MEDGRID industrial initiative 2011 - 2014

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For power system expertise

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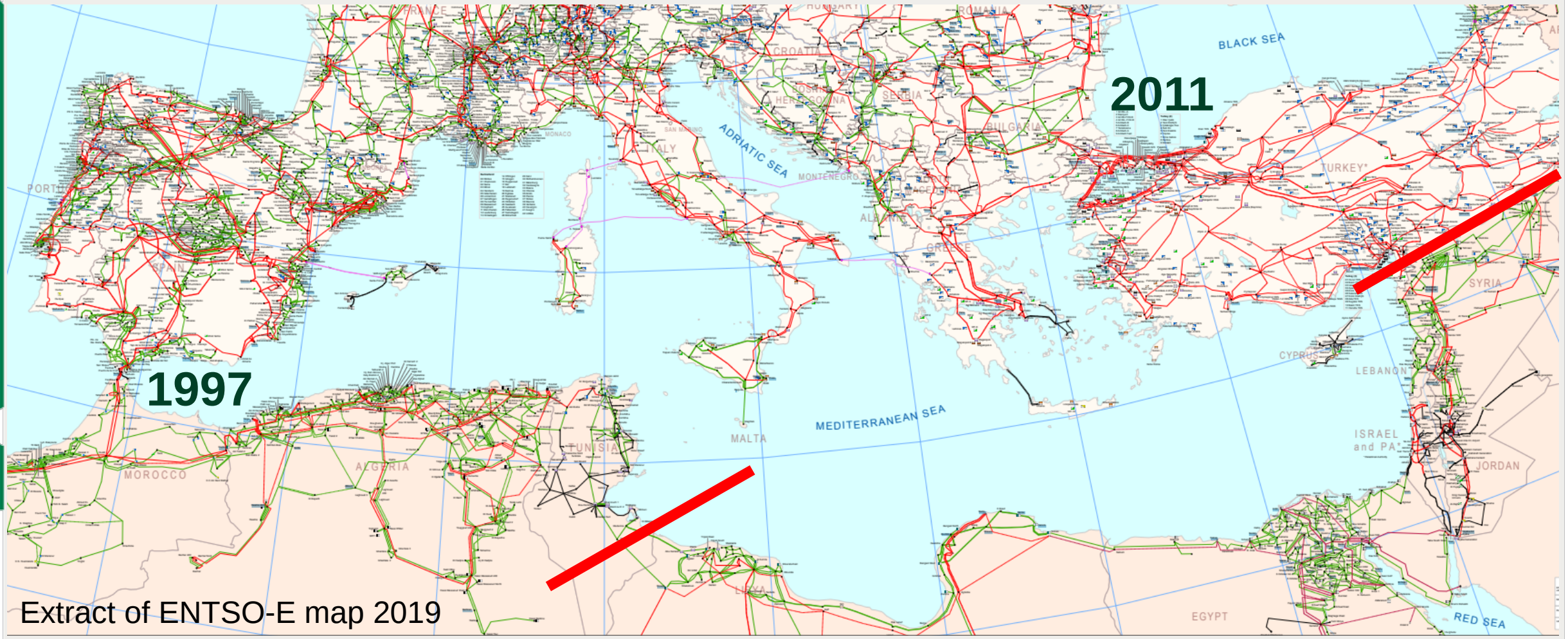
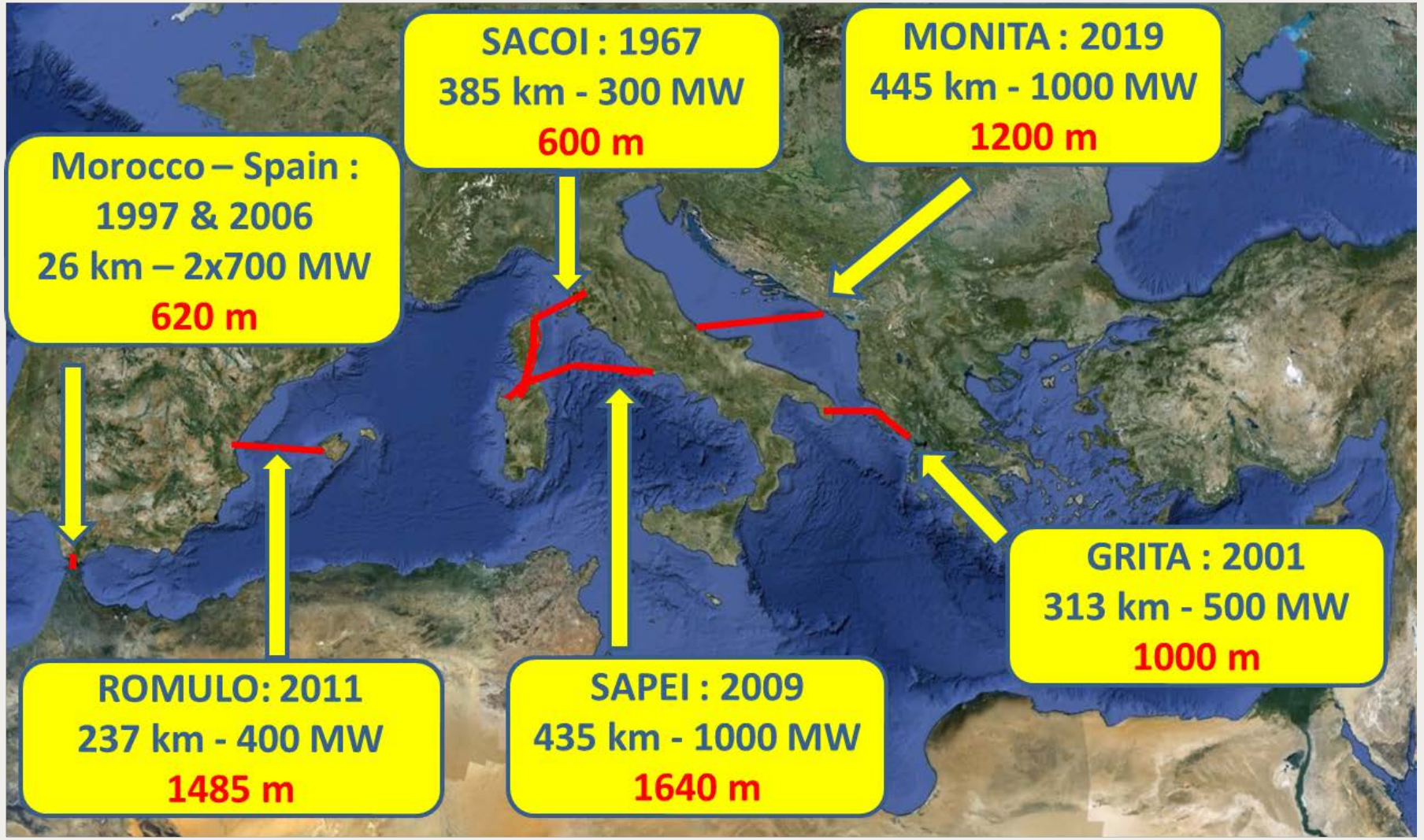
Euro-mediterranean electricity grid in 2019



Extract of ENTSO-E map 2019

Existing submarine power links in the Mediterranean



Context of the creation of MEDGRID (2011 - 2014)

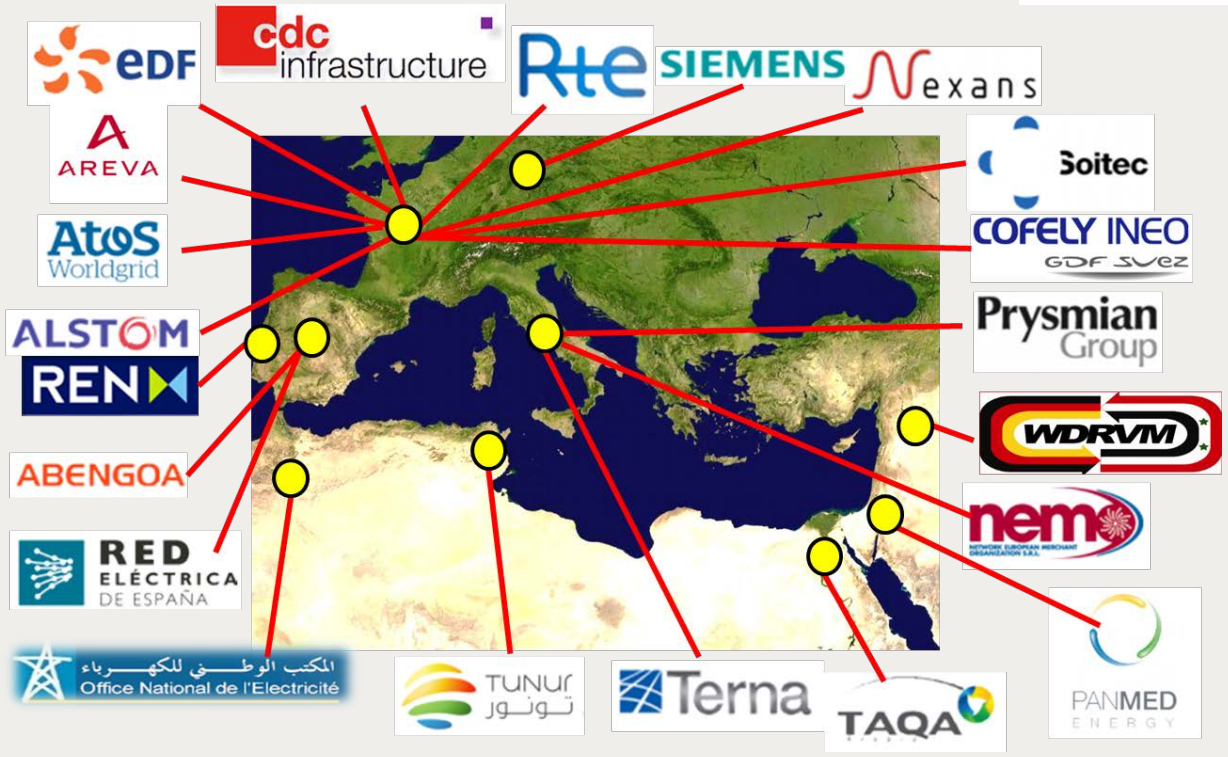
- The Med Ring was an old concept, as the South-Eastern branch of the UCTE system (1951 – 2009)
- The 20/20/20 plan of the EU, defines targets for 2020:
  - A reduction in EU greenhouse gas emissions of at least 20% below 1990 levels
  - 20% of EU energy consumption to come from renewable resources
  - A 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency
- The Mediteranean Solar Plan (MSP): 20 GW RES installed in the SEMC & 5 GW exports to the EU

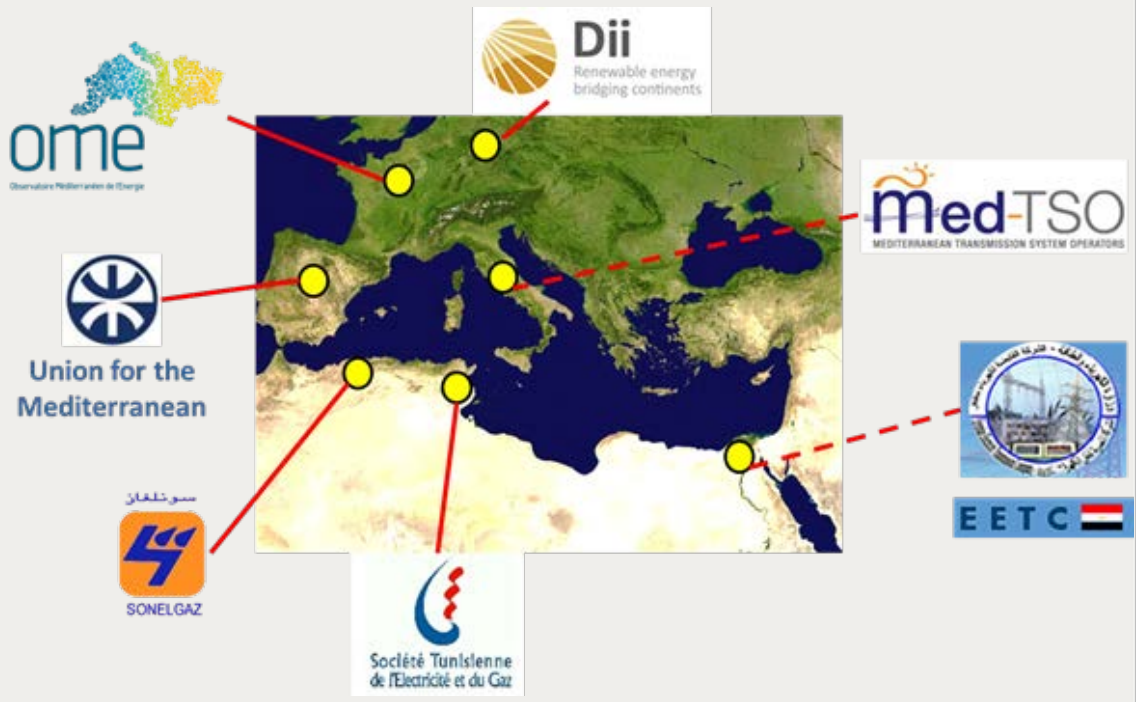
MEDGRID industrial initiative

Shareholders

Medgrid

Partners





MEDGRID vision

- The export of renewable energy from the South and East of the Mediterranean Countries (SEMC) to Europe will be one of the drivers of the development of the trans Mediterranean interconnections.

- The fast growth of the power demand in the SEMC also justifies stronger interconnections with the European electricity market, which offers opportunities for exchanges from North to South and East.

- The extension of the European transmission grid towards the SEMC will improve the security of supply of the interconnected countries.

MEDGRID objectives

- To promote and impulse the development of the Mediterranean transmission and interconnection grid through the provision of a reference grid development plan.
- To give confidence to his shareholders and to public and private investors that :
  - Opportunities of profitable power exchanges between the Mediterranean countries will exist in 2020 – 2025
  - Technical and technological challenges can be managed.
  - Adequate regulatory and financing framework can be recommended

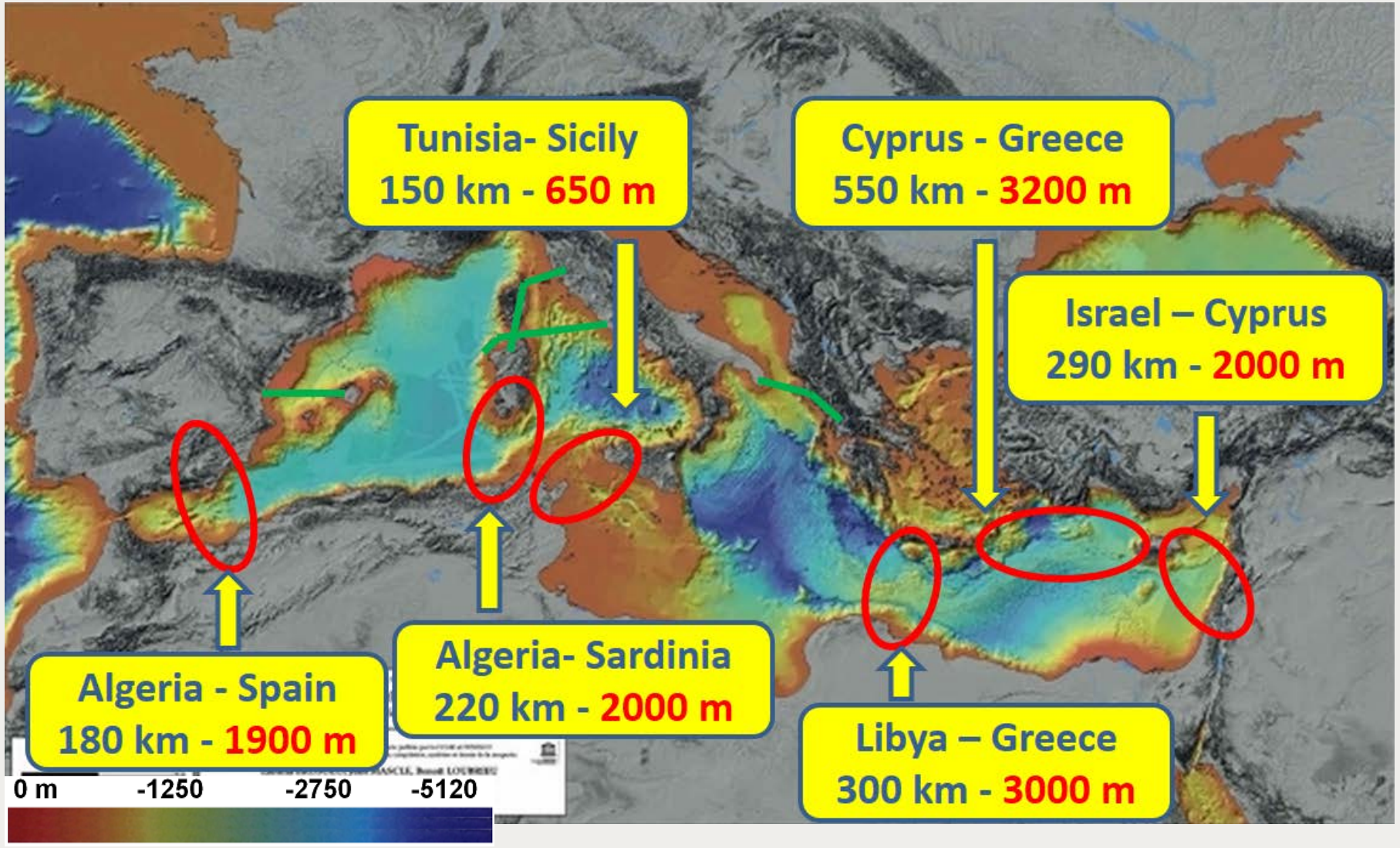
MEDGRID program of works

- Economic analysis of the generation and consumption of Euro-MENA countries
- Definition and costs of the infrastructures necessary to increase the net transfer capacities of the three main corridors (including national grid reinforcements)
- Assess the feasibility and costs of the technologies to be used to implement the Mediterranean grid:
  - High voltage alternative current technologies (HVAC : 400 & 500 kV)
  - High voltage direct current technologies (HVDC : +/-320 kV)
  - Submarine power cable systems for depths up to 2500 meters
- Recommandation of evolutions in the national and international regulations to allow the exchanges of power between the Mediterranean countries

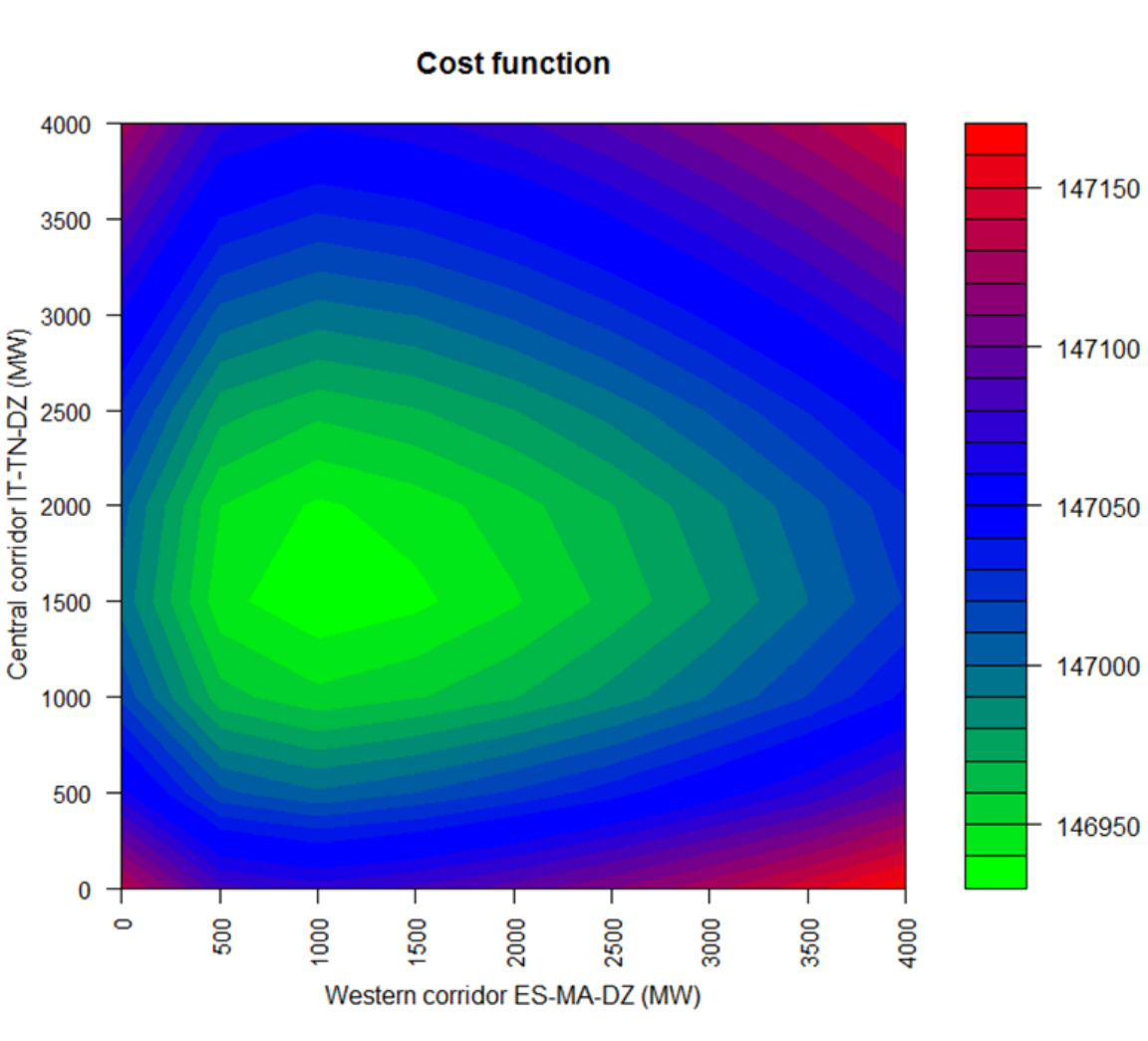
MEDGRID economic analysis

- Economic analysis to assess the opportunities of power exchanges between the Mediterranean countries based on :
  - Their national energy mixes including renewable energy plans
  - The profiles of their demands including their energy efficiency efforts
  - Different contrasted scenarios

MEDGRID findings : eligible paths



MEDGRID findings: optimal interconnection development plan



A GLOBAL APPROACH TO FIND THE OPTIMAL CONFIGURATION OF THE INTERCONNECTED SYSTEM

Example : total cost in M€ (annual investment cost + fuel cost + cost of "unserved energy") as a function of the transmission capacity installed in the western corridor (Spain – Morocco/Algeria) and the central corridor (Italy - Tunisia/Algeria), for a minimum required rate of return on investment of 7%