Annual Report 2015

DIALOGUE

RESPONSIBILITY

NEW START

ampr

Journal 2015

DIALOGUE

RESPONSIBILITY

NEW START

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AMPRION – A BRIEF PROFILE

Amprion GmbH is one of four transmission system operators in Germany. The company can draw on many years of experience in planning, constructing and operating the extra-high-voltage grid. Amprion employs a workforce of around 1,100.

~59 GW

the total installed capacity of the Amprion grid.

78,900 KM²

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

11,000 KM

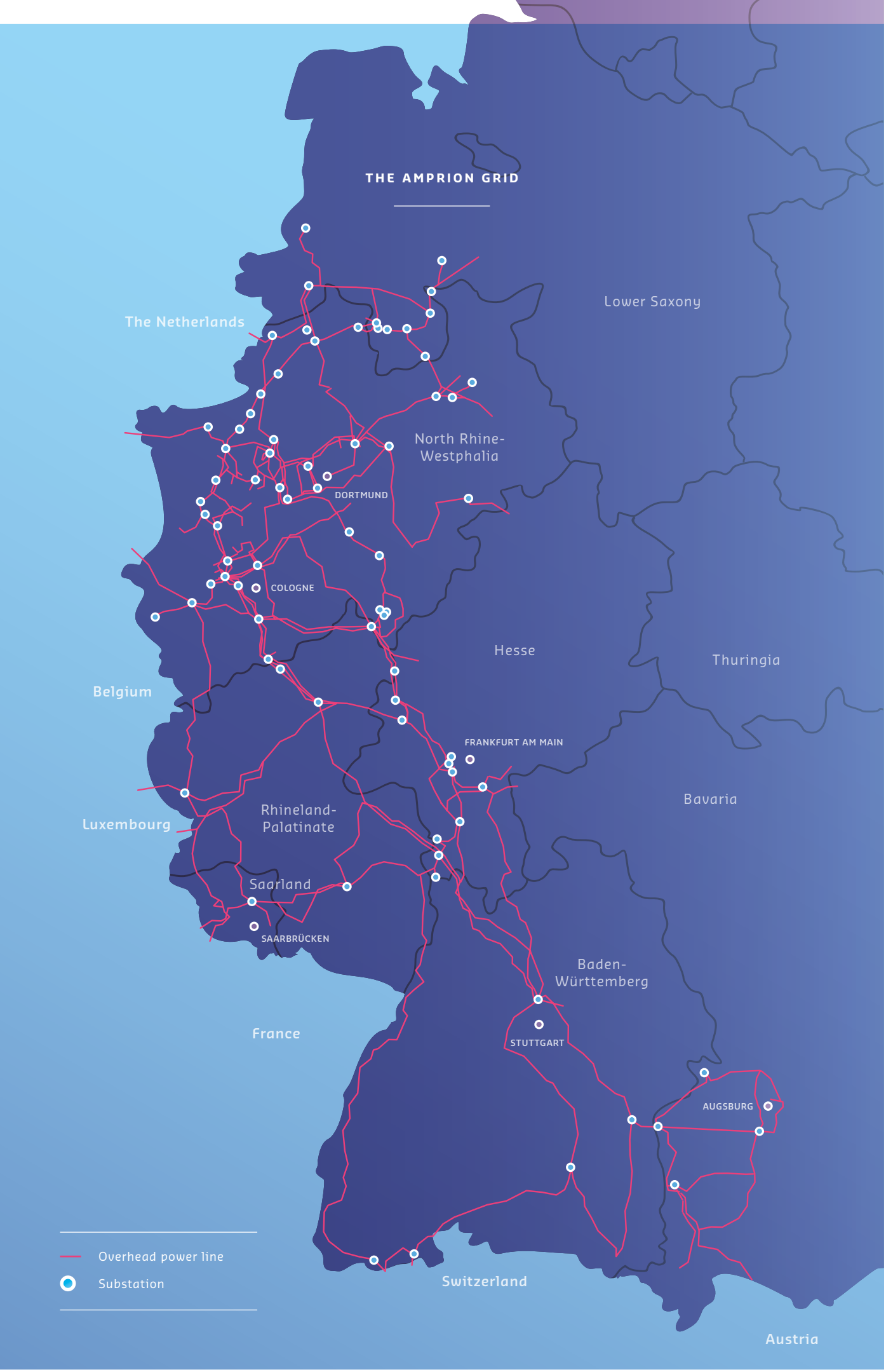
the total length of power lines that make up the Amprion transmission system; it is Germany's longest EHV grid.

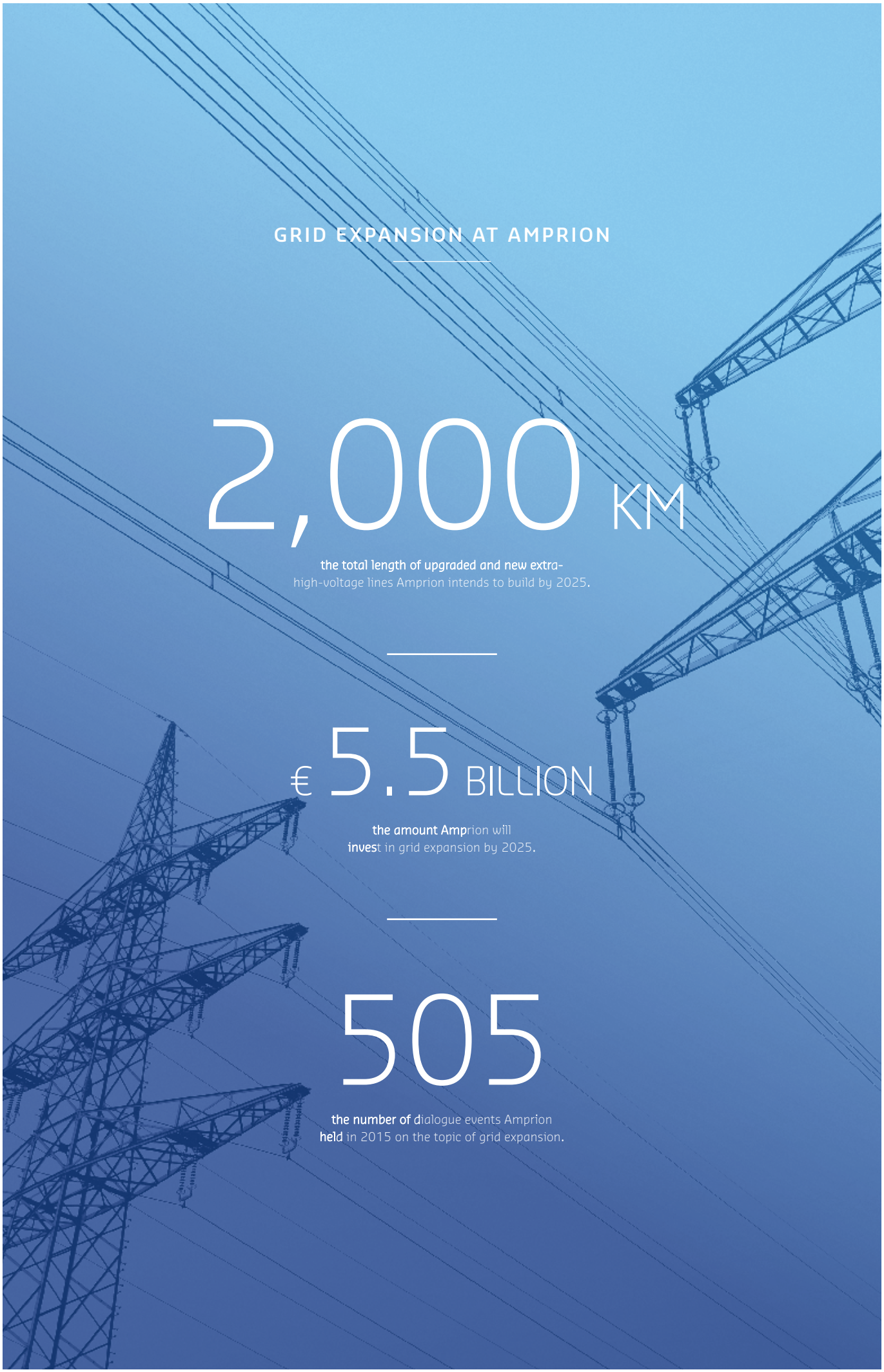
~29 M

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

~170

the number of substations that connect the Amprion grid to the downstream distribution systems.


THE AMPRION GRID
Lower Saxony
The Netherlands
North Rhine-
Westphalia
DORTMUND
COLOGNE
Hesse
Thuringia
Belgium
FRANKFURT AM MAIN
Bavaria
Luxembourg
Rhineland-
Palatinate
Saarland
SAARBRÜCKEN
Baden-
Württemberg
France
STUTTGART
AUGSBURG
Switzerland
Austria
Overhead power line
Substation



GRID EXPANSION AT AMPRION

2,000 KM

the total length of upgraded and new extra-
high-voltage lines Amprion intends to build by 2025.

€ 5.5 BILLION

the amount Amprion will
invest in grid expansion by 2025.

505

the number of dialogue events Amprion
held in 2015 on the topic of grid expansion.

JOURNAL 2015

Amprion is a transmission system operator active in Germany and Europe. Our power lines are the lifelines of the national economy. By operating and expanding our network, we are assuming our share of **RESPONSIBILITY** *[page 8]* for guaranteeing a sustainable future for the power supply. To be able to face the challenges of the energy transition, we are actively engaging in a DIALOGUE *[page 26]* with citizens, society, politics and business. We are developing innovative solutions for this NEW START *[page 38]* into the energy world of tomorrow.

CONTENTS

ACHIEVING DIVERSITY

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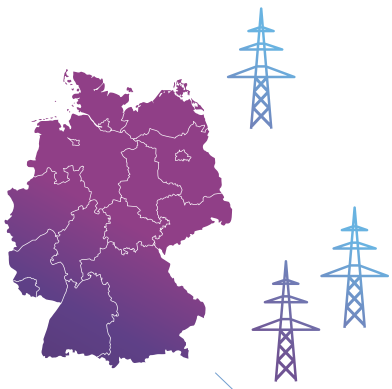
Nature conservation beneath power lines – that's the job of Amprion's biotope managers. They have now been implementing the route maintenance concept developed by Amprion for more than 20 years.

RESPONSIBILITY

DIALOGUE

NEW START



SUSTAINABLE INVESTMENT

–

Grid expansion is an absolutely crucial infrastructure project when it comes to ensuring Germany's position as a location for business and investment. The amount being invested is similar to that being invested in the telephone, road and rail networks.

TRANSPARENT PLANNING

–

Amprion is continuing to develop project communication – by informing citizens at an early stage, conducting an open dialogue and offering opportunities to participate.

PROF. DR CHRISTOPH M. SCHMIDT AND DR HANS-JÜRGEN BRICK

As a transmission system operator, Amprion fulfils a statutory duty, but it also operates in the European electricity market and supports the world of politics by offering technical expertise in relation to energy matters. Lots of points of reference to exchange ideas about for Prof. Dr Christoph M. Schmidt, President of the Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI) and Chairman of the German Council of Economic Experts, and Amprion Managing Director, Dr Hans-Jürgen Brick.

SECURE POWER SUPPLY

Amprion Managing Director, Dr Hans-Jürgen Brick, and the research economist, Prof. Dr Christoph M. Schmidt, talk about the importance of security of supply – and why our energy system has to be expanded and upgraded.

PHOTOS · **MATTHIAS HASLAUER**

MANY PEOPLE REGARD ELECTRICITY AS A MATTER OF COURSE. WHAT ABOUT YOU?

SCHMIDT Yes, I too regard it as a matter of course that electricity is available whenever I want it. A secure energy supply is a prerequisite to our lifestyle and also – and I say this as an economist – for maintaining our prosperity. It guarantees our way of doing business and the way we manufacture.

BRICK This is precisely where we see our responsibility: we have a statutory duty to ensure that our transmission system is reliable 24 hours a day, 7 days a week. But we are finding that this duty, this mandate, is becoming more and more challenging. If the stability of the network is in danger, we cut in backup power plants or restrict the infeed into or the take-up of power from the grid. The more frequently we have to do this, the more expensive it becomes for our national economy.

SCHMIDT What we must not do is neglect the security of supply during this period in which we are implementing our turnaround in energy policy. By 2050, we want to have a system in Germany that is very much founded on renewable energy sources, but that operates efficiently and is technically robust at the same time. This is the social consensus. At the end of the day, all three goals fit wonderfully together. But the task of shaping the path by which we achieve this is extremely complex and challenging.

WHERE ARE THE CHALLENGES?

SCHMIDT If security of supply is so important, then we have to expand the power grids and energy storage capacities at the same time as we expand renewables. These activities should be synchronised, but this is currently not the case.

BRICK Yes, exactly. Grid expansion is lagging behind the expansion of renewable energy sources. And storage technology is a long way from what is needed. This is why we still need bridging technologies such as high-efficiency gas-fuelled power plants, but also innovative elements in the power grid. Because conventional power plants are feeding less and less electricity into the grid, Amprion has, for example, developed systems that stabilise the grid voltage by other means.

SCHMIDT In retrospect, I would say that we have made a number of mistakes in Germany. For a long time, the public at large was given the impression that the energy transition consisted solely of expanding renewables. This pushed the entire project close to the brink, rendering it almost unviable.

» We have a statutory duty to ensure that our transmission system is reliable 24 hours a day, 7 days a week. «

DR HANS-JÜRGEN BRICK

BRICK After a period of political discussion, we have now reached a situation where we once again have the planning security we need. That the energy transition also means we have to expand our power grid is now perfectly clear to most people – just as long as it doesn't affect them. That's why it is important that grid expansion is conducted in a citizen-friendly manner and that we keep close tabs on the affordability of all measures. We need this economic sustainability in order to keep Germany competitive as a business and investment location.

SCHMIDT It goes without saying that Germany must remain industrially and economically capable and productive. We want to maintain a good healthcare system for our ageing society. We want to remain an open-minded and open country that offers shelter to refugees. As an economist, I ask myself if we can't achieve the goals of the energy transition in a more macroeconomically efficient way. The Renewable Energy Sources Act (EEG) was not the ideal route to go down, because it has unilaterally promoted certain technologies by offering feed-in tariffs and has also been far too expensive macroeconomically.

WHAT WOULD YOU LIKE TO HAPPEN?

SCHMIDT In future, subsidies should be technology-neutral and structured in such a way that they pitch the different types of renewable energy source against each other, forcing them to compete on both the technological and the geographical front. The aid offered shouldn't merely promise investors good profits, but also ask such questions as: How do their facilities fit into the system? Are their locations optimal for the system? To achieve this, we could, for instance, introduce regional electricity price zones or a surcharge based on the distance the electricity has to be transmitted. Another option would be to make electricity generators contribute towards the cost of grid expansion if they build generating plants in locations a long way away from regions of high demand.

BRICK For many of the large enterprises in Amprion's grid supply area, maintaining a uniform German electricity market is important. And distance-based surcharges are only possible in the European context, otherwise they would distort competition. We need a harmonised, umbrella approach for all of Europe. Thanks to the deal reached at the UN Climate Change Conference held in Paris in December 2015, there is now greater harmonisation of the goals, leading to Germany and France working together to promote renewables.

SCHMIDT But these steps are still progressing too slowly! Europe could play an important role in limiting climate change. A joint European line of action could quite simply build on the emissions trading system. This system already exists. As we know, it does suffer from a number of teething problems, but we can make changes and refine it. I personally favour a model that stipulates a minimum price for CO_2 emissions. It's not exactly totally in line with free-market principles, but ultimately, it is closer to the free market than everything we've had to date.

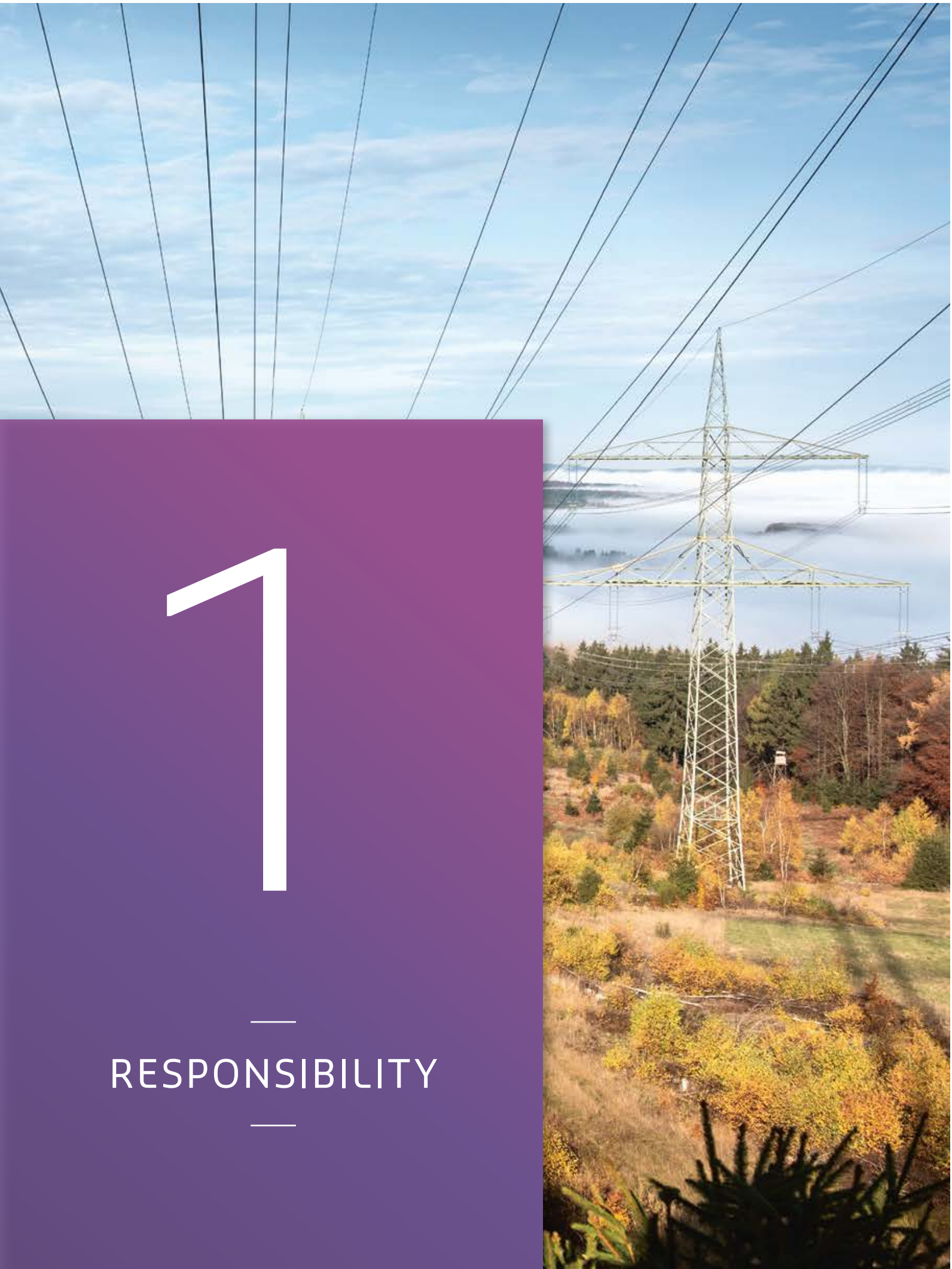
BRICK We welcome all steps taken that make the system as a whole more efficient and more stable. At the moment, it's not yet running smoothly. Owing to the fact that the transmission system is gradually approaching breaking point, the grid operators are increasingly intervening in the way power plants are being operated. The cost of these "redispatch" measures reached a new, record level in Germany in 2015. The expectations people have of a new market design are therefore manifold and are currently being discussed at national and European level. In any case, the advancement and generation of renewables should be interwoven more closely with the market. The system would then harmonise better overall.

DO EUROPE'S GRID OPERATORS HARMONISE, THEN?

BRICK Fortunately, we European grid operators are already in a good place in this regard. Never before have we cooperated with one another as closely as we do now – irrespective of where we originate from and of the energy system we are connected to. We cooperate both bilaterally and regionally because we view system security and reliability as a common duty. We all know how sensitive our energy system is.

»A joint European line of action could very simply build on the emissions trading system. This system already exists. As we know, it does suffer from a number of teething problems, but we can make changes and refine it.«

PROF. DR CHRISTOPH M. SCHMIDT



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RESPONSIBILITY

Amprion bears responsibility for ensuring that the transmission grid is secure, reliable and sustainable – and plays an important role in ensuring Germany's and Europe's position as a location for business and investment. We plan, construct and operate the grid based on the premise of economical and ecological sustainability.

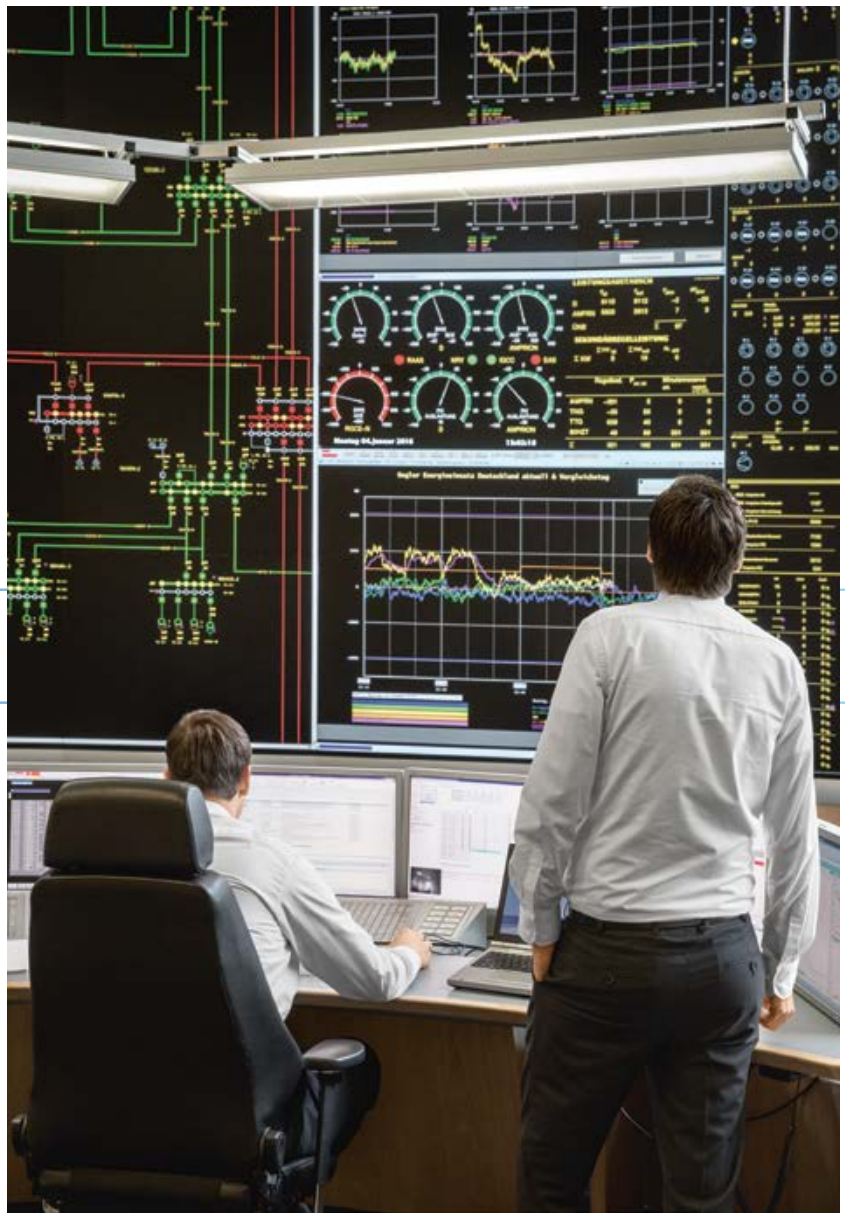
11,000 HA

IS THE SIZE OF THE AREA we manage within the scope of our biotope management plans. More than two decades ago, we were the first transmission system operator to develop and implement a corresponding concept – a concept that ensures safe and reliable operation of our power lines and at the same time protects both flora and fauna.

ALWAYS IN EQUILIBRIUM

24 hours a day, 7 days a week, system operation and control experts at Amprion ensure that power generation and power consumption remain in equilibrium. This job is becoming ever more complex owing to the growth in wind and solar energy and the trade in electricity across Europe's internal borders.

PHOTOS · **MARCUS PIETREK**



Control engineers monitor the electricity flow in the Amprion grid – around the clock.

Joachim Vanzetta, System Operation and Control Manager at Amprion, is responsible for ensuring that electricity generation and consumption in the network remain in constant equilibrium every second of the day.

We're in Brauweiler near Cologne, and it's the first Monday of 2016. The morning weather forecast promises a dull and calm day. Joachim Vanzetta looks out of the window of his office. "When the weather's like this, the wind turbines in the north simply don't turn," says the System Operation and Control Manager at Amprion. "If we had snow in the south, too, the solar farms down there would also feed very little electricity into the grid." We would then have one of those extreme situations that even a pro like Vanzetta views as a "challenge" – situations that are arising ever more frequently as a result of the energy transition. Germany wants to generate the majority of its electricity from renewable energy sources by 2040. But what happens when the wind doesn't blow and the sun doesn't shine?

On the other hand, there are days on which a stiff breeze in the north of the country and sunshine in the south mean that there's so much electricity available that these renewables alone as good as cover the country's entire hunger for energy. "These two situations are worlds apart," says Vanzetta. "We in System Operation and Control have to cope with both of these extremes."

The "system" he refers to is Amprion's 11,000 kilometres of extra-high-voltage power lines. If this system is to transmit electricity reliably, there's a simple equation that must always balance out, every second of the day, no matter what the weather conditions: generation = consumption. It's Vanzetta and his team who are responsible for ensuring this remains the case.

Keeping generation and consumption levels in equilibrium used to be a lot simpler than it is today. "The conventional power plants located all around Germany used to generate precisely as much electricity as was actually consumed," Vanzetta explains. But the electricity landscape has changed since the energy transition. Germany now relies more on renewables – and the amount they feed into the grid varies just like the weather does. On top of this, wind and solar generate electricity in those regions where the weather is most conducive – and not where it's actually needed. This situation is what Vanzetta likes to call "load-remote generation" and it has implications for Amprion's transmission system. "In the old days, we transmitted the electricity a distance of around 60 kilometres from the generator to the consumer. Today, the distances covered are

much longer, and getting longer all the time." This is why the degree to which the capacity of the "electricity highways" is utilised is increasingly rapidly. So, too, the threat of congestion and snarl-ups! Another factor is the European internal energy market. More and more power is being traded on the European electricity exchanges and "delivered" via the German grid. This can also lead to bottlenecks in the grid.

For the System Operation and Control team in Brauweiler, this means that new variables must be factored into the "generation = consumption" equation. Keeping the Amprion grid stable under these conditions requires good planning, experience, expertise and powerful systems. The effort involved is immense. A whole year in advance, Vanzetta's team of electrical engineers, energy exchange experts, weather specialists and IT professionals begins to plan each individual "electricity day" – a never-ending countdown. In this way, the Amprion experts schedule maintenance procedures for power plants, power lines and substations in advance and coordinate this "isolation scheduling" with other grid operators at home and abroad. At the same time, they also take a look at European energy trading.

Site meeting in Amprion's front office – a room with a wall of monitors packed with tables, diagrams and statistics. They are constantly on the move. Ralf Lonsdorfer, Front Office Manager, keeps an eye on every change. He and his colleagues make sure that the electricity traded on the German and European energy exchanges can be "delivered" safely and reliably via the grid. Since mid-2015, a new process known as "Central Western Flow-based Market Coupling" helps them to do this. Experts at Amprion played a major role in the development and launch of this process, together with other transmission system operators and exchanges in Germany, the Benelux countries and France. A mammoth project that Ralf Lonsdorfer has supported: "With this new process and the software based on it, we are able to compare grid capacities and traders' bids automatically." This enables us to reduce the number of critical situations in the grid considerably.

The closer the respective electricity day gets, the more the weather becomes the focus of the system controllers. After all, how much wind and solar power will be available depends totally on the weather. "When it comes to meeting the power demand in Germany, renewables take precedence. And we as a transmission system operator trade large lots of regenerative electricity on the exchange. That's how the legislators want it," explains Lonsdorfer. The better the quality of the weather forecasts, the smoother the cooperation between the power producers, exchanges and grid operators functions.

65 %

SHARE RENEWABLES ARE TO HAVE OF THE POWER GENERATION MARKET BY 2040

As the energy transition progresses, wind and solar power are in the long term to account for the largest share of the electricity consumed. In 2015, renewables accounted for roughly a third of all the electricity generated within Germany's borders.

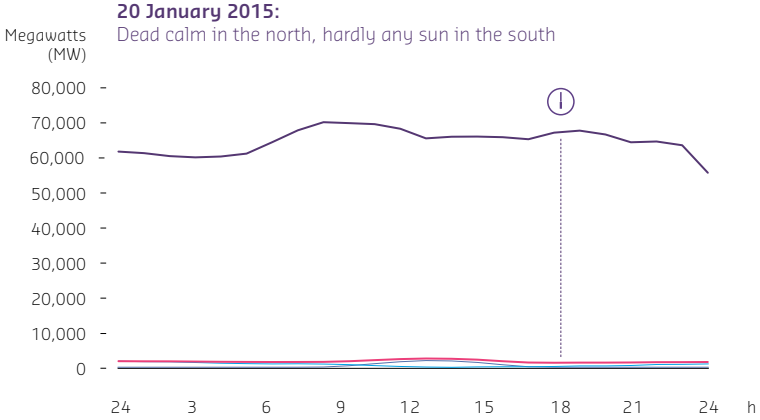
»So far, we've managed to deal with every load situation we've been faced with in the grid. But there was also a fair bit of luck involved. For the challenges are growing ever larger.«

JOACHIM VANZETTA, SYSTEM OPERATION AND CONTROL MANAGER AT AMPRION

EXTREME GRID SITUATIONS

The contribution made by wind and solar power towards meeting the power demand in Germany

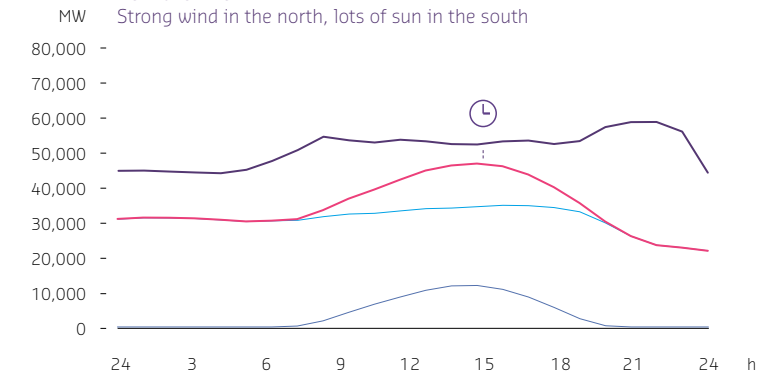
20 January 2015:
Dead calm in the north, hardly any sun in the south



0,1%

of the grid load in Germany was accounted for by electricity generated from renewables at this moment in time.

30 March 2015:
Strong wind in the north, lots of sun in the south



90%

of the grid load in Germany was accounted for by electricity generated from renewables at this moment in time.

- Grid load in Germany
- Total wind and solar infeed
- Wind power infeed
- Solar power infeed

Source: Amprion GmbH

GRID LOAD

The term "grid load" describes the amount of electricity the transmission system delivers to the distribution grids and to bulk consumers, such as electricity-intensive enterprises connected directly to the transmission system. This electricity is for the most part generated by the power plants connected to the grid. Electricity imports must be added to and exports subtracted from this figure.

Ralf Lonsdorfer, Front Office Manager at Amprion, coordinates cooperation with the European electricity exchanges. His goal is to avoid bottlenecks in the grid.

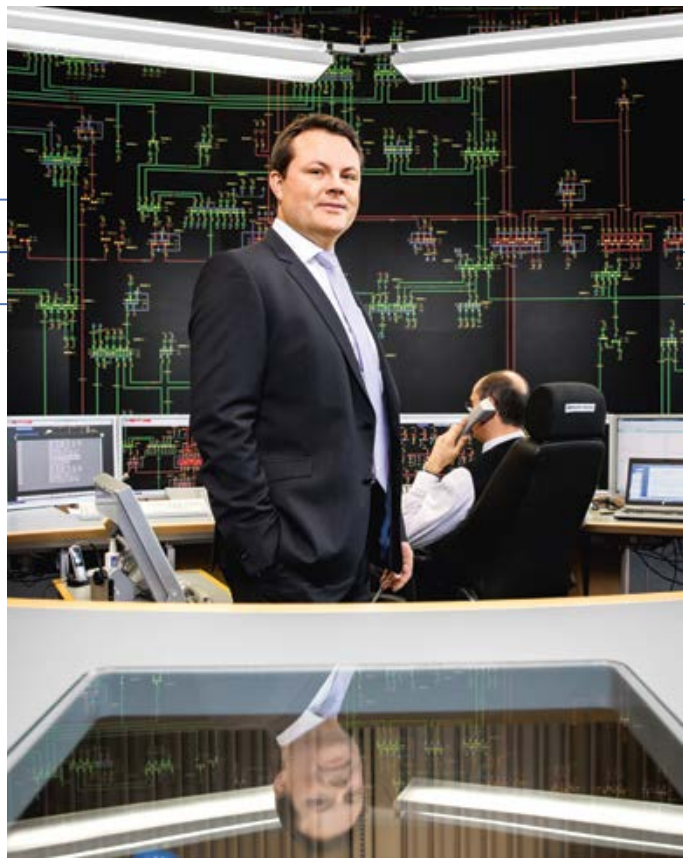
That's why Lonsdorfer and his colleagues in Brauweiler have become weather experts. They have developed a system that uses artificial intelligence models. This system is able to evaluate a large number of existing weather models and to predict how much wind and solar power will be generated in which regions. These models, forecasts and systems are being continuously optimised – amongst other things as part of the EWeLiNE research project that Amprion is actively promoting, along with the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES), the German Meteorological Service (DWD, Deutscher Wetterdienst) and the transmission system operators 50Hertz and Tennet.

Ralf Lonsdorfer glances at the clock and in the meantime, it's turned 1 p.m. The electricity exchanges are now closed and trading for the next day is over. The front office begins to accept and examine the "schedules" for the next electricity day. These schedules stipulate how much energy will be fed into the grid by which power plants and will be taken from the transmission system by which major clients – that is, the regional distribution grid operators and large industrial enterprises – in each 15-minute block.

"If our schedule works out," Ralf Lonsdorfer explains, "and the weather doesn't get up to any antics, we have hopefully created a useful starting point for our colleagues in the control centre to follow the next day."

"Main control centre" – this is the term used to describe the heart of the system operation and control system. Control engineers sitting at three workstations monitor the current flows – 24 hours a day, 7 days a week. Their main tool: the 18-metre-wide and 6-metre-high mimic board. For laymen, the red and green lines, dots and rectangles look like a geometric pattern. For the control engineers, they show which power plants are feeding into the grid and which power lines and substations are transmitting current – and that across a monitoring area that stretches from the French Atlantic coast to the Czech Republic.

"The national power grids in Europe have long been interconnected," says Dr Christoph Schneiders, head of the Brauweiler main control centre. "If there is a problem in a neighbouring country, this can affect us, too. That's why we monitor such a large area."



Dr Christoph Schneiders, Main Control Centre Manager at Amprion – his job is to respond to unforeseen events.

Only when generation and consumption are in equilibrium does the alternating current grid operate with the ideal frequency of 50 hertz. To ensure it stays that way every second of the day, Schneiders and his colleagues play it safe. The "N-1" criterion is their absolute top priority. This stipulates that the grid must remain stable if components such as power lines, transformers or power plant blocks fail – and even at peak load. This is simulated by IT systems every 15 minutes. Based on the results, the control engineers on duty then test whether in such a case there are still sufficient other "highways" available to ensure security of supply. And it's a similar story as regards generation by wind and solar units. The control centre is constantly receiving information about how the infeed of power by renewable energy sources is actually developing and whether this current can also be transmitted.

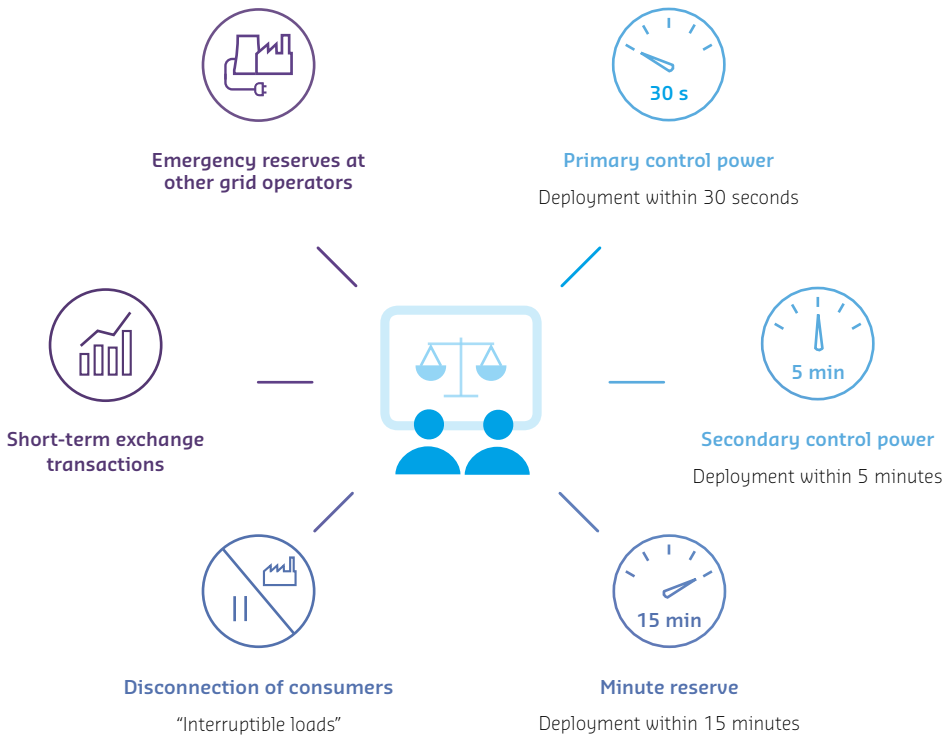
Nevertheless, even perfect planning and preparation isn't capable of completely ruling out surprises. "No matter how good my co-workers' groundwork is, it's never one hundred per cent possible to predict the amount of electricity wind and solar will feed into the grid," says Schneiders. "That's why we're constantly forced to make adjustments."

For this reason, the control engineers have a set of instruments that enable them to compensate frequency fluctuations. Three of these instruments are: primary and secondary control power and minute reserve. These refer to flexible power plants that can increase or lower their output to the grid within 30 seconds, 5 minutes or 15 minutes as required. By installing these power plants, Amprion and other transmission system operators have agreed to guarantee 24/7 readiness for action.

If these measures are not enough, the control engineers can, for instance, disconnect major power consumers from the grid for a certain period of time. However, this doesn't apply to residential customers, only to energy-intensive businesses that have willingly signed up to it and are compensated financially if and when it happens. These are what the experts in Brauweiler call "interruptible loads", with this option being clearly regulated in law. Another option available when balancing problems arise is "redispatch", which allows Schneiders and his team to actively intervene in the agreed plant schedules. Conventional power plants, but wind and solar farms, too, can be down-regulated, or infeed levels can be

SET OF INSTRUMENTS AVAILABLE FOR SYSTEM OPERATION AND CONTROL

The options available to compensate frequency fluctuations in the grid



increased at other points. However, such interventions lead to additional costs for the power plant operators, for which they also receive compensation. According to the latest statements issued by Germany's transmission system operators, redispatch costs reached a new record level in 2015 at more than a billion euros – an indicator of how often the transmission system is now operating at the very limit of its capacity.

In the meantime, it's dark outside. Joachim Vanzetta is content. The electricity day went according to plan: neither were there any unforeseen fluctuations on the renewables side, nor were there any critical bottlenecks on the supply side. "So far, we've managed to deal with every load situation we've been faced with in the grid. But there was also a fair bit of luck involved," says the System Operation and Control Manager. "But to make sure it stays that way in future, we have to take action right now." For the challenges are growing ever larger. In 2015, renewables already accounted for 30 per cent of the total amount of power generated in Germany. By 2040, the share of wind and solar power is supposed to rise to 65 per cent. The variables that make up the electricity equation will therefore fluctuate even more than they do now. The solar eclipse in March 2015 gave us a foretaste of what's to come. Thanks to meticulous preparations coordinated across Europe, the engineers succeeded in managing and mastering its impact. "What we need are even better weather forecasts, more intelligent IT systems and a continuation of the close collaboration we enjoy with our European counterparts," Vanzetta emphasises.

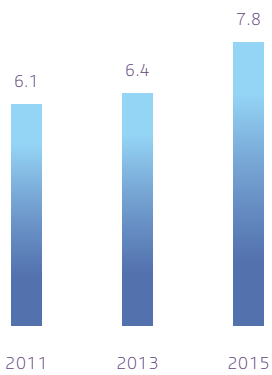
He points to the brick building that's going up across from his office. In two years' time, this will house the new main control centre that should be up and running. At its core is an innovative grid control system, which our experts in Brauweiler are currently working on together with Siemens. Vanzetta is clearly proud of this and other projects in which Amprion's System Operation and Control team is demonstrating its expertise. For him and his team, promoting new system operation and control technologies and methods is extremely important. "After all, we are responsible for one of the most important infrastructures of the national economy," he says. "One thing is clear, however: innovation isn't everything. To continue to be able to operate and control the grid reliably in future, we have to expand it quickly."

SUSTAINABLE INVESTMENT

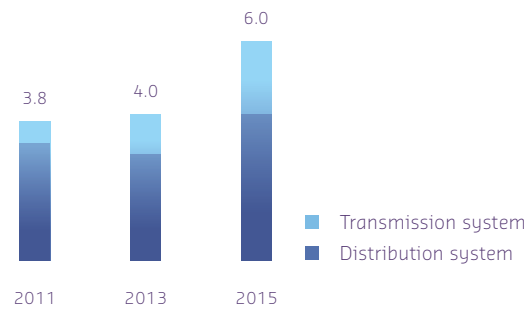
The transmission system is one of the most important infrastructures in the German economy. It is to be expanded as part of the energy transition. The level of investment necessary to do so is comparable with expenditures on the telecommunications, road and rail networks.

Investments in infrastructure in Germany (in € bn)

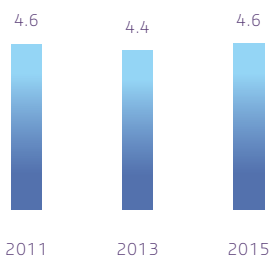
TELECOMMUNICATIONS NETWORK



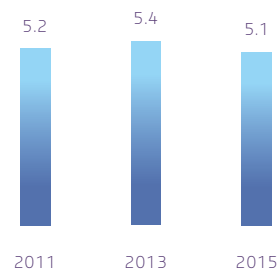
ELECTRICITY NETWORK



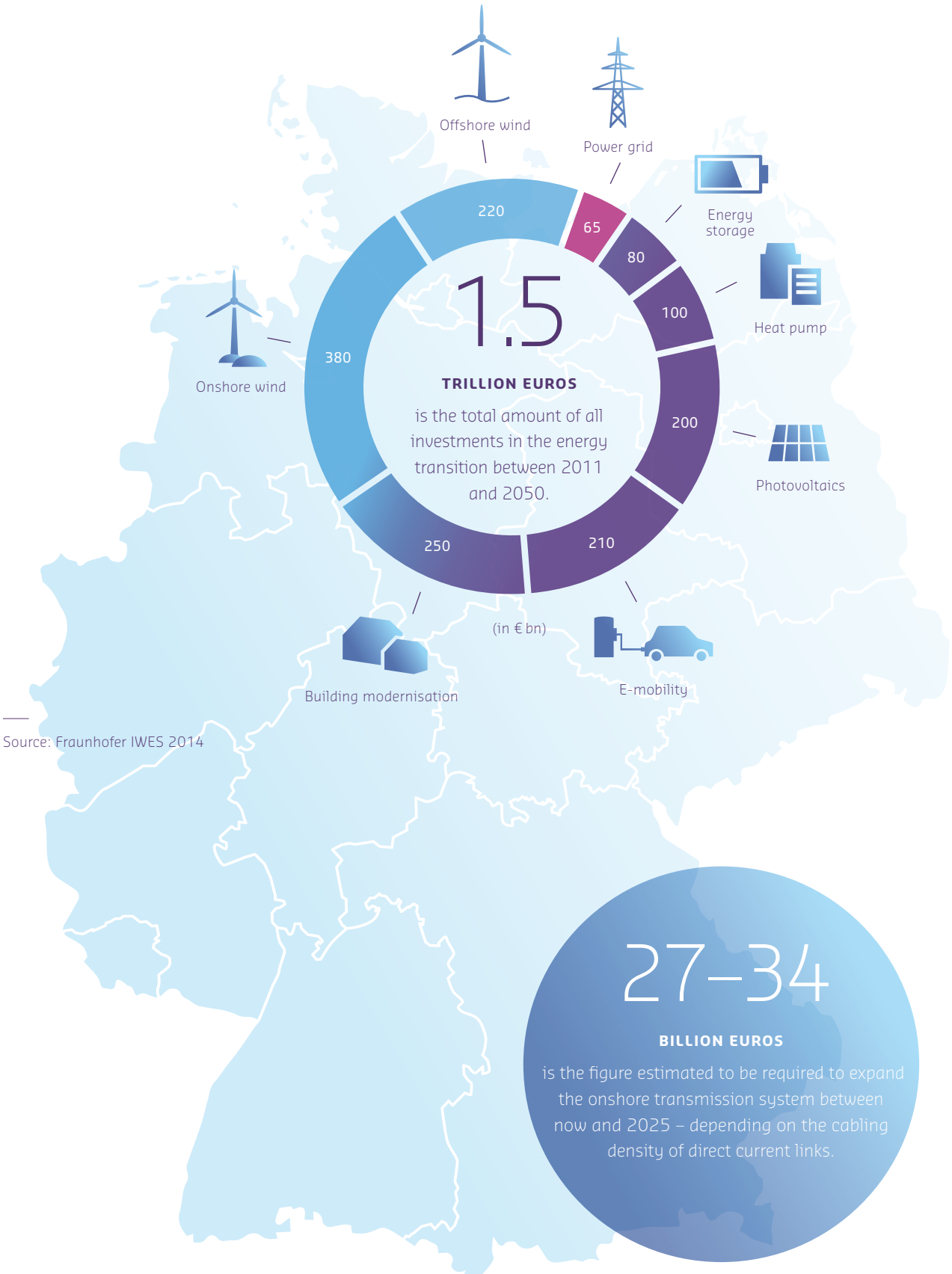
RAIL NETWORK



TRUNK ROAD NETWORK



Source: Federal Network Agency (Bundesnetzagentur)/Federal Cartel Office (Bundeskartellamt)
Energy Monitoring Report 2015 (Monitoringbericht Energie)



Source: Fraunhofer IWES 2014

27–34

BILLION EUROS

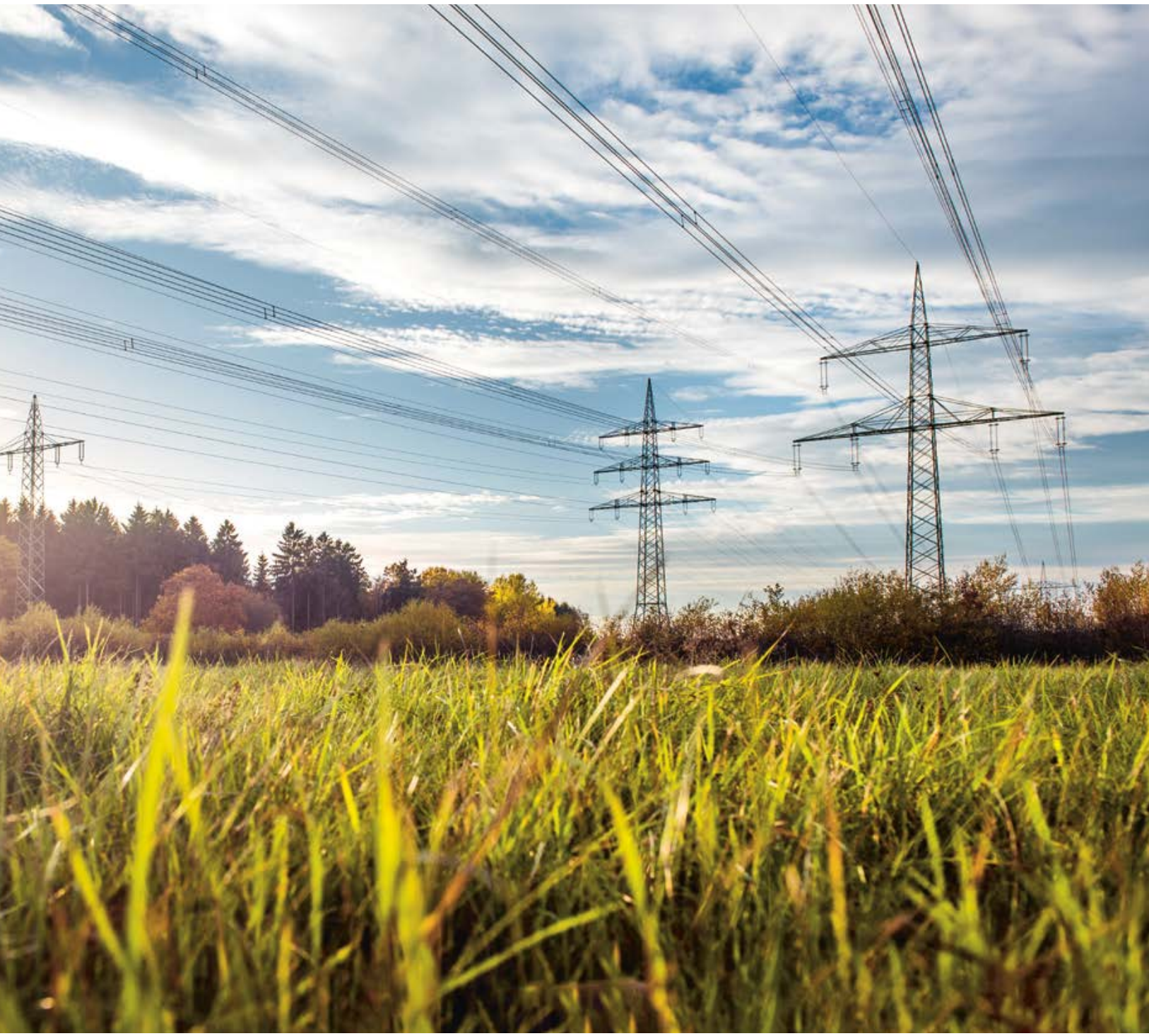
is the figure estimated to be required to expand the onshore transmission system between now and 2025 – depending on the cabling density of direct current links.

Source: Bundesnetzagentur, 2nd Draft of the Network Development Plan 2025

ACHIEVING DIVERSITY

Nature conservation beneath power lines? Biotope management makes it possible. Amprion has been implementing a corresponding concept for more than 20 years. Rare species of orchid in the Hunsrück region are also benefitting.

PHOTOS · **GÜNTHER BAYERL** TEXT · **THOMAS BECKER**



Nature conservation beneath power lines: where grasses sway in the wind at autumn time, rare species of orchid blossom in May.
To bring this about, bushes and trees are cut back every three years.
Amprion experts monitor the work performed.

Route maintenance as scheduled: Amprion has mapped all areas beneath its power lines and divided them into biotopes. This is important in order to retain the diversity of flora and fauna.

A mild autumn day in the "Wiesen am Hirtenborn" nature reserve in the Hunsrück, very close to the Rhine Gorge at Bacharach. Dried grasses sway in the wind. A few steps further and one finds young birch trees growing between sprawling raspberry bushes. An ecological treasure, right beneath a power line.

It's difficult to imagine! In May, herbs and species of orchid that are rare in this region of Germany nowadays blossom, such as the broad-leaved and the green-winged marsh orchid or the white helleborine. "What the Champions League is to football fans, that's what meadows of orchids are to conservationists," enthuses Joachim Jacobs, forest warden of the nature reserve. "What we have here is an area with more than 150 different species of plant that absolutely deserves to be protected."

If we left the bushes and trees to their own devices, the orchids in this reserve would soon disappear. What's more, the trees would grow like wildfire and pose a hazard to the power supply if they reached the height of the lines. Joachim Jacobs and Amprion biotope manager, Matthias Spielmann, want to avoid both of these possibilities. Spielmann is responsible for monitoring the growth of vegetation along the routes of the overhead power lines that cut through the region – through woods and across fields, pylon for pylon, kilometre for kilometre.

150

SPECIES OF PLANT

live in the orchid meadows in the "Wiesen am Hirtenborn" nature reserve in the Hunsrück. "An area that absolutely deserves to be protected," says warden Joachim Jacobs.

Where transmission routes cut through woods, new biotopes sprout – careful intervention makes this possible.

The 25-year-old opens a folder that bears the inscription “Biotope Management”. This contains a detailed description of the cycle of when and precisely how the vegetation along the route is to be cared for. “In the beginning, the idea was that we would mulch this area,” says Matthias Spielmann. What is mulching, then? A machine works its way through the undergrowth, shreds it and leaves behind a layer of mulch that is rich in nutrients. However, as orchids require nutrient-poor soil, biotope manager Spielmann altered the strategy to the effect that a woodsman now mows the poor grassland beneath the power lines every three years and cuts back and places branches to one side, next to the meadow. “This enables the orchids to develop.”

Work is scheduled to begin in the coming weeks – just one of thousands of maintenance measures Amprion commissions from October to February along its transmission routes throughout Germany. The first grid operator in Germany to do so, some twenty or more years ago, Amprion developed a concept designed to optimise route maintenance along ecological lines. In the meantime, all areas beneath its power lines – in all, around 11,000 hectares – have been mapped and divided into biotopes. This concept aims to manage the plants and soils along the routes in such a way that they pose no risk to the overhead power lines. “Then again, we also have a responsibility to maintain and promote the diversity of flora and fauna,” explains Amprion project manager, Dirk Uther, who helped draw up the route maintenance concept.

“In the old days, grid operators simply followed the principle of clear-cutting everything,” the expert explains. Whatever grew along the routes and beneath the overhead power lines was coppiced, that is, cut back to ground level, every 10 to 15 years. Heavy machinery dragged all of the wood and grass cuttings out of the woods, leaving behind deep furrows and barren strips of land. “This seriously disrupted the ecosystem,” says Uther. “Today, however, we coordinate all of our maintenance measures with the needs of the wildlife that lives there.”

And Amprion reaps high praise from other experts for these efforts. Together with local partners, the company won the German

Protection for the power lines: if branches lean towards the route, they are cut back. Part of the grass cuttings remains in the woods. "This enables nutrients to find their way back into the soil," says Amprion biotope manager, Matthias Spielmann.

Landscape Management Award (Deutscher Landschaftspflegepreis) in 2014 for a route maintenance project conducted in the vicinity of Wuppertal.

This award is conferred once a year by the German Association for Landscape Management (Deutscher Verband für Landschaftspflege) – making it a kind of "industry Oscar".

Spielmann, the biotope manager, and Jacobs, the forest warden, look into the distance. Behind the hill with the orchid meadow, the power line drops down into a valley. To the left and right is mixed woodland, with tall Norway spruce, oak and poplar trees – Bingen Forest. Bushes and trees grow beneath the power lines. "What we're trying to do here is ensure that the area beneath the overhead power line is permanently covered with trees – but of the kind that grow slowly, such as oak and beech," explains Günter Lips, the man at Amprion responsible for grid operations in the states of Saarland, Rhineland-Palatinate and parts of Hesse. "This means we don't have to cut them back so often."

The specialist talks about a "staggered development" for the route, where the trees at the edges are taller. Like a trough that curves gently inwards. "Overhead power lines that cut through a forest should be troughed like this if possible," he says. The principle followed for maintaining the route is: "More frequent intervention, but gentle." This means continuous pruning, cutting back, chopping, mowing and mulching.

Precisely what needs to be done along the route through Bingen Forest has been agreed earlier by biotope manager, Matthias Spielmann, with the owner of the area. In this case Joachim Jacobs, the forest warden, is in charge of part of the state-owned forest. The two of them study the map and schedule in the Biotope Management folder. The tops of some trees at the edge of the route, three pylons further on, need to be trimmed. So, let's go and do it!

The men take the car down the hill to pylon 197. A skilled forest worker and a trained tree climber are already waiting for them there. Properly secured, the tree climber clambers up a ladder and up to the crown of an oak tree. Using a handsaw, he saws away at one of the branches that is leaning towards the route. While he busily goes about his work, the pitons attached to his belt jingle and jangle.

Electricity transmission in harmony with nature: this is the basic idea behind biotope management. And this is how Amprion understands its responsibility as a sustainable business enterprise.

» We coordinate all of our route maintenance measures with the needs of the local wildlife.«

DIRK UTHER, EXPERT FOR ENVIRONMENTAL PROTECTION AT AMPRION

Brown oak leaves flutter down to the ground. Then there's a crashing sound and the first branch lies next to the tree.

A car pulls up on the road nearby. A man gets out. He has just read in the newspaper that route maintenance work is underway in Bingen Forest. "We have to do something to protect the power lines," he says, as he watches the tree climber. It turns out that the man is a beekeeper and he's just come from his hives that are located in the vicinity of the orchid meadow on the other side of the hill. He says that the meadow is "somehow sacred" to him. "After all, it's absolutely vital for my bees."

And then another crashing sound and another oak branch falls to the ground. "We leave some of the grass cuttings in the forest to rot," explains Matthias Spielmann. "This enables nutrients to find their way back into the soil." That's good for the environment, but also cost-effective at the same time. "We used to cart tons of wood and cuttings out of the woods, but there's none of that now." Despite this, the cost of ecologically optimised route maintenance is still far from cheap. Amprion spends more than a million euros on these measures in Saarland, Rhineland-Palatinate and parts of Hesse alone – nationwide it's 3.2 million euros. "We see it as an integral part of our remit and our responsibility as a sustainable business enterprise," says Günter Lips. "At the same time, by carrying out this work, we ensure that our power lines are safe and continue to operate reliably."

The working day is drawing to a close. Some distance away, a kestrel is circling above the transmission route, looking for mice. "The hawks nest on our pylons," says Matthias Spielmann as he gets into the car. It's almost knocking-off time for the biotope manager. Tomorrow, the work will continue with more mowing, chopping and mulching – pylon for pylon, kilometre for kilometre.


LEITUNGSBAUPROJEKTE VON AMPRION
amprion
amprion
Merken

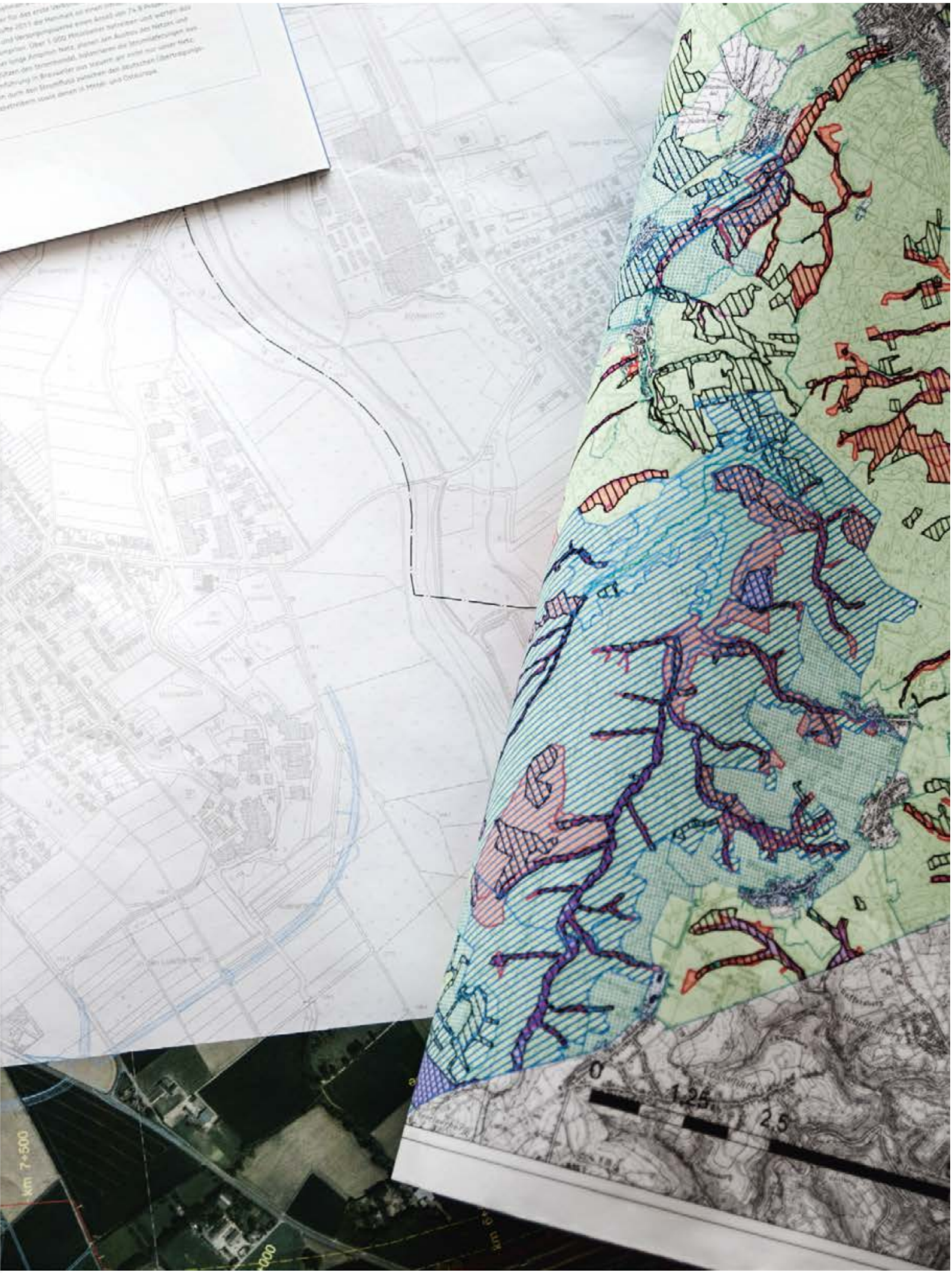
2

DIALOGUE

Amprion actively seeks to engage in dialogue with its stakeholders – with citizens, social groups and organisations, its European partners, politics and business. Only through dialogue, by talking to one another, will we be able to implement the level of grid expansion that is so essential to the success of the energy transition.

505

That's the number of **EVENTS** we organised in 2015 in order to converse with our stakeholders – about the energy transition, our company and actual projects. This dialogue helps us to advance grid expansion in as citizen-friendly a manner as possible.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GUEST ARTICLE

INCREASING OPPORTUNITIES TO PARTICIPATE

Germany needs new power lines. Local residents should be involved in the planning phase from an early stage, because people who have a say are more likely to grasp the necessity of infrastructure projects.

ILLUSTRATION · **SILKE WERZINGER**

The decision to phase out nuclear energy and the energy transition mean that Germany is faced with two enormous challenges. The goal is to reduce the share of coal and oil in the national energy mix to less than 20 per cent by 2050 by increasing the use of wind and solar power, while maintaining the security of supply. This assignment demands high levels of investment, far-reaching structural changes, a readiness to cooperate on the part of everyone involved and innovative political initiatives. It's a challenge that can only be successfully resolved if residents along the proposed routes are able to participate in planning the infrastructure projects, such as new power lines or wind farms.

In theory, nine out of ten Germans support the energy transition. At the same time, however, the prevailing attitude is that politics and business will join forces and somehow carry out and master this transition on their own – and do so while guaranteeing full security of supply and acceptable prices, but without causing any further negative impact on the environment. But when people realise that the energy transition will cost money and give rise to new concerns and challenges, enthusiasm quickly turns to disappointment and scepticism. This is reflected by, among other things, the resistance to expansion of the power transmission systems.

To enable people to grow to accept changes that will result from infrastructure projects, a number of different criteria must be taken into account. First of all, local residents need guidance in order to comprehend the aims of the respective project as well as information about the planning options and the planning process.

»Readiness to engage in dialogue isn't always enough to increase acceptance. Instead, local people should be given more opportunities to become involved.«

Moreover, the level of acceptance increases the more oneself and people closely connected to oneself benefit from the project in question. It's important, then, that local residents

PROF. DR ORTWIN RENN
is one of Germany's most eminent sociologists specialised in the fields of technology and the environment. He took up the post of Scientific Director at the Institute for Advanced Sustainability Studies (IASS) in Potsdam (Germany) in February 2016.

are clear about the pros and cons of planned power lines and wind farms. Being able to identify emotionally with a project also plays a massive role. Grid operators, businesses and local authorities should help local residents to understand the significance of a project for the development of their local and regional environment.

People tend to reject intervention in and changes to their environment if they fear that this could impact on their own personal freedoms and self-empowerment. Conversely, they are willing to get personally involved if they are certain that their own efforts towards realisation of a project can make a difference.

Information and communication activities must take these aspects into account. But opportunities and a readiness to engage in dialogue aren't always enough to increase acceptance – especially if a project is bound to impact residents' lives. Instead, local people should be given more opportunities to become involved. This presupposes that there is genuine room to manoeuvre.

Communication is designed to convey a decision made by legislators to those affected, in the hope that they also accept or at least tolerate this view. The idea of participation goes a step further. It presumes open policy-making processes and, within the scope of the legal limits, leaves it to the citizens involved to come up with new options and assess existing ones based on their own ideas. The moment people become decision makers themselves, the more likely they are to identify with the project simply as a result of their participation in the process.

Participation processes must take a specific form. It has been shown that especially in the initial phase, the key points must be made transparent for all participants. There must be clarity regarding the form in which citizens can participate towards the success of the process and the degree to which the results of their contribution are binding on the outcome. Likewise, it's absolutely essential to have a realistic perception of the possibilities and limitations of the participation process from the technical, legal and planning point of view.

If these cornerstones are in place, the chances of local residents being able to better acquaint themselves with the opportunities and risks of new infrastructure projects and to gain a greater insight into the planning projects than before are good. This doesn't mean that the acceptance of participants is a given, but it does make it easier to persuade and convince them. All in all, early inclusion and greater opportunities for citizens to participate could help the population at large to see the energy transition as a common mission for society as a whole.

Kaarst near Düsseldorf: this is where Amprion plans to build the converter at the northern end of the Ultranet link.

TRANSPARENT PLANNING

Amprion continues to develop project communication. Informing citizens from an early stage, engaging in an open dialogue and offering opportunities to participate are important components of this. The company has used pilot projects to gather valuable experience.

PHOTOS · **GÜNTHER BAYERL** · **MARCUS PIETREK** · **FRANK PETERSCHRÖDER** TEXT · **HEIMO FISCHER**

Heinz Smolibowski has read in the newspaper about Amprion's "citizens' info market". The pensioner from Sinzig is now standing in the hall of his local club, studying the maps that employees of Amprion have attached to display boards. An EHV power line nearby is to be upgraded. "I would like to know what this means," says the 69-year-old. His questions this evening are answered by, amongst others, Jonas Knoop. The 31-year-old is a project communicator at Amprion. He sees information markets like this one in Sinzig as an important element in the dialogue. "They have proven to be successful, because they enable us to start a dialogue with the local residents."

Amprion has held more than 500 information and dialogue events during the course of 2015, around 50 of which have been citizens' info markets. And there will be even more in 2016. This is because over the coming years, the company wants to upgrade and expand its transmission system by a further 2,000 kilometres – installing the majority of this new equipment along existing routes. And it isn't just info markets that play an important role. "Practical experience shows that we need to engage in a wide range of measures to inform the public about our projects and to campaign for acceptance. There is no patent method for communicating one's message that fits all projects," says Joëlle Bouillon, who is developing new formats for citizen participation at Amprion. "We see ourselves as an adaptive, learning enterprise," says the 38-year-old. "And we have a steep learning curve."

Some projects, however, require more than a targeted campaign to inform the public. That's why Bouillon and her colleagues have conducted pilot projects aimed at developing new forms of dialogue and participation. Take the example of Ultranet, the 340-kilometre-long direct current link, which is expected to carry electricity between North Rhine-Westphalia and Baden-Württemberg as of 2020. Scheduled for construction at either end of the line is a converter (see page 40). One of these facilities is to be built in Kaarst near Düsseldorf.

When Amprion's plans were made public, reservations began to grow among the population of this small town. The people were worried about the overall appearance of the landscape and some were even worried about their health. Amprion promptly organised an information evening to be held at short notice, but attracted the resentment of those opposed to the converter in the process. "The invitation went out two days before it was to be held, which was far too late," criticises Guido Otterbein, the spokesman of the local citizens' action group. This meant that there was no time to mobilise the members. He felt like he'd been steamrollered.

Amprion learned from this mistake and set up a discussion group with the town and parish councils and citizens' action committees that met regularly. Joëlle Bouillon, the project communicator, meets with council representatives and citizens interested in the converter construction project in a hotel in the neighbouring town, where up to 30 people gather. They inform themselves about the progress of

Guido Otterbein, spokesman of the citizens' action group in Kaarst, endorses the discussion group set up to help plan construction of the converter.

50

CITIZENS' INFO MARKETS

were held by Amprion in 2015.

Jonas Knoop, project communicator, and Heinz Smolibowski in conversation.

» There is no patent method for communicating one's message that fits all projects.«

JOËLLE BOUILLON,
PROJECT COMMUNICATOR AT AMPRION

the plans, ask questions and offer suggestions. In the meantime, communication between the various parties is much better, Otterbein confirms. "As regards communication skills, Amprion has taken a great leap forwards."

Even though the positions held by advocates and opponents of the converter are still far apart, there is one point on which everyone agrees: wherever projects like this are concerned, parish councils, residents and organisations must be brought on board at the earliest possible stage – even if relevant approval procedures haven't even yet begun.

The problem for Amprion often lies with the fact that at the very beginning of a grid expansion project, it is difficult to tell who really is affected. The only facts stipulated by the legislators are the starting point and destination of the planned link – no more, no less. Drawing a straight line between these two points is as good as pointless. For example, new lines are not allowed to run through either built-up areas or nature reserves. In which parishes a new route is to be built often doesn't become clear until months later, when the planning process has been underway for quite some time. "The problem is that if the people don't find out about the planning work until this point, they feel they have been presented with a fait accompli," says dialogue expert Bouillon.

This is why Amprion today contacts all councils through which a new route could pass right from the word go. What's required is sensitivity, says Joëlle Bouillon. "Face-to-face meetings are far better than any letter when it comes to canvassing for a long-term exchange of views on equal terms."

One example of good communication is the district of Bissendorf in Lower Saxony. It comprises several villages across the boundaries of which the new transmission link from Osnabrück to Wehrendorf is to pass. There were already two power lines in the district, and the new route was initially intended to follow one of them. But this would have meant having to replace all of the old pylons. This in turn threw up the question as to whether it wouldn't be better to relocate whole sections of the route – and if so, where the route should then run. Amprion and Bissendorf's mayor, Guido Halfter, resolved this question in a multiphase "route identification process" into which the public was consistently integrated. This process could act as a model for future planning projects.

It began in 2014 with three workshops, to which around 20 representatives from the local administration, administrative district and regional planning authority were invited. The working groups set up were asked to simply mark recommendations for a preferred route on a map – without laying down any requirements. In a second step, experts examined the result and clarified the situation with regard to legal restrictions. During the second and third rounds of discussion, two potential corridors materialised along which the line could run.

"We presented the result to our fellow citizens at the beginning of 2015," says Lisa Ziemer, who represented Amprion in the route identification process. The citizens of Bissendorf pointed out to the

» We have collated an enormous amount of knowledge and know-how – about the project and how route planning functions.«

GUIDO HALFTER, MAYOR OF BISSENDORF

planners that a popular riding school was located on the one route, while a moated castle, a listed building, stood on the other. "We learned a great deal about the sort of things in people's own neighbourhoods that are important to them," says Ziemer. This defused or even totally eliminated conflicts from the outset and was an important lesson for the future.

Bissendorf's mayor, Guido Halfter, backed the process from the word go. "Our citizens have collated an enormous amount of knowledge and know-how – about the project and how route planning and the approval procedures function," he explains. The council is now in a position to discuss matters with the authorising agency and with Amprion on equal terms and to develop optimal solutions for Bissendorf.

Amprion has also learned from Bissendorf – how to shape potential forms of participation even better. "Sitting down together in front of a blank piece of paper is not the best or most constructive way to kick off joint planning efforts. There are technical criteria and statutory provisions for approval processes that have to be taken into account," explains the project planner, Ziemer. That's why Amprion will in future do the necessary groundwork before initiating public route identification processes, so that only planning alternatives that can actually be implemented are discussed.

Experiences already gained with new forms of dialogue and participation are now being channelled into the communication plans for "Corridor A North" – the northern extension of Ultranet. This link is to run from the Rhineland to East Frisia and should go into operation in 2025. With respect to communication, this project represents a first. The people who lived in any of those areas through which the route could potentially run are to be informed of and involved in the process from a very early stage.

Amprion is calling the package of measures that is to be worked up during the coming months the "transparent planning office". "Pilot projects such as Kaarst and Bissendorf have taught us how regular dialogue or a joint route identification process best functions. As a result, we now have a number of sophisticated information, dialogue and participation formats at our disposal," says Jonas Knoop. One decision already taken is that we will open a local office manned by a permanent member of staff who will answer questions about the route at regular citizens' consultation meetings and take on board all suggestions made. In addition to this, Amprion will keep local residents informed about the progress and status of the planning process by posting the latest news on the corporate website and holding citizens' info markets. Another essential component of this strategy are face-to-face meetings. These will enable district administrators and mayors, for instance, to regularly voice the feelings and any proposals put forward by their colleagues on the local and parish councils. As Jonas Knoop and his Amprion colleagues sincerely hope, these measures will allow all parties involved to develop a mutual understanding and trust.

COMMUNICATION FORMATS

Amprion has a number of different formats at its disposal from which it can develop a tailor-made communication concept for each and every one of its projects.

INFORMATION

Project brochures and leaflets

provide information about why projects are necessary, how they are planned and the approval process.

Amprion's website

brings together and publicises all information about the company and its expansion projects.

www.amprion.net

Newsletter

regularly reports on the progress and status of the larger expansion projects.

DIALOGUE

Citizens' info markets

offer local citizens information on the project in their area and the chance to talk to Amprion employees.

Citizens' consultation meetings

are meetings held with Amprion employees to discuss concrete route planning activities.

Discussion groups

bring all parties together round one table – the citizens' action groups, the councils and the authorising agency.

"direktzu Amprion"

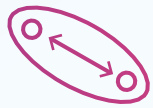
is an online platform that enables people to ask questions about the company, grid expansion and projects.

www.direktzu.de/amprion

CITIZEN PARTICIPATION

Site selection processes

such as the one underway with respect to the Ultranet converter, help the various interested parties to jointly define the criteria according to which the location for a large-scale facility is to be selected.



Route identification processes

like the one in Bissendorf, serve to jointly develop a route that is both technically feasible and as citizen-friendly as possible.

Mediation processes

bring together different interest groups in order to reach a consensus on the path of a power line or the location of an installation or building.

QUESTION TIME

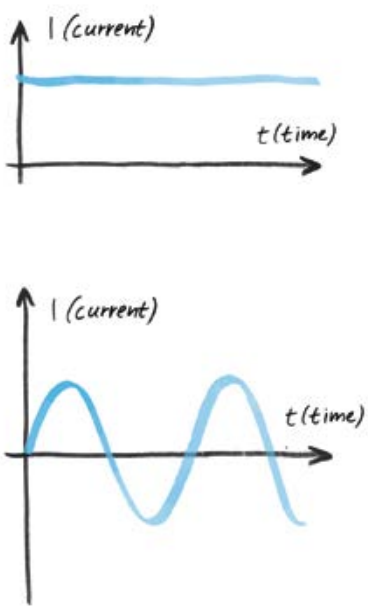
The German government is increasingly turning to underground cables as the solution to the problem posed by grid expansion. From now on, priority is to be given to using underground cable to construct the major direct current links. The cable technology to be employed to carry alternating current is currently undergoing trials in pilot projects. Why this distinction is necessary and important is explained here by Amprion's Dr Christoph Gehlen, who is responsible for transmission line technologies.

ILLUSTRATION · **SILKE WERZINGER**

1

WHAT'S THE DIFFERENCE BETWEEN DIRECT CURRENT AND ALTERNATING CURRENT? AND WHY DO WE NEED BOTH TYPES OF CURRENT IN THE TRANSMISSION GRID?

Direct current may be familiar to you if you've ever played with certain toy train set models: one rail acts as the positive pole, while the other is the negative. With alternating current, however, the polarity is constantly being switched back and forth – in the European power supply system, 50 times every second; that is, with a frequency of 50 hertz. In the past, alternating current came out on top as regards the grid system, primarily because it's relatively simple to change the voltage of the power supply with the aid of transformers. This ability is crucial for grid operation, because it enables us to connect power plants – including wind and photovoltaic systems – and consumers such as distribution systems and electricity-intensive enterprises to our grid without any problem. Changing the voltage of a direct current is more complicated. It requires converters, which need a lot more space and are much more expensive compared with AC transformers. This is why direct current technology is more suitable for transmitting large amounts of energy over long distances with minimal losses. In future, Amprion will be using DC technology for our Ultranet link, the German-Belgian ALEGrO connection and Corridor A North.



DC current profile (top)
AC current waveform (bottom)

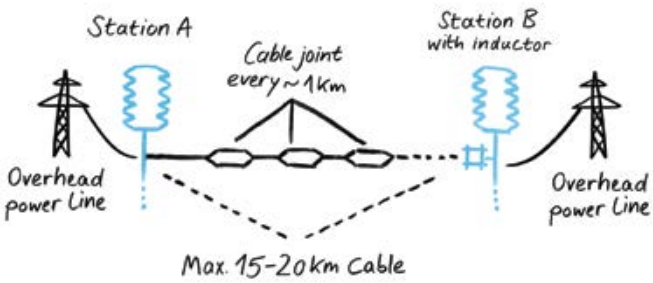
DR CHRISTOPH GEHLEN

manages the "Operation/Project Planning Lines and Cables" department at Amprion.

2

HOW DO DC AND AC UNDERGROUND CABLES FUNCTION?

Underground cables have a far greater capacity than overhead power lines. Before current flows, this capacity must first be "charged up". This requires what's known as "reactive power", and a DC cable needs to be charged up with it only once. Once this has been done, the current can flow – and over distances of several hundred kilometres. The situation is different with alternating current. Since the polarity keeps changing back and forth, reactive power is required continuously. As of a length of 15 to 20 kilometres, however, extra-high-voltage underground cables require so much reactive power that it "clogs" the cable and the amount of active power capable of flowing through the cable is minimal. The reactive power must then be compensated with the aid of inductors, which resemble large transformers. This results in a rather complex system technically speaking, which is more susceptible to faults and makes the grid less stable.



Schematic diagram of partial cabling in an AC application

The cable transfer stations, inductors and joints that connect the roughly one-kilometre-long sections of the underground cable can give rise to a technically complex system.

3

WHAT ARE THE CONSEQUENCES OF THIS WITH RESPECT TO UNDERGROUND CABLING OF DC AND AC POWER LINES AT AMPRION?

When it comes to transmitting electricity in the EHV range, the overhead power line fundamentally remains the best solution from both the technical and the economic point of view. Whenever new lines are required, DC connections are, for technical reasons, much more suitable for underground cabling. However, the only experience available with this technology to date relates to submarine power cables. In December 2015, Germany's legislators decreed that in future, priority must be given to underground cables when planning all DC connections – with the exception of Ultranet. In Amprion's case, this affects the ALEGrO and Corridor A North projects. We are currently developing planning and technical solutions for this connection. The situation is different with regard to AC underground cables. Here, too, practical experience is very limited, especially in relation to transmitting high power levels. For this reason, legislators have given the transmission system operators the opportunity to test cables in pilot projects. Amprion has already built the first such pilot section in Raesfeld. Trial operation is set to begin in summer 2016. We'll then be able to see how this technology fares. After a period of around five years, we'll have gained initial experience with this technology and be able to assess how reliable and safe AC cables function in the transmission system under the conditions cited.

3

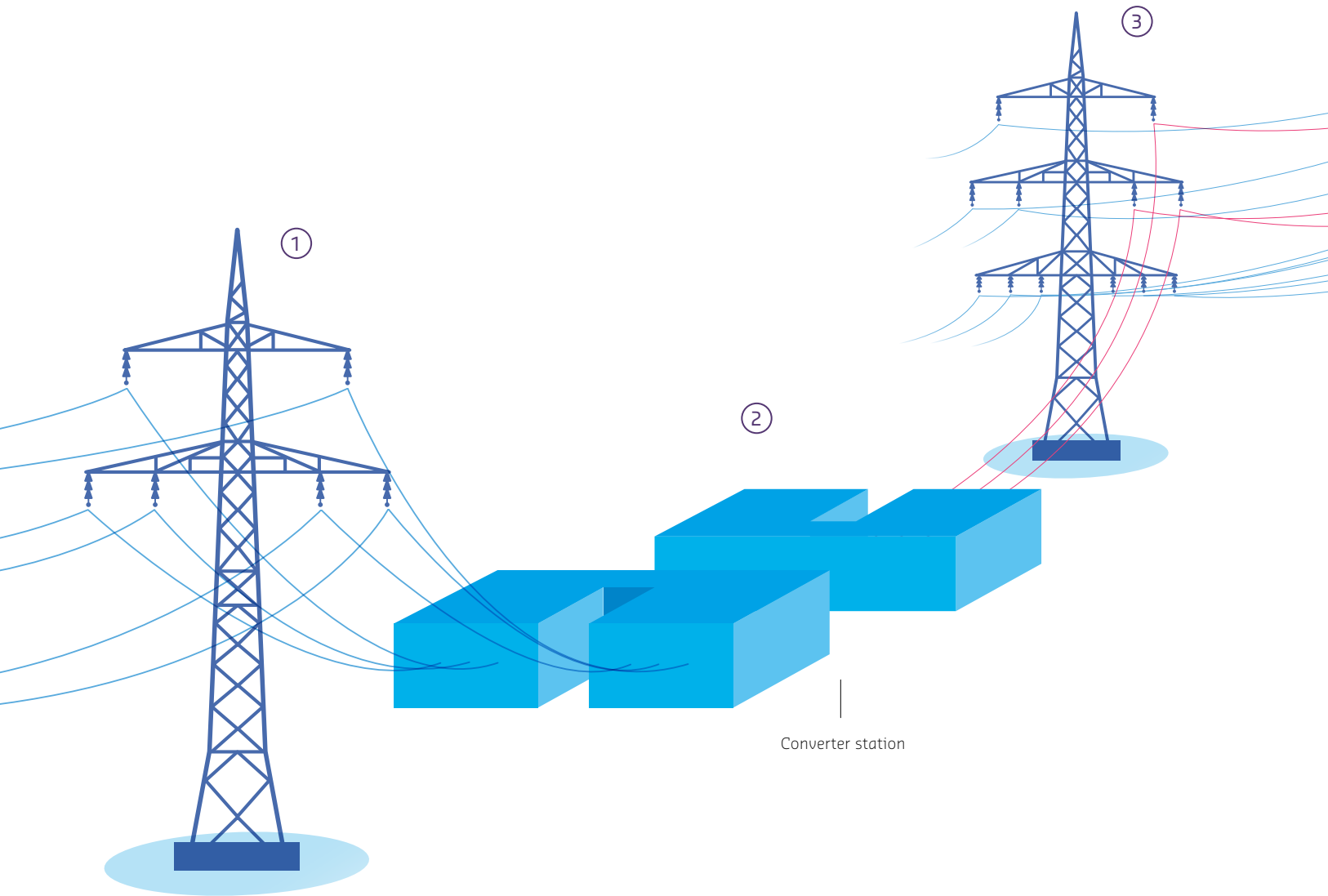
NEW START

Amprion is pushing on with the new start into the energy world of tomorrow. In the context of our grid expansion work, we are developing and integrating new, innovative technologies. These will strengthen the system reliability of the grid and help us to overcome the challenges of the energy transition and the growing electricity trade.

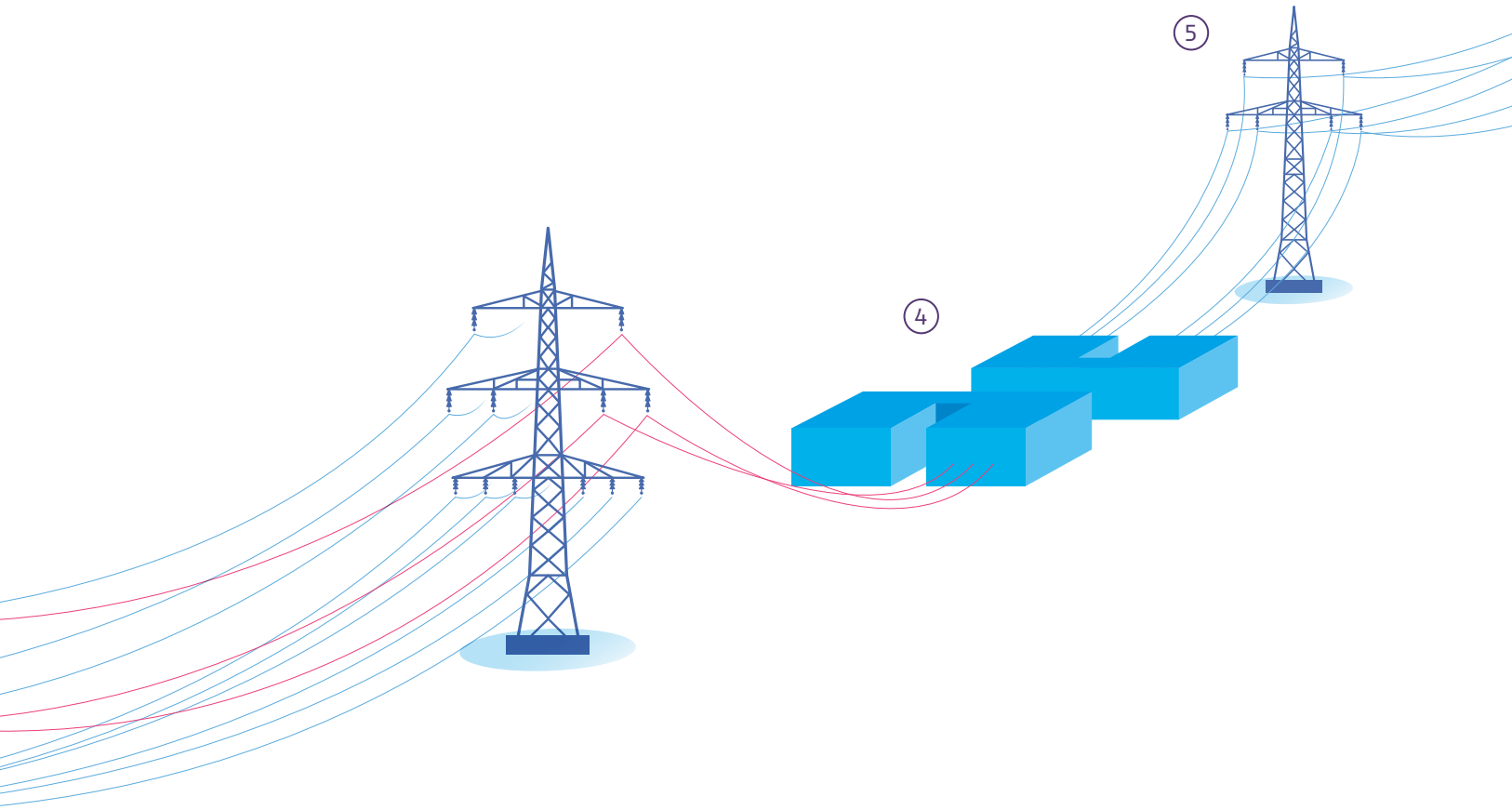
6,000

SUBMODULES will be controlled by the power electronics integrated into the Ultranet converters planned. These high-tech units are indispensable for this key project of the energy transition: they will facilitate the low-loss transmission of wind and solar power and at the same time make the grid even more reliable.

EFFICIENT OVER LONG DISTANCES



① Pylon with AC line ② Converter station in Osterath area
③ Hybrid pylons with AC and DC lines (HVDC)
④ Converter station in Philippsburg area ⑤ Pylon with AC line



Ultranet is the first of the three major north-south DC links to take shape. This also applies to the converters that will enable the low-loss transmission of electricity over long distances. Amprion, TransnetBW and Siemens are jointly planning the high-tech facilities.

PHOTOS · **MARCUS PIETREK · DANIEL SCHUMANN** TEXT · **VOLKER GÖTTSCHE**

The pencil flies across the paper. “This here is a switch,” explains Jochen Haude, “and that’s a capacitor.” With short strokes of the pencil, the engineer draws circuit symbols and current paths. “When the switch is in the one setting, the current flows through the capacitor; in the other setting, it bypasses the capacitor,” he explains. A single switch consists of two high-power transistors and two diodes. Together with a control unit, these elements form what’s known as a “submodule”. “By interconnecting a whole array of submodules, you create the core of a converter.” Haude lays the pencil to one side. “Technically speaking, it’s actually an amazingly good idea, put together from what are familiar, standard components.”

But what these submodules achieve is remarkable. Without them, one of the key projects of the energy transition simply would not be feasible. Ultranet is one of three major north-south DC links in Germany that above all are intended to transmit wind power from the north to southern Germany. Transmission system operators Amprion and TransnetBW are working together to plan the 340-kilometre-long “electricity highway” to be built between North Rhine-Westphalia and Baden-Württemberg. Transmitting high power levels over long distances in DC mode is particularly favourable, above all because transmission can be better controlled and losses are low. As, however, the rest of the grid operates with alternating

» Premium-performance control electronics: the switching behaviour of each of the 6,000 submodules is computed separately and precisely in a matter of microseconds. «

JOCHEN HAUDE, PRIMARY AND OPERATING EQUIPMENT MANAGER AT AMPRION

voltage, the power first has to be converted to direct voltage – at the extra-high-voltage level. Only then can the electricity be transmitted efficiently over this long distance. The same applies before the current can be fed into the AC grid again. This function is performed by two converters, one at either end of the Ultranet link.

Each of these Ultranet converters comprises almost 6,000 submodules that are arranged in three strings connected in series and put together to form "inverters". In addition to these submodules, the converters are equipped with transformers and cooling systems, inductors and mechanical switchgear. Together, they are capable of transmitting two gigawatts (GW) of power. As you can see, this type of unit plays in the champions league in the power transmission world, so to speak. "This enables us to transmit electricity to keep around two million people happy," says Jochen Haude, who heads the Primary and Operating Equipment department at Amprion and who, together with his team, is responsible for converter technology, among other things. The high supply capacity of Ultranet is required to compensate the energy shortfall in Baden-Württemberg when the two remaining nuclear power plants there are taken offline in a few years' time.

The electronics built into the converters must perform an extraordinary task, switching over the submodules electronically in line with precisely computed models and with timing accuracy down to the microsecond. "Each individual submodule is switched approximately 150 times per second," Haude explains. "Each switching instant of every single submodule is continuously computed by central control units." It's these very control units that make the converters such high-tech devices. The transmission system operators are investing around a billion euros in the Ultranet link, including the two converters. Planning, approval and construction are expected to take four to five years.

In autumn 2015, Amprion and TransnetBW commissioned Siemens to plan and build the Ultranet converter stations. The technology giant has extensive experience in the field of high-voltage DC transmission (HVDC). "By linking up with Siemens, we have an accomplished partner at our side," says Amprion's Managing Director, Dr Klaus Kleinekorte (see interview on page 44). To date, Siemens has commissioned more than 40 HVDC lines, with the latest converters to go online last September, being in Spain and France.

The project planners are presently in the middle of the 18-month engineering phase, computing and designing each individual component and the system as a whole by means of simulations. "How does the converter behave in specific situations in the high-voltage grid?

THE COURSE TAKEN BY ULTRANET

The DC link will run between North Rhine-Westphalia and Baden-Württemberg. Amprion (violet section of the route) and TransnetBW (pink section) hold joint responsibility for the project. With the exception of a few kilometres, Ultranet can be installed on existing pylons. A converter will be installed at either end of the link.

»KEY PROJECT OF THE ENERGY TRANSITION«

DR KLAUS KLEINEKORTE
Dr Klaus Kleinekorte, Managing Director of Amprion, talks about the significance of the Ultranet DC link – and the collaboration with Siemens.

WHY ARE DIRECT CURRENT LINKS LIKE ULTRANET SO IMPORTANT FOR THE ENERGY TRANSITION?

A number of factors come together here. Wind turbines being built in the north of the country are generating more and more electricity. This electricity is needed in the south of the country, where the nuclear power plants will be decommissioned over the next few years. The grids that exist now are not up to transmitting the huge amounts of electricity being generated in the north. This is why we need Ultranet and its extension to northern Germany, Corridor A North. This link will carry the East Frisian wind power to the south, bypassing today's already overloaded grid routes. In addition, solar power generated in the south can be brought to the Rhine-Ruhr region. These are the reasons why Ultranet is a key project for the energy transition – and the plans are already well advanced. One advantage of the project is that we can combine the new DC lines with the existing AC lines by using what we call "hybrid pylons" along the south-bound route. This will save a great deal of valuable time.

THERE ARE PLANS TO INSTALL A CONVERTER AT EITHER END OF THE LINK. COULD WE DO WITHOUT THEM?

In a word, no! Ultranet is a long-distance power link and transmitting electricity over such long distances works best with direct current. This requires converters that connect the link to the AC grid by converting alternating current to direct current and back again. These converters are indispensable for Ultranet. Apart from that, they have another significant additional benefit, for the technology on which they are based will help us make the grid safe, secure and reliable to operate well into the future.

THE CONVERTERS ARE AMONG THE MOST MODERN OF THEIR KIND. IS ULTRANET TECHNICALLY PERFECTED AND CONTROLLABLE?

The answer to that one is a definite "yes". You see, converters are nothing new in the world of electrical engineering. Systems like this have been around for decades. What we are doing with Ultranet is developing this technology further so that we can deploy it in a new power range and connect it to overhead power lines. And to help us achieve all this, we – meaning the transmission system operators Amprion and TransnetBW – have linked up with Siemens, an accomplished partner.

HOW'S THE WORKING RELATIONSHIP WITH SIEMENS GOING?

Very good. We've become a well-organised team. Based on our requirements, Siemens is carrying out calculations aimed at determining the exact design of the converters. And we're working closely with them, offering our own technical expertise. This collaboration is running very smoothly. Once we have completed these detailed plans, we will then quickly switch our attention to the approval process. Our goal is to implement Ultranet, one of the key projects of the energy transition, as quickly as possible.

How does the control software respond? How are the components loaded? To find the answers to these questions, we're working through every conceivable scenario possible," says Haude, "so that in the end, we know exactly what we have to do technically and practically to ensure that all demands are met." The Amprion team is in contact with the engineers at TransnetBW and Siemens on an almost daily basis. "Teamwork is what's required here, and across company boundaries, too."

For the first time in Germany, what's known as "full bridge technology" in the gigawatt range is to be implemented in the Ultranet converters. This is a special variation of what's known as "VSC technology". VSC stands for voltage-source converter. A dozen or so installations with VSC technology have been built over the past years in Europe alone. It can be used to regulate and stabilise the grid voltage, a function that until now has chiefly been performed by conventional power plants. In the event of an emergency, i.e. a power outage, the converters can also help reconfigure the grid. This technology also enables us to set precisely the direction in which electricity is to be transmitted and how much energy. Depending on how much wind power is being generated in the north and how much solar power in the south, the HVDC link can supply electricity to exactly where it's needed. "With this new converter technology, we are taking an important step towards securing the transmission of electricity both during and after the energy transition," says Klaus Kleinekorte.

Furthermore, full bridge technology also makes it possible to repair faults – such as those that result from a lightning strike in a power line – quickly and reliably. What's more, Ultranet is highly flexible should it need to be expanded. The planned DC link from East Frisia to North Rhine-Westphalia – known as "Corridor A North" in the network planning – is to be connected directly to the converter at the northern end of the Ultranet, in the Rhineland. "Thanks to VSC technology, we will then be in a position to flexibly control the flow of electricity between East Frisia, North Rhine-Westphalia and Baden-Württemberg," explains Jochen Haude.

And it's not just with respect to the converters that Amprion and TransnetBW are backing new innovations – their route planning concept is also going down new paths. Ultranet is to be the first transmission link to carry both direct and alternating current, with a voltage of 380 kilovolts – and for the most part using existing pylons, to boot! "We're certain," continues Kleinekorte, "that we will succeed in implementing this hybrid concept quickly and in running it reliably."

And that applies to the converters, too. "There are similar installations already up and running," notes Haude, enthusiastically. And how reliable are they? "As reliable as any conventional substation. On that score, the converter is like any typical electrical appliance – just bigger." With standard technical components, such as capacitors and switches.

High-tech installation built for the French-Spanish project Inelfe: the converters pack high-performance electronic equipment for efficient electricity transmission.

WIND OF CHANGE

Amprion is constantly working to make its grid even more flexible and intelligent. To this end, the company will be installing more than 400 weather stations along its transmission routes during the next few years. By doing so, Amprion is implementing the requirements laid down in the Power Grid Development Plan with regard to weather-dependent operation of overhead power lines and we are continuing to further develop the approaches already in place today.

TEXT · **PETER GAIDE**

A clear morning in December 2015. A helicopter takes off from an airfield in Essen-Mülheim and quickly gains height. It heads for the Siegerland, a region in central Germany on the border triangle of the states of North Rhine-Westphalia, Rhineland-Palatinate and Hesse. On board are the pilot, two measurement engineers and Dr Thomas Butschen. Together with a team of 12 Amprion experts from various specialist fields, the latter is currently developing models and methods for implementing weather-dependent operation of overhead power lines.

The team takes thermal images of overhead power line conductors. In view of the total length of the lines to be examined, this job is much easier to do from a helicopter than it is from ground level. The images reveal whether or not lines are up to the additional task asked of them. "We are currently examining the lines pylon by pylon. We will then decide whether or not the lines can be approved for weather-dependent operation or not," Butschen explains.

This "overhead power line monitoring" is a grid optimisation measure and therefore part of what's known as the "NOVA principle", a key statutory principle of grid expansion in Germany. This stipulates that the existing grid must be optimised first. Only once all options available have been fully exploited are lines then permitted to be upgraded or new ones built. As such, weather-dependent operation of overhead power lines is an integral part of the Power Grid Development Plan.

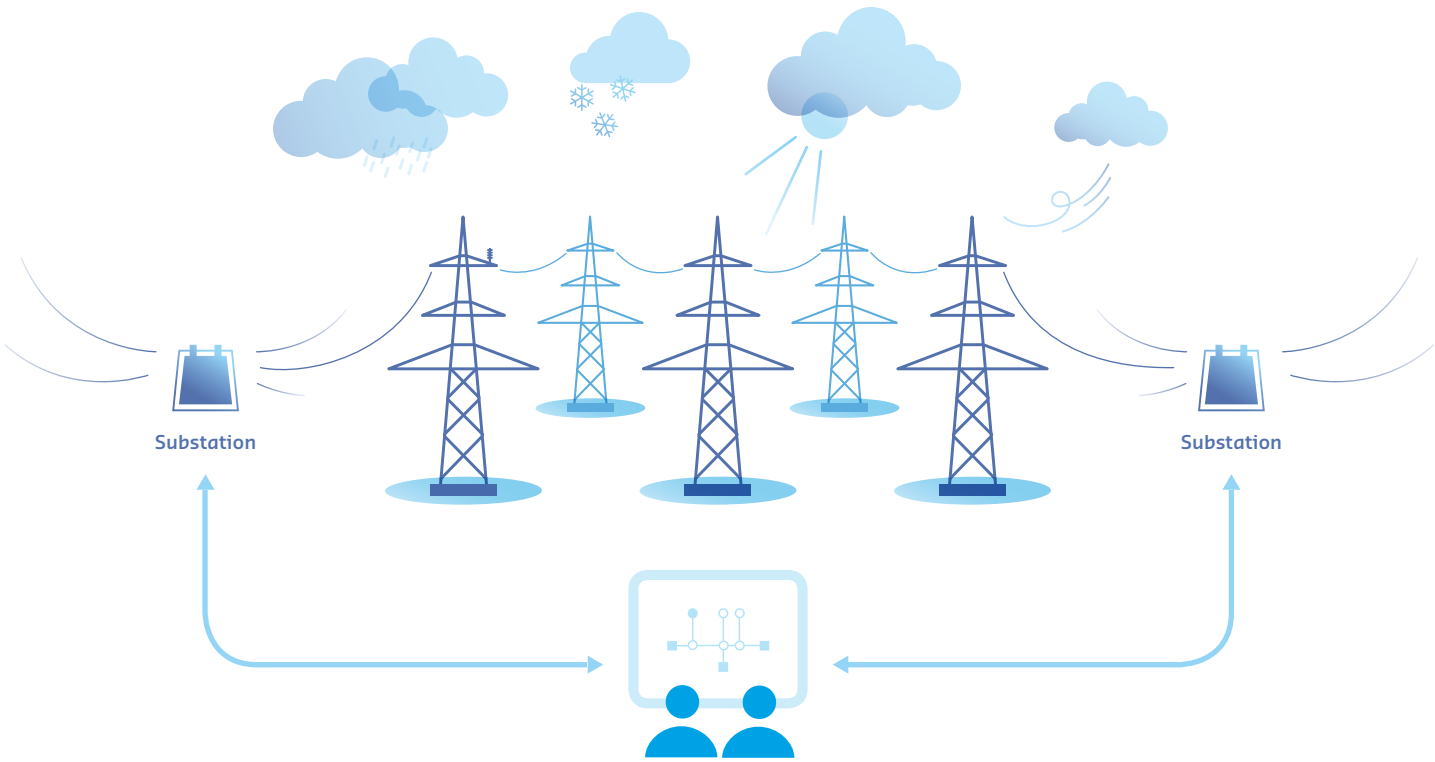
The key lies in joint consideration of physics and meteorology: when current flows through overhead power line conductors, these conductors heat up. Furthermore, the weather – i.e. the wind, ambient temperature and insolation – also impacts on the conductors, either cooling them or heating them up. As a basic principle, the operating temperature of a typical overhead conductor should not exceed 80 degrees Celsius. These factors dictate the maximum amount of current an overhead conductor can carry.

Until now, the engineers charged with calculating this limit have based their work on seasonal assumptions relating to the development of temperature, wind and insolation levels and used these figures to derive the transmission capacity of the overhead power lines. This approach is now being significantly refined. Instead of general assumptions and empirical values, Amprion's experts will in future employ actual weather data recorded on site. "What one needs, then, is precise knowledge about the actual weather that prevails – not just everywhere, but at many different points along the actual grid," says Thomas Butschen.

That he would spend so much of his time recording weather data is something the engineer could never have imagined when he first joined Amprion in September 2012. Butschen was appointed manager of this project in 2013. His team has consulted with and taken the

THE GRID IS INTELLIGENT

Overhead power lines are exposed to all weathers: the wind, sun and ambient temperatures either heat up the conductors or cool them down. This impacts on the maximum amount of current that can flow through the cables. In future, by measuring local weather data, Amprion will be in a position to plan the maximum current load of the conductors even better.



Amprion System Operation and Control

Recording of measured values and computing the limit values

WEATHER SENSORS

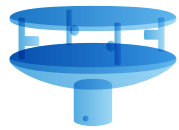
The sensors of the weather stations measure a number of meteorological data. They will be mounted on the overhead power lines and equipped with solar cells and mobile communications data modules, so that they are completely autonomous as regards their power supply and they can transmit their data online.

Thermo-hygro sensor

Relative humidity and temperature

Pyranometer

Insolation



Ultrasonic anemometer

Wind direction and speed

» Weather-dependent operation of overhead power lines and the planned grid expansion go hand in hand.«

DR THOMAS BUTSCHEN, PROJECT MANAGER OF OVERHEAD POWER LINE MONITORING AT AMPRION

advice of meteorologists and developed its own weather stations, whose sensors are capable of measuring the air pressure, ambient temperature, wind speed, wind direction and the intensity of insolation, and transmitting this data back to the team.

The first two weather stations are already undergoing trials. Amprion plans to install more than 400 stations by 2022 – at locations where there is less cooling wind and insolation is particularly intensive. "These are the points on the transmission routes at which the conductors heat up most. If we have accurate figures for these temperatures, we can calculate precisely the maximum load the conductors will be subjected to," Butschen explains. The weather stations installed at these "hotspots" are equipped with solar cells and a mobile communications data module, so that they are completely autonomous as regards their power supply and they can transmit their data to System Operation and Control without any need for wiring.

Once the project is fully implemented, the 400 stations distributed across our entire network will continuously supply precise data about the specific local temperatures, wind speeds and directions as well as insolation levels. This will enable Amprion's experts to compile even more detailed weather forecasts, which in turn will allow them to compute the maximum possible current loads that can be sent down the lines in the coming hours and to plan grid operations based on this data. This is what distinguishes this model of overhead power line monitoring from others, in which the temperature in the conductors is measured directly. "That said, we will only be able to fully exploit the benefits under certain weather conditions," Butschen observes. "In summer, we won't be able to transmit any more current than we can now."

The helicopter trip is coming to an end and the airfield in Essen-Mülheim is in sight again. The measurement engineers in Thomas Butschen's team will assess the thermal images he has taken during the course of the coming weeks. They will then be yet another step closer to achieving their goal. "Weather-dependent operation of overhead power lines and the planned grid expansion go hand in hand: one cannot function without the other. All in all, we'll succeed in making our transmission system fit for the increasing demands that lie ahead."

living

Amprion continues to develop and advance.
It's an opportunity for all members of staff to play an
active role in shaping the ongoing transition.

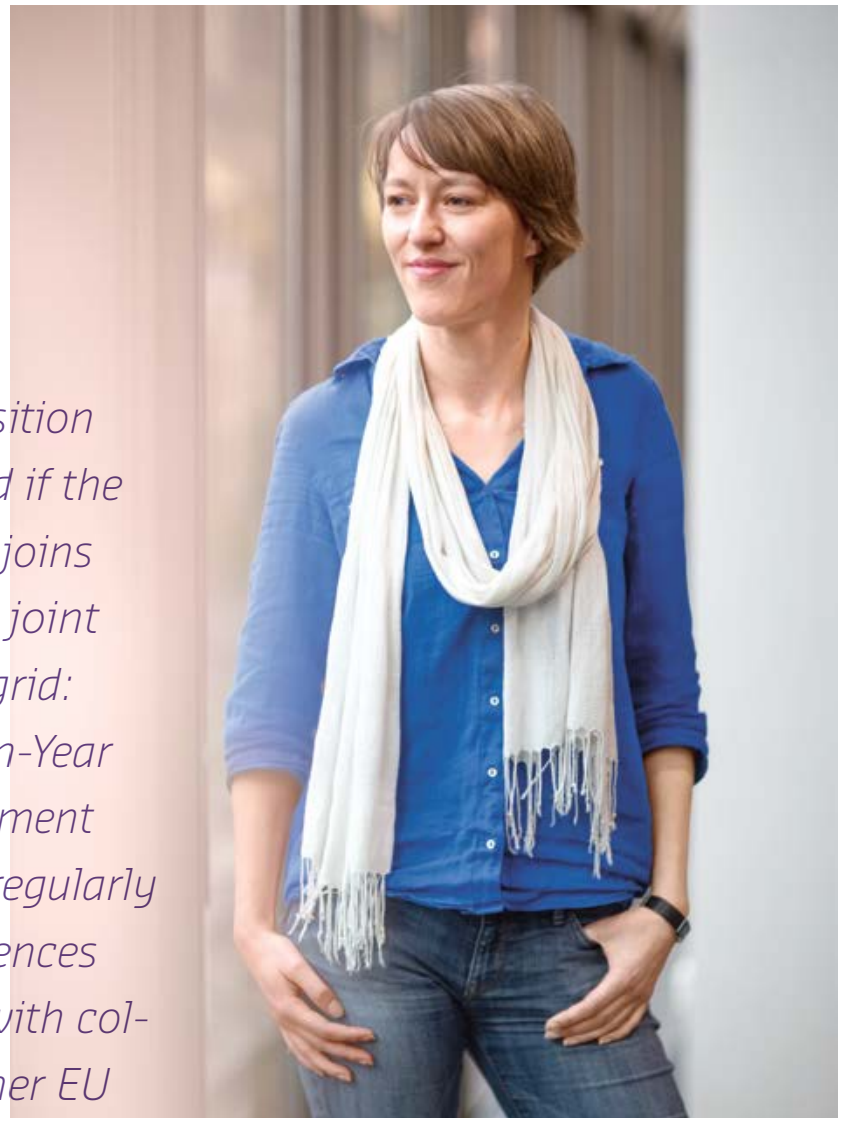
PHOTOS · **MATTHIAS HASLAUER** · **MARCUS PIETREK**

I have specialised in public law. For a lawyer dealing with planning legislation, there is no more exciting a challenge out there in the coming years than that offered by grid expansion in Germany and Europe.«

Mona Fachinger is a lawyer and joined Amprion in February 2015.

I like working in a team that tackles innovative issues. This includes planning work for the Ultranet converters. What really excites me about my work is that we're implementing the very latest technologies – it's this that makes the energy transition tangible.«

Dr Daniel Eichhoff is an electrical engineer and has been at Amprion since September 2015.



The energy transition can only succeed if the whole of Europe joins in. This requires joint planning of the grid: the European Ten-Year Network Development Plan (TYNDP). I regularly exchange experiences and know-how with colleagues from other EU countries. It enriches my day-to-day work.«

Yvonne Surmann is an industrial engineer and joined Amprion in 2013.

Amprion is a relatively young company. New technologies and workflows keep us on our toes. Among other things, I'm currently coordinating scheduled outages and carrying out maintenance work on our systems. I look forward to being able in future to work even more intensively with innovative technologies.«

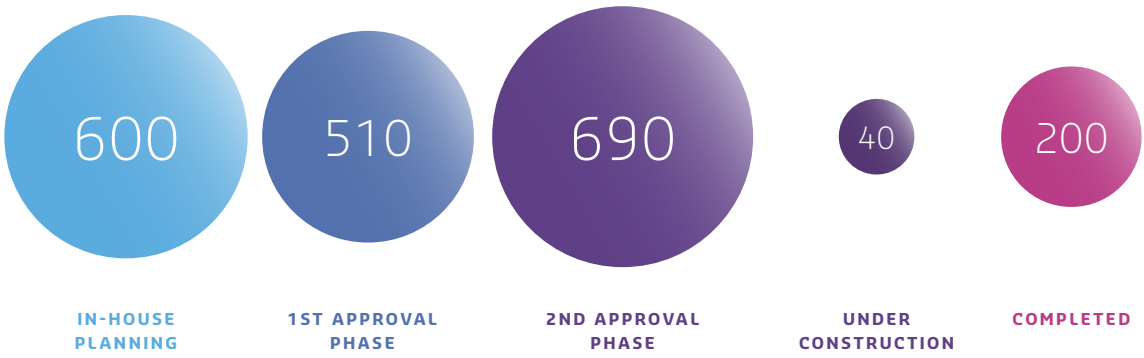
Timo Jonas is a fitter and has worked for Amprion since 2010. He has successfully completed a degree in engineering while continuing to work full time.

Systems and IT security go hand in hand at Amprion. I'm involved in planning a whole range of IT projects. Project management means that I'm faced every day with new problems and it's precisely this that makes my work so exciting.«

Dr Frank Brüggemann joined Amprion in October 2015. He manages IT projects.

STATUS QUO 2015

GRID EXPANSION AT AMPRION



(km)

In 2009 and again in 2013, Germany's legislators commissioned Amprion with the task of expanding and upgrading around 2,000 kilometres of power lines. It takes at least five years before all the planning work and approval procedures for an expansion project are completed. The situation at the end of 2015 was as follows: in-house planning activities were still underway for projects with a total line length of around 600 kilometres. 510 project kilometres were either about to have an application submitted for or were already in the first approval phase – what's known as "federal sectoral planning" (Bundesfachplanung) or "regional planning procedures" (Raumordnung). 690 new or expansion kilometres were just about to enter or were already in the planning approval phase, the second approval phase. Around 40 kilometres of line were under construction. Expansion projects with a total length of 200 kilometres had already been completed.

Source: Based on "EnLAG- und BBPlG-Monitoring", Q4/2015; January 2016

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NOTE REGARDING USE OF MALE/FEMALE

We would appreciate your understanding that for reasons of readability, we have not used the male and female forms of language throughout. Naturally, all texts refer equally to men and women.

ANNUAL REPORT 2015

2015 was a successful year financially for Amprion. This positive development is the result of efficient implementation of our statutory duty: to use our transmission system to deliver safely and reliably electricity to the 29 million people who live and work in the area covered by our grid. To ensure that we can continue to meet this responsibility far into the future, we are upgrading and expanding our transmission system in line with the needs and demands that lie ahead of us. It's on this basis that Amprion aims to develop along sustainable lines.

KEY TO ICONS USED

Reference to glossary

Internet link

CONTENTS

DR KLAUS KLEINEKORTE
Chief Technical Officer

DR HANS-JÜRGEN BRICK
Chief Commercial Officer and Chief Financial Officer

Dear readers,

2015 was a successful year financially for Amprion GmbH. This positive development is the result of efficient implementation of our statutory duty: to run the Amprion transmission system safely and reliably and to expand it in line with requirements. On this basis, our company achieved sales revenues worth 11,868 million euros – a new record. Of this, 9,968 million euros were apportionable to the handling of the Renewable Energy Sources Act (EEG) balancing mechanism, which had no effect on net income, and 1,763 million euros attributable to the power grid side of the business. The annual net income of our company amounted to 171 million euros and was therefore 14 per cent higher than the year before.

2015 saw us make good progress on the grid expansion front. This is made clear by our capital expenditure, which reached a record level in 2015 at 474 million euros – a trend that will continue in the coming years. By 2015 we want to invest a total of around 5.5 billion euros in the modification, upgrading and improvements in the flexibility of our transmission network. Our stable credit ratings (Moody's A3, Fitch A–) help shoulder this financial challenge. Another prerequisite is a stable regulatory framework.

Last year, politics and the public at large also conducted an intense discussion on the topic of transmission system modification, in particular, about the use of underground cabling. At the beginning of 2016, a new legal framework came into force in this regard. In this context, January 2016 saw the German transmission system operators reorganise responsibility for the direct current corridors in the country. Instead of the south-east passage, Amprion will now be responsible for building the entire northern extension of Ultranet, taking it up to the North Sea – Corridor A North. A bundling of responsibilities is playing a major role in enabling us to implement these key projects of the energy transition not only swiftly but also in a citizen-friendly manner.

Based on the statutory parameters, we will be planning the DC link known as Corridor A North primarily as an underground cable connection. With respect to the AC side of the technology, we are trialling underground cabling in three further pilot projects. The experiences we are gaining in the context of our pilot underground cable project in Raesfeld will stand us in good stead. We successfully completed construction work and voltage tests in 2015, and 2016 will see us begin with trial operation.

Last year, we advanced all route sections for Ultranet to the first approval phase. With regard to planning and construction of the Ultranet converter, we have brought a strong technology partner on board. In addition to these flagship projects, we have also pressed ahead with more than 300 power-line-construction and plant-engineering projects in 2015.

The restructuring of our energy system currently remains the most comprehensive infrastructure project in Germany from the macroeconomic and technological point of view. The only way we can succeed in implementing it is on the basis of a broad consensus in society. And Amprion is playing its part in this. During the last financial year, at around 500 different events, we struck up a dialogue with citizens, authorities, politicians, journalists, associations and commercial enterprises. Our objectives in doing so were to inform people about our company and business and to engage with all interested parties in an open dialogue in order to search for the best solutions for expansion projects. 2015 saw us once again go down new paths – such as the dialogue portal "direktzu Amprion" or communication activities covering all aspects of the pilot underground cable project in Raesfeld.

In parallel with grid expansion, we are turning our attention to the future, which we also view as belonging to our scope of responsibility. Connected with this are a number of issues that we are confronting: for example, continued development of the European transmission network that reliably integrates ever more regenerative power generation. At the same time, we aim to join forces to work together to strengthen Europe's internal energy market. And we need new technologies in order to synchronise the grid even better with the fluctuating infeed of renewables. We are working non-stop on all of these topics together with our partners in Germany and around Europe. Amongst other things, this is what the European Network Development Plan "eHighway2050" or the work on our new control system for System Operation and Control in Brauweiler is all about.

This variety of subject matter and duties is being managed by our 1,100 employees every day with a great deal of know-how and enthusiasm. They are laying the foundations of our commercial success, and it is precisely for this that we would like to thank them most sincerely! It's on this basis and in dialogue with our stakeholders that Amprion aims to develop along sustainable lines in the 2016 financial year, too.

DR HANS-JÜRGEN BRICK
Chief Commercial Officer and
Chief Financial Officer

DR KLAUS KLEINEKORTE
Chief Technical Officer

For more information about Amprion's executive management, go to:
↓ http://www.amprion.net/en/executive-management

Report of the Supervisory Board

Ladies and gentlemen,

For Amprion, financial year 2015 was dominated by grid expansion activities conducted in connection with the energy transition. One particular focus was on the question of how grid expansion can be promoted in a manner that is more acceptable to the public at large and yet macroeconomically responsible at the same time. The company has taken an active part in these discussions and succeeded in getting its perspective across. Parallel to this, further progress has been made with respect to grid expansion. 2015 saw Amprion work on planning and gaining approval for expansion projects that together covered a total length of some 1,800 kilometres. Around 270 kilometres of new line were added to the approval process. By acquiring an indirect interest in the European Power Exchange (EPEX SPOT), Amprion also played a part towards advancing Europe's internal energy market.

Financial year 2015 also saw the Supervisory Board perform all duties and responsibilities required of it by company articles of legislation and, in particular, fulfil its monitoring and advisory functions vis-à-vis the Executive Management. To this end, the Board requested written and verbal reports from the Managing Directors regarding the status of commercial operations, fundamental issues of business policy and the position and development of the company. Furthermore, the Board discussed significant business transactions with the Management Board in depth and took all necessary decisions. Moreover, the Chairman of the Supervisory Board also discussed important individual transactions and matters of corporate strategy and business policy in meetings held with management outside the Supervisory Board meetings, in preparation for the committee meetings. Furthermore, the Audit Committee performed all duties and responsibilities required of it by company articles and, in particular, carried out all preparations for approval of the annual financial statements by the Supervisory Board.

The Supervisory Board held four meetings over the course of the reporting period. These meetings focused on the detailed reports submitted by the Managing Directors relating to the position of the company, including the sales trends, earnings performance and the company's strategic goals. In addition, the Supervisory Board engaged in intensive discussion regarding the financial budget submitted for 2016 and approved said budget. Furthermore, the company's long-term investment plans through to 2025 were likewise debated in great detail and approved by the Supervisory Board. The Supervisory Board has also concerned itself with the regulatory environment in which the company operates and the pending or effected changes of the legal framework.

BDO AG Wirtschaftsprüfungsgesellschaft of Düsseldorf, the auditors chosen in accordance with the resolution of the shareholders passed on 14 April 2015 and engaged by the company's Supervisory

Board to carry out the audit, has audited the annual financial statements and the management report of Amprion GmbH for financial year 2015, including the accounting, and issued an unqualified auditors' opinion.

The auditors' report, the annual financial statements and the management report were delivered to the members of the Supervisory Board in good time, prior to the Supervisory Board meeting held on 12 April 2016, and discussed in depth at this meeting. The auditors participated in the meetings of the Supervisory Board and reported on the fundamental results of their report. Furthermore, the auditors were also available to provide supplementary information as required. The Supervisory Board has endorsed the results of the audit. For its part, the board has studied the annual financial statements and the management report prepared by the Executive Management. In accordance with the final results of its review, the Supervisory Board confirms that no objections are to be raised. The Supervisory Board has approved the management report and the annual financial statements for financial year 2015, and the financial statements are thus adopted.

The following changes were made to the composition of the Supervisory Board in financial year 2015:

Stephan Illsinger resigned as a member of the Supervisory Board effective from 15 May 2015. A shareholders' resolution adopted on 19 May 2015 elected Christoph Manser, Head of Infrastructure Investments at Swiss Life Asset Management AG, as a member of the Supervisory Board of Amprion GmbH effective from 15 May 2015.

The Supervisory Board wishes to acknowledge and express its thanks and appreciation to the management and all employees of Amprion GmbH for their commitment and the work they have performed during financial year 2015.

Dortmund, 12 April 2016

PROF. HEINZ-WERNER UFER
Chairman of the Supervisory Board

MANAGEMENT REPORT

OF AMPRION GMBH
FOR THE 2015 FINANCIAL YEAR

Fundamentals of the company

Business activity of the company

Amprion GmbH, based in Dortmund, is one of four transmission system operators (TSOs) in Germany and has around 1,150 employees. In a balancing zone that stretches from Lower Saxony to the Alps, Amprion operates its network with voltage levels of 220 and 380 kV and expands it in accordance with market requirements. Measuring around 11,000 kilometres in length and with around 170 substations and **transformer stations**, Amprion's extra-high voltage network is the longest in Germany. It links the power plants with the main centres of consumption and is a vital component in the transmission network in Germany and Europe. The company provides its extra-high voltage network to industrial customers, redistributors, energy traders and generators via approximately 1,100 feed-in and tapping points at standard prices in line with the market.

Page 61

In addition, Amprion steers and monitors the secure transportation of electricity within the extra-high-voltage network in its balancing zone. For this purpose, the system management in Brauweiler/Pulheim ensures that electricity consumption and generation are kept in balance at all times. The system output required (primary control, secondary control and tertiary control) and the necessary electricity for the compensation of grid losses are sourced using transparent tender processes in line with the regulations. The company also coordinates the exchange programmes and the subsequent volume balancing, both for the entire transmission network in Germany and for the northern section of the integrated European grid.

Thanks to its central location within Europe, Amprion's network is a vital hub for the European electricity trade between north and south and between east and west. Amprion provides transmission network capacities to the interconnecting feeder lines to France, the Netherlands and Switzerland by means of market-based auctions.

Amprion's shareholders are M 31 Beteiligungsgesellschaft mbH & Co. Energie KG, a company whose owners largely comprise German institutional financial investors from the insurance industry and pension funds, with 74.9 % of the shares, and RWE AG with the remaining 25.1 % of the shares.

Financial report

Political and energy regulatory environment

Renewable Energy Sources Act

In 2015, the expansion of underground cabling in the direct current and three-phase current areas moved to the centre of the debate on energy policy. The associated costs were justified by greater acceptance and accelerated expansion of the network, declared the coalition parties CDU, CSU and SPD in in their resolution of 1 July 2015 concerning the "key points for a successful implementation of the energy transition". The law for the amendment of provisions of rights pertaining to the Power Grid Expansion Act (Energieleitungsausbaugesetz – EnLAG), which was passed by the Bundestag (German Parliament) on 3 December 2015, picked up on the coalition's resolution. The possibility of partial underground cabling for HVDC transmission lines, which has already existed since 2014, was upgraded to an underground cabling priority. An exception from this is provided by the HVDC connection "Ultranet" that Amprion is planning as hybrid technology. In addition, further **underground cabling** criteria as well as additional pilot projects from the three-phase current area were included in the Act. The number of pilot projects increased from four to 11, with Amprion being involved in three of these further projects.

Page 61

Page 61

In their resolution, the coalition parties also instructed the **Federal Network Agency** (BNetzA) to examine whether the Isar hub near Landshut was basically suitable as the southern terminal point of corridor D. While the Federal Network Agency still confirmed the requested Gundremmingen grid connection point in the **NEP** 2024, the Isar grid connection point was adopted in the parliamentary procedure and passed by the Bundestag on 3 December 2015.

Page 61

Electricity market legislation

A comprehensive amending law for the prevailing energy market legislation will follow in 2016 with the draft law for the future development of the electricity market. It will be based on the German government's draft law dated 4 November 2015 and stipulates that the network reserve should be continued until at least 31 December 2023 on the basis of the network reserve regulation. As from the winter half-year in 2021/2022, moreover, new generation plants with up to 2 GW are to be constructed and established by force of law as network reserve. The draft also gives remuneration specifications for redispatch measures in the Energy Industry Act (**EnWG**), which is designed to increase the level of legal certainty for all market participants.

Page 60

Another crucial element is the "security standby" role assigned to particular brown coal power stations. In order to achieve the climate target for 2020, the government plans to decommission brown coal power stations gradually from 2016 onwards and provisionally close them down. It is intended that each of them should function for four years as the last, and time-limited, backup for the power supply. They will finally be closed down when this standby period has come to an end. In Amprion's balancing zone, brown coal power stations with a capacity of around 1.5 GW would be affected. In the planned separate capacity reserve, emergency power stations not at the disposal of the market will be ready for operation as emergency power stations. The intention is that they should step in when both the technical measures (including the network reserve) and the market-based measures have been exhausted. The costs resulting from the decommissioning of the brown coal power stations and the newly introduced capacity reserve can be passed on via the network charges.

Law on the digitalisation of the energy transition

In January 2016, the German parliament began its deliberations on the German government's draft law dated 4 November 2015 regarding the digitalisation of the energy transition. A crucial element of this will be the law on metering point operation and data communication in intelligent energy networks (law on metering point operation). The law on metering point operation will include, inter alia, the existing rules in Sections 20b–i **EnWG** and Sections 18a–22 of the regulation on electricity feed-in to and consumption from electricity supply grids (Stromnetzzugangsverordnung – StromNZV) in condensed form and new regulations, especially concerning modern metering point facilities and intelligent metering systems. The draft envisages that all final consumers with consumption of more than 6,000 kWh should be provided with an intelligent metering system. Responsibility for the rollout will be borne by the distribution system operator, who will be able to transfer authority to a third party by way of tendering.

Page 60

Combined Heat and Power Act

When the law on the maintenance, modernisation and expansion of combined heat and power (KWKG/CHP) came into effect as of 1 January 2016, the operation handling practice that applied until then was codified conclusively under the law. The amendment was based on the implementation assistance from the Federal Association of the German Energy and Water Industry (BDEW) pertaining to KWKG that was agreed in the industry. It stipulates the binding nature of the distribution system operators' cost forecast for in-year charging during the subsequent year as well as the value date for the annual statement between transmission system operators and distribution system operating operators in the year after the subsequent year, thereby strengthening the balance-sheet neutrality of allocation handling for the TSOs. This new legal arrangement affects all allocation systems and thereby contributes to the standardised handling of all CHP-based allocations and to the further standardisation of operating processes.

EEG amendment

Page 60 A further amendment to the Renewable Energy Sources Act (**EEG**) is planned for 2016. Its basic features have already been outlined in the benchmark paper prepared by the Federal Ministry for Economic Affairs and Energy (BMWi) in December 2015. To ensure that the new regulations can be implemented operationally without any delays, Amprion will give continuous guidance to the legislative process.

"DigiNetz" law

In January 2016, the Bundestag passed the law to facilitate the expansion of digital high-speed networks (DigiNetzG). The law serves to implement Directive 2014/61/EU issued by the European Parliament and Council concerning measures to reduce the cost of expanding high-speed networks for electronic communication (cost-reduction directive). The law's objective is to reduce the cost and increase the efficiency of the broadband expansion. Among other things, the claim to shared use of passive network infrastructure in accordance with Sections 77a et seq., German Telecommunications Act (TKG) is put in concrete terms and rules on the coordination of construction work have been established.

Incentive-based regulation

The report on the evaluation and further development of incentive-based regulation was published by the **Federal Network Agency** on 21 January 2015 and transferred to the BMWi. In its statements to date, Amprion has always demanded stability and reliability in the regulatory framework and a targeted, evolutionary ongoing development of specific aspects. On 16 March 2015 the BMWi, on the basis of the evaluation report, published the position paper "Modern regulatory framework for modern distribution networks". It largely contains adjustment proposals for distribution system operators and takes up the further development of the existing Incentive Regulation Ordinance (**ARegV**) system that is preferred by the BNetzA.

Page 61

Page 60

The transmission system operators are affected only marginally by the position paper. Amprion is nevertheless guiding the process actively and espousing a stable regulatory framework. In particular, adherence to the proven instrument of investment measures in accordance with Section 23 ARegV, which guarantees effective regulation of the large-scale projects typical of TSOs, is a matter of great interest for Amprion. The investment cost difference model in particular – which the distribution system operators had demanded – is the subject of controversial discussions between the BMWi, the Federal Network Agency and the federal states' regulatory authorities. A draft ordinance on the future regulatory framework has therefore not been published.

Business performance

Grid business

Amprion determines the network charges and the revenue cap by way of incentive-based regulation and in accordance with the guidelines of the **EnWG**, the **ARegV** and the Electricity Network Fee Regulation Ordinance (Stromnetzentgeltverordnung – StromNEV). The revenue cap was fixed for the second regulation period on the basis of the costs from 2011 (base year). Under Section 4 (3) in conjunction with 34 (1) ARegV, Amprion can adjust the revenue cap, and consequently the network charges, on 1 January of each calendar year. Adjustments may be carried out by network operators only in the event of a change in so-called permanently non-controllable costs. The **Federal Network Agency** must be notified of these adjustments accordingly. Since the start of the incentive-based regulation, increases or decreases in revenue have been recorded in the regulatory account in accordance with Section 5 ARegV. Generally, the applicable revenue cap is not changed until the subsequent regulatory period.

Page 60

Page 61

As of 1 January 2015, Amprion adjusted its network charges depending on the duration of use and the voltage level. Particularly in the range of usage hours between 5,000 and 8,760 hours that is relevant to the majority of customers, network charges changed at the extra-high voltage level from +20.7% to +25.2%. This was caused by the passing on of costs for the network connection of offshore windfarms and capital costs from approved investments.

Amprion's customers are industrial companies, distribution networks and power stations directly connected to the extra-high voltage network. The sales and revenue structure is characterised largely by major distribution network operators, which account for approximately 86% of Amprion's network charges. Some 9% of the network charges originate from the chemical, steel and aluminium industries. The remaining network charges result from the requirements of the power stations connected to the transmission network.

Every two years since 2006, Amprion has conducted customer surveys in collaboration with a market research institution among the directly associated industrial companies, distribution system operators and power stations. In past surveys the participation rate was between 70% and 80%. The objectives of these regular surveys are to assess the performance spectrum, ascertain image factors and gather information on how the marketing mix might be improved. The classical indicators of customer satisfaction and loyalty, too, were surveyed. Customer satisfaction has increased continuously since 2006. In 2014, at 71%, it was higher than the industry average of 61%. Loyalty to Amprion is likewise high at 62%. According to the survey's findings, Amprion is characterised primarily by competence and customer orientation.

Annulment of FNA stipulation on redispatch

Page 61 On 28 April 2015, Düsseldorf Higher Regional Court declared as unlawful the **Federal Network Agency**'s stipulations with relevance to the TSOs concerning the standardisation of contractual frameworks for possible interventions by the TSOs in the operational mode of production plants (BK6-11-098) and concerning the criteria for the determination of appropriate remuneration in the case of electricity-related redispatch activities and in the case of voltage-related adjustments in the supply of active power into the grid (BK8-12-019). The FNA annulled the stipulation BK6-11-098 on 15 June 2015 and the stipulation BK8-12-019 on 19 August 2015. The revocation of these stipulations has no influence on the Page 60 operational utilisation of redispatch because the TSOs, according to Section 13 para. 1a **EnWG**, have the right to request redispatch. A regulation governing the future and retroactive remuneration of redispatch activities is included in the draft electricity market law. According to Section 13a para. 2 EnWG-E, the actual production outlays, the proportional value consumption of the plant in question and lost revenue potential, insofar as these exceed the other costs to be reimbursed, must be remunerated.

EEG implementation

Page 60 The **EEG** equalisation mechanism operates on the basis of the Ordinance on a Nationwide Equalisation Page 60 Scheme (**AusglMechV**) and the German Equalisation Scheme Execution Ordinance (AusglMechAV). The amount of electricity fed in under the EEG outside of direct marketing measures is marketed by the TSOs on the electricity exchange, with the difference between the revenues and expenditures for the EEG feed-in amounts being passed to energy utility companies via the EEG allocation. The EEG process is generally income-neutral for the TSOs.

The TSOs published the EEG allocation for 2016 within the set deadline on 15 October 2015. This resulted in a slight increase of around 3 % in the EEG allocation from 6.17 cents / kWh to 6.35 cents/kWh. The main reasons for this were the forecast for further expansion of renewable energies and the expected decrease in market proceeds from EEG electricity to be marketed. The EEG allocation also included the maximum permissible liquidity reserve throughout Germany of € 2,331 million (corresponding to 10 % of the shortfall).

Interruptible loads

In accordance with the ordinance on interruptible loads (AbLaV), the German transmission system operators can impose an overall breaking capacity of 3 GW. Amprion is the coordinator for the interruptible loads in Germany. This contractual volume has not yet been completely exhausted throughout the country. For interruptible loads amounting to 979 MW (of which 715 MW in the Amprion balancing zone), it proved possible to reach a general agreement and have it certified by way of the prequalification process. In June 2015, the TSOs automated operating activities completely, and since then interruptible loads have been used increasingly for supporting the system's balance and rectifying bottlenecks. The AbLaV was due to expire at the end of 2015 and on 18 December 2015 was then prolonged until 30 June 2016. An amendment to the framework conditions is being drafted and is scheduled to take the place of the previous AbLaV in 2016. Political initiatives to this effect are guided intensively by Amprion.

System services

The control reserve continues to be procured in Germany by the TSOs jointly in accordance with the stipulations of the **Federal Network Agency**. Compared to the previous year, the secondary control reserve in 2015 decreased only slightly in volume while tertiary control, on the other hand, saw its volume decline significantly. This is the result of a reduction in the imbalances in the German control block. Prices for secondary and tertiary control reserves showed a strong downward trend.

Page 61

In overall terms, the cost of procuring lost energy (grid losses) has decreased for Amprion. This can be attributed largely to the lower prices that Amprion achieved thanks to the long-term procurement of the lost energy that was agreed on back in 2014.

The costs for redispatch activities remained at their forecast low level in the financial year 2015.

Reserve power stations

Page 61 Every year, on the basis of analyses conducted by the TSO, the **Federal Network Agency** publicly announces the grid's reserve needs for the next five years. The remaining additional needs that cannot be covered by reserves already contractually secured have to be covered by expression-of-interest procedures (IBV). In its report dated 4 May 2015, the FNA announced a grid reserve requirement range of 6,700 MW to 7,800 MW for the whole of Germany for the winter half-year 2015/2016. The concrete grid reserve requirement depends on how the plants available after the expression-of-interest procedures take effect in the grid. The aforementioned grid reserve requirements led to an immediate additional requirement of generation capacity of 489 MW to 1,388 MW in Amprion's balancing zone for the winter half-year 2015/2016, for whose coverage, in accordance with Section 4 of the Ordinance on Reserve Power Stations (ResKV), expression-of-interest procedures had to be carried out. For the winter half-years 2015/2016 and 2016/2017, Amprion had already contracted an additional volume amounting to 429 MW as grid reserve and called upon it on several occasions. The costs of the grid reserve are refinanced fully via voluntary self-obligations in accordance with ResKV.

System management

The winter half-year 2015/16 was characterised by moderate temperatures. In 2015 the German TSOs nevertheless requested a redispatch volume of more than 8 GW in accordance with Section 13 para. 1 Page 60 **EnWG** and almost 4 GW in accordance with Section 13 para. 2 EnWG. Never before have redispatch measures in such quantities been required to maintain the security of the system. In terms of implementation, the TSOs therefore found themselves confronted by major operational challenges. The requirements analyses in accordance with ResKV reveal that in five years, the need for redispatch measures will be up to 25 GW. This development is a consequence of the high feed-in of wind energy and, in terms of system responsibility, concerns ÜNB 50Hertz GmbH and TenneT GmbH. Amprion is helping the other German TSOs to find a solution to the problem.

There was no disruption of supply in 2015, i.e. no large-scale grid outages occurred in Amprion's balancing zone.

Research and development

In the area of research and development, Amprion's targets are to increase the performance capacity and security of the network as well as its efficiency. One example of increasing the performance capacity is the utilisation of overhead power lines depending on local weather conditions. The maximum load of **overhead power lines** is determined by, among other things, the maximum cable slack resulting from thermal expansion of the cable. As overhead power lines are designed for summer weather, additional transport capacity with lower ambient temperatures and higher wind speeds is theoretically available for the rest of the year. This is an important correlation because it is on windy days that more energy is generated by windfarms and has to be transported. Amprion is developing a system to be able to use these weather depending transport capacities: Weather stations will be placed on selected overhead pylons to collect and transmit the measurements online. The system determines the maximum electricity load of the overhead power lines. To ensure that this additional capacity can also be used operationally, moreover, Amprion is enhancing the protection systems with associated plant steering technology and the overall system management in Brauweiler.

Page 61

The central concern of European climate policy is to achieve the climate targets for 2050. Renewable energy sources have a fundamental part to play in this context. If their potential is to be exploited, highly productive and efficient transmission networks will be essential. Amprion therefore took on a leading role in the e-Highway2050 project, in which energy scenarios and grid architectures for the year 2050 were developed. In addition to Amprion, other European TSOs participated in the project, which was supported financially by the European Union. The necessity of a pan-European planning approach and a long planning horizon required the development of new planning approaches and methods. This gave rise to a model of the European integrated network and, based on that, structures for the network of the future. Those involved succeeded not only in establishing a broad data and methodical basis for future planning tasks, but also in assessing and confirming Amprion's grid expansion needs in the context of the European climate objectives. It transpired that the projects developed in the German grid development plan are sustainable and efficient. Amprion led the work on defining the energy scenarios, the equivalent grid models and the target grid architectures.

Staffing

Amprion continued to expand its workforce throughout the financial year. The number of permanent employees increased by 5.7 % over the previous year from 1,052 FTE (full time equivalents) to 1,112 FTE; this is virtually the level that was forecast in the 2014 Management Report. Based on the process-related growth in assignments, the staffing needs for 2016 were updated to 1,183 permanent FTE on the basis of a process-related employment plan.

In addition, 10 apprentices began their training in commercial and technical occupations. All in all, 37 apprentices are currently receiving their training at Amprion. Seven apprentices successfully completed their training in 2015. Amprion offered all of the apprentices employment and six of them accepted. In this way, the company is taking care to ensure that its future staffing needs are covered and that it meets its social obligations towards young people.

The encouragement and advancement of the workforce is a matter of high priority at Amprion. In 2015, for example, there were more than 1,400 participations in internal and external ongoing training measures designed to strengthen the occupational and personal competencies of the employees. In addition, the company is applying a procedure for potential assessment so that future management positions will preferably be occupied by its own employees. The potential candidates identified in this way are further developed as executives in needs-based programmes. The assessments take place every two years.

The Amprion workforce is characterised by long-term professional experience and a strong commitment to the company. This is reflected in an average employment period (including predecessor companies) of around 15 years and the unchanged very low turnover rate of 0.7 %. The average age of the workforce decreased slightly due to the large number of appointments in recent years and was 42.3 years as at 31 December, 2015. The proportion of women in the workforce increased continuously and was 16.9 % (previous year: 15.8 %) at the end of the reporting year. This proportion of women, still low compared to other sectors, is attributable to the company's specialised, technical business activities and is connected with the low proportion of women who take electrotechnical degree courses.

Amprion continued with its employee equity participation scheme based on the issuance of jouissance rights. The participation rate of around 81 % was at the previous year's level. This continues to reflect the staff's high level of confidence in the company.

Industrial safety and health protection

Industrial safety and health protection is an important corporate objective for Amprion. That is why the company has implemented an industrial safety management system based on the standard "Occupational Health and Safety Assessment Series 18001" (OHSAS 18001), which was successfully recertified in 2015 by the employers' liability association Berufsgenossenschaft Energie Textil Elektro Medienerzeugnisse. All processes with relevance for industrial safety that must be adhered to in connection with statutory and company-level regulatory frameworks are described in binding form for executives and employees in the industrial safety management system. The workplaces should be designed in such a way that the requirements of industrial safety and health protection can be fulfilled by the company's own staff and by the employees of the service companies that work on the premises of Amprion. In the financial year 2015 the accident frequency level remained low. There were no accidents that resulted in serious injuries.

Promoting the health of the workforce is the objective of Amprion's plant-level health management. This incorporates a broad spectrum of activities and assistance measures. Among other things, prevention courses, preventive health cures and external welfare consultations are offered to the staff.

Environmental protection

Amprion is exempted from the obligation to carry out an energy audit in accordance with Section 8 para. 1 of the energy services and efficiency measures law EDL-G because the company has adopted the alternative energy management system provided for under Section 8 para. 3 EDL-G (in accordance with DIN ISO 50001) in its entirety. The proof to be furnished for this purpose in accordance with Section 8c para. 6 (1) EDL-G was provided in the form of the certificate issued in December 2015. Divisions of the company with high and influenceable levels of energy use were analysed and assessed in order to develop effective measures for a further reduction in energy consumption. With this in mind, Amprion stipulated strategic and operational energy objectives in a plan of action. This procedure is ecologically sustainable and economically sensible.

With its ecologically conscious maintenance of overhead power cables (biotope management), Amprion has been creating living space for animals and plants successfully for years now. In 2015, Amprion initiated a new project in collaboration with the environmental organisation Deutsche Umwelthilfe and Weihenstephan-Triesdorf University of Applied Sciences. The intention is to test a variety of cultivation methods and compare them systematically up until March 2017. The project is designed to help promote biological diversity in Germany and to contribute to an acceleration in grid expansion. For this reason too, the German Federal Agency for Nature Conservation and the Rhineland-Palatinate-based nature and environmental foundation Stiftung Natur und Umwelt Rheinland-Pfalz are supporting the project financially.

Acquisition of shares in Holding des Gestionnaires de Réseau de Transport d'Electricité (HGRT)
In October, Amprion acquired 5 % of HGRT's share capital. The company bundles the equity participations of European TSOs on the electricity exchange EPEX SPOT. The transaction was concluded via the transfer of a 5 % stake in HGRT by its existing shareholders (Elia, RTE und TenneT) to Amprion GmbH. The investment is an important milestone in the further integration of the European electricity markets.

Financial situation

Earnings

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014	CHANGE
Revenues and income	11,974.1	11,322.2	651.9
Operating expenses	–11,706.3	–11,023.7	–682.6
Operating result	**267.8**	**298.5**	**–30.7**
Financial result	–24.5	–29.2	4.7
Profit on ordinary business activities	**243.3**	**269.3**	**–26.0**
Tax on income and earnings	–72.0	–118.9	46.9
Net profit	**171.3**	**150.4**	**20.9**

Revenues increased by 6% to € 11,867.6 million (previous year: € 11,241.2 million) and are therefore slightly higher as set out in the previous year's management report. The aforementioned increase essentially relates to the income-neutral implementation of the **EEG** equalisation mechanism amounting to € 9,967.5 million (previous year: € 9,360.6 million). This results from higher income from the allocation-liable power supply companies and sales activities, accompanied by lower income from the reduced EEG allocation in 2015 (2015: 6.17 cents/kWh; 2014: 6.24 cents/kWh). Revenues from grid business amount to € 1,763.4 million (previous year: € 1,741.4 million). The increase of € 22.0 million in grid revenues is attributable to higher revenues from the passing on of connection costs for offshore windfarms and further increases in revenues from the surcharge under Section 19 StromNEV. The lower revenues from the offshore-surcharge have a contrary effect. These surcharges correspond to expenditures of the same amount.

Page 60

The € 30.7 million fall in the operating result was essentially caused by the higher staff costs that resulted from the planned appointment of additional employees and higher pension expenses and higher depreciation occasioned by the increased investment volume. Lower expenses from the EEG allocation for the company's own power consumption had a contrary effect.

The improvement of € 4.7 million in the financial result was essentially the consequence of lower expenses from the accretion of the pension provisions. These are attributable to the exercising of the option in accordance with Art. 75 para. 7 EGHGB, according to which the provisions for pension obligations in accordance with Section 253 para. 2 (1 HGB) were discounted at the average market interest rate from the last ten financial years.

The tax result includes expenditures for income taxes for the current financial year and deferred taxes. The improvement in the tax result is attributable largely to the cessation of the previous year's expenses incurred for provisions for tax periods that have not yet been irrevocably completed.

Due to the effects referred to above, net profit increased by a moderate 14 % to € 171.3 million. This is higher than the level forecast in the 2014 management report.

Financial situation

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014	CHANGE
Cash flow from operating activities	141.2	1,341.8	–1,200.6
Cash flow from investing activities	–456.4	–647.9	191.5
Cash flow from financing activities	325.1	–208.7	533.8
Change in cash and cash equivalents	**9.9**	**485.2**	**–475.3**
Cash and cash equivalents at the end of the period	916.8	906.9	9.9

Page 60

The cash flow from operating activities essentially continues to be influenced by the **EEG** equalisation mechanism, which has led to a considerable outflow of cash.

Cash flow from investing activities is characterised by the investments in the transmission network, which increased by 14 %. A contrary effect has resulted from the cessation of the previous year's purchase of marketable securities (current assets) in the amount of € 240.0 million that led to a substantial outflow of cash. These securities are committed to cover future liabilities arising from the EEG equalisation mechanism.

The increase in cash flow from financing activities is essentially the result of the shareholders' additional payment of € 400.0 million into the company's equity and the complete elimination of financial liabilities from the EEG account in the previous year.

A significant portion of the cash and cash equivalents is committed to cover future liabilities arising from the EEG equalisation mechanism.

Financing

In addition to its internal financing, Amprion financed its investments in the financial year by means of a capital increase from shareholders amounting to € 400.0 million. An undrawn credit tranche of € 250.0 million with a term until August 2016 is additionally available to finance investments via a syndicated loan agreement. The interest rate is determined according to the EURIBOR reference rate plus a maturity-based margin. The renewal of the syndicated loan agreement is planned for the first quarter of 2016. In addition to the above, there is a borrower's note loan of € 185.0 million concluded in the 2011 financial year with a maturity in March 2021 at a fixed rate of interest.

Amprion has covered its refinancing of the **EEG** equalisation mechanism by securing a syndicated loan agreement. The company also has a hitherto unused credit tranche of € 1,800.0 million with a core group of six banks that falls due in August 2016. The interest rate is likewise determined according to the EURIBOR reference rate plus a maturity-based margin. The credit tranche will ensure that the necessary liquidity for the EEG equalisation mechanism will be available over the term of the loan. The renewal of the syndicated loan agreement is planned for the first quarter of 2016.

Page 60

In their annual review, the rating agencies Moody's Investors Service Ltd. and Fitch Ratings Ltd. confirmed the rating of "A3" and "A–" respectively with a stable outlook. Amprion continues to be firmly anchored in the sound investment grade area. This positive rating contributes to ensuring access to the capital markets for future financing.

Investments

Demands on the transmission network have risen significantly in the past few years. Significant increases in feed-ins from renewable energy sources and changes in the power station fleet mean that increased electrical output must be transported over permanently widening distances. In addition, the significant increase in energy transports throughout the European area due to trading resulting from the liberalisation of the European energy market is a further driver of the need to expand the network.

The legally defined deadlines for the decommissioning of the nuclear power stations still in operation determine the necessary pace of network expansion. Foreseeable bottlenecks in the network must be eliminated in good time. To guarantee the security of the system, Amprion has continued to increase the investments in measures to increase transport capacity as well as in projects to stabilise the transmission network. The north-south axes of the transmission network will be expanded continuously to integrate renewable energy into the grid and ensure the provision of the required transmission

capacities in the long term after all nuclear power stations go offline. This year, the biggest investments in this field were made in the "Ultranet", Dortmund–Frankfurt, and Münsterland–Westphalia projects and at the central control station in Brauweiler. In 2015, Amprion put specific sections of the Gütersloh–Bechterdissen and Wesel/Niederrhein–Dörpen projects into operation.

In addition, Amprion is pressing ahead with projects to increase cross-border grid capacities and thereby reduce existing grid bottlenecks into neighbouring countries. Implementation of the two interconnector projects to Belgium and the Netherlands respectively continued in 2015. The D-NL (Niederrhein–Doetinchem) project will shortly be granted approval under public law. As for the D-BE (ALEGrO) interconnector, Amprion has prepared the planning documents. These two projects constitute an important element in the further development of European market integration.

Page 61 The work on the pilot stretch of **underground cabling** in Raesfeld likewise proceeded on schedule in the financial year 2015. The partial section "Raesfeld" is part of the new Dörpen-Wesel connection. Here, Amprion is working on a partial section with partial underground 380 kV cabling with a length of 3.4 km. The construction and cabling work has now been completed and the voltage test was passed successfully. The subsequent trial operation as from 2016 is designed to prove this cable technology's operational capability in the extra-high voltage network.

With regard to the HVDC project "Ultranet", Amprion submitted the applications for federal planning for the last three sections during the financial year. The first two applications for the total of five sections had already been submitted in 2014. This means that the entire project is now in its approval phase.
Page 61 The next stages envisaged in 2016 are that all outstanding **Federal Network Agency** application conferences should be carried out. In a process of intensive dialogue, Amprion has identified and acquired a suitable plot of land for the converter. The company has also awarded the order for the planning and construction of the converter in October 2015.

The total volume of investments in 2015 came to € 473.5 million, some 95 % of the level forecast in 2014. Of these investments, € 385.8 million related to investments in expansion and € 87.7 million to investments in renovation of the transmission network and other investments.

Since 2008, Amprion has made a total of 92 applications to the Federal Network Agency. They relate to investments for the period until 2028. Thanks to the applications approved so far, most of the planned investments in expansion over the next few years have been secured.

Assets and liabilities

ASSETS

IN € MILLION	31 DEC. 2015	31 DEC. 2014	CHANGE
Non-current assets	2,516.4	2,163.5	352.9
Current assets	2,271.4	2,255.9	15.5
	4,787.8	**4,419.4**	**368.4**

LIABILITIES AND SHAREHOLDERS' EQUITY

IN € MILLION	31 DEC. 2015	31 DEC. 2014	CHANGE
Equity	1,576.1	1,079.1	497.0
Non-current liabilities	683.3	643.4	39.9
Current liabilities	2,528.4	2,696.9	–168.5
	4,787.8	**4,419.4**	**368.4**

At 52 % (previous year: 49 %), fixed assets make up the largest portion of the company's assets and are covered up to 91 % (previous year: 80 %) by equity and non-current liabilities. The slight increase in the proportion of fixed assets results primarily from the expansion and renovation investments accompanied by only a slight increase in current assets. The equity ratio is 33 % (previous year: 24 %). This upward trend has been caused mainly by the additional payment amounting to € 400.0 million made into the additional paid-in capital by the shareholders and by the allocation to retained earnings of € 80.5 million from the net profit from 2014.

General statement on the development of business and the financial situation

The Amprion management assesses the course of business and the financial situation as positive. The overall financial situation can be regarded as sound and provides the basis for further investments in the transmission network.

Subsequent events

No events of particular importance took place during the period prior to the preparation of the company's financial statements.

Outlook, opportunities and risk report

Outlook

Grid business

Page 60
Page 61

The update of the revenue cap under Section 4 (1) and (2) **ARegV** for the second regulatory period from 2014 to 2018 was approved by the **Federal Network Agency**. The base level calculated and the development of the permanently non-controllable costs constitute the basis for the 2016 network charges published on 17 December 2015. They have increased as a result of the following changes:

- An increase in the passed-on costs from the coastal TSOs for connecting offshore windfarms
- Higher costs from approved investment measures for further expansion of the network due to the energy transition
- Increased costs for reserve power stations
- Lower costs for system services

The network charges will therefore increase moderately in a range from +9.2% to +12.7% at the extra-high voltage network level in the spectrum between 5,000 and 8,760 hours of use that is relevant for the majority of customers.

In accordance with Section, 6 para. 1 ARegV, the Federal Network Agency ascertains the starting level for determining the revenue caps for the third regulation period from 2019 to 2023 based on a cost examination as per the provisions of StromNEV. The cost examination will be based on the data from the financial year 2016.

System services

As before, the control reserve will be sourced by Amprion together with the other German TSOs according to the Federal Network Agency guidelines. In connection with this, it is assumed that increasing quantities and prices will lead to increased expenses for control reserve. The tendering of the long-term component for lost energy has been completed for 2016, with prices remaining constant compared to the financial year. Expenses incurring for the replacement of lost energy are expected to be around the previous year's level. The cost of redispatch activities, too, is expected to remain at the previous year's low level.

Investments

The first draft of the **NEP** Electricity 2025 was published on 30 October 2015 by the TSOs. For Amprion's network area, the NEP shows over 2,100 km of additional circuit length by 2025 as a result of the construction and replacement of power lines, additional cabling and re-cabling, and includes all the significant investment measures for the next ten years. The NEP constitutes the basis for Amprion's project planning. The **EnLAG** (Power Grid Expansion Act) and the BBPlG (Federal Requirement Plan Act), which is based on the NEP, ensure approximately € 3.3 billion of investment in expansion by Amprion over the coming ten years and are thereby putting investment planning on a legally secure basis. They confirm with legal force that the projects are necessary in terms of the energy industry and that they are urgently required. BBPlG projects are also subject to an accelerated approval process. In connection with this, it must be borne in mind that only the need for a cable between a starting and finishing point has been ascertained in the EnLAG and BBPlG. Alongside the cable itself, however, all further measures necessitated by such a cable – including e.g. restructuring in the subordinate grid or additional transformers – have to be seccured by investment applications.

Page 61

Page 60

The overall volume of investment planned by Amprion up until 2025 consists of investment in expansion, renovation and other investments and amounts to € 5.5 billion – of which some € 549 million is allotted to 2016.

Revenues and profit or loss

A slight increase in revenues, especially from Amprion's income-neutral **EEG**-based activities, is expected in the financial year 2016. The main reason for this is the higher EEG allocation of 6.35 cents/kWh. Revenues from network business, on the other hand, are increasing robustly due to the higher CHP allocation, higher connection costs for offshore windfarms and increased capital costs for investment measures.

Page 60

Against the backdrop of the regulatory environment described above, the expectation regarding the financial year 2016 is for a moderate downward trend in net income for the year, the reason being that the financial year 2015 was characterised by one-off effects such as the change in the discount rate in relation to pension provisions, the bonus as per the voluntary self-obligation control reserve and lower expenses from the EEG allocation for the company's own electricity consumption.

Overall statement on future development

The management is expecting to see continued positive development in the course of business in the financial year 2016 thanks to the prevailing regulatory conditions as well as a stable assets, finance and earnings situation of the company.

Opportunities and risk report

Risk management

The objectives of risk management are the avoidance and control of risks which impact the financial result and liquidity or even endanger the existence of the company, as well as the reduction of unavoidable risks and the optimisation of the overall portfolio of opportunities and risks. Amprion's risk management includes extensive organisational measures pertaining to the company's processes and structure with the aim of ensuring that risks are identified, analysed and controlled at an early stage and that they are reported – and thereby taking into account the requirements of the German Corporate Control and Transparency Act (Gesetz zur Kontrolle und Transparenz im Unternehmensbereich – KonTraG). Risk identification includes the structural recording of possible risks in all operational processes and functional divisions. As part of the risk analysis, the risks identified are assessed in terms of their origin, early warning indicators, risk control and preventive measures, the amount of any loss and the probability of their occurrence. The objective of risk control is to reduce the potential amount of any loss and the probability of its occurrence or – insofar as this is possible – to avoid risks by not carrying out high-risk activities. As part of regular risk reporting, the Executive Board and the Supervisory Board are kept informed of the current risk situation. If there are any fundamental changes, decision makers are informed immediately outside of normal risk reporting. Risk management is an integral component of the business, planning and control processes and is reviewed regularly for its functional capability and its effectiveness. In addition, a risk-oriented approach is used as part of internal audit checks to ensure a comprehensive appraisal of risks. The existing risk portfolios and the resulting areas for action are specified as early as at the preparation stage for auditing plans and the individual auditing activities.

Essential opportunities and risks

System services

Market opportunities and risks result from the supplying of the balancing zone. Risks and opportunities arise from changes in costs, especially in the procurement of the control reserve due to unforeseen volume effects. The voluntary self-obligation for control reserve approved by the **Federal Network Agency** provides for price indexing so that opportunities and risks, which are limited by an incentive regulation, exist for the company's income due to volume effects. Only 25 % of the cost savings or increases achieved will affect Amprion's result up to an absolute upper threshold.

Page 61

In the event of voluntary self-obligation network losses, a minimal risk or an opportunity arises from the price development because the procurement price is fixed. On the other hand, there are only very minor risks or opportunities from the procurement of the volumes of network losses caused by the

time lag of the cost shifting. The tendering of the long-term component for network losses is complete for 2016 and has been partially completed for 2017.

There is a marginal risk or opportunity contained within voluntary self-obligation redispatch due to the interest on the difference between the planned costs stated in the revenue cap and the actual costs.

Financing

As a TSO, Amprion is responsible for the implementation of the **EEG** equalisation mechanism in its balancing zone. In principle, implementation of the EEG is income-neutral based on the statutory provisions. In the event of developments that differ from the forecast, however, income from the EEG allocation and the actual revenues from sales on the electricity exchange may not be sufficient to cover the volatile remuneration of feed-ins to EEG plant operators. As a result of this, a periodic liquidity risk arises which is neutralised by the maintenance of a sufficient credit line.

Page 60

Credit risks arise if business partners meet their payment obligations either insufficiently or not at all. Credit risks are largely avoided by making appropriate checks on creditworthiness, continuous receivables management, and the requirement of collateral security (in justified cases).

Regulation

Regulatory risks arise from changes in European and national laws. Amprion follows and assists in legislative processes in order to use any possible opportunities for financial stability in the regulated grid business and to limit costs to the company.

Charges for the use of the network are subject to regulatory supervision by the **Federal Network Agency**. Approvals or decisions by the Federal Network Agency may have a positive or negative impact on the income of the company. The practice of approval in cost audits is a key point because the basis of network charges for a regulatory period is fixed here. In the decision of the Federal Network Agency determining the revenue cap for the second regulatory period from 2014 to 2018, the costs applied for by Amprion were largely approved and will therefore form the basis for the company's stable financial development in the future.

Page 61

Page 61

Further risks may arise if the investment measures applied for are only partially recognised by the **Federal Network Agency** because these may lead to lower imputed costs and thus to lower revenues from network charges in the future. The company reduces this risk by controlling costs and justifying the costs of investments to the Federal Network Agency.

Overall statement on risks

During the financial year 2015, there were no identifiable risks that threatened the existence of the company, either individually or in their entirety, or that might significantly impair the assets, financial and earnings position of the company. There are also no such risks in the foreseeable future based on current knowledge.

Corporate governance declaration pursuant to Section 289a para. 4 HGB (German Commercial Code)

As the target figure for the proportion of women, the shareholders stipulated a quota of 8.3 % for the Supervisory Board and the Supervisory Board stipulated a quota of 0.0 % for the Management. For the two management levels below the senior management, the senior management stipulated a quota of 6.7 %. The deadline for meeting these targets was determined by the respective bodies as 30 June 2017 in all cases.

Dortmund, 17 March 2016

Management

DR HANS-JÜRGEN BRICK

DR KLAUS KLEINEKORTE

FINANCIAL STATEMENTS

Balance sheet

OF AMPRION GMBH AS AT 31 DECEMBER 2015

ASSETS

	NOTES	31 DEC. 2015 IN € MILLION	31 DEC. 2014 IN € MILLION
Non-current assets	(1)		
Intangible assets		4.9	4.0
Tangible assets		2,483.1	2,157.7
Financial assets		6.6	2.1
		2,494.6	**2,163.8**
Current assets			
Inventories	(2)	53.6	45.2
Accounts receivables and other assets	(3)	998.5	1,000.5
Securities	(4)	300.0	300.1
Cash and cash equivalents	(5)	916.8	906.9
		2,268.9	**2,252.7**
Deferred income		**2.3**	**2.9**
Active difference resulting from asset offsetting	**(6)**	**22.0**	**–**
		4,787.8	**4,419.4**

LIABILITIES AND SHAREHOLDERS' EQUITY

	NOTES	31 DEC. 2015 IN € MILLION	31 DEC. 2014 IN € MILLION
Equity	(7)		
Subscribed capital		10.0	10.0
Jouissance rights capital		6.7	4.5
Additional paid-in capital		1,003.0	603.0
Retained earnings		385.1	311.2
Net profit		171.3	150.4
		1,576.1	**1,079.1**
Special items	(9)	35.9	**37.7**
Provisions	(10)	**514.9**	**623.7**
Liabilities	(11)	**2,456.8**	**2,505.0**
Deferred liabilities	(12)	**93.0**	**87.6**
Deferred tax liabilities	(13)	**111.1**	**86.3**
		4,787.8	**4,419.4**

Income statement

OF AMPRION GMBH FROM 1 JANUARY TO 31 DECEMBER 2015

	NOTES	1 JAN. – 31 DEC. 2015 IN € MILLION	1 JAN. – 31 DEC. 2014 IN € MILLION
Revenue	(15)	11,867.6	11,241.2
Other own work capitalised		52.1	51.6
Other operating income	(16)	54.4	29.4
Cost of materials	(17)	–11,375.4	–10,729.6
Staff costs	(18)	–125.5	–111.5
Depreciation		–124.6	–112.5
Other operating expenses	(19)	–80.8	–70.1
Financial result	(20)	–24.5	–29.2
Profit from ordinary activities		**243.3**	**269.3**
Taxes on income and earnings	(21)	–72.0	–118.9
Net profit		**171.3**	**150.4**

Development of assets

OF AMPRION GMBH FROM 1 JANUARY TO 31 DECEMBER 2015

	ACQUISITION AND PRODUCTION COSTS IN € MILLION				
	BALANCE AT 1 JAN. 2015	ADDITIONS	TRANSFERS	DISPOSALS	BALANCE AT 31 DEC. 2015
Intangible assets					
Purchased concessions, patent rights and similar rights and assets, and licences in such rights and assets	24.5	2.5	0.1	*	27.1
Prepayments	0.1	0.3	–0.1	*	0.3
	24.6	**2.8**	**–**	*****	**27.4**
Tangible assets					
Land, land rights and buildings including buildings on third party land	335.5	53.1	3.5	4.4	387.7
Technical plant and machinery	5,910.4	298.3	23.2	63.5	6,168.4
Other equipment, factory and office equipment	41.0	4.7	*	1.3	44.4
Advanced payments and construction in process	68.1	109.6	–26.7	0.9	150.1
	6,355.0	**465.7**	**–**	**70.1**	**6,750.6**
Financial assets					
Investments	0.4	5.0		0.2	5.2
Other loans	1.7			0.3	1.4
	2.1	**5.0**		**0.5**	**6.6**
	6,381.7	**473.5**		**70.6**	**6,784.6**

* Negligible amount

	ACCUMULATED DEPRECIATIONS IN € MILLION				CARRYING AMOUNTS IN € MILLION	
	BALANCE AT 1 JAN. 2015	DEPRECIATION IN THE REPORTING PERIOD	DISPOSALS	BALANCE AT 31 DEC. 2015	BALANCE AT 31 DEC. 2015	BALANCE AT 31 DEC. 2014
	20.6	1.9	*	22.5	4.6	3.9
					0.3	0.1
	20.6	**1.9**	*	**22.5**	**4.9**	**4.0**
	170.2	4.4	1.4	173.2	214.5	165.3
	4,000.7	114.8	49.9	4,065.6	2,102.8	1,909.7
	26.4	3.5	1.2	28.7	15.7	14.6
					150.1	68.1
	4,197.3	**122.7**	**52.5**	**4,267.5**	**2,483.1**	**2,157.7**
					5.2	0.4
					1.4	1.7
					6.6	**2.1**
	4,217.9	**124.6**	**52.5**	**4,290.0**	**2,494.6**	**2,163.8**

Notes to the financial statements

OF AMPRION GMBH AS AT 31 DECEMBER 2015

Basis of presentation

The company is registered in the Commercial Register of the District Court of Dortmund under registration number HRB 15940.

The financial statements are prepared in accordance with the provisions of the German Commercial Code (Handelsgesetzbuch – HGB) for a large-scale capital corporation in accordance with Section 267 (3) HGB, the supplementary provisions of the German Limited Liability Companies Act (Gesetz betreffend die Gesellschaften mit beschränkter Haftung – GmbHG) and the Energy Industry Act (**EnWG**).

Page 60

The company has made use of the option in accordance with Art. 75 para. 7 of the Introductory Act to the German Commercial Code (EGHGB) for premature application of the provisions of the Law on the Implementation of the German Residential Property Credit Guideline and for the Amendment of Commercial Code Provisions for the 2015 financial statements. The provisions for pension obligations were discounted in accordance with Section 253 para. 2 (1) HGB at the average market interest rate from the previous ten years. The transition effect is leading to a pre-tax relief of the result of € 22.0 million.

To ensure clarity of presentation, individual items are combined in the balance sheet and in the income statement and explained separately in the notes. The income statement has been prepared using the nature of expense method. The amounts in the financial statements are stated in millions of euros (€m) and in thousands of euros (€ 000s).

Accounting policies

Assets

Non-current assets

Separately acquired intangible assets are initially reported at acquisition cost and are depreciated using the straight-line method over their normal useful lives of two to five years.

Tangible assets are valued at acquisition or production cost less accumulated planned linear depreciation and impairment losses where applicable. Production costs include all individual costs and necessary overheads. The planned depreciation is based on the following normal useful lives:

USEFUL LIFE OF	YEARS
Buildings	30–50
Electricity grids	40
Substations	25–35

Low-value assets with acquisition costs of up to € 150 are recorded as costs in the year of acquisition in accordance with Section 6 para. 2 of the German Income Tax Act (Einkommensteuergesetz – EStG). If acquisition costs are between € 150 and € 410, the item is capitalised as a low-value asset with immediate full depreciation and disposal as of the end of the financial year.

Financial assets are stated at the lower of cost or fair value.

Current assets
Inventories are stated at acquisition or production cost according to the lower of cost or market principle using sliding average prices. Inventory risks resulting from reduced value inventories are accounted for by recognising suitable impairments.

Receivables and other assets are reported at the lower of nominal or fair value. All identifiable individual risks and the general credit risk are taken into account using appropriate allowances.

Securities are reported at the lower of cost or fair value.

Cash and cash equivalents are reported at nominal value.

Deferred income
Deferred income comprises payments made prior to the balance sheet date for expenses related to certain periods after the balance sheet date. It is reserved in accordance with the respective term.

Active difference resulting from asset offsetting
The provisions for pensions and similar obligations are covered by means of assets held in trust as part of a contractual trust arrangement that is recognised at fair value and offset against the respective underlying obligations in accordance with Section 246 para. 2 (2) HGB.

Liabilities and shareholders' equity
Special items
Special items include advances and contributions in aid of construction and building connection that were received as from 1 January 2003 and up to 31 December 2010, and are reversed in line with the useful lives of the related assets.

Provisions

Provisions for pensions and similar obligations are created on the basis of actuarial calculations, taking into account Klaus Heubeck's 2005 G reference tables and using the projected unit credit method. They are discounted by 4.31% per year, based on the average market interest rate as at 31 December 2015 published by the German central bank with an assumed residual term of 15 years. Other calculation assumptions include a 3.50 % per year increase in wages and salaries and pension increases of 1.00 % and 2.10 % per year.

In the assessment of other provisions, all identifiable risks and contingent liabilities have been taken into account. They are recognised at the amount required for settlement based on reasonable commercial judgement. Provisions with a residual term of more than one year are discounted in accordance with their residual term using the average market interest rate for the previous seven financial years published by the German central bank. Interest accretion on these provisions is calculated using the interest rate at the end of the financial year. The effects of the change in the discounting rate or in the estimation of the residual term are shown in the financial result.

Provisions for service anniversaries are accrued on the basis of an actuarial analysis, taking into account Klaus Heubeck's 2005 G reference tables. They are discounted using the average market interest rate as at 31 December 2015 of 3.89 % per year published by the German central bank. Furthermore, depending on the relevant service anniversary regulations, wage and salary increases of 2.75 % and 3.50 % per year are used as actuarial assumptions.

Provisions for pre-retirement part-time employment are accrued on the basis of actuarial calculations, taking into account Klaus Heubeck's 2005 G reference tables. They are discounted using the average market interest rate as at 31 December 2015 of 2.34 % per year for concluded pre-retirement part-time employment agreements. Furthermore, wage and salary increases of 3.50 % per year are used as actuarial assumptions.

Provisions for pensions and similar obligations are covered in full by assets held in trust as part of a contractual trust arrangement. Credits from the block model pre-retirement part-time employment in accordance with Section 8a of the German Partial Retirement Act (Altersteilzeitgesetz – AltTZG) and credits on long-term working time accounts under Section 7e of the German Social Code Vol. IV (Sozialgesetzbuch – SGB IV) are likewise secured by assets held in trust as part of a contractual trust arrangement. These assets held in trust are recognised at fair value and are offset against the respective underlying obligations in accordance with Section 246 para. 2 (2) HGB. Expenses associated with the interest accretion to provisions are netted against income and expenses from the related assets in the financial result.

Liabilities
Liabilities are generally stated at their settlement amount. Exceptions concern the liabilities to the Pensions Security Association and those arising from early retirement obligations which are stated at present value. Liabilities from early retirement obligations are created on the basis of an actuarial analysis, taking into account Klaus Heubeck's 2005 G reference tables. They are discounted using the average market interest rate as at 31 December 2015 of 2.02 % per year published by the German central bank. Furthermore, wage and salary increases of 1.00 % per year are used as assumptions.

Deferred liabilities
The advances and contributions in aid of construction and building connection accrued up until 31 December 2002 and after 1 January 2011 reported as deferred items are reversed through profit and loss using the straight-line method over a period of 20 years.

Deferred tax liabilities
Deferred taxes are calculated on the basis of temporary differences in accounting treatment under commercial and tax law and are calculated using the current applicable tax rate and shown net.

Currency conversion
Transactions in foreign currency are valued at the current exchange rate at the time of their initial posting. Assets and liabilities quoted in foreign currency are converted at the mean rate of exchange prevailing on the accounting date.

Notes to the balance sheet

(1) Non-current assets

The structure of the non-current assets summarised in the balance sheet and their development in the financial year 2015 are set out on page 38.

(2) Inventories

Inventories include raw materials, supplies and operating materials.

(3) Accounts receivable and other assets

IN € MILLION	31 DEC. 2015	31 DEC. 2014
Trade receivable	985.2	960.4
Accounts receivable from companies with participation interest	*	*
Other assets	13.3	40.1
	998.5	1,000.5

* Negligible amount

(4) Securities

This item consists of miscellaneous securities relating to shares in an investment fund.

(5) Cash and cash equivalents

The cash and cash equivalents consist largely of bank deposits.

(6) Active difference resulting from asset offsetting

Due to the offsetting rule under Section 246 para. 2 (2) HGB, provisions for pensions and similar obligations are netted against plan assets and reinsurance policies.

IN € MILLION	HISTORICAL COST	FAIR VALUE	SETTLEMENT AMOUNT
Netted assets			
Non-current securities	120.9	127.7	
Other assets	*	*	
	120.9	**127.7**	
Netted liabilities			
Provisions for pensions and similar obligations			105.7
			105.7
Difference from offsetting			**22.0**

* Negligible amount

The fair value corresponds to the market value as at 31 December 2015. The corresponding offsetting of expenses and income is shown under the financial result.

(7) Equity

The company's authorised capital is paid up in full; 74.9 % is held by M 31 Beteiligungsgesellschaft mbH & Co. Energie KG and 25.1 % is held by RWE AG.

The jouissance rights capital is held by employees and can be called after a holding period of at least five years.

By means of a resolution passed by the shareholders on 15/17 April 2015, a sum of € 400.0 million was allocated to additional paid-in capital.

Retained earnings relate to other retained earnings.

By means of a resolution passed by the Supervisory Board on 14 April 2015, € 70.0 million of the net profit of € 150.4 million for the 2014 financial year was distributed to the owners. The remaining € 80.4 million was transferred to other retained earnings.

By means of a resolution passed by the shareholders on 1 December 2015, a sum of € 6.6 million was withdrawn from other retained earnings.

(8) Payout block

The total amount of non-distributable profits in accordance with Section 268 para. 8 HGB of € 4.7 million results from the € 6.8 million fair value measurement of covering assets in accordance with Section 246 para. 2 (2) HGB less the related deferred tax liabilities of € 2.1 million.

The non-distributable balance in accordance with Section 253 para. 6 HGB arising from the recognition of the provisions for pension obligations using the average market interest rate from the previous ten and seven financial years amounts to € 22.0 million.

The free reserves of € 1,388.1 million exceed the non-distributable amounts totalling € 26.7 million.

(9) Special items

Advances and contributions in aid of construction and building connection received as from 1 January 2003 and up to 31 December 2010 are recognised under special items for investment grants associated with fixed assets.

(10) Provisions

IN € MILLION	31 DEC. 2015	31 DEC. 2014
Tax provisions	44.0	75.7
Other provisions	470.9	548.0
	514.9	**623.7**

Tax provisions relate to tax periods not yet irrevocably completed.

Other provisions are accrued essentially for obligations for the overhaul of pylons, claims under the Combined Heat and Power Act (Kraft-Wärme-Kopplung-Gesetz – KWK-G [former version]), obligations from the personnel division and for regulatory obligations.

Due to the offsetting rule under Section 246 para. 2 (2) HGB, the provisions for pre-retirement part-time employment and long-term working time accounts reported under other provisions are netted against plan assets.

IN € MILLION	HISTORICAL COST	FAIR VALUE	SETTLEMENT AMOUNT
Netted assets			
Other assets	10.5	10.5	
	10.5	**10.5**	
Netted liabilities			
Provisions for pre-retirement part-time employment and long-term working time accounts			23.6
			23.6
Difference from offsetting			**13.1**

The fair value corresponds to the market value as at 31 December 2015. The corresponding offsetting of expenses and income is shown under the financial result.

(11) Liabilities

IN € MILLION	31 DEC. 2015	OF WHICH: RESIDUAL TERM ≤ 1 YEAR	OF WHICH: RESIDUAL TERM > 5 YEARS	31 DEC. 2014	OF WHICH: RESIDUAL TERM ≤ 1 YEAR	OF WHICH: RESIDUAL TERM > 5 YEARS
Liabilities to credit institutions	191.1	6.1	185.0	191.2	6.2	185.0
Prepayments received	15.5	9.4	1.8	14.2	8.7	–
Trade accounts payable	2,067.5	2,067.5	–	2,163.8	2,163.8	–
Liabilities to companies with participation interest	0.1	0.1	–	–	–	–
Other liabilities	182.6	93.1	0.1	135.8	79.3	0.2
– of which from taxes	(13.5)	(13.5)	(–)	(14.3)	(14.3)	(–)
– of which relating to social security	(0.7)	(0.3)	(0.1)	(1.2)	(0.7)	(0.2)
	2,456.8	**2,176.2**	**186.9**	**2,505.0**	**2,258.0**	**185.2**

Liabilities to credit institutions largely concern a long-term promissory note totalling € 185.0 million.

Other liabilities consist mainly of liabilities for regulatory obligations.

(12) Deferred items

Deferred liabilities include € 33.6 million in advances and contributions in aid of construction and building connection received up until 31 December 2002 and after 1 January 2011 (previous year: € 34.5 million) and various other advance earnings amounting to € 59.4 million (previous year: € 53.1 million) for income in subsequent years.

(13) Deferred tax liabilities

The deferred tax liabilities result essentially from valuation differences with regard to land and buildings as well as to technical plant and machinery. These liabilities exceed the deferred tax assets, which stem mainly from differences in the valuation of provisions for pensions and similar obligations and other provisions. The calculation was based on a tax rate of 31.24 % (previous year: 31.11 %).

(14) Guarantees and other financial obligations

The guarantees consist exclusively of liabilities from guarantee contracts totalling € 158.8 million (previous year: € 136.1 million), with € 155.9 million of this amount (previous year: € 135.3 million) relating to the joint liability for pension obligations stated in the partner RWE AG's accounts. Amprion is responsible for the economic burdens and relief.

Guarantees are provided only after a thorough review of the related risks and are restricted to the company's scope of business activities. Based on all indications available up until the preparation of the annual financial statements, it is assumed that the main debtors will be able to fulfil the obligations underlying the guarantees and that the guarantees will therefore not be called upon.

The aggregate total of other financial liabilities is € 637.9 million and relates to the following circumstances:

Acceptance obligations for 2016 and 2017 totalling € 107.3 million were entered into for the procurement of electricity for the market-oriented balancing-out of lost energy.

There is an order commitment of € 496.5 million from investment and maintenance orders issued.

The company has acceptance obligations from framework agreements amounting to € 9.9 million.

There are undiscounted financial liabilities of € 19.7 million (of which < 1 year: € 7.8 million) from primarily long-term lease agreements.

There is a payment obligation totalling € 4.5 million from land acquisitions whose legal and commercial transfer takes place after 31 December 2015.

Due to the transfer of certain pension scheme liabilities to RWE Pensionsfonds AG which took place in previous years, the company – in its capacity as the employer – has a legally mandated funding obligation in the event of a possible shortfall in the pension fund in the future. This financial liability is currently not quantifiable.

Notes to the income statement

(15) Revenues

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014
Electricity	11,849.1	11,226.1
Other	18.5	15.1
	11,867.6	**11,241.2**

Page 60

Electricity revenues essentially include revenues from passing on expenses from **EEG**, transmission charges, and income-neutral allocations. They are generated mainly within Germany

(16) Other operating income

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014
Reversal of provisions	14.7	5.2
Profit from disposals of non-current assets	4.7	2.0
Miscellaneous	35.0	22.2
	54.4	**29.4**

Other operating income includes income related to other periods totalling € 38.5 million (previous year: € 10.7 million). Earnings from currency conversion amounted to € 7,200 (previous year: € 39,100).

(17) Cost of materials

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014
Cost of raw materials, supplies and purchased goods	–10,774.6	–10,141.5
Cost of purchased services	– 600.8	– 588.1
	–11,375.4	**–10,729.6**

The cost of materials essentially consists of charges from **EEG** feed-ins and expenses for system services and income-neutral allocations.

Page 60

(18) Staff costs

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014
Wages and salaries	– 94.6	– 88.4
Cost of social security, pensions and other benefits	– 30.9	– 23.1
– of which relating to pension	(–16.9)	(–10.2)
	–125.5	**–111.5**

	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014
Executive employees	30	30
Non-tariff employees	214	200
Employees covered by collective wage agreements	870	804
	1,114	**1,034**

The figures stated relate to average employee equivalents during the financial year. Part-time employees are taken into account in proportion to their working hours.

(19) Other operating expenses

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014
Services	– 32.2	– 28.7
Losses from disposals of non-current assets	– 5.5	– 7.4
Impairments or losses from the disposal of current assets	– 0.6	– 2.5
Miscellaneous	– 42.5	– 31.5
	– 80.8	**– 70.1**

Other operating expenses include expenses relating to other periods totalling € 6.1 million (previous year: € 9.9 million) and other taxes totalling € 2.1 million (previous year: € 1.7 million). Losses from currency conversion amounted to € 4,700 (previous year: € 2,400).

Expenses for services relate largely to information processing and the management of real estate.

The remaining miscellaneous operating expenses essentially comprise expenses for the provision of personnel, fees and consulting.

(20) Financial result

IN € MILLION	1 JAN. – 31 DEC. 2015	1 JAN. – 31 DEC. 2014
Earnings from other securities and loans of financial assets	*	*
Other interest and similar income	4.3	5.9
Interest and similar expenses	– 28.8	– 35.1
– of which remuneration for jouissance rights	(– 0.3)	(– 0.3)
– of which interest accretion	(– 6.6)	(– 19.6)
	– 24.5	**– 29.2**

* Negligible amount

Expenses and earnings from plan assets were netted against expenditure from accrued interest in accordance with Section 246 para. 2 (2) HGB. The resulting net amount is included in the item "Interest and similar expenses".

	IN € MILLION
Netted income	
Other interest and similar income	*
Netted expenses	
Other operating income	– 0.6
Interest and similar expenses	– 0.5
	–1.1
Difference from offsetting	**–1.1**

* Negligible amount

(21) *Taxes on income*

Of the expenses arising from taxes on income and earnings, € 47.2 million is accounted for by the current financial year and € 24.8 million by deferred taxes. Tax income from previous years has the opposite effect.

Additional information

The option provided under Section 286 para. 4 HGB was exercised so the information on the total remuneration paid to the management within the financial year pursuant to Section 285 no. 9a HGB is not being disclosed.

Members of the Supervisory Board received remuneration of € 281,700 during the financial year.

The members of the Supervisory Board and the Management are listed below.

Supervisory Board

- **Prof. Heinz-Werner Ufer**
  Lecturer at the Chair of Management Accounting and Control at the Technical University of Dortmund
  Chairman

- **Dr Andreas Kretschmer**
  Managing Director of Ärzteversorgung Westfalen-Lippe
  1st Deputy Chairman

- **Josef Frankemölle***
  Chairman of the General Works Council of Amprion GmbH and Chairman of the Works Council of Amprion GmbH at the Dortmund site
  2nd Deputy Chairman

- **Frank Amberg**
  Head of Private Equity & Infrastructure der MEAG MUNICH ERGO AssetManagement GmbH

- **Detlef Börger-Reichert***
  Deputy Chairman of the Works Council of Amprion GmbH at the Dortmund site

- **Christian Fuhrmann**
  Member of the Management Board of Evangelische Zusatzversorgungskasse, Finance Director

- **Malte Glasneck***
  Chairman of the Works Council of Amprion GmbH at the Hoheneck site

- **Stephan Illsinger**
  Managing Director of Swiss Life Asset Management GmbH
  • until 15 May 2015

- **Natalie Kornowski***
  Chair of the Works Council of Amprion GmbH at the Brauweiler site

* Employees' representatives

- **Dr Thomas Mann**
  Management spokesman of Ampega Investment GmbH

- **Christoph Manser**
  Head of Infrastructure Investments of Swiss Life Asset Management AG
  • since 18 May 2015

- **Fred Riedel**
  Auditor, tax advisor

- **Uwe Tigges**
  Member of the Management Board of RWE AG, Personnel Division

Management Board

- **Dr Hans-Jürgen Brick**
  Chief Commercial Officer and Chief Financial Officer

- **Dr Klaus Kleinekorte**
  Chief Technical Officer

The total fee for the auditor amounted to € 500,700 in the financial year and is broken down as follows:

	IN € 000S	OF WHICH FOR PREVIOUS YEARS
Auditing services	118.1	–
Other assurance services	364.3	26.7
Other services	18.3	–
	500.7	26.7

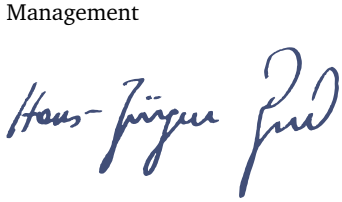
Information pursuant to EnWG

The company's business activity relates exclusively to the "transmission of electricity" field. The activity statement pursuant to Section 6b (3) EnWG thus corresponds to the financial statements.

Page 60

Dortmund, 17 March 2016

Management



DR HANS-JÜRGEN BRICK

DR KLAUS KLEINEKORTE

Independent auditors' report

We have audited the annual financial statements, comprising of the balance sheet, the income statement and the notes to the financial statements, together with the bookkeeping system and the management report of Amprion GmbH, Dortmund, for the financial year from 1 January 2015 to 31 December 2015. In accordance with Section 6b, Paragraph 5 of the Energy Industry Act (EnWG), the audit also involved verifying the fulfilment of the accounting duties pursuant to Section 6b, Paragraph 3 of the EnWG, which stipulates that separate accounts be maintained and separate financial statements be prepared for activities defined in Section 6b, Paragraph 3 of the EnWG. The maintenance of the books and records and the preparation of the annual financial statements and the management report in accordance with German commercial law as well as compliance with the obligations specified in § 6b (3) EnWG are the responsibility of the legal representatives of the company. Our responsibility is to express an opinion on the annual financial statements, together with the bookkeeping system, and management report as well as on the fulfilment of the accounting duties pursuant to Section 6b, Paragraph 3 of the EnWG based on our audit.

We conducted our audit of the annual financial statements in accordance with Section 317 of the German Commercial Code and German generally accepted standards for the audit of financial statements promulgated by the Institute of Public Auditors in Germany. Those standards require that we plan and perform the audit such that misstatements and violations materially affecting the presentation of the net assets, financial position and results of operations in the annual financial statement in accordance with German principles of proper accounting and in the management report are detected with reasonable certainty and that the fulfilment of the accounting duties pursuant to Section 6b, Paragraph 3 of the EnWG can be verified with reasonable certainty in all material respects. Knowledge of the business activities and the economic and legal environment of the company and expectations as to possible misstatements are taken into account in determining the conduct of the audit procedures. The effectiveness of the accounting-related internal control system and the evidence supporting the disclosures in the books and records, the annual financial statements and the management report as well as the fulfilment of the accounting duties pursuant to Section 6b, Paragraph 3 of the EnWG are examined primarily on a test basis within the framework of the audit. The audit includes assessing the accounting principles used and significant estimates made by the legal representatives, as well as evaluating the overall presentation of the annual financial statement and management report, and assessing whether the valuations and the allocations of the accounts pursuant to Section 6b, Paragraph 3 of the EnWG are appropriate and clear and whether the principle of continuity has been adhered to. We believe that our audit provides a reasonable basis for our opinion.

Our audit has not led to any reservations.

In our opinion, based on the findings of our audit, the annual financial statements comply with the legal requirements and give a true and fair view of the net assets, financial position and result of operations of the company in accordance with the principles of proper accounting. The management report is consistent with the annual financial statements and as a whole provides a suitable view of the company's position and suitably presents the opportunities and risks of future development.

The audit of the fulfilment of the accounting duties pursuant to Section 6b, Paragraph 3 of the EnWG, which stipulates that separate accounts be maintained and separate financial statements be prepared for activities defined in Section 6b, Paragraph 3 of the EnWG, has not led to any reservations.

Düsseldorf, 17 March 2016

BDO AG
Auditors

signed Eckmann
Auditor

signed ppa. Wiening
Auditor

Glossary

ARegV

The Ordinance on Incentive Regulation (Anreizregulierung – ARegV) is an official instrument for the regulation of monopolistic markets. As networks are seen as natural monopolies, in theory network operators do not have any incentive to maintain their efficiency and thus keep the costs of their services low. The Federal Network Agency therefore sets a revenue cap for network operators via the Incentive Regulation which is stipulated on the basis of the efficiency ratings of the most favourable network operator. Within this framework, network operators are allowed some leeway, for example, for investments in the network. The difference between the revenue cap and actual revenues is placed in a regulatory account by the Federal Network Agency. The revenue cap is implemented through the transmission charges. If revenues exceed the cap by more than 5 %, the transmission charges must be adjusted.

AusglMechV

The Ordinance on a Nationwide Equalisation Scheme (Verordnung zur Weiterentwicklung des bundesweiten Ausgleichsmechanismus – AusglMechV) regulates the marketing of electricity generated from renewable sources. This electricity must be sold at the level of the transmission network operator and must no longer be sold by energy utilities which supply end customers. In addition, the AusglMechV contains provisions on calculating the EEG allocation.

BBPlG

The Federal Requirement Plan Act (Bundesbedarfsplangesetz, BBPlG) contains 36 of the grid expansion projects certified as necessary by the Federal Network Agency which must be implemented by the transmission system operators. They are considered to be necessary for the energy industry and are urgently required. The Federal Network Agency normally carries out federal planning for these projects.

→ www.netzausbau.net

EEG

The Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) regulates the preferential feedin of electricity from renewable sources, such as wind, sun, water or biomass, into the German electricity grid. This is intended to allow the operation of regenerative generation facilities on a financially sustainable basis. According to EEG, network operators are obliged to accept electricity from these facilities and market it in the spot market on the electricity exchange. The law also lays down fixed rates of remuneration for electricity from renewable sources. The difference between the remuneration and the price achieved in the spot market is balanced out via the EEG allocation.

EnLAG

The Power Grid Expansion Act (Energieleitungsausbaugesetz, EnLAG) regulates the accelerated expansion of power lines in the extra-high-voltage transmission network and the introduction of technologies such as “high-voltage direct current transmission”. Attached to the law as an appendix is a Consumption Plan which contains the planned construction projects for the expansion of the transmission networks.

EnWG

The Energy Industry Act (Energiewirtschaftsgesetz, EnWG) contains fundamental regulations on the law on power-line-based energies. EnWG has the goal, among others, of ensuring a “best possible secure, affordable, consumer-friendly, efficient and environmentally sustainable” energy supply to the general public. This includes safeguarding effective and transparent competition on the energy market. The law also contains regulations on the supervision of the network operations by the regulatory authorities.

Federal Network Agency

The Federal Network Agency (Bundesnetzagentur, BNetzA) is a regulatory body that supervises, maintains and promotes competition in the network markets (electricity, gas, railway tracks). Once a year, the Federal Network Agency reviews and approves the Power Grid Development Plan and its basis as produced by transmission system operators and the scenario parameters for the development of electricity generation for the next ten years.

NEP

The Power Grid Development Plan (Netzentwicklungsplan, NEP) sets out the expansion projects in the German transmission network in the following ten years. The Power Grid Development Plans are developed by the four transmission system operators on the basis of assumptions about the development of electricity generation and consumption, the scenario parameters. The plan was created in 2012 for the first time and as of 2016 is to be developed further every second year.

Overhead power line

Overhead power lines – also known as overhead transmission lines – are electrical transmission lines where the conductor ropes – unlike underground cables – are insulated by the surrounding air. For the foreseeable future, overhead power lines will continue to be the most economical form of power transmission, particularly over long distances.

Transformer station

This is a junction in the electricity grid. Several high-voltage and extra-high-voltage transmission lines converge at a transformer station. In these facilities, individual electricity circuits can be selectively switched on and off. It is also possible to direct the electricity via the transformers – voltage converters – to be distributed further on grids with lower voltage.

Underground cables

The use of underground cables is widespread among lines for supplying towns and in regional electricity networks. On the other hand, in sections with 380 kilovolts, underground cables are unusual. Pilot sections with underground cables are provided for in EnLAG, for example, when a line is located less than 400 metres from a residential area. Cabled sections are essentially more cost-intensive than overhead power lines. The additional costs are passed on to the consumer through network use charges.

IMPRINT

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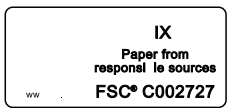
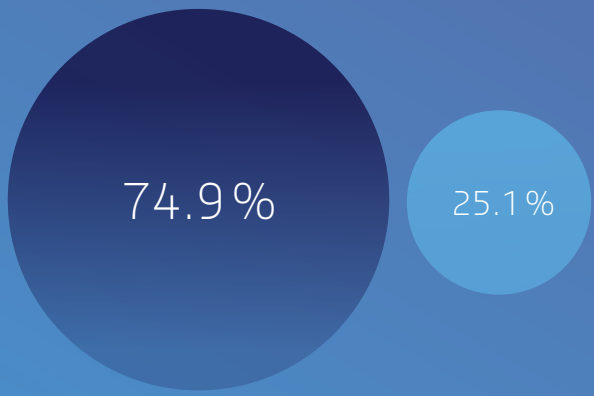


NOTE REGARDING USE OF MALE/FEMALE

We would appreciate your understanding that for reasons of readability, we have not used the male and female forms of language throughout. Naturally, all texts refer equally to men and women.

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

SHAREHOLDER STRUCTURE



M31 Beteiligungsgesellschaft mbH & Co. Energie KG*

RWE AG

* M31 Beteiligungsgesellschaft mbH & Co. Energie KG is a consortium of German institutional investors from the areas of insurance, pension funds and pension plans, including MEAG MUNICH ERGO, Swiss Life and Talanx as well as medical pension funds.

KEY FIGURES 2015

€ 9,968 MILLION

in income generated by Amprion from the revenue-neutral management of the EEG equalisation mechanism.

€ 1,763 MILLION

generated in revenue from the network business.

€ 474 MILLION

invested by Amprion in the modernisation and expansion of its grid.

€ 171 MILLION

net profit made by Amprion.

CONNECTED TO EUROPE

The Amprion grid is located in the heart of Europe and connected to the grids in the Netherlands, Luxembourg, France, Austria and Switzerland through cross-border interconnectors. Amprion is working towards making the European electricity network even more secure and efficient through numerous cooperations and projects.

COOPERATION WITH EUROPEAN PARTNERS

Amprion works intensively in many areas with other European transmission system operators. The topics of system security, network planning,and development of transmission technology are the main focus.

SECURITY SERVICE CENTRE (SSC)

In the SSC in Rommerskirchen near Cologne, there is a joint team of experts from Amprion, TenneT Netherlands and Germany supporting the security management and the extra-high voltage network in Germany and the Netherlands.

JAO

Together with 19 European transmission system operators, Amprion has a holding in the Luxembourg company JAO (Joint Allocation Office). The company acts as a central auction platform and contact point for the provision of transmission capacities for electricity trading in the European Union.

ENTSO-E

As part of the “European Network of Transmission System Operators for Electricity” (ENTSO-E), Amprion is continuing to develop the European electricity network together with 40 transmission system operators. The key challenges are promotion of the EU internal market for electricity, network expansion and developing rules for network operation.

TSO SECURITY COOPERATION (TSC)

Together with 12 European transmission system operators, Amprion is involved in the security cooperation TSCNET Services. TSC supports the transmission system operators in the coordination and planning of network operations, the forecasting of network bottlenecks and the calculation of available transmission capacity.

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June 2016