



# MVDC electricity network consulting

Supporting you with innovative solutions for energy transition

Catering to the developers, operators and equipment manufacturers of future electricity networks, we offer advanced expert services to support you in defining the technical feasibility of your medium voltage direct current (MVDC) network projects and provide a unique approach to understanding their techno-economic implications.

## OVERVIEW

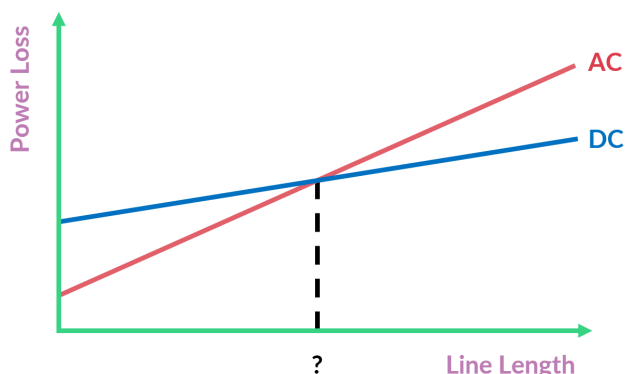
Energy requirements are changing rapidly, with an ever-increasing demand for innovative solutions capable of integrating renewable energy sources, supporting data centres, electrical transportation, electrolysers, etc. In response to the requirement to drastically reduce CO<sub>2</sub> emissions globally, MVDC electricity networks are the solution.

Innovative systems and technologies are required to meet the demands of this complex, challenging and ever-changing context. At SuperGrid Institute, we offer customised system solutions for MVDC networks, providing the best possible insights for you and your end customers.

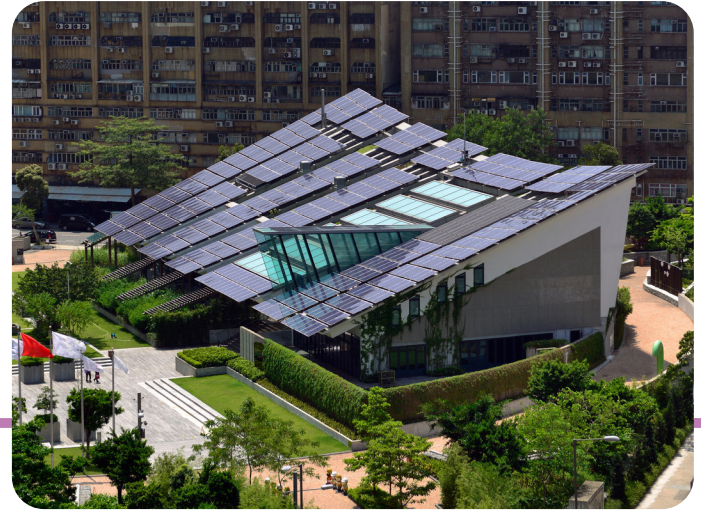
## WHY AN MVDC NETWORK?

Thanks to many recent innovative technologies, MVDC networks surpass the performance of their MVAC counterparts by far. MVDC networks offer:

- Increased power capacity.
- Longer power supply distances.
- Reduced power losses.
- Simplified integration of new loads and generation systems.

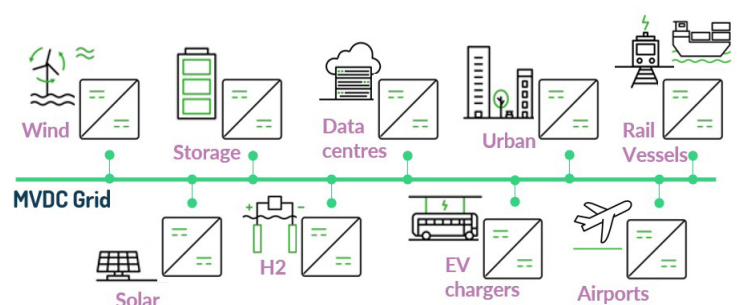


Publication EPE 2021: Break-even distance for MVDC electricity networks according to power loss criteria



## THE SCOPE OF OUR SERVICES

- Expert consulting services specialising in MVDC network architecture, control, protection and equipment, drawing on the best industry practices and our in-house innovative technologies.
- Voltage range: few kV DC to several tens of kV DC.
- Power range: 100 kW to several tens of MW.
- Techno-economic analysis of the proposed architectures.
- Recommendations on component specifications (converters, cables, substation equipment, etc.)
- Training on systems and technologies.



## OUR ADDED VALUE

- Broad expertise in MVDC all under one roof: from system design to enabling technologies (power converters, switchgear and cables, etc.).
- Proven experience in MVDC network consulting
- At the forefront of MVDC technology research and development.
- Design and testing services available.

# PV POWER PLANT CASE STUDY

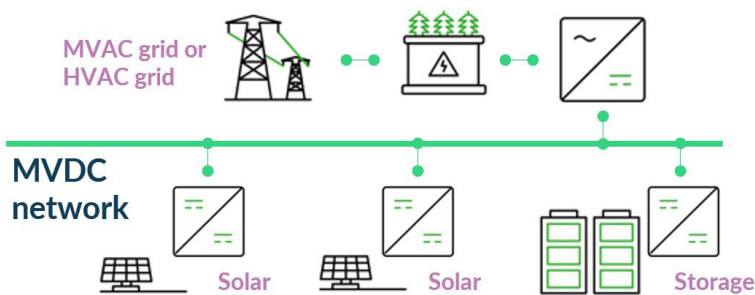
Linear photovoltaic power plant on the banks of the River Rhône (France).



## Mission

Carry out a feasibility study for the project and confirm the appeal of using an MVDC electrical architecture to transport solar energy produced over long distances of around 20 kilometres.

## Main targeted architecture



## Accomplishments

- Defined the MVDC network architecture and ratings.
- Developed simulation models to define the main MVDC network equipment's sizing and to propose control and protection algorithms.
- Completed an in-depth feasibility study of the MVDC network equipment: MVDC cables and switchgear, AC-DC converters and transformers, DC-DC converters based on medium frequency transformers and SiC power semiconductors.
- Carried out an industrial feasibility study in collaboration with equipment manufacturers.

## Key take away

This project aims to maximise the capacity for renewable energy production in France by making use of linear terrain.

The proposed architectural solution uses MVDC to reduce losses when transporting the energy produced over long distances.

**CNR** This project was developed by the *Compagnie Nationale du Rhône (CNR)* in collaboration with *SuperGrid Institute* and the *CEA*.

# OFFSHORE WIND FARM CASE STUDY

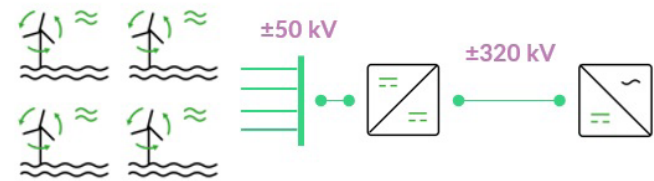
Evaluation of a DC inter-array-based solution for connecting offshore wind farms to the AC mains.



## Mission

Carry out a feasibility study, suggest design concepts and evaluate several indicators related to CAPEX and performance (e.g. life-cycle losses, availability rate) in order to assess the techno-economic benefits of DC arrays in comparison to conventional AC solutions.

## Main targeted architecture



## Accomplishments

- Assess the feasibility of applying conventional AC offshore wind farm operating principles (control, protection, start-up procedure, ...) to DC inter-arrays.
- Define the general requirements for DC-DC converters and evaluate the suitability of various topologies (3-level converter, modular multilevel converter, diode rectifier, etc.).
- Perform a quantitative techno-economic study based on realistic operational scenarios.

## Key take aways

- Defined the range (transmitted power and distance to shore) in which the use of DC inter-arrays is the optimum solution, based on our techno-economic analysis.
- Evaluated the maturity level of DC inter-array technologies and operational concepts.

## CONTACT

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## Shaping power transmission

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