

# connect

4 100 years of PFISTERER –  
connecting power for the future

10 HV with a spectacular design –  
compact and powerful



## Legal Notice

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## **PFISTERER** **Customer Magazine** Issue 1 **2021**

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Stephan Götschel



Dr Konstantin Kurfiss

Dear Readers,

100 years of PFISTERER – that's 100 years of energy history. Together with you, our partners and customers, and with energy suppliers, municipal utilities and industrial enterprises, we have been shaping the future of the energy industry and driving the development of power grids worldwide, right from the very beginning. The coronavirus pandemic has shown how important this spirit of partnership and cooperation is, and we are happy to be able to report positive results from recent months, despite all the restrictions.

So we are looking to the future, even as we celebrate our anniversary year. PFISTERER solutions can be found in all types of power grids, both above and below ground. And we are always focused on trends in the energy sector, so that we can offer you solutions today for the challenges in the decades ahead.

In this issue of CONNECT, read about how we strengthen our power grids against extreme weather in a changing climate, the solutions we offer for a sustainable energy supply, and how this energy can be transported to fast-growing urban areas in future with the acceptance of the local residents.

We look forward to our shared future together, and thank you for placing your trust in us – in some cases for decades!

With best regards,

A handwritten signature in black ink, appearing to read 'Götschel'.

Stephan Götschel

A handwritten signature in black ink, appearing to read 'Kurfiss' followed by a stylized flourish.

Dr Konstantin Kurfiss

PFISTERER Holding AG Board of Directors

# 100 years of PFISTERER – connecting power for the future

PFISTERER products play an essential role in our everyday lives. PFISTERER is an inventor, pioneer and solution provider with unparalleled innovative expertise that has shaped progress in the energy industry for 100 years. As we celebrate our anniversary year, Stephan Götschel and Dr Konstantin Kurfiss have their sights firmly set on the future. In this interview, they talk about the challenges ahead in the world's energy markets – and about PFISTERER's recipe for success.

**Mr Götschel and Dr Kurfiss, what comes to mind personally when you think of 100 years of PFISTERER?**

**Stephan Götschel:** What impresses me the most is our ability to transform! PFISTERER has dynamically pursued a process of change over generations. From the foundation of the company in Stuttgart, with production still in Gussenstadt, to the courageous step from a metal processor only to the company's launch of silicone processing in Winterbach, to the establishment of the first foreign branches in Switzerland and subsequent internationalisation on a large scale. And last but not least the construction of our modern production facility at Kadaň in the recent past.

**Dr Konstantin Kurfiss:** With our team and a good mix of experienced and young employees, we have managed time and again to position ourselves as a trendsetter in technology. CONNEX, ISICOMPACT or SICON have shaped the technology in the industry, which confirms that we are doing the right thing in terms of technology. And at the same time, it drives us to constantly seek new improvements and solutions. This enables us to meet the international competition on an equal footing – sometimes the little shark in the shark pool is simply more agile than the big ones.

**How has PFISTERER remained successful over decades?**  
**Stephan Götschel:** You need a good team and the staying



power of a family business with a future-oriented perspective, without just looking at the quarterly figures. Firstly, our market is characterised by high-quality, long-lasting products and customer relationships, some of which have continued for decades. Secondly, we are nevertheless subject to constant change.

**Dr Konstantin Kurfiss:** “We work at PFISTERER” is a statement and, at the same time, a shared understanding. We have always ensured stability, even in turbulent times. That is what distinguishes PFISTERER as a family business.

#### What challenges do your customers face?

**Dr Konstantin Kurfiss:** Every decade has its own challenges: in the 1950s and 60s, it was building the infrastructure.

But that also means that our networks in Germany and Europe are now 60 years old. The switch to renewables requires modification of the grid structure – from centralised power generation to decentralised organisation. This makes grid structures more complex. At the same time, we will have to transport energy over much longer distances in future, right across Europe. And depending on the importance of battery-powered electromobility in the years ahead, considerable amounts of energy will need to be made available, in some cases at short notice and in a localised area. So there are plenty of challenges.

**Stephan Götschel:** And those are just the current issues in Europe. Globally, there are many other requirements for which we offer suitable solutions. With our products,



# PFISTERER – a family business since 1921



**Karl Pfisterer** had a clear goal when he established his “factory for special electrotechnical articles” in 1921: to make better and safer electrical fittings. As a pioneer in electrical engineering, from 1900 he had worked as an installer for the P. Schröder company, later becoming its technical plant manager for the construction of local electricity networks in Germany and other countries. His own inventions were influential in this role. After his father’s death, **Walter Pfisterer** took over the business in 1942 and shaped it according to his ideas for 40 years – from post-war reconstruction to laying the foundations for an international group of companies by the end of the 1970s. **Karl-Heinz Pfisterer** has continued this development since 1981, first as Managing Director and today as a member of the Supervisory Board. PFISTERER benefits from the company’s independence, and is still 100% owned by the family.

we are represented worldwide – from power generation to grid connections and distribution networks to the home power connection. This solution expertise, coupled with our market knowledge in Asia, Europe, America and Africa, is unique.

## How is PFISTERER positioned for the future?

**Dr Konstantin Kurfiss:** We always ask ourselves what PFISTERER stands for in Germany and the world. After all, it is part of the Swabian tradition to concentrate on the essentials. And of course this also applies to investments. For this reason, for example, we divested the LAPP Insulators ceramics division. This is not a “no” to ceramics – in our view they will continue to retain their importance – but it is a decision for our future path in the metal and silicone sector. This is where we can move forward, and we will

continue to invest in development, laboratories and production in this area over the next few years.

Furthermore, renewable energy generation, e.g. from offshore wind, is currently making huge technological advances in Europe. In the coming years, however, this trend will become more international. This will require us to have a local presence in these markets. That will be a challenge for all market participants in the years ahead.

**Stephan Götschel:** Our sites in Germany, Switzerland and the Czech Republic are excellently positioned. Production in Europe has proved to be a consistent advantage in supply chains. But this does not preclude future partial localisation in expanding markets. Our technology leadership provides the basis for successful localisation. We already

have a site in China and, in line with our customers' wishes, we will build up value creation with additional local teams in growth markets.

#### What are PFISTERER's strengths?

**Dr Konstantin Kurfiss:** Our strength resides in our employees – and in the values of continuity, humanity and fairness, even in difficult times. This includes a certain Karl-Heinz Pfisterer, who is always there and available, with the sense of responsibility, dependability and attentiveness of a family businessman. And it also includes taking responsibility for structural changes.

**Stephan Götschel:** Treating each other with respect and the long-term development of employees are important to us. We want to pass on the PFISTERER gene. That's why we also train our future specialists ourselves, out of conviction and responsibility, not with an eye on the costs. We want to offer our employees attractive prospects and a future-proof working environment, and we can do that.

We organise and accomplish our tasks as a team and always find a sensible balance of interests, by working together and keeping a sense of proportion. Employees, the works council and unions all pull together, and only in this way have we been able to overcome even the most difficult times together. And solidarity among our colleagues extends from Wuxi in China to Europe and Buenos Aires. That is not something that can be taken for granted.

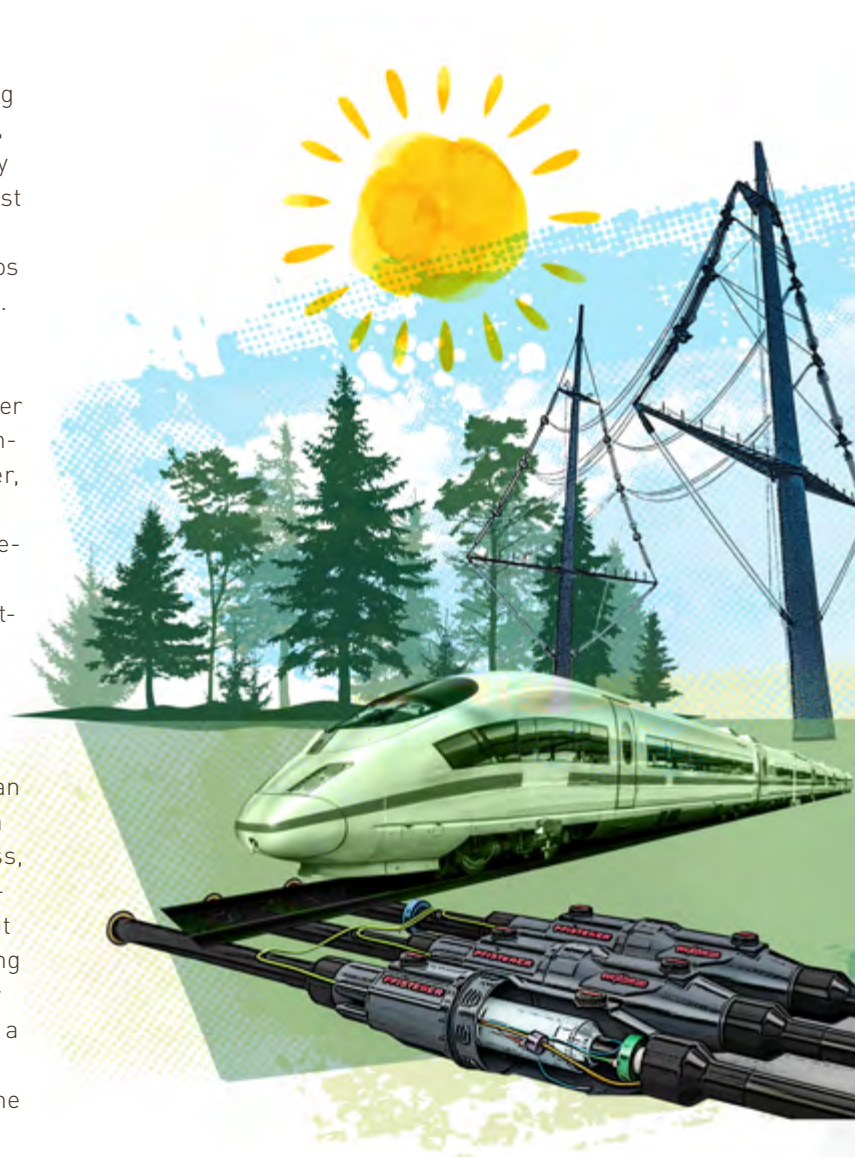
**Dr Konstantin Kurfiss:** The same applies externally in our dealings with our customers: a promise to a customer is a promise from our company. That is our common understanding. It is important to be open with each other, because we can only be successful together. Ultimately, it is technology that decides – this is where we must prevail. With our products, we contribute to a secure and sustainable energy supply and therefore make an important contribution to society. We are proud of this and want to continue to work on it with an eye to the future.

#### Your outlook for the next 25 years?

**Stephan Götschel:** I have a very high regard for Swabian entrepreneurship, even if – as someone who comes from Munich – it's a little hard for me to say so! Inventiveness, social commitment and sustainable business management – that is a successful symbiosis and, in a sense, it is also our recipe for success. It is better to do something right than just quickly and cheaply – and this caters to our market segment very well. For PFISTERER, this means a long-term strategy as well as respect and consideration for employees and business partners in awareness of the requirements of the markets. If we maintain these characteristics of our company, that will be an important building block for further success.

»Turning thoughts into deeds – that is the true creative act, the birth of the company.«

Walter Pfisterer



**PFISTERER brings the power to the people –  
above and below ground**

Since 1921, PFISTERER has supported the energy industry with overhead line technology, cable systems and components for power distribution. Initially for the newly developing local grids, then from 1937 in the high voltage (HV) sector as well. The first products were steel components like hangers. Later, HV overhead line clamps and tension fittings were manufactured at the Gussenstadt plant, established in 1946. These successful solutions quickly gained an international reputation. In the 1960s, the expansion of HV transmission networks in Europe was in full swing. Since then, solutions by PFISTERER have been tried and tested in the construction of overhead lines in extreme Alpine terrain, in the South African desert, in the Gulf region and at the Guri Dam in Venezuela – from 110 V to 1,100 kV. As a pioneer in HV cable connection technology, PFISTERER also offers fittings and solutions for submarine and underground cable systems, including turnkey cable installation. Smart accessories for collecting operating data will play an increasingly important role in future.



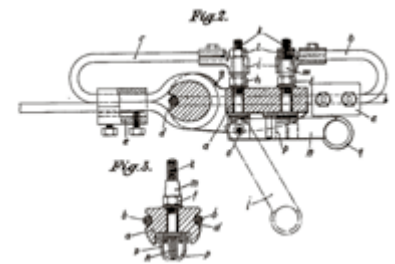
**1921** Company founded.  
Karl Pfisterer sets out to develop  
better electrical fittings.

# Historical development and innovations

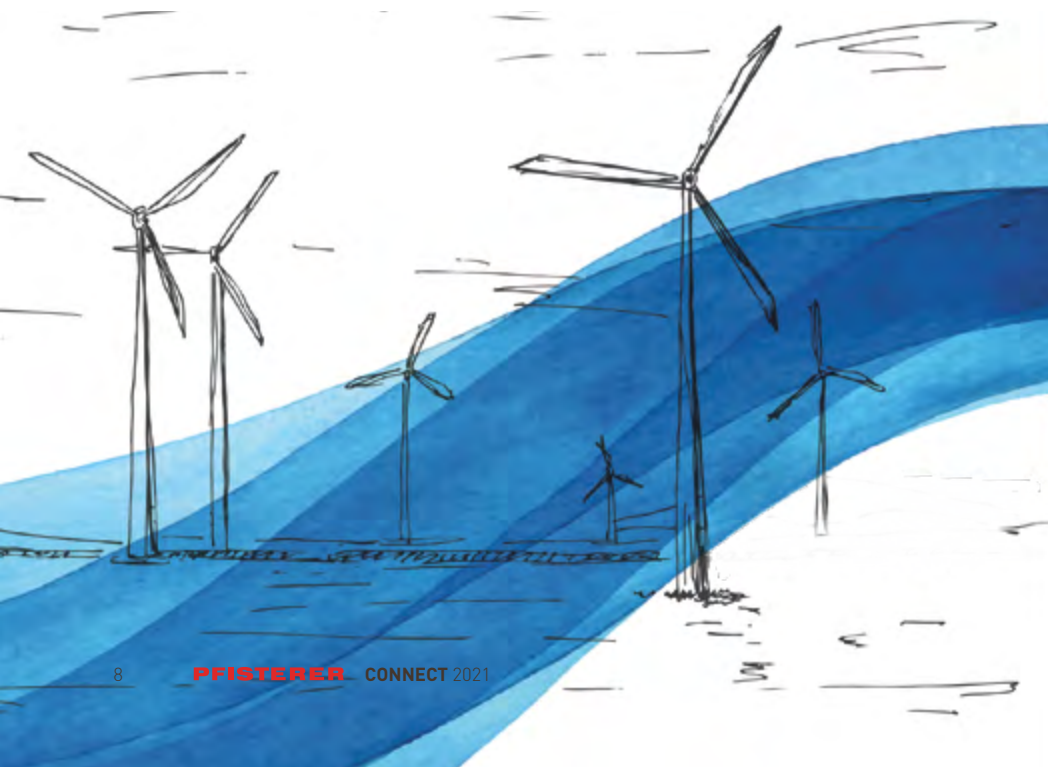
1921–2021

**Innovation as a business driver**

PFISTERER meets future challenges with the knowledge that comes from one hundred years of experience. This expertise has developed continuously with advances in technology – and technology has advanced thanks to PFISTERER's expertise. Numerous innovations and patents continuously drive our growth. Their success has made PFISTERER into a globally active company – with a distribution network in 70 countries and 21 locations in Europe, North and South America, Asia and the Middle East. 2,100 employees worldwide, state-of-the-art manufacturing processes and a seamless quality management system ensure that we will continue to provide the right solutions into the future.



**1937** Production of first fittings  
for high voltage overhead lines.



**1946** The factory in Gussenstadt  
is built during the post-war  
reconstruction period.





**1957** First international branch established in Malters, Switzerland.



**1962** Large-scale use of plastics begins at the new plant in Winterbach.



**1968** SCK compact screw terminal – the solution for more than 22 million safe home power connections to date.



**1969** Patent for compact fuse panels for plastic distribution cabinets.



**1975** The pluggable cable connection system CONNEX is presented for the first time.



**1985** PFISTERER develops a new kind of silicone composite insulator.



**1988** PFISTERER patents pluggable surge arresters.



**1997** PLUG ensures safe and reliable connections in high-speed trains and wind turbines.



**2003** Invention of the SICON screw connector with its unique sheathless shear bolt.



**2007** The new catenary wire tensioning system TENSOREX C+ is patented.



**2015** The Kadaň plant opens – silicone processing to the highest standard.



**2018** FrontCon solves the problem of connecting single-strand insulated conductor types.



**2020** SEANEX – the optimum HV connection solution for modern offshore wind farms.

# HV with a spectacular design – powerful and compact

To maintain a reliable power supply to the world's growing urban centres, more electricity has to be transported into the cities. For this reason, higher-capacity compact transmission lines are increasingly replacing existing links. The aesthetic impact on the landscape plays an important role in this.

📷 P. 10-12 RTE



connecting power for the future.

**100** YEARS  
PULVER  
SINCE 1921

The futuristic design of the new HV link between Avelin and Gavrelle in northern France, near Lille, immediately catches the eye. In a joint project for French grid operator RTE, PFISTERER and the construction contractor Eiffage are extending the existing 30-kilometre link built in 1963, and increasing its capacity from 400 kV to 2 x 400 kV. This will make it ideally prepared for the growing energy needs of the heavily industrialised Hauts-de-France region, for transporting renewable wind energy from the coast to French metropolitan areas, and for the expansion of the European power grid with neighbouring countries, the United Kingdom and Belgium.



### Unique

“The unusual ‘Équilibre’ design of the 45 pylons with a height of over 70 metres is technically very challenging. The sail shape alludes to the characteristics of the flat terrain in the north of France – echoing the sea and the wind – and therefore achieves a high level of public acceptance. This is an important consideration in the construction of compact lines,” reports Ivan von Meister, OHL project manager at PFISTERER. With a string length of 32 metres, the design is absolutely unique. The suspension of the three phases one above the other generates enormous mechanical forces, which are further amplified by the wind. Nevertheless, PFISTERER developed a safe and stable solution with its SILCOSIL silicone composite insulators – up to a tensile load of 3,200 kilonewtons. SILCOSIL insulators are compact in design, while at the same time offer excellent corona protection. An important point, since the length of the insulators was determined by the pylon design. “It was not an easy task, and required complex electrical field calculations and simulations to start with. But we have, in the past, successfully integrated silicone insulators into existing string designs for glass

cap insulators with RTE, which meant we had the skills to meet RTE’s high requirements,” von Meister says. However: no laboratory in Europe was able to test the new insulator strings – simply because of their length and weight of 8.7 metric tons. “So at first, the very demanding electrical radio interference voltage (RIV) and corona tests were carried out with individual segments in the EGU HV lab, and at KEMA in Prague. After that, the complete strings were tested by us in a special laboratory in Canada, at IREQ in Quebec, with the support of our colleagues from PFISTERER in the United States. The short distances were a great help in this process.” In addition to supplying the insulators, the corona protection fittings and corona rings, PFISTERER also assumes overall responsibility for the electrical function of the entire strings.

### Trendsetting

Because of their sleeker design, compact lines are an important component in future grid expansion. In 1998, PFISTERER with EOS Holding Lausanne implemented the first 420 kV compact line with silicone composite insulators. These set the trend for all subsequent compact transmission lines with an insulator crossarm. In 2012, the architecture and design firm Bystrup, together with PFISTERER, developed a multiple award-winning design for aesthetic and forward-looking high voltage pylons for Danish energy supplier Energinet.



With its sail shape, the special pylon design draws on typical features of the coastal region.



## Successful together

For more than two years, PFISTERER has been working with mentally and physically disadvantaged people in Spain – with great success. “We believe in a community where people develop together through mutual support,” says Operations Manager Alex Carreño. “And that meaningful and productive work is an important aspect of quality of life for everyone.” But nevertheless, integrating a team from Fundació Tallers directly into PFISTERER meant a big step into a real working environment for the participants. PFISTERER is one of the few companies in Spain that offers this opportunity. “Of course it was new ground for us all at the beginning, but it quickly became clear that the partnership is a positive step,” reports Pedro Durán, Head of Country Sales Unit and Sales Director at the PFISTERER site in Barcelona. Everyone benefits. The support reduces the workload for PFISTERER employees, and the programme participants feel fully integrated and proud to be part of PFISTERER. A continuation of the partnership is already planned.

## PFISTERER expands range of medium voltage cable fittings

PFISTERER has expanded its range of products based on proven and patented SICON screw technology. In addition to the individual screw connectors, PFISTERER now also offers connection joints and terminations for plastic insulated medium voltage cables. The silicone and contact technology experts have therefore combined two core competencies, underlining their technological leadership in the field of cable fittings.

Cold shrink terminations are supplied together with SICON cable lugs; hybrid cold shrink joints are supplied with SICON screw connectors. Both applications are designed for medium voltage cables with cross-sections of 25 to 1,000 mm<sup>2</sup> and voltage levels from 12 to 42 kV. In each case, complete kits are supplied ready to fit.



Seagreen is expected to be operational from 2023, and will make a significant contribution to Scotland's climate goals. With a capacity of around 1,075 megawatts, it can supply enough energy to power 1.6 million homes. That is around two-thirds of all Scottish households. The renewable electricity will save more than 2 million metric tons of carbon dioxide emissions each year from fossil fuel power generation, equivalent to just over a third of Scotland's annual automotive emissions.

#### **Streamlining manufacturing and supply processes**

Building cable systems on offshore substations is challenging. So SEANEX was developed as a compact, robust connection system that is a perfect match for 66-kV offshore wind farms. For the installation of the more than

100 Vestas V164-10.0 MW wind turbines in the Seagreen project, PFISTERER is supplying SEANEX joints as well as preassembled and tested cables with SEANEX connectors. These link the submarine cables to the gas-insulated switchgear (GIS) in the tower. "The SEANEX connection system has helped us streamline our manufacturing and supply processes by providing a clear interface point between the array cables and the turbine. It speeds up project completion and saves time and money, while at the same time providing a durable, robust and secure connection," says James Allan, Lead Engineer – Array Cables for Seagreen/SSE Renewables, summing up the advantages.

#### **Straightforward and time-saving offshore installation**

As the wind turbines are installed, the pluggable connection

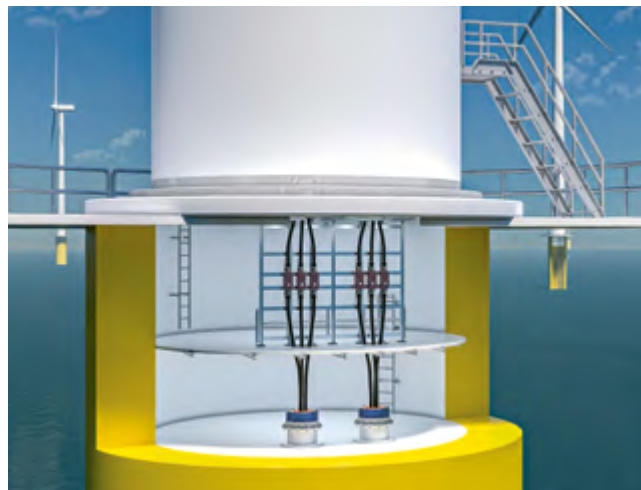


# Largest Scottish wind farm saves 2 million tons of CO<sub>2</sub>

Stormy winds, rough seas: the typical weather in the western North Sea is ideal for Seagreen, Scotland's largest offshore wind farm, which is currently being built 27 kilometers off the Angus coast. For straightforward and time-saving installation of the more than 100 wind turbines, and for their safe and reliable operation via 66-kV inter-array cabling, the Scottish operator SSE Renewables and turbine manufacturer Vestas opted for a modern connection solution from PFISTERER.

SEANEX makes the offshore installation of wind turbines significantly more straightforward.

between the submarine cable and the tower cable allows the project partners' individual construction phases to be clearly demarcated. In addition, the 39-centimetre long SEANEX cast resin joints enable more flexible handling during the offshore installation process. They are solid-insulated and therefore SF<sub>6</sub> gas free, resistant to salt water and UV radiation, and submersible. They are suitable for various cable types up to a cross-section of 800 mm<sup>2</sup>. In the Seagreen project, the XLPE insulated submarine cables are connected to the switchgear via highly flexible, pre-assembled and pretested "dropper cables". At sea, when installing the turbine, it is simply a case of plugging the cable into the preassembled joint. This significantly reduces the offshore installation time. The touch-safe, gas-free and therefore maintenance-free inner cone fittings feature



To install the more than 100 offshore wind turbines, the pretested "dropper cables" are plugged into the SEANEX joints – job done.

separate mechanical and electrical contacts, which are highly stable in continuous operation under load.

#### **Tested before installation**

"A pluggable connection system represents a more straightforward, faster, more cost-effective and more reliable approach for connecting the wind turbine HV network to the array cable infrastructure. SEANEX ensures an end-to-end pretested configuration and allows the entire array cable infrastructure to be tested prior to turbine installation. And it is as durable as the turbine itself. The system also reduces the time required to connect the individual offshore turbines to the array network, while the direct connection to the high voltage switchgear eliminates the need for a primary gas-insulated switchgear in the transition piece. It's just like plugging in an extension lead at home – except on a larger scale," explains Stephan Kremers, Project Manager at Vestas.

# Green energy flows underground

Thick forests, rugged cliffs, rivers that have carved deep valleys – the unspoiled landscape of the Hunsrück is a paradise for nature lovers. This windy region is also an ideal location for wind turbines. For a high-voltage land cable project, however, the special topography of the highlands is a real challenge.

PFISTERER installed the longest underground 110-kV cable system in Rhineland-Palatinate.

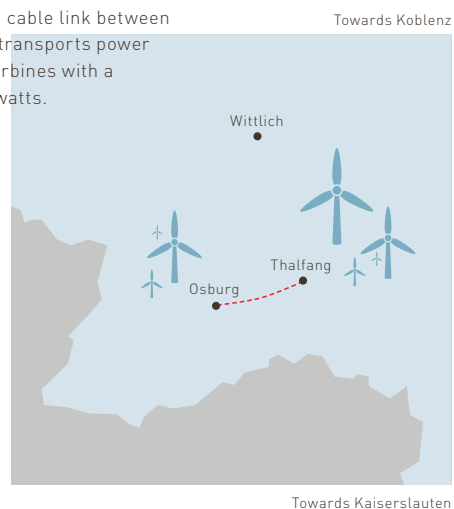


Rhineland-Palatinate is aiming to generate electricity from renewable sources by only 2030. In addition to new wind and solar power plants, this also requires a resilient infrastructure to bring the green energy to consumers. Westnetz, Germany's largest distribution grid operator, is investing in a new 18-kilometre underground cable system in the Hunsrück region. The underground 110-kV link, which included laying a total of 52 kilometres of underground cable, was constructed as a turnkey solution and was PFISTERER's largest HV AC land cable order to date.

## 18-kilometre long cable route

### Wind energy for 300,000 homes

The new underground cable link between Thalfang and Osburg transports power from about 80 wind turbines with a capacity of 260 megawatts.



PFISTERER supplied and laid the complete 110-kV cable system on a turnkey basis from a single provider.

Group photo (l. to r.): Nino Labahn, Bernd Kirsch, André Stegmann, Vukašin Basara.

### Changing conductor cross-sections along the route

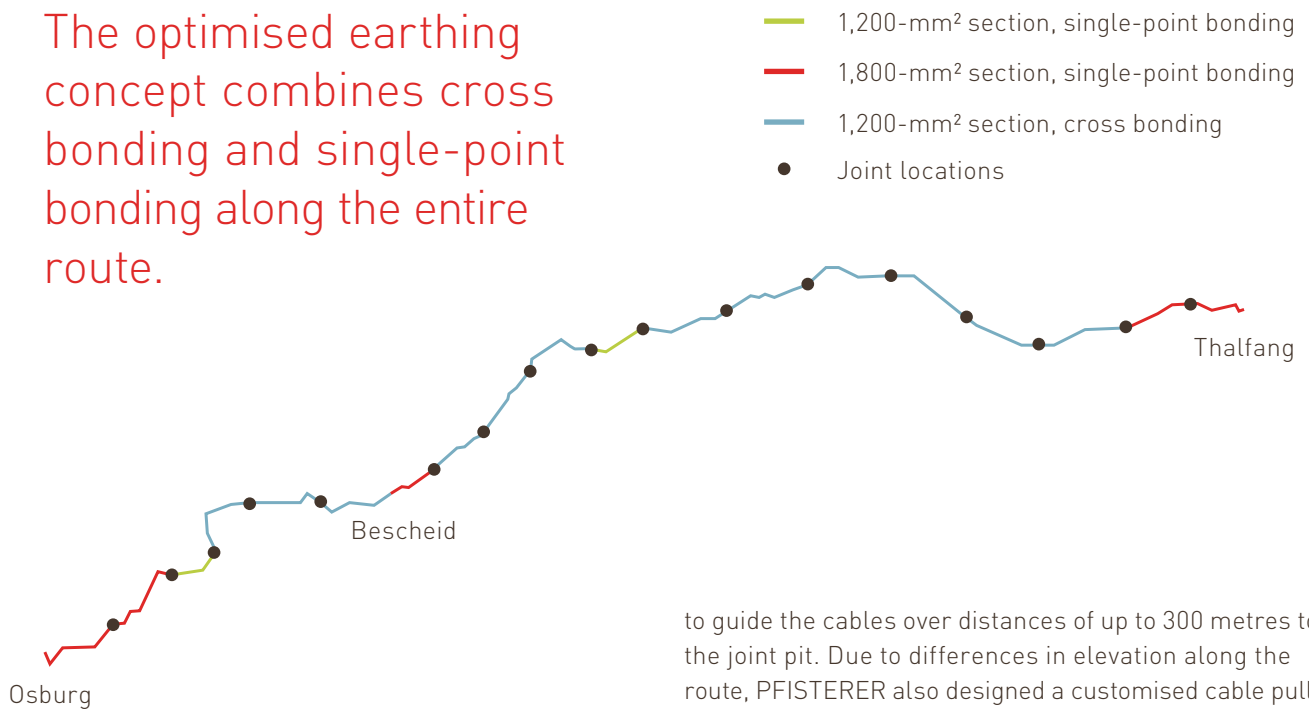
Together, Westnetz and PFISTERER developed a detailed plan for a technically feasible routing. "The cable link was necessary to make the increasing energy volumes from local wind turbines available to the transmission network. In this way, we have made an important contribution to the energy transition in Rhineland-Palatinate," reports Bernd Kirsch, Project Manager for High-Voltage Cables at Westnetz. "The main challenge in the project was the length of the cable link, as well as the topography in the Hunsrück. We are all very happy that we were able to complete the project on schedule." Trenches 1.5 metres deep were dug for the route. In addition, a ridge, a motorway and a river had to be crossed under using a special drilling technique. Due to the cable system's poorer heat dissipation at lower temperatures in deeper layers of earth,

it was necessary to alternate the conductor cross-sections between 1,200 mm<sup>2</sup> and 1,800 mm<sup>2</sup>. To do this, the planners had to optimise the earthing concept and consider each group of joints separately.

### Cross bonding and single-point bonding combined

For connection joints, a cross-section jump between 1,200 mm<sup>2</sup> and 1,800 mm<sup>2</sup> is at the limit of what is technically feasible. To fulfil the requirement, the joints needed a specially developed SICON screw connection to be able to connect different conductor cross-sections. Joint types MSA 123-XLFR and 123-DEFER were modified for this purpose, using a great deal of engineering expertise. In addition, type MSA 123-XKFR joints were used. This diversity is partly due to the optimised earthing concept, combining cross bonding and single-point bonding, which

## The optimised earthing concept combines cross bonding and single-point bonding along the entire route.



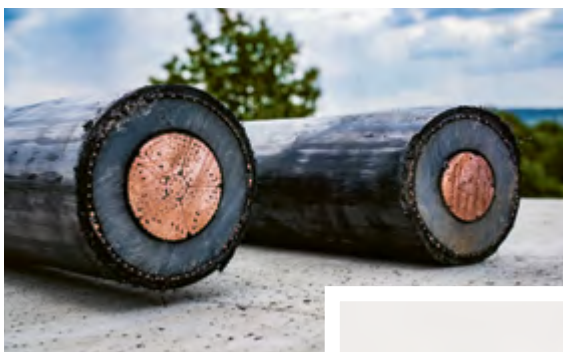
again was made necessary by the geographic conditions. In cross bonding, the section lengths between the joint locations have to be approximately equal, which was not feasible in the Hunsrück project.

The challenging terrain also influenced the cable laying arrangement. For the most part, they were laid flat side by side, except in the sections with undercrossings, which required a triangular arrangement. In many places it was difficult even to get to the joint pits. The access roads were too narrow for the enormous dimensions of the cable drums, each weighing 20 tons. In some cases, heavy concrete foundations and cable rollers had to be installed

to guide the cables over distances of up to 300 metres to the joint pit. Due to differences in elevation along the route, PFISTERER also designed a customised cable pulling concept and installed additional fastening clips in the joint pits at critical points to support and securely hold the XLPE cables – which are coated with slippery graphite – on both sides of the joint. “With this project, we demonstrated our ability to install long and complicated power cable routes. Especially in projects on this scale, precise planning is an essential factor in making the project a success,” states Vukašin Basara, Senior Manager HV Underground Cable Projects at PFISTERER.

### Blueprint for the future

With its many challenges, the underground cable link between Osburg and Thalfang is a blueprint for the construction of new transmission routes in the three-phase system. At the same time, new findings for future projects are to be obtained through so-called fibre-optic monitoring along the entire route. This will provide information on the actual temperature distribution in the cable with different loads, laying arrangements and ground conditions. Given the increasing share of fluctuating wind energy, this knowledge is becoming increasingly important for optimal energy grid capacity utilisation.



For the changing conductor cross-sections, PFISTERER developed connection joints that simultaneously combine cross bonding and single-point bonding.

# Short news



## Automation in metal machining

At PFISTERER, smart manufacturing concepts make a significant contribution to business growth and to securing jobs. We aim to deploy automation solutions to relieve employees of repetitive activities, and so enable them to increasingly take on control tasks where their technical expertise is in demand. To this end, the Gussenstadt site recently invested in a new robot cell for loading lathes, which increases both output and efficiency in metal machining.

The new, mobile and highly flexible robot cell follows a series of assistive automation solutions, such as feeder belts, bar feeders and bar magazines, which have already been integrated into production. It enables uninterrupted 24-hour production without downtime, even during staff breaks. As a result, the degree of utilisation of the machines increases to almost 100 percent.

## Sale of ceramic business unit



On 1 July, PFISTERER sold its Overhead Line Systems Ceramic business unit to PHI Industrial Acquisitions. From now on, the PFISTERER Group will be concentrating on its core competencies in metal and silicone processing, and making further investments in research and development in this field. The sites at Jedlina (Poland), Turda (Romania) and the ceramic divisions at LeRoy (United States) and Wunsiedel (Germany) are being transferred to the new investor PHI with the sale. However, PFISTERER and LAPP Insulators will continue to work closely together, particularly in Wunsiedel and LeRoy. The Overhead Line Systems Composite business unit with the brands RODURFLEX, LIKE and SILCOSIL MODULAR, as well as the High Voltage Lab in Selb, will remain in the PFISTERER Group, as will the composite insulator business in LeRoy.

## Global market leader four times in a row!

For the fourth consecutive year since 2017, PFISTERER has been named a "Global Market Leader" by WirtschaftsWoche magazine (November 2020). We are delighted to receive this accolade, which is extended to companies that are active globally and particularly successful in their market segment. The ranking is based on the Global Market Leader Index developed by the HBM School of Entrepreneurs at the University of St. Gallen, in partnership with the Academy of German Global Market Leaders (Akademie Deutscher Weltmarktführer – ADWM) and media partner WirtschaftsWoche. It lists companies in Germany, Switzerland and Austria that occupy a leading position in their market – demonstrating the outstanding quality of their products and services. The complete list and the selection criteria are available online at [wirtschaftswoche.de](http://wirtschaftswoche.de).



# Simplicity at last – the Universal Repair Kit for all XLPE cables

Schleswig-Holstein Netz AG opted for the Universal Repair Kit from PFISTERER as a universal fault reserve system for 110-kV XLPE cables, and is now equipped for all kinds of emergencies.

Storms, floods and lightning strikes – extreme weather associated with climate change is seen increasingly often. These phenomena are major challenges for energy grid reliability. PFISTERER offers various preventive emergency concepts for quickly restoring the power supply even in extreme situations. These are known as Quick Deploy Solutions – e.g. for connecting emergency transformers, bridging system components in substations, or repairing defective underground cable sections. With the Universal Repair Kit, Schleswig-Holstein Netz AG has opted for a permanent repair solution and universal fault reserve system for 110-kV XLPE cables. It is suitable for all XLPE



Installation is easier for the fitters, too,  
as only one universal system needs to be used.



The pluggable CONNEX  
connection joint up to 170 kV  
fits all cables in the network

Universal reserve cable  
for faulty cable section

insulated cables. Energy suppliers can now repair damage to cable systems within a very short time, even in historically evolved networks, regardless of the cross-section, structure or manufacturer. At the same time, their need to stock reserve cables is reduced to a minimum.

### One system for all fault scenarios

For Schleswig-Holstein Netz AG, fault-free grid operation is essential for meeting grid availability requirements. But damage to conductors caused by construction work, ageing or water ingress can never be completely prevented. When it happens, the damaged cable system has to be replaced quickly. Yet preventive inventory holding for historically evolved networks is extremely cost-intensive, given the large number of installed cable types and cable cross-sections. In the network of the largest electricity network operator in the German state of Schleswig-Holstein, there are twelve different cable types for 110-kV XLPE cables alone, with conductor cross-sections from 240 to 2,500 mm<sup>2</sup>. "We wanted to find a universally applicable fault reserve system for 110-kV cables that could cover all cable types in the network with just a few components," explains Torsten Kröger, Head of Operation and Service for 110-kV overhead lines and cable networks at Schleswig-Holstein Netz AG.

PFISTERER supplied the solution – the Universal Repair Kit. It features the PFISTERER universal pluggable inner cone cable connection system, comprising connection joints, cable plugs and pluggable terminations. These allow cables with different conductor shapes, materials and structures to be connected for selective and fast repairs to damaged sections of installed cables. From its existing range, PFISTERER also developed a universal epoxy resin joint suitable for underground use, for voltages up to 170 kV. In combination with just one defined

»It really simplifies things and saves around three-quarters of the conventional costs.«

Thorsten Kröger from Schleswig-Holstein Netz AG

reserve cable – for example the cable with the largest cross-section in the network – universal connecting cables can now be preassembled for faulty cable sections. Thanks to the CONNEX epoxy resin joint, the pluggable replacement part fits all 110-kV cable types in the network.

### Well equipped at minimal expense

With this solution, Schleswig-Holstein Netz AG is now equipped for all kinds of emergencies – from faulty cables to faulty joints to a faulty termination. This is because once again, PFISTERER has developed a pluggable product. At the same time, the need to hold a stock of all cable types is eliminated. "It really simplifies things and saves around three-quarters of the conventional costs," says Torsten Kröger of Schleswig-Holstein Netz AG. "Another key point is that the repair is a permanent solution and not a temporary stopgap that would have to be replaced again after a period of time, despite the high costs involved."

Schleswig-Holstein Netz AG will now always replace faulty cable sections using universal reserve cables. These are simply connected using joints and pluggable connectors – regardless of the cable cross-section. The expense of holding stock is reduced to a minimum.



CONNEX separable connector

# Packed watertight: GIS bypass solution for island infrastructure

If a gas-insulated switchgear (GIS) system fails on the mainland, it can have a massive impact on the power supply. But if the failure occurs on an island, the isolated location presents an additional logistical challenge. To be able to respond quickly in an emergency, the network operator for the Balearic and Canary Islands decided on an unusual solution: a turnkey GIS bypass cable system that is easy to transport across the water in seagoing containers.

The energy infrastructure on the popular vacation islands in the Mediterranean and Atlantic has grown over decades to include various cable and connection systems from different manufacturers. So the main criterion for the Spanish transmission network operator Red Eléctrica de España (REE) was that a solution must work for all types of transformers and gas-insulated switchgear (GIS), regardless of the manufacturer or applicable standard. REE conducted a study that identified around 30 different deployment scenarios.

## A few components for many scenarios

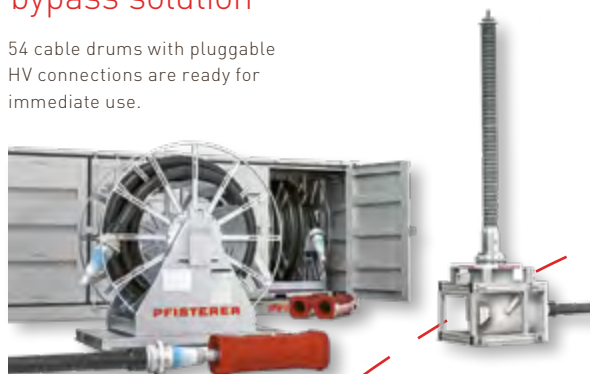
For this demanding task, in an EU-funded project, PFISTERER developed and supplied a transportable universal cable system up to 132 kV for rapid use in the event of GIS failures in substations, and for disruption-free installation or maintenance of existing system components. In the first stage, 54 cable drums, preassembled, including all required connection components, are ready for use and safely stowed in 18 twenty-foot, high-cube shipping containers. These turnkey, dry cable connection solutions enable bypasses in the event of a faulty GIS system as well as disruption-free installation or maintenance of existing system components. To reduce complexity, all connections are based on pluggable, dry CONNEX cable connectors and dry terminations. As a result, only these components have to be kept on hand for bypass cable systems from GIS to GIS, or from GIS to air-insulated switchgear (AIS).

“PFISTERER showed with this project that the company also meets the highest requirements as a provider of complete solutions. Everyone involved worked very closely together, and as a result, we received a unique solution

to secure our island infrastructure,” says Juan Carlos Sanchez, Canary Islands Project Director at Red Eléctrica de España (REE).

## Universal GIS bypass solution

54 cable drums with pluggable HV connections are ready for immediate use.



CANARY ISLANDS





PFISTERER  
Spain,  
Barcelona

Mallorca  
Menorca  
Ibiza  
BALEARIC ISLANDS



### Transportation by ship and truck

The seaworthiness of the quick deploy solution is important for maritime transportation between the islands.

Each container holds everything necessary for a particular bypass scenario in the event of faulty GIS in a substation. This includes three motorised cable drums with cable lengths of 50 to 100 metres in different configurations. The containers are stackable and can easily be transported by lorry or ship – seaworthiness is important for maritime transportation between the islands. Thanks to the motor-driven cable drums, the cables can simply be unrolled at the place of use. When everything is done, they can be

wound back onto the drums to be used again. Motorised doors on both sides provide optimum access in the field. A mast and lifting equipment are built into the container to enable the installation of terminations on an overhead line. The solution with integrated surge arrester protects the cable and the fitting while facilitating fast installation, since the surge arrester is simultaneously used as the fixing point for the termination.

### Turnkey ready within the shortest time

As the general contractor for the complete container solution, PFISTERER set up a temporary production site in Spain. This also made the logistics easier for the 18 containers and 54 cable drums plus 4,000 metres of cable. For the full final testing of all systems and components, PFISTERER installed a mobile HV test field on site. "With a delivery time of just a few months, the project was on a tight schedule. So logistics and workflows had to be optimally coordinated," reports Maria Gutierrez, Service Manager at PFISTERER Spain. The team worked in two shifts, seven days a week – with success: all containers were ready on time for shipment to four destinations in the Canaries and Balearics. In the final stage, the system will comprise around 30 shipping containers – suitable for all existing installations and possible application scenarios on the island groups of the Canaries and Balearics.

# Efficient and environmentally safe: the new DOC termination up to 170 kV

Solid-insulated and lighter than conventional oil or gas-filled terminations, dry outdoor cable terminations by PFISTERER have been used worldwide for decades. Their silicone solid insulation ensures environmental and operational safety as well as durability in use in substations and on overhead power lines, with no risk of leakage. With the new DOC (dry outdoor composite) termination, PFISTERER now also offers the first self-supporting, dry and compact version up to 170 kV. Completely preassembled and fully routine tested, it cuts installation time from hours to minutes. Energie Steiermark in Austria is already using this maintenance-free, environmentally and operationally safe solution.

As official partner to a green world, Energie Steiermark ensures safe, comfortable and sustainable living – so the new environmentally friendly and operationally safe DOC by PFISTERER is a perfect fit. The power utility and grid operator is Austria's fourth-largest energy and services company, and is also active in Slovakia, the Czech Republic and Slovenia. The two companies have a longstanding partnership going back 70 years.

Energie Steiermark was quick to recognise the benefits of DOC, and used the solid-insulated solution in a substation in Graz. The project involved a 110-kV line with a cable cross-section of AL 1,200 mm<sup>2</sup>. PFISTERER supplied a



At the substation in Graz, maintenance-free operation of the environmentally safe terminations means less monitoring is required from now on.

total of three DOC terminations, including splice boxes for operational control of the cable system using fibre optic cables. Maintenance-free operation of the dry terminations means less monitoring is required. Another plus point is that the environmentally safe technology is in line with Energie Steiermark's corporate vision.

## Fully system-tested and preassembled

"The one-piece, self-supporting design reduces the number of components and facilitates installation at the place of use. The DOC central unit, comprising a hollow insulator, stress grading device and base plate, is delivered to the site fully preassembled and tested," explains Tarek Fahmy,



Senior Product Manager at PFISTERER. Testing under IEC 60840 section 9 is carried out on the whole central unit, instead of (as is usual) only on the stress grading device. PFISTERER is currently the sole manufacturer to offer this full testing programme. DOC also meets all criteria of the highest pollution class in accordance with IEC 60815-3. It is therefore suitable for areas with high levels of dust, even deserts.

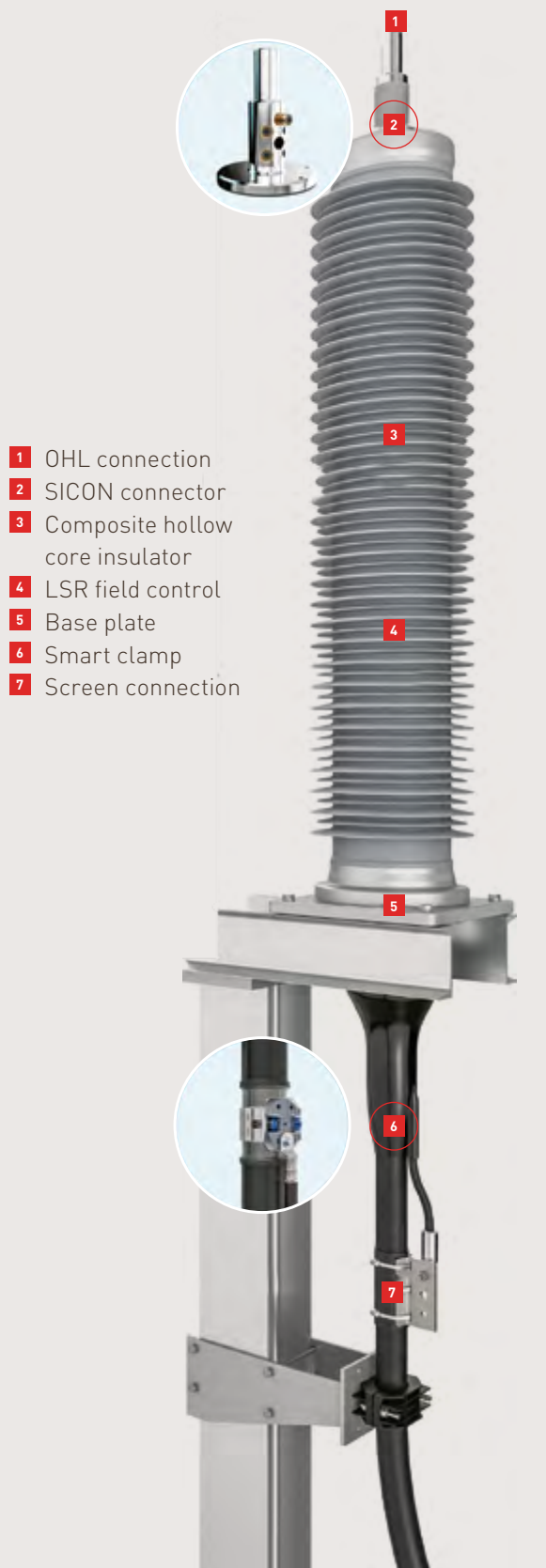
### Fitted in minutes, not hours

Compared to conventional terminations, the modular



design of the DOC simplifies handling across the board during transportation and installation. "The DOC offers other advantages during installation as well. That is why internally, we call it the five-minute termination," Tarek Fahmy says. Since the central unit is fully preassembled, it simply pushes onto the cable – the number of elements to be fitted is minimised, time-consuming gluing work and drying phases are eliminated entirely. Thanks to the silicone solid insulation, no filling is required on site either. The conductor is connected quickly and reliably using SICON shear bolt technology – without hydraulic pressing tools. PFISTERER also offers FrontCon – a highly advanced connection solution for single-strand insulated conductors.

## Self-supporting, dry outdoor termination up to 170 kV



- 1 OHL connection
- 2 SICON connector
- 3 Composite hollow core insulator
- 4 LSR field control
- 5 Base plate
- 6 Smart clamp
- 7 Screen connection

# Smart waste management at Gussenstadt site



**A question of volume:** Waste officer Wolfgang Uhl (l.) and production manager Hermann Schuller are significantly reducing transportation costs.



PFISTERER attaches great importance to sustainability – not only in product development, but also in our own production activities. For example, machining hundreds of tons of aluminium and brass every year at our Gussenstadt metalworking site produces an enormous amount of metal chips. Previously, these were taken away and recycled on a daily basis. However, this waste also contains residues of oils and cooling lubricants that are required during machining. So the idea was to find a way to recover the oils and simultaneously slash the transportation costs for the metal swarf.

## **Pressing aluminium – centrifuging brass**

First, the oils used for cooling lubricants were homogenised. As a result, the new type of oil can now be returned to the production cycle and reused. Then a solution was found for recovering oil from the aluminium shavings: a new briquetting machine compresses the chips. This allows us to squeeze out the cooling lubricants, filter them,

and feed them back into the production process. This cuts our lubricant consumption by more than 50 percent. It also shrinks the volume of the aluminium chips by 75 percent. For the brass waste, we use a centrifuge instead of the briquette press, because the chips are already high density. In this process, oil adhering to the metal is spun out, enabling us to recover around 75 percent of the oil.

## **Sustainable and economical**

Together, the measures achieve a considerable reduction in resource use. Thanks to the smaller volume of aluminium chips, two to three collection trips per month are now sufficient, instead of every day, as before. And reusing the recovered cooling lubricants substantially reduces their consumption. All in all, this means that many thousand fewer litres of oil are needed per year, CO<sub>2</sub> emissions are significantly lower, and we also trim our internal costs. A real investment in our future!

# Retrofit with foresight

Spanish grid operator i-DE Redes Eléctricas Inteligentes, a company in the Iberdrola group, is using the advantages of new oil and gas-free retrofit terminations from PFISTERER for the renewal of its network infrastructure. These allow the existing cable to be retained when ageing terminations are replaced. Easy to install because of their low weight, they also protect the environment in the long term.

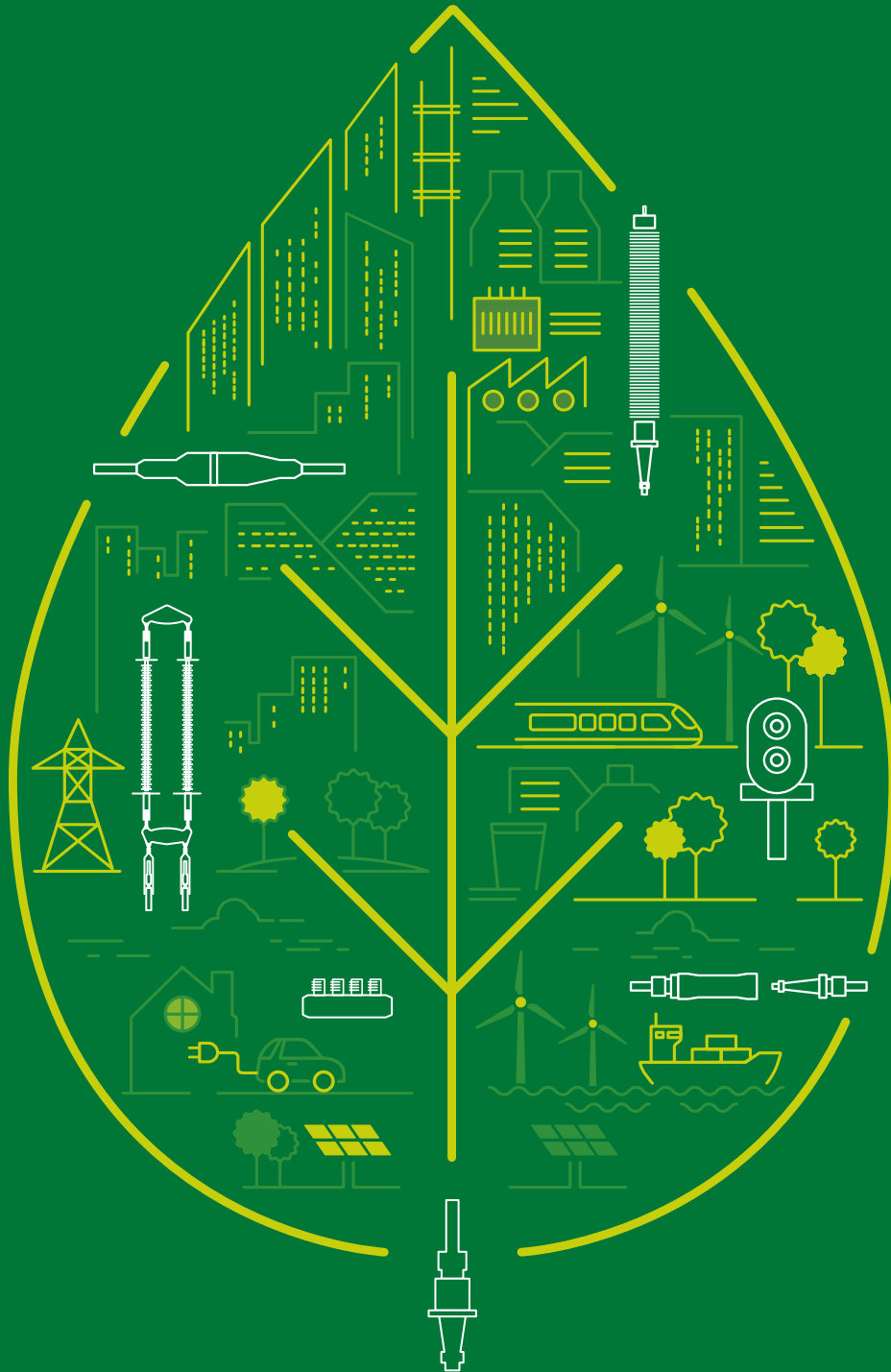
Highly versatile: i-DE is using the new terminations on the transmission tower as well as in a substation.

i-DE Redes Eléctricas Inteligentes, based in Bilbao, is one of Spain's main grid operators. Like many network operators, it faces the challenge of long-term infrastructure renewal. Networks have to be maintained, updated and brought into line with future requirements. In this case, the task was to replace ageing porcelain terminations on a 132-kV line in the Madrid metropolitan area. A modern solution was sought, but one that did not necessitate changing the existing cable. "This is a typical requirement that we fulfil with our push-on EST retrofit terminations. In principle they are suitable for all XLPE cables up to a conductor cross-section of 2,500 mm<sup>2</sup>. However, the solution can also be adapted for other cable types – such as here for i-DE, where an EPR cable is used," explains Tarek Fahmy, Senior Product Manager at PFISTERER.

## Environmentally safe and flexible

Whether in the substation (with or without integrated surge arrester), as a flexible solution, or on the transmission tower – with its dry retrofit terminations, PFISTERER offers a comprehensive range for all requirements and voltage levels from 72.5 to 170 kV, tested in accordance with IEC 60840. The advantage with these solid-insulated, oil and gas-free terminations is that they are explosion-resistant with no risk of leakage in the event of a fault, and there is no environmental hazard at any time. Plus the terminations are maintenance-free over their entire service life. "Beside the installation and maintenance cost savings, the environmental aspect is just as important as it allows us to sustainably renew our energy infrastructure," says Jose Miguel Sánchez Pereira, Maintenance Manager EHV Lines Central Region at i-DE. The PFISTERER solution meets all of the grid operator's needs. It has been in use since November 2020 in a substation and on a transmission tower, each with six terminations.





**KEEPING AN EYE ON EVERYTHING GREEN.** The sustainable products and latest technologies we offer for use on land and at sea allow us to help ensure a reliable energy supply, and therefore our quality of life – as we always have.