprion places the order to build Dirk – and Felix Mangold goes to work. A stressful time? The mechanical engineer smiles and ponders briefly. "We had already acquired a lot of knowledge." Mangold is a technology fan and likes to talk about it. Even before the order from Amprion, he had had one Schnabel car overhauled and a new one built for Kübler. That's why he knows where to find suitable design offices, which steel companies come into question, and who he can trust to manufacture bogies, brakes or hydraulic cylinders.

25

companies worked on constructing Dirk.

Dirk's development is a complex project. Almost 200 employees from around 25 suppliers are involved. "The most important task is to keep track of everything," says project manager Mangold. Especially as the schedule is tight. For legal reasons, Dirk's construction period must not exceed twelve months.

The finished components are first sent to Kübler's headquarters in Schwäbisch Hall (south-western Germany). There they are checked and, if necessary, reworked once again. In April 2020, they travel on ten flat-bed trucks to Halle, where the Schnabel car is assembled over two days with the help of a heavy-duty crane. This phase, known as the "marriage", is a crucial time. Only then do we discover whether the work carried out has been accurate and all the parts fit together.

Flurry of activity before the marriage

As with all marriages, a flurry of activity breaks out just before the scheduled date: the electricians commissioned from an Austrian company are not allowed to travel to Germany because of the pandemic. Colleagues from Kübler have to take over the work. But unfortunately, the hotels in Halle are closed. Mangold finds a solution: "We rented a big house and lived there, observing the social-distancing rules." On the evening of the second day, everyone involved was able to relax again. Everything fits, the fitters tell us. Marriage successfully consummated!

After being assembled, Dirk – who is now capable of rolling – still has to pass one more test: the approval test on a railway test track. There are only two of these in Europe, and the one chosen is located about 60 kilometres east of the Czech capital, Prague. "Experts there put a vehicle through its paces over several days," Mangold explains. To test whether the brakes also work in an emergency, the car is uncoupled from the locomotive while travelling at full speed. Dirk masters the challenge. The safety systems function and the brakes work without fault.

After coming through the tests with flying colours, Dirk is ready to get down to business. Before handover, there's one finishing touch: the Amprion logo and stripes in the company colours are applied. After all, Dirk the Great should always cut a good figure on his journeys around Germany.

crossing borders

Amprion's grid is located at the heart of Europe. Together with international partners, many employees are working to ensure that Europe achieves its climate targets. We'd like to introduce some of them to you.

Text HEIMO FISCHER **Portraits** SELFIES

“There aren’t many jobs where you get to talk to people from 35 different countries in a short period of time. It also means you’re constantly getting to know new angles on your own work. Not only does it give me valuable new experiences, I also draw a lot of energy from it.”

YANNICK JONAT (27)
Leader of the administrative team of Joachim Vanzetta, boss of the European Network of Transmission System Operators for Electricity (ENTSO-E)

“It’s a stroke of luck to work at the interface of Europe’s transmission system operators – and to help build a climate-friendly energy system in partnership with other countries. In this way, my job enables me to fight for an issue that’s also close to my own heart.”

LISA BEUGER (41)
International Regulation Management Consultant

“In order to keep our grid stable, we are constantly coordinating with our European partners. For example, I talk to and exchange information with the Swiss TSO Swissgrid. Together with Amprion, they coordinate Europe’s interconnected grid and are therefore a key partner for us. Communication runs smoothly – which isn’t just down to the common language.”

SEBASTIAN OLIVARES (28)
is a system services engineer

“I was born in Alsace, France, and have lived in Germany for many years. I’m at home in both cultures. This helps me when I consult with my colleague from the French transmission system operator RTE. We regularly exchange information about the best components and their suppliers – helping us to support each other across national borders.”

JÉRÉMY UNTERFINGER (37)
is an electrical engineer and develops new components for overhead lines

“Unilateral national initiatives are of no use at all when it comes to setting up a climate-friendly and secure energy system for Europe. The more countries that cooperate, the better. We are currently working on integrating the Baltic states into Europe’s Continental Synchronous Area. I think it’s great to be involved in such a politically important project.”

DR ANDREAS ROEHDER (35)
works in Asset Management and passed the baton to Axel Müller on 1 February 2021

“The future A-North DC link will see us use an innovative cable technology, for which only a few manufacturers are qualified. That’s why we put our trust in international suppliers when we invited tenders for the cable systems – and also because we trust them to supply the most cost-effective solution. The two contracts – covering a total contract value of around 1 billion euros – were awarded to an Italian and a Japanese company.”

STEFAN SCHLEMPER (45)
Head of Purchasing Transmission System Requirements

Amprion connects …

millions of people and thousands of businesses in an area stretching from Lower Saxony down to the Alps. Our 2,000+ employees make sure that the grid is operated safely and dependably at all times. And to ensure they can, we're expanding it in line with consumers' needs. And we're looking ahead, working today on solutions for the decarbonised energy world of the future.

So that the lights never go out.

11,000 KM

the total length of power lines that make up the Amprion transmission grid.

64 GW

the total installed generation capacity in the Amprion grid area.

29 MILLION

the number of people supplied with electricity via the Amprion grid.

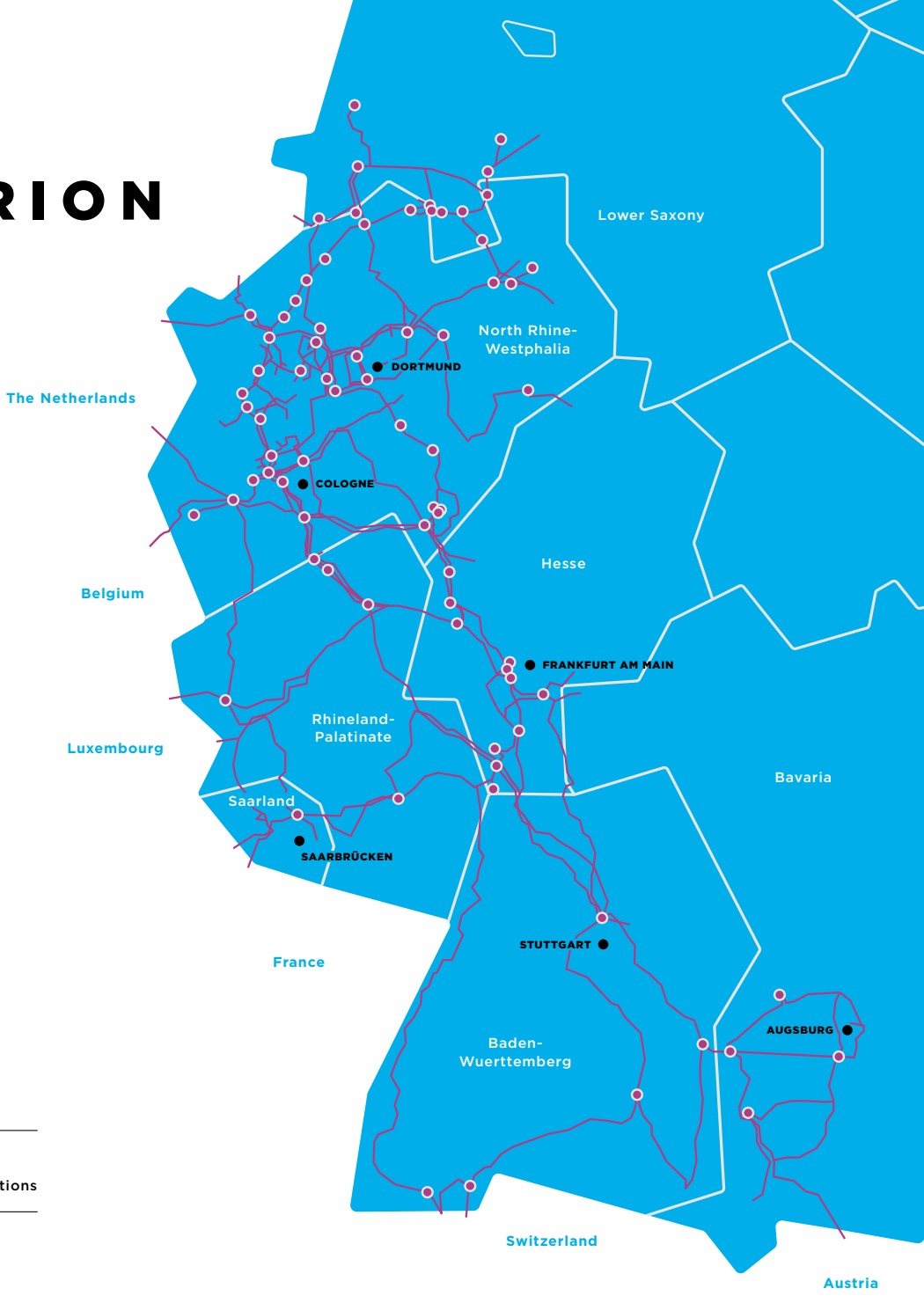
79,200 KM²

the area covered by the Amprion grid, stretching from Lower Saxony down to the Alps.

170

the number of substations that connect the Amprion grid to power utilities, regional distribution networks and our customers in industry.

THE AMPRION GRID



IMPRINT

PUBLISHER
Amprion GmbH
Phone +49 (0)231 584 914 109
Email info@amprion.net

CONCEPTION AND DESIGN
3st kommunikation GmbH, Mainz

MANAGING EDITOR
Heimo Fischer

PHOTOS
Marcus Pietrek (cover, back cover)
Frauke Schumann (page 1)
Michael Heinsen (image intro, pages 2–7)
Daniel Schumann (image intro, pages 8–9, 27 top, 28 bottom, 29 bottom)
Hartmut Nägele (pages 12, 44)
Frank Peterschröder (page 13)
shutterstock (pages 15, 28–29)
123Trimm (pages 16–17, 19, 20, 23)
iStock (pages 21–22)
Getty Images (pages 24–25)
E.ON-Netz, Detlef Gehring, 2008 (page 26)
Amprion GmbH (page 27 bottom)
DE-CIX (pages 30–31)
Mario Kirchner (page 43)

ILLUSTRATIONS
Xenia Fink (page 18)
shutterstock (pages 40–45)

NOTE
This is a translation of the German version. In cases of uncertainty or conflict, the German version shall prevail.

Amprion GmbH
Robert-Schuman-Straße 7
44263 Dortmund
Germany

June 2021