Long length UHV Cable Systems in Spain

WETS 07 (World Energy Transmission System)

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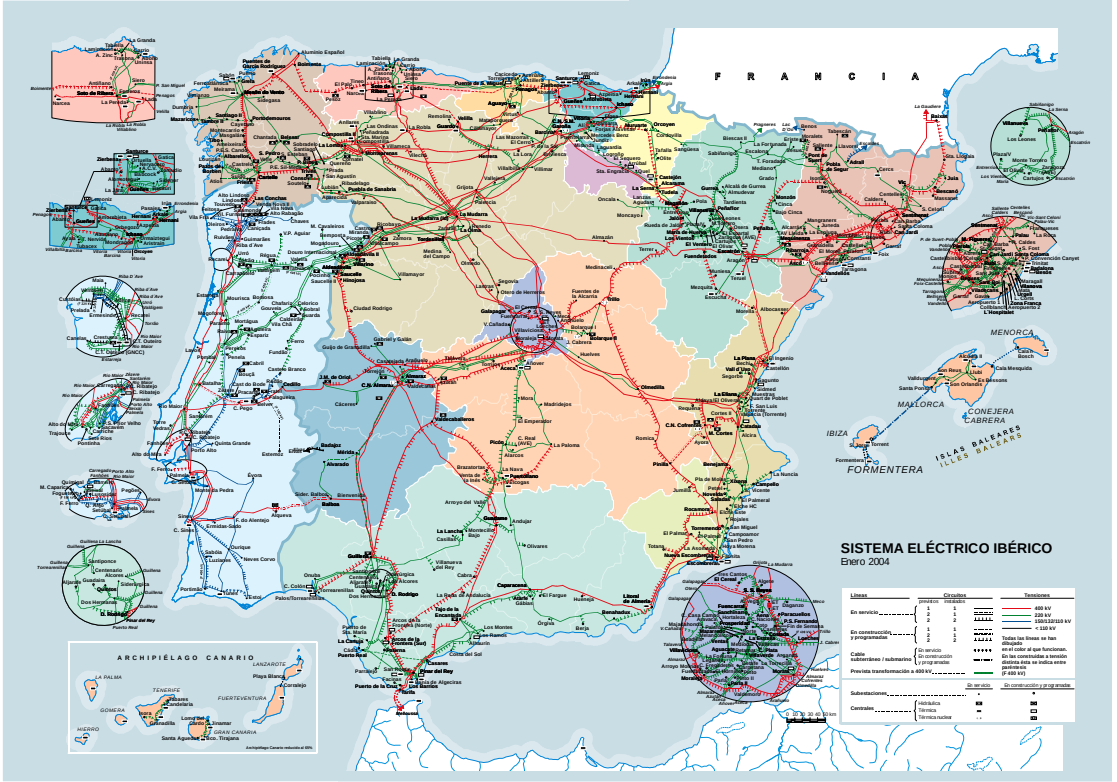
Long length UHV cable systems in SPAIN

Introduction

- **RED ELÉCTRICA DE ESPAÑA (REE) and the Spanish Transmission network**
  - REE is the Spanish TSO
  - 22 years since REE creation
  - 33.500 km 220 and 400 kV lines
  - 450 Substation
    2.900 bays
  - 55.400 MVA transform.
  - 1.400 employees
- **Investment plan**
  - 2007: 626 M€
  - 2007/2011: 3.000 M€
- **UHV Cables**

400 kV	220 kV
90 km	200 km



Long length UHV cable systems in SPAIN

220 kV Cables

- Mostly in Madrid and Barcelona urban areas (220 “distribution” rings)
- Around 200 circuit km; 35 circuits; <10 km (1-6km normally)
- Around 50% OF, 50% XLPE
- Shared tunnels, directly buried, in ducts…

Long length UHV cable systems in SPAIN

Barajas 400 kV project

- *Double circuit 400 kV. Length 2 x 13 km*
- *Voltage levels U, U0, Um: 400, 230, 420 kV*
- *Circuit Ratings: 1720 / 1390 MVA (winter/summer)*
- *Short circuit current: 50 kA, 0.5 s*
- *Impulse voltage levels: 1050 / 1425 kV*
- *Type of installation: Ventilated Tunnel (dedicated) 2 x 2,5 m*
- *Three cables per circuit in vertical flexible config. Phase separation of 500 mm.*
- *XLPE Cables, 2.500 mm^2 cupper conductor (miliken 6 segments) from ABB and Pirelly, including all accessories (96 joints y 12 outdoor terminations).*
- *RTTR (including a DTS system) to supervise circuits and command the ventilation system: 5 air intakes and 7 out lets.*
- *Each circuit is structured in 17 sections: 15 Cross Bonded (810 m) with both ends Single Point Bonded.*

Long length UHV cable systems in SPAIN

Spain – Morocco 400 kV AC interconnection

- First circuit between Spain and Morocco in service since 1997. Second circuit commissioned in June 2006.
- SCFF 400 kV AC, 30km 2 x 700 MW, 7 cables (1 spare) max depth 615 m
- Cables designed also for DC
- 115 M€ turn-key project, awarded to Nexans/Prysmian as consortium.
- Co-owners of the links: REE and ONE

Technical features of the link

Submarine Section

- Conductor cross-section: 1x800 mm2 Cu
- Outer diameter: 139 mm
- Weight in air: 56 kg/m
- Metallic sheath: lead alloy
- Bronce tape reinforment
- Double Cu flat wires armour

Land Section

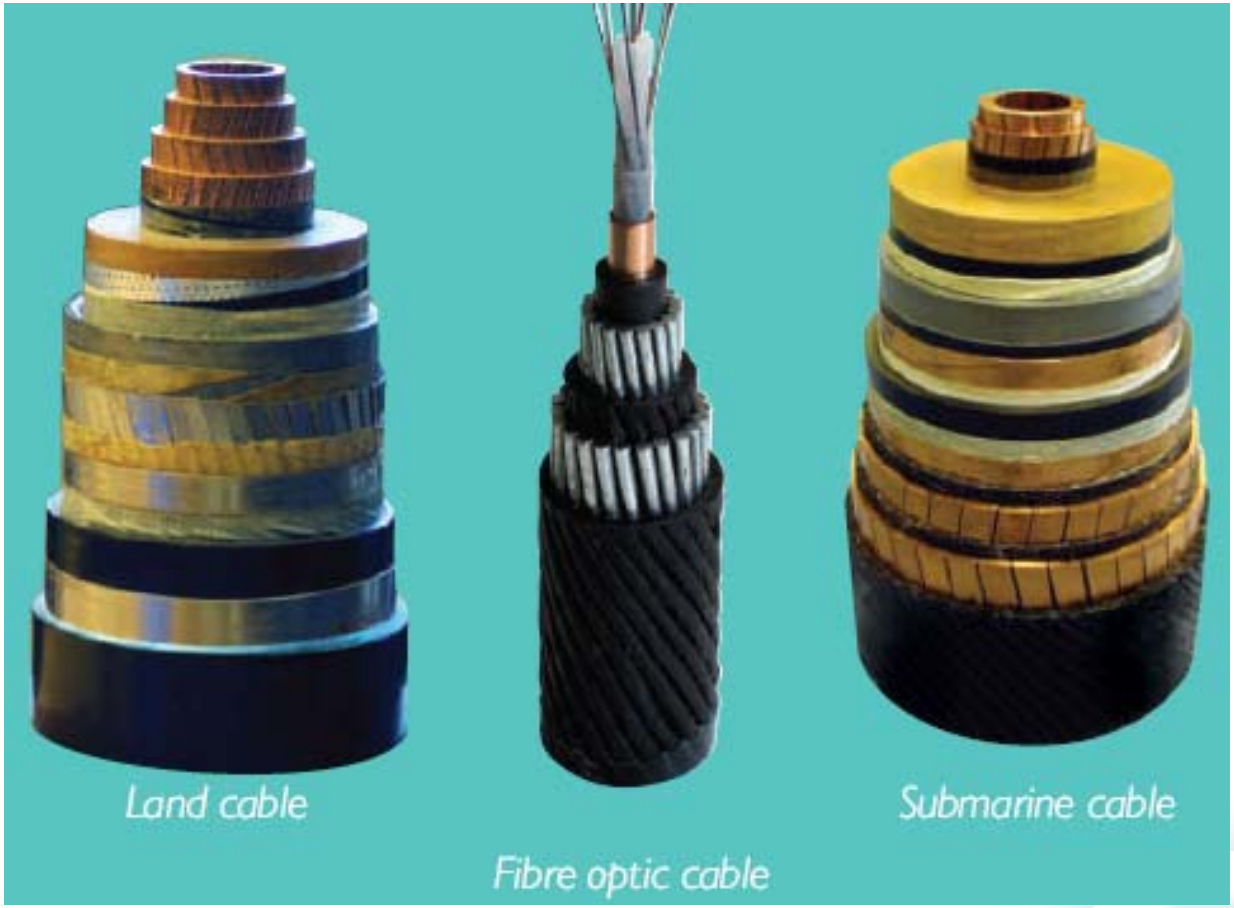
- Conductor cross-section: 1x1600 mm2 Cu
- Outer diameter: 122 mm
- Weight in air: 42 kg/m

Fibre Optic Cables

- Number of cables: 2
- Cable Type: MF-48
- 42 f. o. G.652 + 6 f. o. G.655

Second circuit: 3 additional cables + 2 F.O. cables

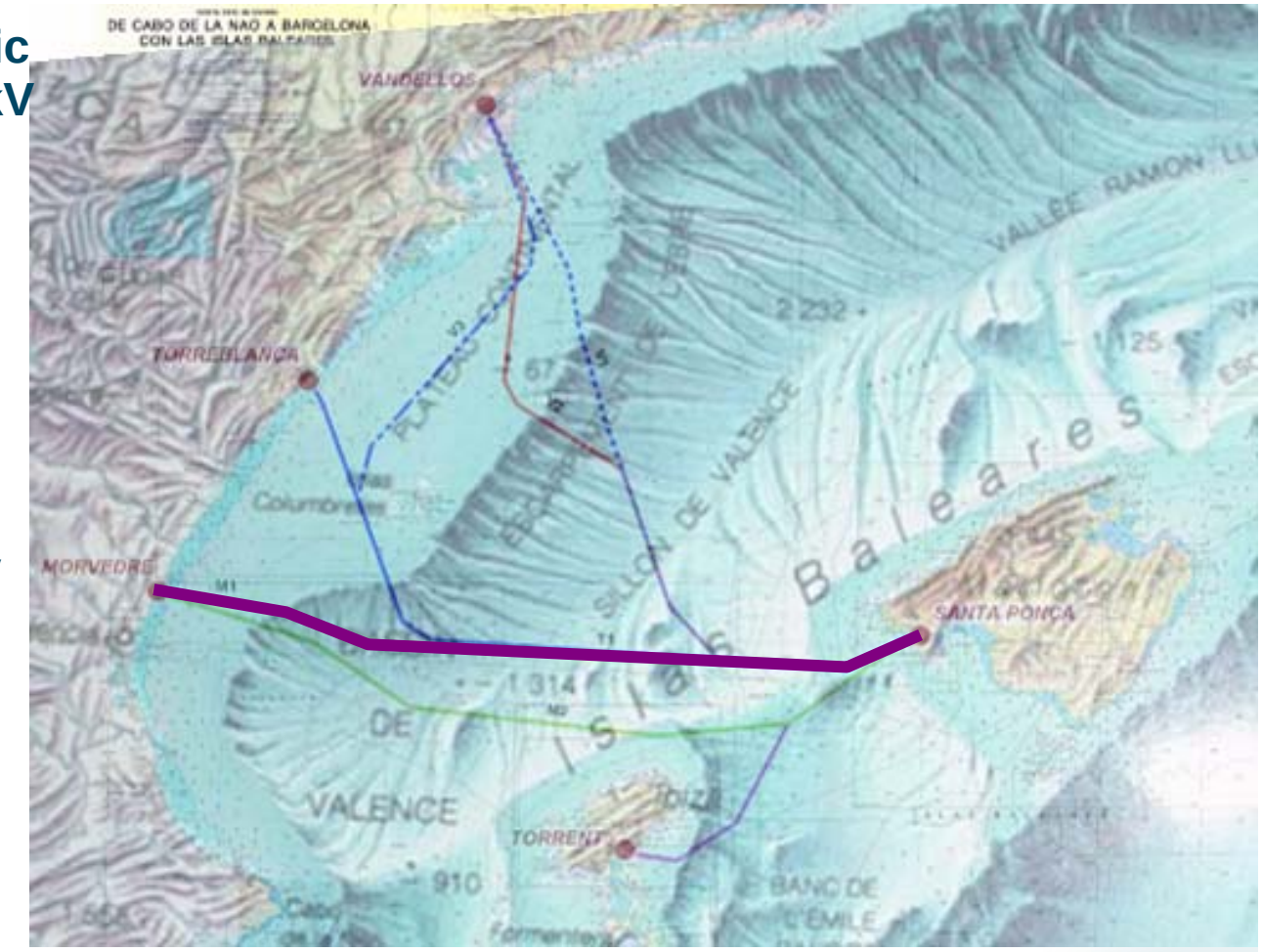
Power cable design: Self Contained Fluid Filled (OF)



Long length UHV cable systems in SPAIN

HVDC Peninsula – Mallorca

- HVDC Bipole with metallic return, 2x200 MW, ±250 kV
- Lengths. Submarine section: 240 km. Land sections: 3 km
- Max. Depth: 1485 m
- Overall cost of cable system: 300 M€
- Contract awarded in May 2007 (Nexans/Prysmian consortium)
- Commissioning planned for 2010/2011



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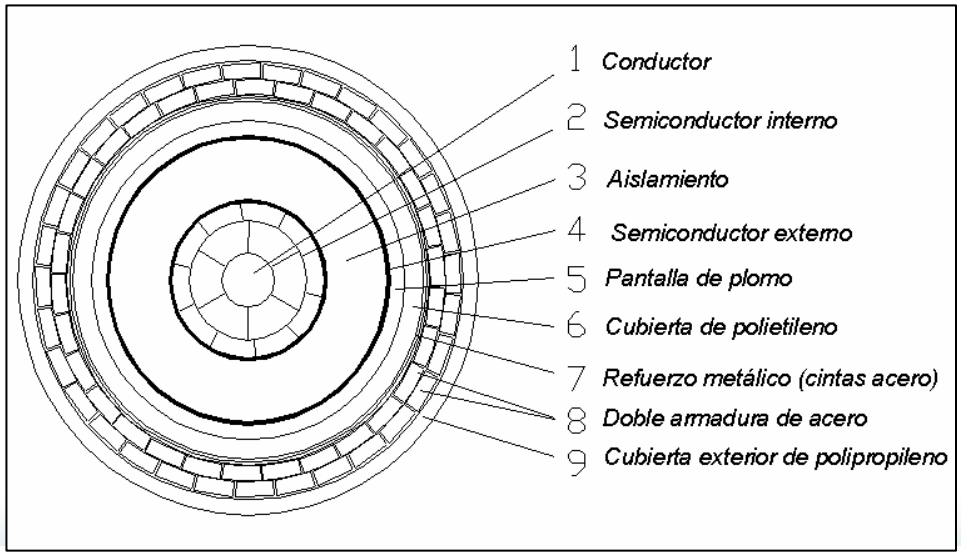
HVDC Peninsula – Mallorca

- **HVDC Cables**
  - **Conductor: Cupper 750mm² - 1200 mm²**
  - **Insulation: mass impregnated paper**
  - **Screen: lead alloy**
  - **Double flat Cupper wire armour**
  - **Diámetro: 94 mm**

CABLE HVDC (polos)		
Cable Subterráneo	**Cable Submarino poco profundo**	**Cable Submarino profundo**
Cu 1200 mm² Sin armadura	Cu 750 mm² Simple armadura Profundidad < 200-220 m	Cu 750 mm² Doble armadura
Peso aprox: 23 kg/m	Peso: 23.5 kg/m	Peso: 29.5 kg/m



CABLE MV (cable de retorno)		
Cable Subterráneo	**Cable Submarino poco profundo**	**Cable Submarino profundo**
Cu 1200 mm² Sin armadura	Cu 630 mm² Doble armadura	
Peso aprox: 23 kg/m	Peso: 19 kg/m	

Thank you

for your attention

RED ELÉCTRICA DE ESPAÑA