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**Breakthrough in the performance of superconducting cables**

**World record in low AC loss**

A new world record in low AC loss brings long supercables closer to reality. The Dutch distribution-grid operator Alliander, the cable developer Ultera® – A Southwire / nkt cables Joint Venture, and the Technical University of Delft succeed in achieving the ambitious goals of the Dutch HTS cable project.

In a critical experiment carried out in September of 2010, Ultera, Alliander and TU Delft succeeded in achieving a long-awaited result, namely to break the barrier of AC losses in HTS cable conductors. “Our electrical grid will only benefit from superconducting cables if they can be installed in lengths of 5-10 km,” says Senior Consultant Electrical Power Systems, Alex Geschiere, of Liandon – the subsidiary of Alliander responsible for technical service and upgrades, and continues: “This requires very low losses – otherwise the cables cannot be cooled. We had set up a goal of 0.2 W/m at 3000 Arms. Only a year ago, this seemed almost insurmountable, and very few believed it could be reached with today’s materials.”

Project manager- Consultant Electrical Power Systems Irina Melnik explains: “We have performed simulations of uses of HTS cables in many places in our grid, and the benefits will start accumulating for lengths beyond 5 km. For example, many new production facilities are located 10-15 km away from a grid connection point. These new results in superconducting cable performance show that it will be possible to connect new renewable production facilities with superconducting cables.”

Ultera joined forces with the Dutch network company, Alliander, to bring superconducting cables to life back in 2006. The goal of this joint development project was from the start to make a quantum leap in the performance and length of HTS cables, so they can be placed into existing rights of way instead of costly new rights of way in old city centres. “The new high-temperature superconducting cables have the potential to become an energy-efficient and environmentally friendly alternative to many of our old cable systems,” says Alex Geschiere.

Ultera worked closely together with the Department of Electrical Sustainable Energy, High-Voltage Components and Power Systems Group of the Technical University of Delft, and the materials supplier SuperPower Inc to make a cable design with the lowest possible losses using the new high-performance 2G materials. “There were different ideas of how to achieve low losses. SuperPower provided us with 6 mm wide tapes and 3 mm wide tapes of very high quality.

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We definitely have proven that the narrow tapes is the way to go,” says Ultera’s project lead, Dag Willén. “We hardly believed it when we measured only 0.11 W/m of loss at 3000 Arms,” he continues. “We repeated the measurement several times just to be sure.”

The Dutch-owned superconducting materials manufacturer SuperPower, located in Schenectady, New York in the U.S.A., is a world-leading provider of the second-generation high-temperature superconducting tapes. “We are enthusiastic about providing our latest development in energy efficient superconductors to this leading-edge project,” says Traute Lehner, director of marketing and government affairs, responsible for strategic partnerships at SuperPower. “We are aggressively up-scaling our manufacturing capability to be able to meet the performance and volume-requirements of this and other large-scale projects,” she continues.

Following this success, the project team turned its attention to the flow properties of the thermal insulation. “A long superconducting cable will be installed in a long thermally insulating duct,” explains Dag Willén. “We pump coolant through this duct, and the flow friction has to be low enough. We built a 45 m long thermally insulating duct using a mix of straight and corrugated lines, and we achieved the values we needed,” he continues. Oleg Chevchenko, Associate Professor at TU Delft, was responsible for the measurement and data treatment, and concludes that “with the few millibars that we saw over a 45 m length, the pressure drop over 6 km would be in the order of only 2 bars, and not the several ten’s of bars that some people had feared. Two bars of pressure drop is perfectly realistic to pump with existing components.”

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