Thermos against blackout

In Munich, the power grid is being renewed so that there will be no blackouts when electric cars are being charged everywhere. The city is relying on a new technology and wants to build the longest superconductor cable in the world. By Henning Peitsmeier, Munich

It is the nightmare of every electricity supplier: the lights go out, trains and subways come to a standstill, thousands of households are without power. Because more and more energy from wind and sunlight is being fed into an electricity grid that is ill-equipped to cope with large fluctuations and at the same time the demand for energy in the metropolises is rising, blackouts could occur more frequently in the future. Even a city with a good grid infrastructure like Munich would not be immune to this, say critics of the energy transition. "I don't believe in the danger of a long-lasting, widespread power blackout; our grid has - sufficient reserves for that, and Munich has its own power generation plants today," counters Peter Michalek from Stadtwerke München. The electrical engineer admits: " But of course we have to renew the supply cables in the 110kV technology in terms of construction."

This "structural renewal" of the high-voltage grid, in which electricity flows at 110,000 volts, has begun in the Bavarian capital with a multi-million dollar research project called "Super-Link". In just a few years, so-called high-temperature superconductors (HTS) are to make the high-voltage grid fit for the future. The Munich project is attracting attention beyond the country's borders because it involves by far the longest HTS cable in the world, which has to pass its practical test here. The project manager is convinced of the little-tried technology: "The superconductor technology does not produce any electromagnetic radiation, is - environmentally neutral thanks to the cooling agent nitrogen and has almost no resistance losses," Michalek describes the advantages. In addition, the superconducting power cables can be used to expand the grid without having to dig up half of Munich. "One HTS cable replaces up to five old gas pressure cables in our network, and if we can lay it in the existing steel pipes, significantly less civil engineering work is needed."

The ambitious plan is to build a twelve-kilometre underground high-voltage line between the main substation in the west of Munich and the load centre in the south. Project manager - Michalek does not see any major risks. As one of the largest municipal supply and service companies in Germany, Munich's municipal utilities are committed to the common good - so nothing should be buried that has not been put through its paces. At the same time, the costs should remain within limits. We are talking about an amount in the mid-double-digit millions. Compared to the old technology, Michalek also sees a cost advantage: "The reference line will be at least twice as cheap as a plastic cable line."

Approximately half of the research and development costs, which are expected to amount to eight million euros, will be borne by the federal government. In addition to the municipal utilities, the project consortium includes the South Westphalia University of Applied Sciences and the Karlsruhe Institute of Technology (KIT), the cable manufacturer NKT and Linde AG. The heart of "Super-Link" comes from Theva Dünnschichttechnik GmbH, a medium-sized - company with 46 employees from the suburb of Ismaning.

In a 1000 square metre factory hall on the edge of a dreary industrial estate, the high-tech wires are produced that turn a power line into the very same high-temperature superconductor cable. "We are the first in Germany to be able to mass-produce -

superconductors," says Theva managing director Werner Prusseit. "But we are still some way from industrial production." At least a second hall twice the size has already been rented to ramp up superconductor production to 24-hour operation. Prusseit holds a spool the size of an old film reel in his hand, on which are the specially cut HTS tapes, and enthuses about "top performance with low material input".

Superconductors are materials with extremely low resistance. Electricity can be transported and transmitted through them with very low losses. Theva supplies the coils to NKT, where the cable is assembled from the high-tech wires. Linde supplies the liquid nitrogen for cooling. It is the heat-insulating principle of the thermos flask. It takes a week on Theva's equipment to polish and coat 600 metres of wire for one coil.

"Of course, we can still optimise the process," says 58-year-old physicist Prusseit, who - founded the company 25 years ago from the chair at Ludwig Maximilian University in Munich. After arduous early years, he now sees superconductor technology on the verge of a breakthrough because the Munich Superlink project and the upcoming series production will significantly reduce the costs of the ribbon conductors through scaling effects in - manufacturing. Then other commercially interesting projects will come into focus for Theva and the partners.

Unlike Linde and NKT, however, belt ladder specialist Theva still has to invest significantly in the set-up. Prusseit estimates the investment requirement at 15 million euros in the coming years. After a financing round of 6.4 million euros, investors provided another seven million euros last year. In addition to the previous backers eCapital, Bayern Kapital, Target Partners and BayBG, the investment capital company of the energy supplier ENBW is also participating. "We will continue to accompany Theva," promises investor Michael Mayer from eCapital, "but of course we are open to further investors." If growth materialises as planned, Theva should soon be a candidate for the stock exchange - or attract the interest of a large cable manufacturer such as Shanghai Cable.

For the city of Munich with its 1.5 million inhabitants, it is a matter of ensuring security of supply. The white-blue "Super-Link" could become a blueprint for other metropolises. All over the world, major cities are facing the challenge of absorbing the growing supply of green electricity into their grids in the course of urbanisation and electrification. "In Munich, the demand for electricity will increase enormously in the coming years, and not only because of electromobility. "The superconducting power cables can be a milestone for the energy transition in this regard," says Stadtwerke project manager Michalek.

The Ampa City project in Essen has shown that the technology works. The first-generation HTS cable laid there bridges two substations underground over a distance of one kilometre and has been working for six years without incident. For Theva's Managing Director Prusseit, this is reassuring. Because the previous power supply in the industrial area in Ismaning could not always be relied upon. Last year alone, the power failed five times in the Theva factory building, the last time after a heavy thunderstorm.