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Green light for the ‘Made in Italy’ superconducting cable to power data centres

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Work has begun on the production of an Italian-made superconducting cable, designed to power data centres. The project, named Sure (an acronym for Superconducting – reliability & efficiency), stems from an agreement between ASG Superconductors (a company within the Malacalza Group) and the INFN (National Institute of Nuclear Physics), involving the INFN-LASA laboratory in Milan, which is leading the operation, and the National Laboratories in Frascati, also part of the INFN. It is a superconducting cable, manufactured entirely using Italian and European technology, which does not lose heat (and therefore does not generate heat), transports 10 times more energy than a copper cable, eliminates losses due to electrical resistance, takes up 10 times less space than traditional cables and is produced without the use of rare earths. The project is funded by the Ministry of Universities and Research, through the Italian Fund for Applied Sciences (FISA), with total funding of 5.8 million euros over five years, and is due to be completed in 2031.

Addressing data centre challenges

‘Of course,’ explain the companies involved, ‘it combines the INFN’s expertise in cutting-edge research using particle accelerators with ASG’s experience in the design and manufacture of superconducting magnets, cables and systems.’ The aim is to develop a magnesium diboride (MgB_2) cable capable of addressing one of the key challenges facing next-generation data centres: reconciling the growing demand for electrical power – particularly from artificial intelligence applications – with energy efficiency and environmental sustainability. The project is a technology transfer initiative, building on the results of the Iris project – funded by the Regional Ministry of Research and Education (MUR) using PNRR funds – which is leading to the development of a 1-gigawatt superconducting cable

prototype for the more efficient transmission of high levels of electrical power.

Zoccoli: ‘Research can help create more efficient and sustainable infrastructure’

“This,” says Antonio Zoccoli, president of the INFN, “is a prime example of technology transfer from research to industry. The technologies developed by our institute for cutting-edge physics are now finding a new application in a strategic sector such as data centres, whose energy requirements are set to grow with the development of artificial intelligence and high-performance computing. Furthermore, they can also be used in many other areas characterised by high energy consumption. Projects such as this demonstrate how research can help create more efficient and sustainable infrastructure, whilst at the same time fostering innovation and strengthening the country’s competitiveness.”

Davide Malacalza, chairman of ASG, emphasises that the company has been investing “for years in the development of magnesium diboride superconducting cable technology, a solution that enables significantly greater amounts of energy to be transmitted in confined spaces. “We are proud that this initiative, designed to support the evolution of data centres, has originated in Italy and, thanks to our partnership with the INFN, represents a shining example of collaboration between industry and research, addressing a strategic challenge of global significance.”

It all kicks off with the National Laboratories in Frascati

First and foremost, the new cable will be used to power the new data centre at the Frascati Laboratories. Unlike the superconductors used in large particle accelerators, which require cooling with liquid helium to around 2 kelvin, the Sure cable uses, as mentioned, magnesium diboride, which operates at around 20 kelvin (-253 degrees Celsius), reducing cooling

costs by more than tenfold. This temperature can be achieved using closed-cycle cryogenic systems, which are already widely used in industrial applications; this makes the technology easier to integrate and suitable for continuous use in data centres. Furthermore, at such a temperature, MgB_2 allows for the transmission of much greater amounts of energy, for the same physical dimensions, compared to conventional cables, thereby eliminating losses due to electrical resistance.

Marco Nassi, CEO of ASG Superconductors, points out that this technology “is characterised by the absence of heat dissipation along the cable during operation; a feature which, together with the availability of industrial cryogenic systems capable of maintaining an operating temperature of around 20 kelvin, makes magnesium diboride a particularly promising solution for next-generation digital infrastructure. Furthermore, this superconductor is produced without the use of rare-earth elements and via a short supply chain’.

He concludes that the use of superconducting cables ‘also makes it possible to reduce the space required by a factor of 10 compared with traditional cables’. Furthermore, the system “will be designed to provide a transmission capacity exceeding the data centre’s initial requirements, ensuring the infrastructure is ready for future expansions in computing capacity and the associated energy demands”.

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