

Jicable HVDC'16 Workshop

Topic 4

Submarine HVDC Links

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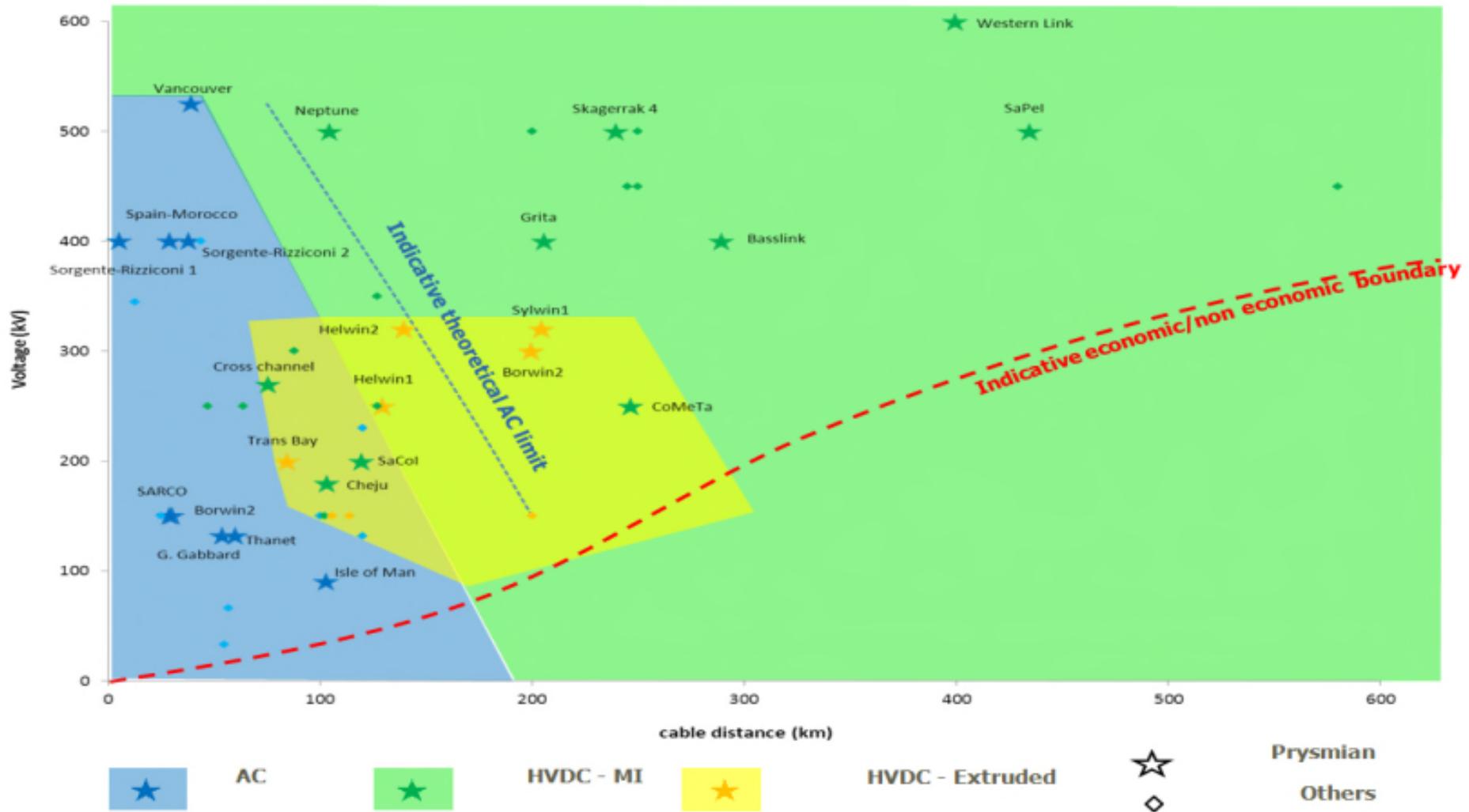
Submarine HVAC and HVDC cables



Submarine cables could make use of different technologies, depending on specific choices of system operators. In general:

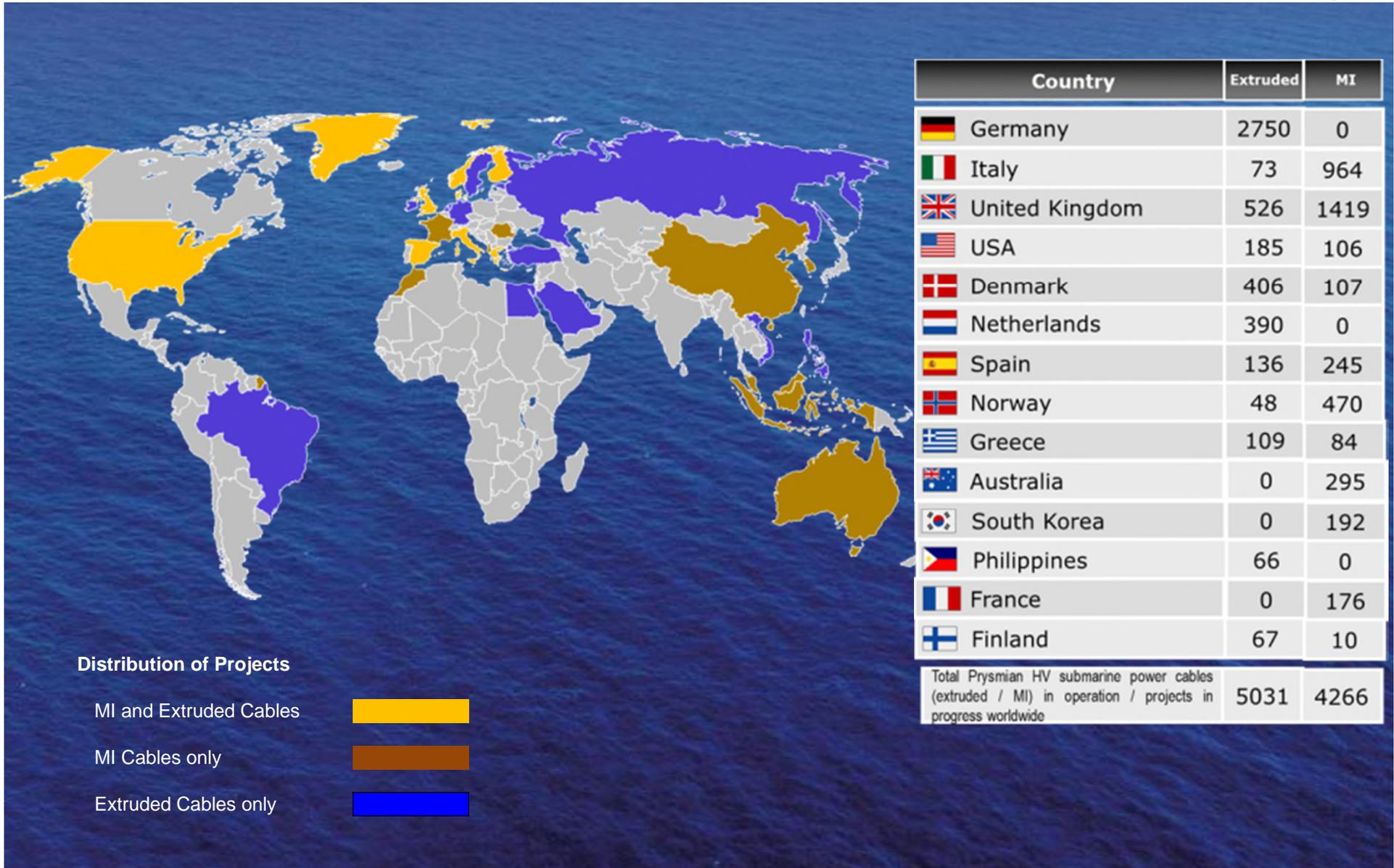
- **Long connections make use of DC transmission**
- **Large powers require high voltages**
- **Long HVAC connections suffer power de-rating vs. length**

Submarine power cable projects worldwide



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GLOBAL EXPERIENCE – HV SUBMARINE CABLE SYSTEMS



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Submarine HVDC Cable Technologies



XLPE

- ±600 kV
- 3000 MW
- VSC any voltage
LCC up to 250 kV

P-Laser

- ±525 kV
- 2700 MW
- Both LCC and VSC

MI paper

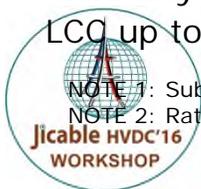
- ±525 kV
- 2400 MW
- Both LCC and VSC

MI-PPL

- ±700 kV
- 3400 MW
- Both LCC and VSC

NOTE 1: Submarine cables may have different armouring design mainly depending on water depth

NOTE 2: Rating depends on ambient and installation parameters

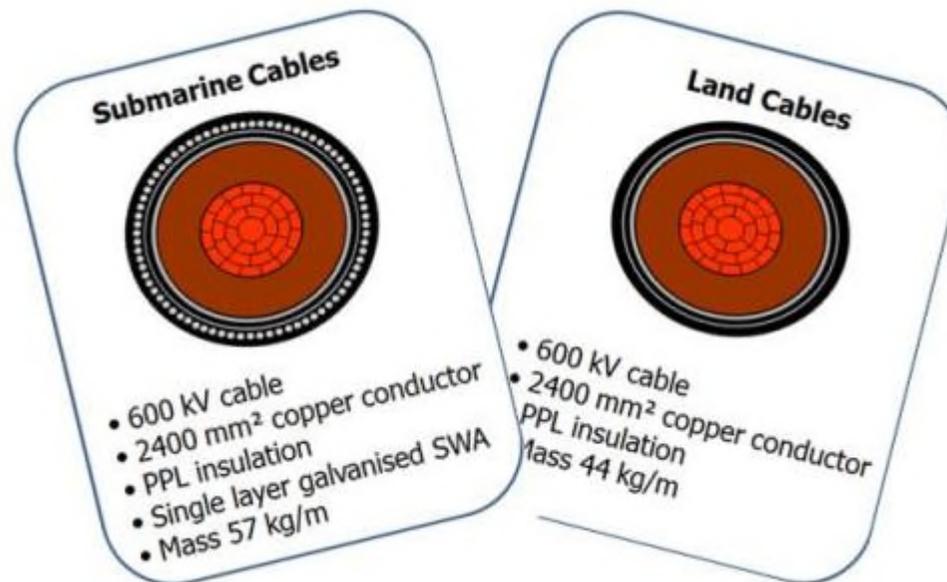


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The Western Link HVDC Project

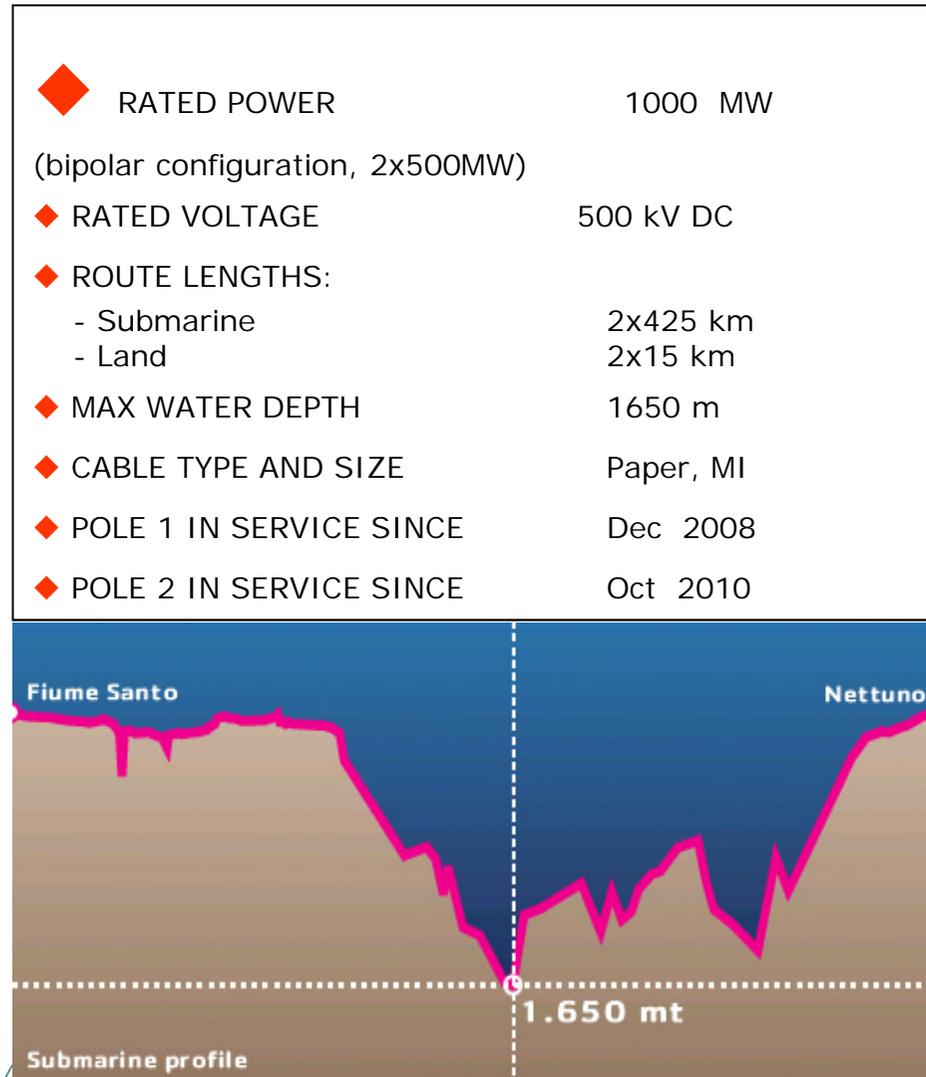
Main features

- ✓ Largest Cable Contract ever awarded
- ✓ Highest Voltage DC System ever (600 kV with PPL insulation)
- ✓ Highest Power of any long length DC system (2250 MW continuous, 2400 MW 6 hour overload)
- ✓ Overall route length approx. 422 km (37 km underground, 385 km submarine)



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SA.PE.I (Sardinia-Peninsula Italiana) PROJECT MAIN FEATURES

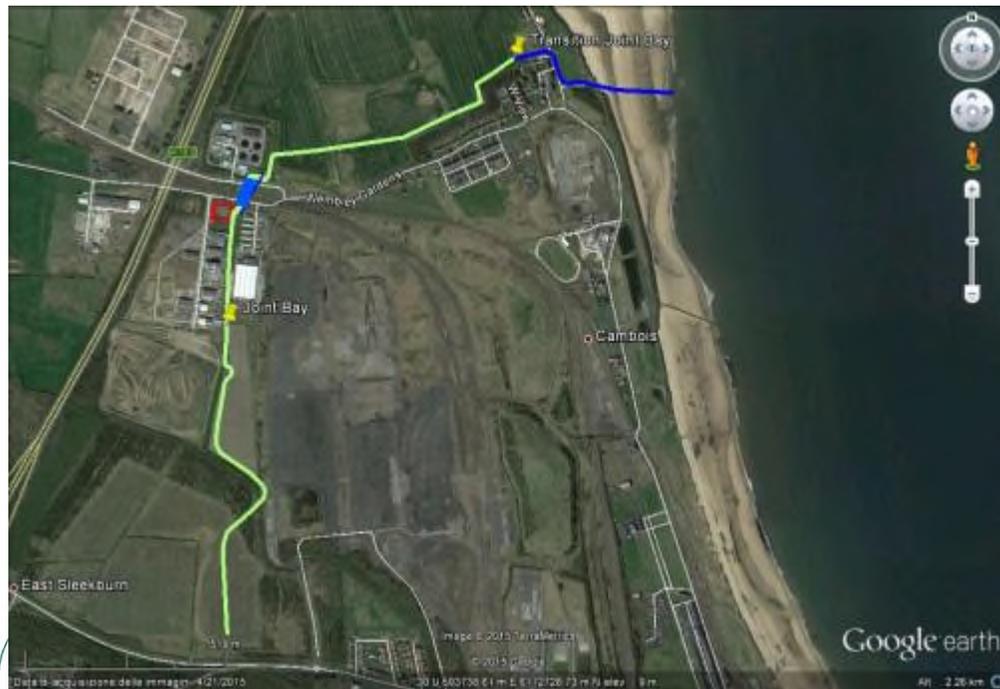


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North Sea Link HVDC Interconnector 1400MW

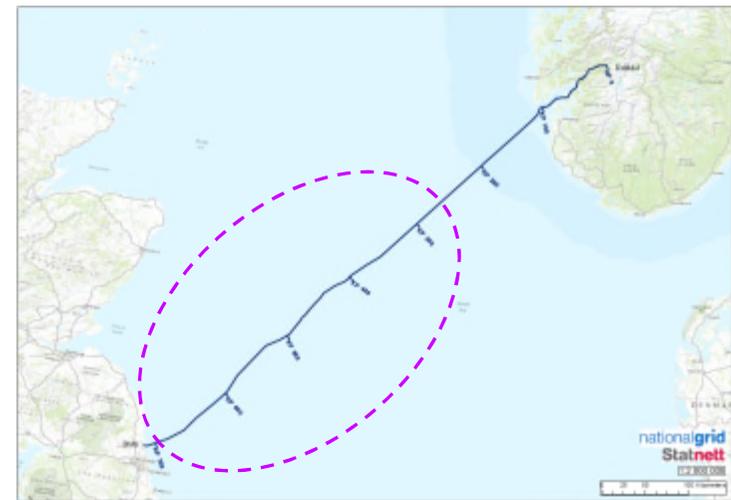
Main features

- ✓ At 740Km it is the longest ever HVDC Link with subsea / land cables
- ✓ Prysmian has been awarded Lot 2 and Lot 3, route length 2 x 470Km
- ✓ Proven Prysmian mass impregnated paper cable, nominal DC voltage ± 515 kV
- ✓ 2.5Km land cables to the UK converter station, converter is based on VSC



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WORKSHOP

North Sea Link

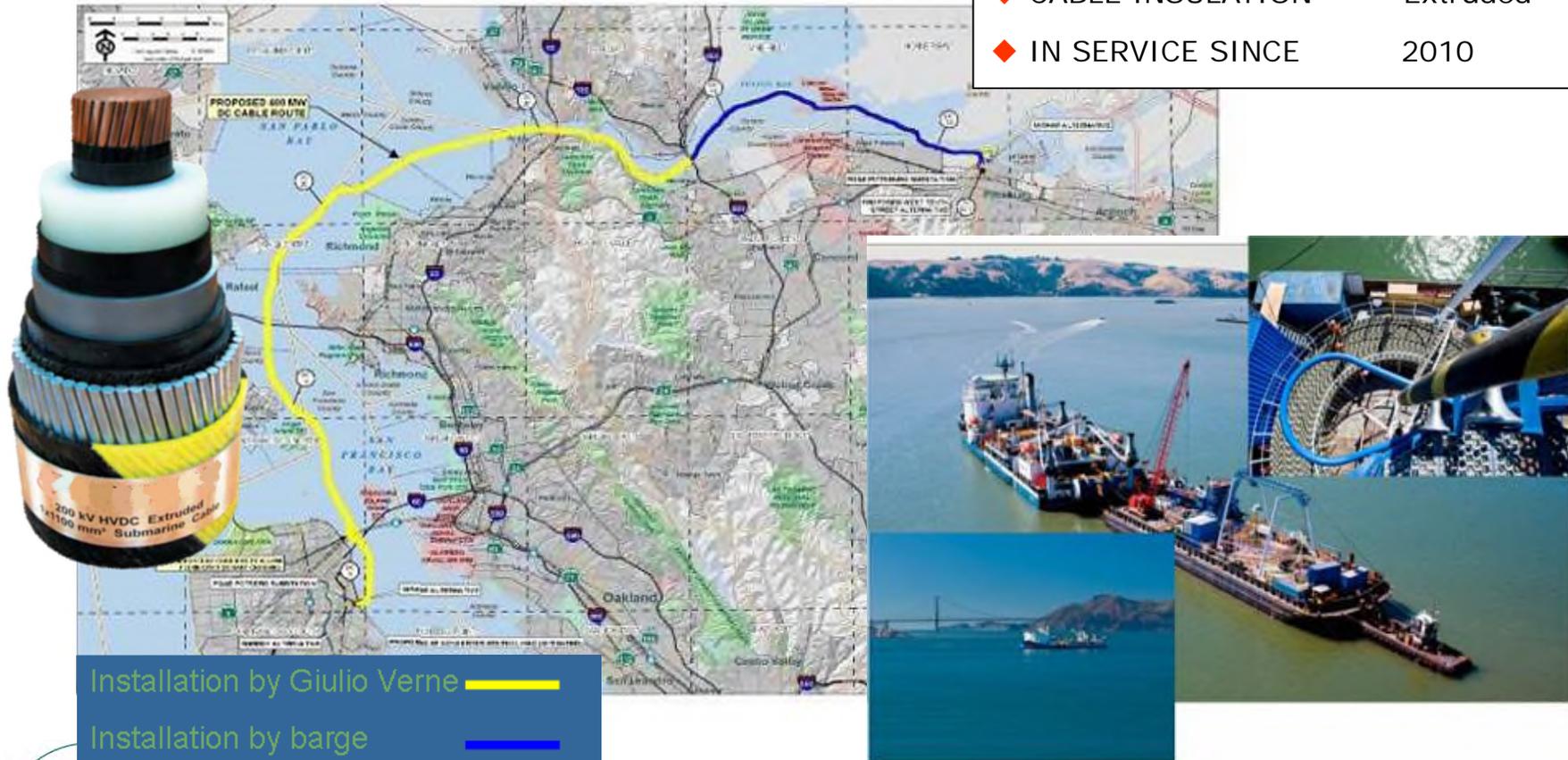


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TRANS BAY HVDC CABLE PROJECT - San Francisco bay

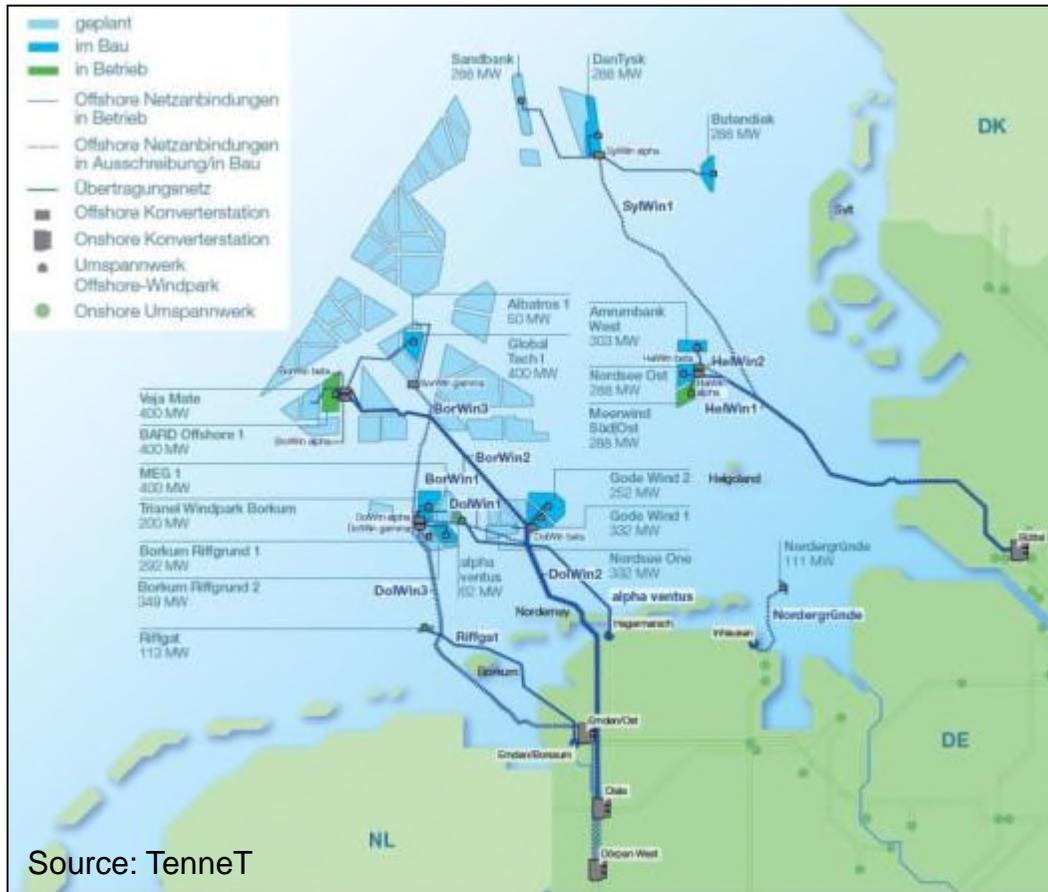
✓ The first 200 kV HVDC extruded cable in operation

◆ RATED POWER	400 MW
◆ RATED VOLTAGE	200 kV DC
◆ ROUTE LENGTHS:	85 km
◆ CABLE INSULATION	Extruded
◆ IN SERVICE SINCE	2010



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German HVDC Projects - Prysmian



HVDC Submarine & Land Connections in the German North Sea

Project	Voltage (kV)	Power
BorWin2	300 kV	800 MW
HelWin1	320 kV	864 MW
HelWin2	250 kV	576 MW
SylWin1	320 kV	690 MW
BorWin3	320 kV	900 MW
DoWin3	320 kV	900 MW

Approx. 2000 km HVDC cable, ~ 650 km of which are land cables, with more than 900 joints

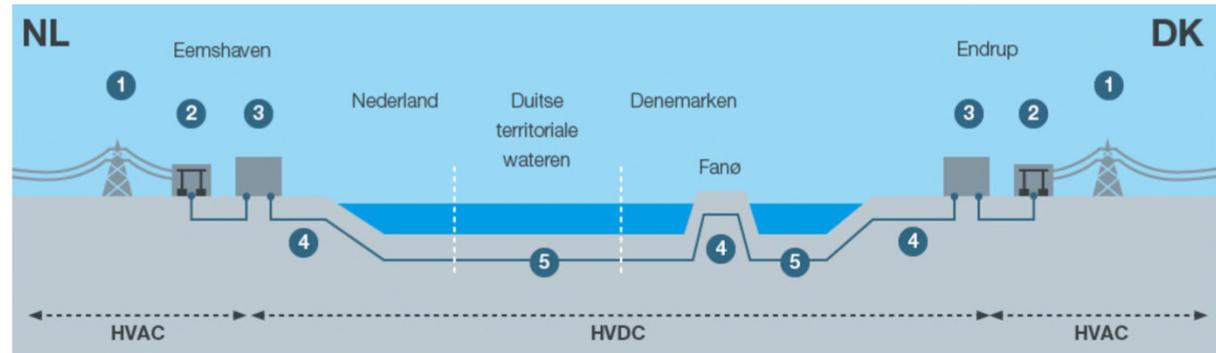


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COBRACable HVDC interconnection



COBRACable



Main features

✓ Submarine section

- route length 310 km
- max. burial depth 13 m
- max. water depth 50 m
- minimum burial depth requirement (2K criteria)

✓ Land section

- route length 21 km
- max. burial depth 1,3 m



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Land Systems



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INELFE 320 kV DC Spain-France Interconnection



Main features

2000 MW Power Rating

65 km route length

Longitudinally Welded Aluminum Sheath (WAS)

320 kV XLPE cable with 2500 mm² Cu conductor

Long lengths (Up to 2190 m)



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320 kV DC France-Italy Interconnection



Main features

Nominal voltage: ± 320 kVdc

Rated power: 2x600 MW (two bipoles, 4 cables)

Al conductor 2500 mm² with extruded insulation

190 km fully underground

Under construction



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Thank You for Your Attention !



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