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## Italia leads the world with superconducting cable

A study in Nature identifies that technology as the best way to transport energy. Zoccoli (Infn): 'We are ahead'

by Raoul de Forcade  
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### Key points

- Cable made by Asg of the [Malacalza family](#)
- Nuclear physics institute tests technology in Salerno
- Rossi: 'Very advantageous coupling of cable and liquid hydrogen'

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[f](#) Italia is at the forefront, worldwide, in the production of superconductive cables for use in industrial applications and for transmitting renewable energy. This is confirmed, indirectly, by a recently published study in Nature, the world's most important scientific journal, which states that MgB2 technology (magnesium diboride, that of superconducting wires) is the best from a cost-benefit standpoint for creating infrastructures for transporting energy and liquid hydrogen over long distances. The latter,

moreover, cools the superconductor, allowing the passage of electrons and eliminating losses and dispersions. The Nature study was carried out by Chinese universities and research institutes as well as the University of Cambridge and compared MgB<sub>2</sub>, which was found to be the best, with BscCo (copper, calcium, strontium and bismuth oxide) and Ybco (yttrium, barium and copper oxide).

Today, there are very few companies in the world capable of producing MgB<sub>2</sub> wires: they can be counted on the fingers of one hand in the USA, South Korea, Japan, China and Italia. The only company, however, that has so far been able to boast a patented superconductor production process suitable for the manufacture of flexible cables (inside which superconducting wires run) for the transmission of energy through industrial processes, is Italian. It is the Ligurian company Asg (owned by the [Malacalza](#) family) which, not by chance, has already supplied this technology to CERN, where numerous cables have been produced, and are currently operational, that will power the Lhc (Large hadron collider) particle accelerator, in its upgrade called Hilumi.

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Il cavo italiano per trasmettere energia

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#### Cable made by Asg of the [Malacalza](#) family

But Asg is also collaborating with the Infn (National Institute of Nuclear Physics): together they are developing a superconducting cable with a power rating of 1 gigawatt (potentially capable of transporting the energy produced by a nuclear power plant in just a few centimetres in diameter), which is currently being tested at the Asg plant in Genoa and is being installed at an Infn facility in Salerno.

Antonio Zoccoli, president of Infn, confirms the leading position that Italia, and therefore Europe, has in this sector. 'Yes,' says the physicist, 'we are ahead. But we are so for a very precise reason, because we have, by

now, a tradition in this field. Infn and Asg have been working on superconductivity for many years, and the Ligurian company has supplied a third of the magnets to Lhc, is working with Iter (the project that aims to achieve clean nuclear energy), on the Dtt (Divertor tokamak test, the Enea energy and fusion project in Italia) and so on; all thanks also to the experience it has gained together with us'.

Asg, he continues, 'uses a cable while many others use wires; what Asg has done is to be able to industrialise this technology. Now, therefore, it is easier to produce a cable that can be used very quickly. We have moved from basic research to industrial research'.

#### **The Institute of Nuclear Physics tests technology in Salerno**

The Infn, adds Zoccoli, 'has succeeded in setting up a project, which has obtained funding from the Ministry of Research with Pnrr funds, and we have involved Asg for the construction of the cable: over the past three years, we have carried out the project, which has a total funding of 50 million euro, and within this, again together with Asg, we have developed the cable that we are now starting to test in Salerno. This is an initiative that involves a large territory: there is Milan, where we have all our experts, there is Genoa where Asg works, and there is Salerno, where we have built a facility for testing. Then, we would like to try to install this cable and use it for practical purposes; just as, according to the Nature article, the Chinese want to do; and as has also been experimented in Paris, in the Montmartre district. The advantage of these cables is that they consume very little energy and take up very little space, so they can be buried quietly, without dissipating too much energy and with advantages in terms of both economics and logistics.

Lucio Rossi, Associate Professor of Physics at the University of Milan and researcher at Infn, also emphasises that Italia 'is definitely at the forefront of superconducting cables right now. I am not saying that we are alone, but we are definitely the first in the western world. Compared to the Chinese, who are also working on this technology, I would be cautious; but I would say that we are certainly not further behind'.

#### **Rossi: 'Very advantageous coupling of cable and liquid hydrogen'**

The development of superconducting cables is part of the innovation challenge that the energy transition poses to electricity grids: renewable energy sources, sun and wind, are intermittent and geographically concentrated in areas often far away from centres of consumption. The surplus energy generated at certain times, and in certain regions, cannot reach the grid areas of possible use. It risks, consequently, to be wasted.

The system proposed by the Nature researchers solves this problem: MgB<sub>2</sub> cables, cooled by liquid hydrogen flowing within the same pipeline, transmit electricity with almost no losses, over hundreds of kilometres. Excess energy is, at the same time, converted into liquid hydrogen through electrolysis, stored and transported through the same infrastructure. Simulations conducted on real generation and consumption data from all the Chinese provinces show," the study says, "that the system could double the capacity of renewable energy and multiply the production of liquid hydrogen 4.8 times over conventional solutions.

'The Chinese have done,' Rossi concludes, 'a fair calculation on this, showing that the coupling of electric cable and liquid hydrogen is very advantageous. They have done well, but we are in that groove there, our

cable can also run on liquid hydrogen'.

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