Power Cables

OTEC Technology Workshop

November 3-5, 2009

Steinar Dale

Center for Advanced Power Systems

Florida State University

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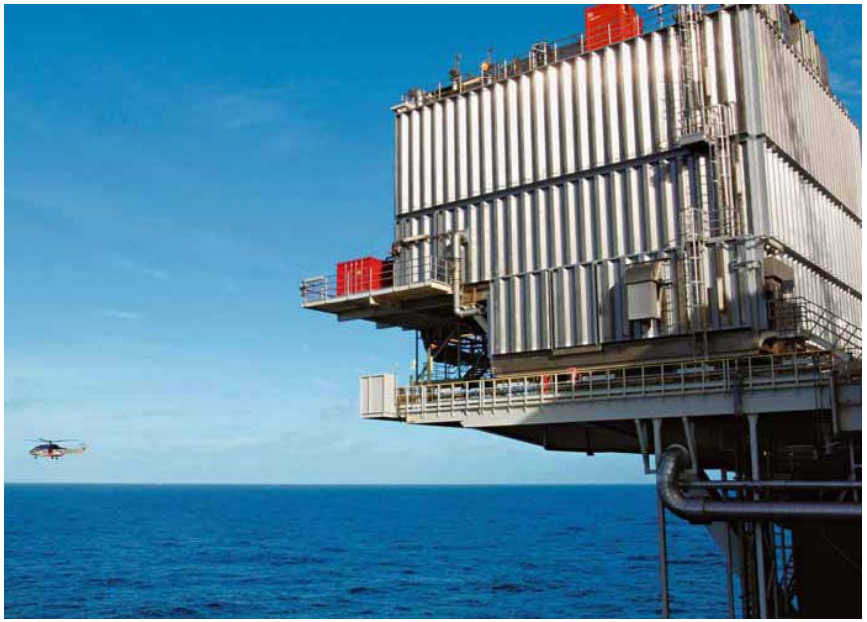
- **Factors**
  - Generation nameplate capacity
  - Cable length -Distance from shore and to grid connection
  - AC or DC
  - Cable voltage
  - Robustness of on-shore grid system (weak systems)
  - Cable laying route on sea bottom and trenching needs
  - Size and weight of the power generation and conditioning plant
  - Black-start requirements
- **Similar applications**
  - Oil drilling platforms powered from shore (North Sea)
  - Offshore wind farms
  - Sea cable connections –existing and planned
- **Types of Cables**
  - XLPE
  - Mass Impregnated
  - HTS?
- **Environment**
  - The high voltage equipment must be protected from the ocean environment (salt water, dampness/condensation, corrosion)

Troll-A oil platform in the North Sea and cable laying ship (ABB)



HVDC Light Module on Troll-A platform (ABB)

Cable laying ship

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Nysted offshore wind farm, Denmark

Transformer unit (33 kV/132 kV) for the aggregation of the 72 wind turbines of the park, 165 MW

ABB Review 2/2007

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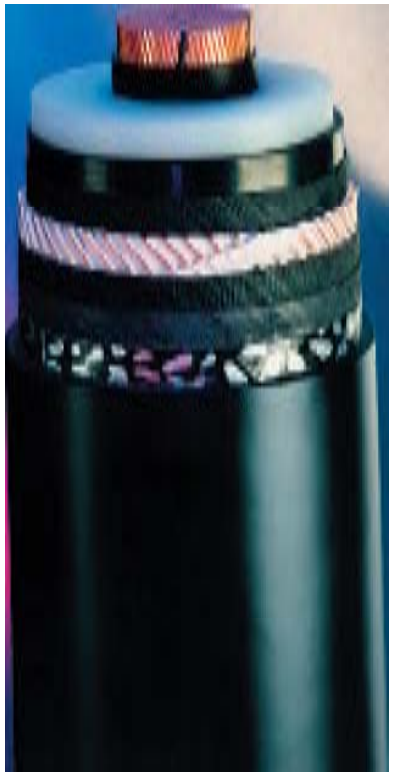
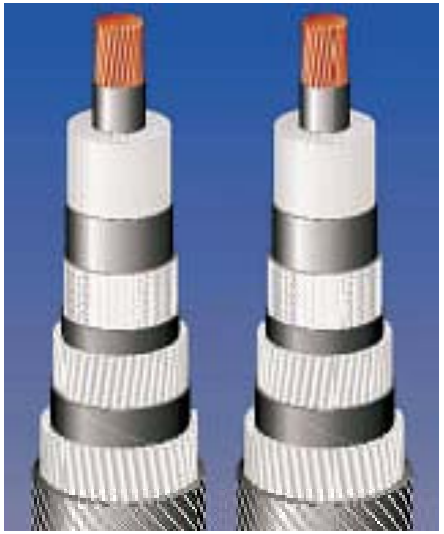
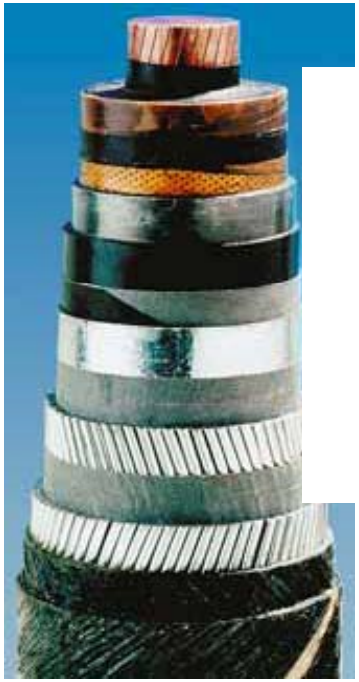


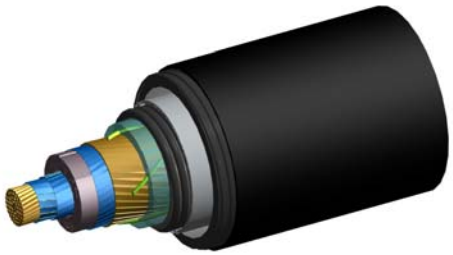
400-kV XLPE cable. The copper conductor is divided into five segments to reduce skin effect losses.



HVDC Light™ extruded submarine cable, with double armoring (80 kV rating)



Submarine cable for the 600 MW, 450kV Baltic Cable HVDC link between Germany and Sweden (Nexans)



American Superconductor

Superconducting cable 132 kV

Source: ABB Review

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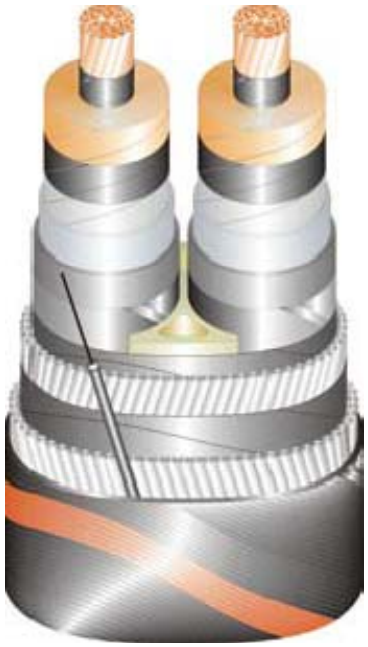
- The most powerful HVDC submarine
- cables to date are rated 700 to 800 MW
- at 450 to 500 kV. The longest of these
- are the the 580 km NorNed link between
- Norway and The Netherlands
- in service in 2008.

Source: Statkraft



Flat submarine cable

Source: ABB