



Second Euro-mediterranean **Rendez-vous on Energy**

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Technology Issues for the Development of Mediterranean Interconnections: present Status and Perspectives

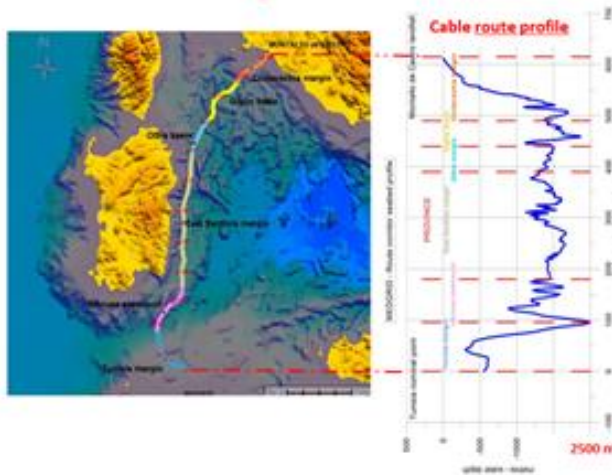
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THE CABLE SYSTEM

- Mediterranean corridor for cable route
- Technological challenges of a deep sea design
- Cable system technology
- Market challenges at the target Years
- Horizon for commissioning

CABLE SYSTEM FEATURES AND ROUTE



→ Submarine power cable system in bi-pole configuration

→ 1000 MW HVDC

→ 600km long submarine cable (Centre Corridor)

→ Water depth of up to 2500m

→ Seabed profile: 60% at depths > 1500m*

* Romulo: 2x200 MW, 1485 m, 30/23 kg/m

* SAPEI: 2x500 MW, 1640 m, 36/25 kg/m

TECHNOLOGICAL CHALLENGES OF A DEEP SEA CABLE DESIGN

→ The mechanical design

- conductor
- insulation
- lead sheath
- armour

- smallest possible outer diameter
- lowest possible weight
- high electric power transmittability
- high electrical stress withstandability
- ability of withstanding high tensile strength and of limiting water propagation following a possible fault (250bar)

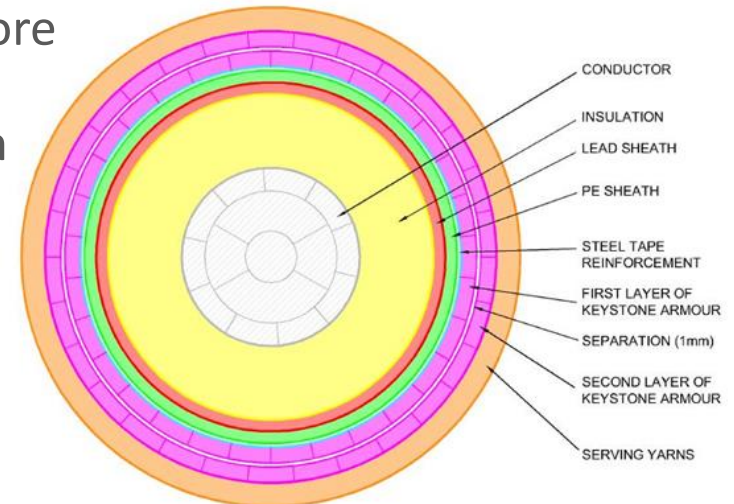
→ The design of cable laying methods and means

- capability of vessel to handle:

- deep water cable lay
- cable catenary control
- cable touch down monitoring
- single vs. bundle lay
- very deep marine survey
- cable recovery

CABLE SYSTEM TECHNOLOGY

- 400kV, 1400mm² Al, mass impregnated-MI insulated cables for the near future (Year 2020), being this technology considered to be better proven for high depths
- 320kV, 1600mm² Al /400kV or 1400mm² Al, with extruded insulation may become a priority for near future (Year 2020)
- 500 kV, 1150mm² Al, extruded for the more distant future (Year 2030), envisaging material technology advances and proven technology of cables and accessories by that date in a competitive market
- Cable site joints: location on the route



MARKET CHALLENGES FOR A 2X600 KM CABLE LINK

- Competing projects at the Target Years may have the potential to cause delays
- availability of raw materials
 - limits to cable system production
 - factory production capacities
 - manufacturing slots availability
 - lead times compliance
 - testing facilities

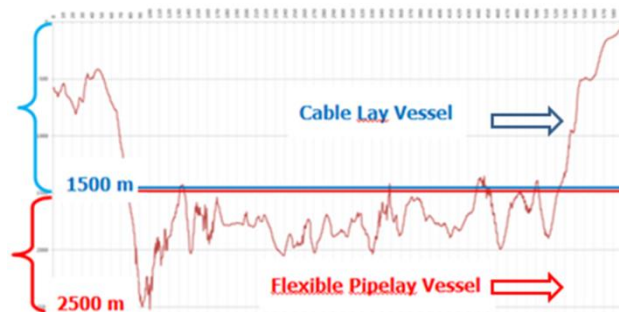
INSTALLATION CHALLENGES FOR A 2X600 KM CABLE LINK

→ Cable lay vessels market

- Max. mechanical dynamic tensions at 2500m depths: 90 – 115 tonnes
- dynamic tension limits of the largest vessels currently on the market
 - cable ships: 55 – 65 tonnes
 - flexible pipelay vessels (100 – 550 tonnes)



- 1 x Cable Lay Vessel (up to 1500m depth)
- 1 x Flexible Pipelay Vessel (1500 ÷ 2500m)



HORIZON FOR COMMISSIONING

→ Time to procure a complete bi-pole (2 x 600 km):

8* or 10** years

- tender activities: 2 y
- pre-qualification activities: 1.7 y
- project implementation: 5** or 7* y
 - engin.and detailed marine survey: 1.2 y
 - cable manufacturing: 3* or 5** y
 - installation: 1.5* or 3.4** y
 - commissioning: 0.3 y

* *two production lines working in parallel*

** *only one production line engaged*

→ time for activities preliminary to those for the procurement

- licensing, permits and way leaves tasks: **2 years**
- booking-ahead period: **4 years**

CONCLUSIVE REMARKS

→ Technology

- MI solution for the near future (2020)
- extruded 400/500 kV cables to become a priority for the more distant future (2030) envisaging material technology advances in a competitive market

→ Laying

- 1 x Cable Lay Vessel (up to 1500m)
- 1 x Flexible Pipelay Vessel (from 1500 – 2500m)

→ O&M

- achieving a rapid repair or a guarantee of availability of a suitable repair vessel, within an agreed time frame.
- new design of ROVs may be required to support repair activities in deep water