

PUBLICATION

# Supergrids: the challenging comeback of direct current

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Today the challenge is to enable better transmission from one country to another while reducing CO2 with efficient links between renewable energy and the grid. **This is where the high-voltage direct current (DC) supergrids come in:** they add to and sometimes replace the old high tension alternating current grid (AC).

**Direct current can transport electricity over extremely long distances with little loss of power** (only 3% every 1,000 km) and it offers broader prospects for developing interconnected and integrated grids worldwide. In particular, DC lines can cover several hundreds of kilometres, whereas AC lines can run at most for 70-100 km.

Furthermore, it is possible to connect grids that have different voltages, frequencies and operating regimes, and use the DC connection as a generation reserve group. This is because direct current is capable of providing the amount of input power required in a short time, guaranteeing more stability, flexibility and grid security.

DC cables also occupy less space than the traditional alternating current lines and can run underground over long distances. People therefore have less concerns about safety or expropriation of private property and the grid can expand more rapidly.

**Even if the advantages of DC are unquestionable, this doesn't mean that alternating current is gone forever.** For instance, AC allows the use of transformers, which are high performance machines for switching electricity voltage. It also happens to be more economical over short distances.

“We will have multifaceted, interconnected grids, with layers of AC and DC, and a two-way flow of energy”, says Thomas Pozzi, from General Electric Grid Solutions, “Thanks to the DC meshes intertwined with alternating current, the AC grid will become more stable, more controllable and blackouts will become rare events”.

**The European Commission's energy roadmap envisages a supergrid for Europe by 2050.** But already today, direct current interconnections between the countries of the Baltic and North Seas are rapidly developing.

The agreement between **ENEA** (National Energy and Environmental Agency) and **NEDO** (Japanese Agency for energy and technological development) for the construction of a new generation plant for DC electric power transmission is part of this context. The plant was designed by the giant Japanese Toshiba Corp and will be implemented at the Enea Research Centre in Casaccia, near Rome, Italy.

The new technology consists of a high voltage direct current system based on multilevel converters (MMC) using VSC (Voltage Source Converter) technology, which offers greater control over the power flows. “The fact that a new player has come onto the market for direct current energy transmission is an advantage also for the European utilities that will have a wider array of options from which to choose”, said Munehiko Tsuchiya, Executive Director of NEDO.

**Another project is the underwater power line between North Africa and Italy.** “We have presented the project to the European Commission. It was approved in the first phase and we hope we will obtain financial support to achieve this connection from the south of Sicily to the north of Tunisia”, said the CEO of Terna, Matteo Del Fante, who has been studying for this project for many years with the Tunisian operator STEG.

The Italian company is also part of the Best Paths project, **an initiative aimed at facilitating the large-scale integration of electricity networks with renewable energies in the European energy mix.** They coordinate a research area that promotes the development of technologies “to achieve a reliable and efficient direct current grid, which is required for bulk energy transmission even over long distances, and to enable clean sources of energy to be integrated”, says a Terna representative. This could allow **electric current transmission with less power loss**, for example, from a photovoltaic plant in a sun-beaten African desert to an office in cold Scandinavia, from a wind farm in the North Sea to a cosy apartment in Spain.

By Elena Veronelli