Management of High Voltage DC Transmission Systems in Pakistan

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BY

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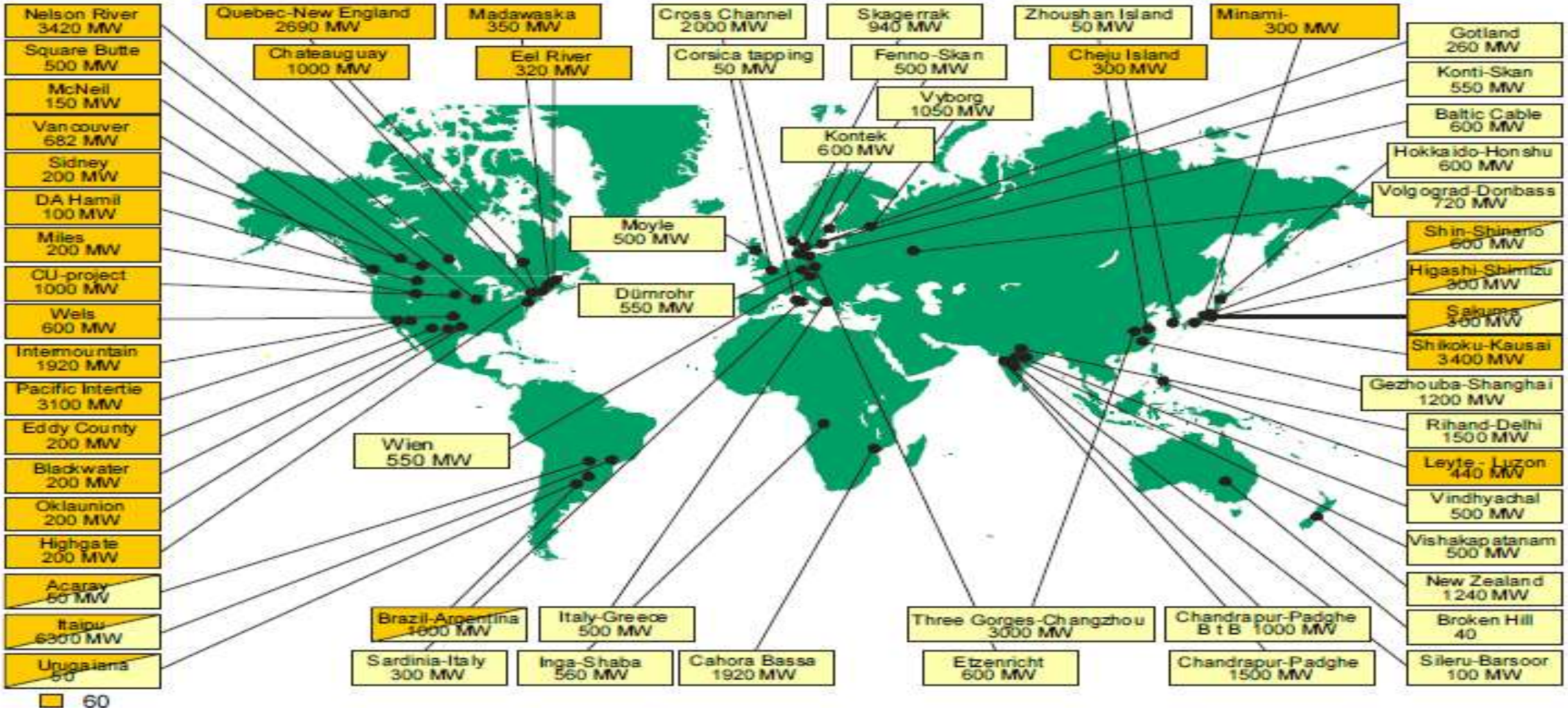
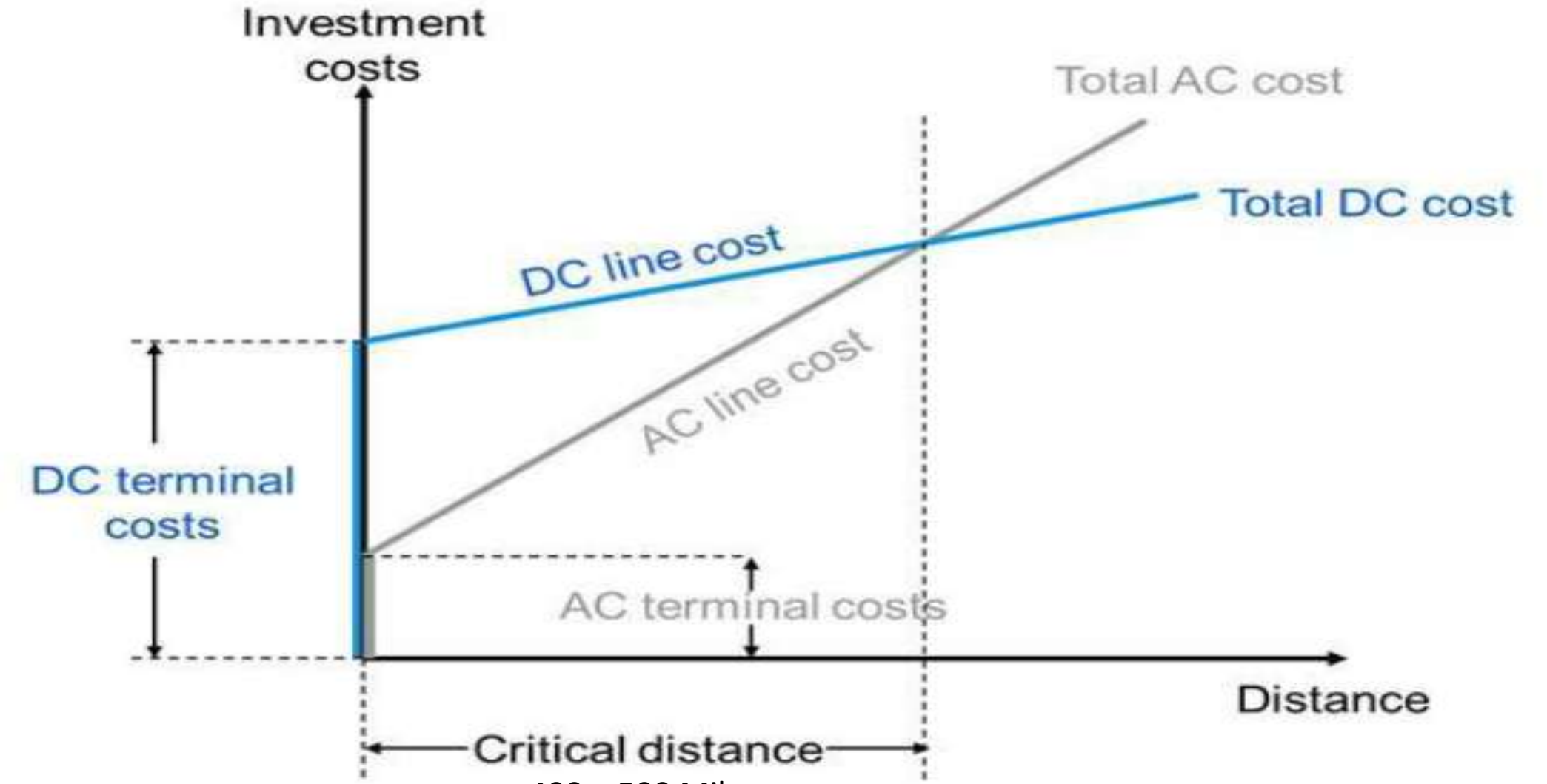
High Voltage DC Transmission Systems in the World



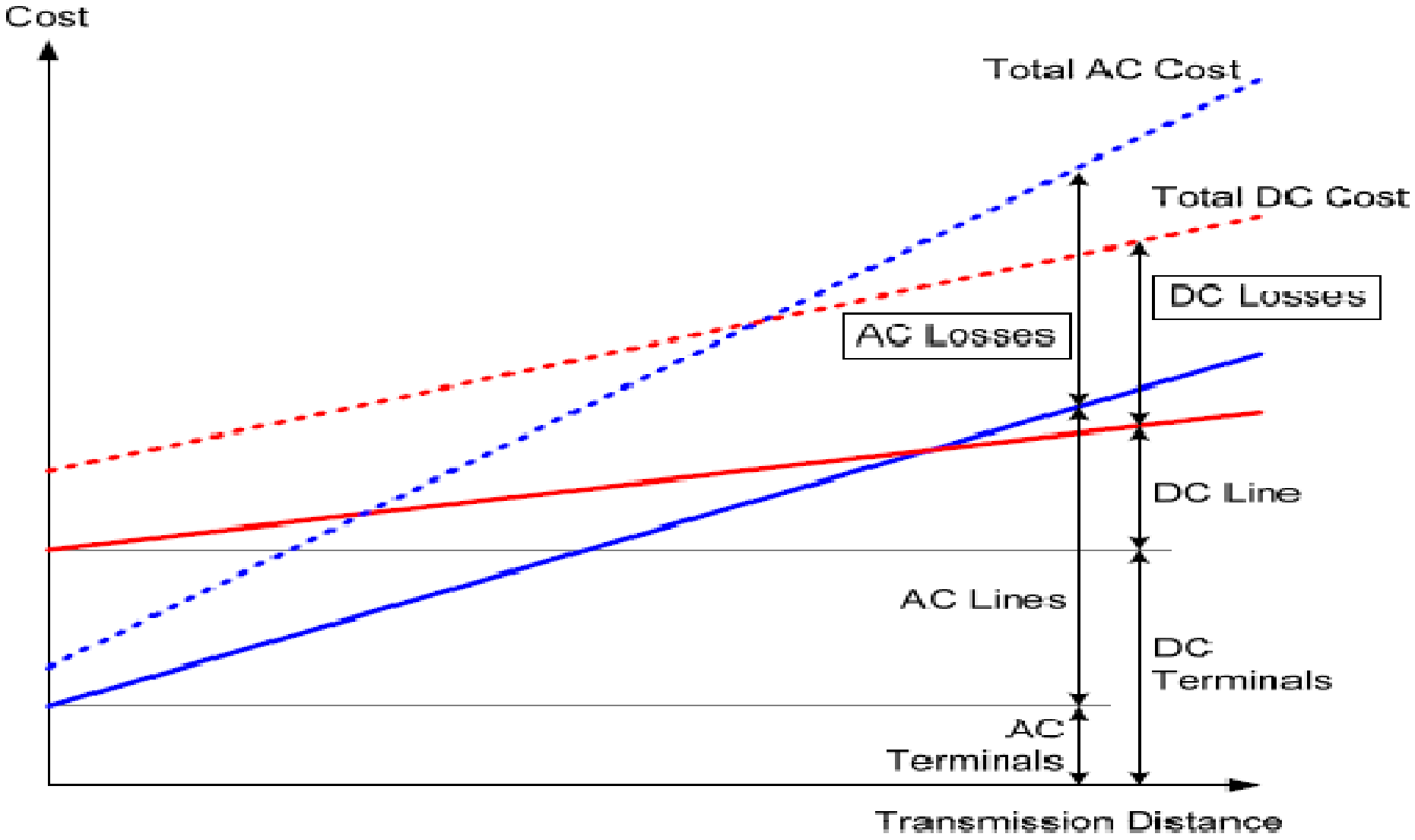
When to use High Voltage DC

- Large amount of power over long distances
- Long underground/submarine cables
- Reduced right of way requirements for poles
- Interconnection of asynchronous systems

Elaboration of HVDC Supporting Criteria

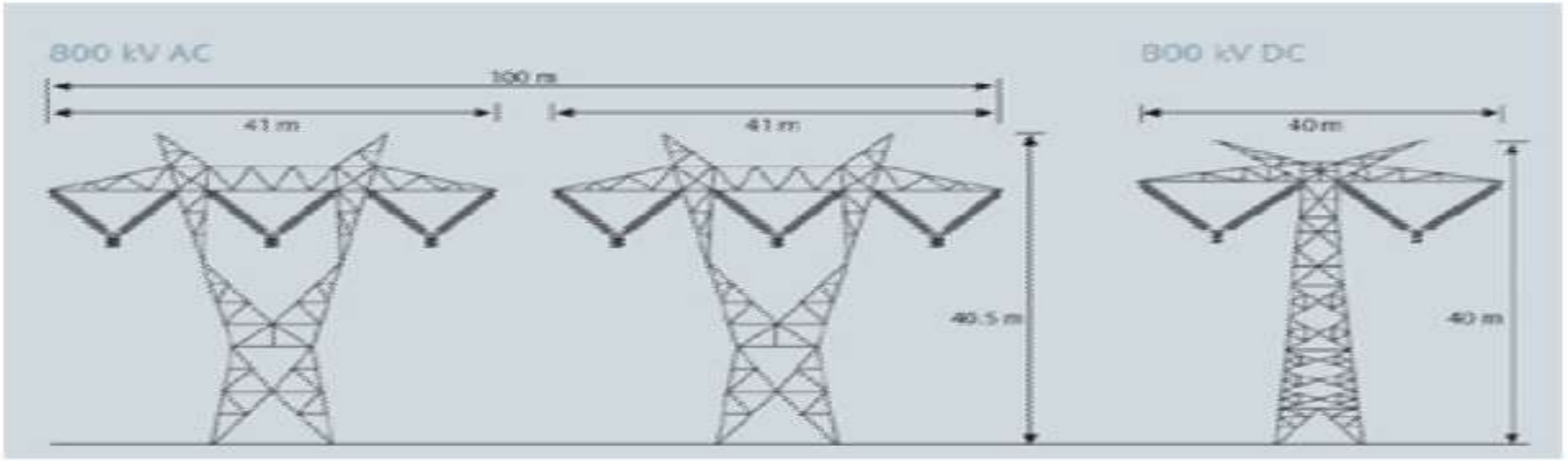


Distance vs Cost and Losses Consideration



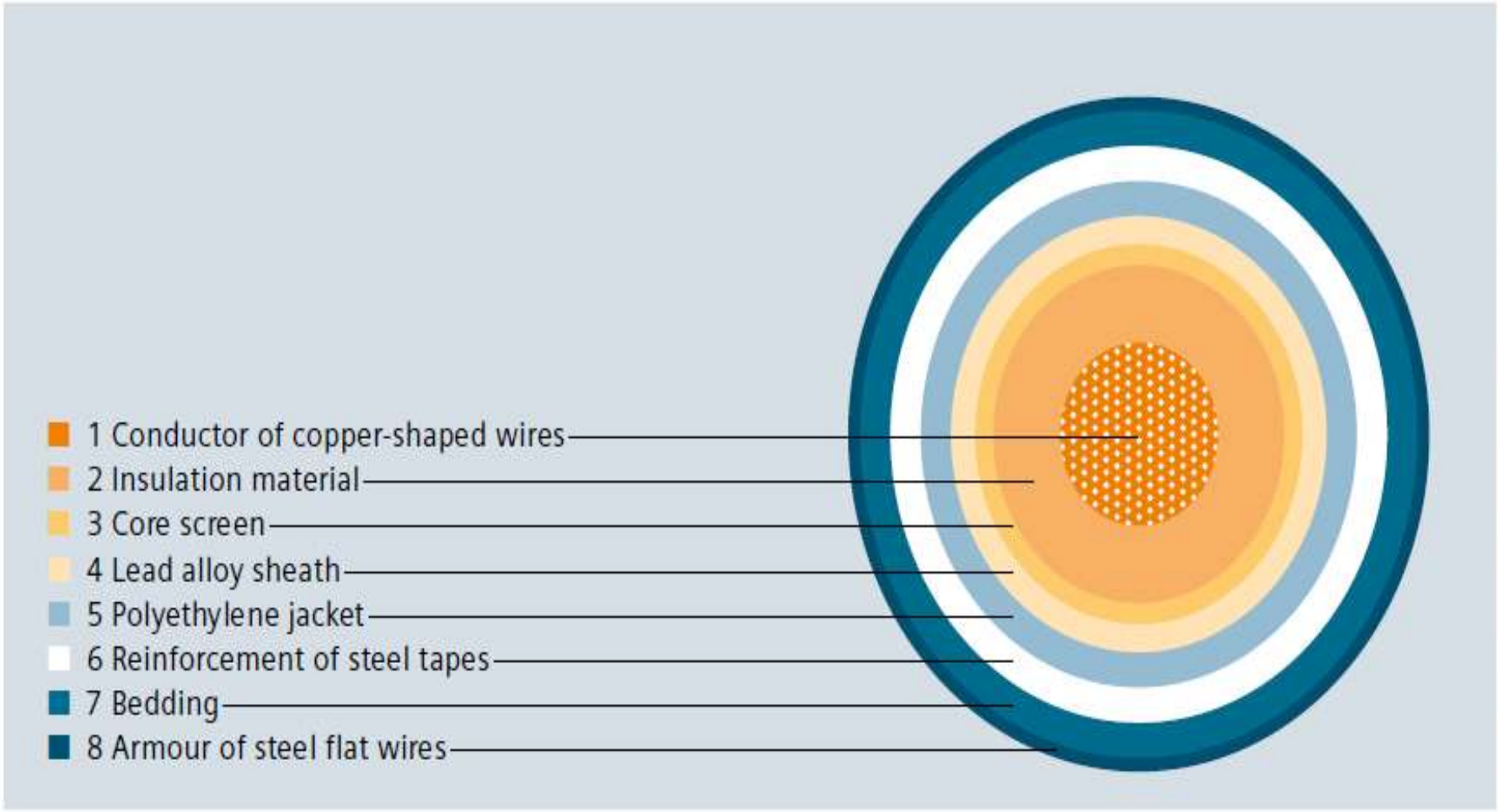
Right of Way Considerations

±500kV vs. 500kV AC

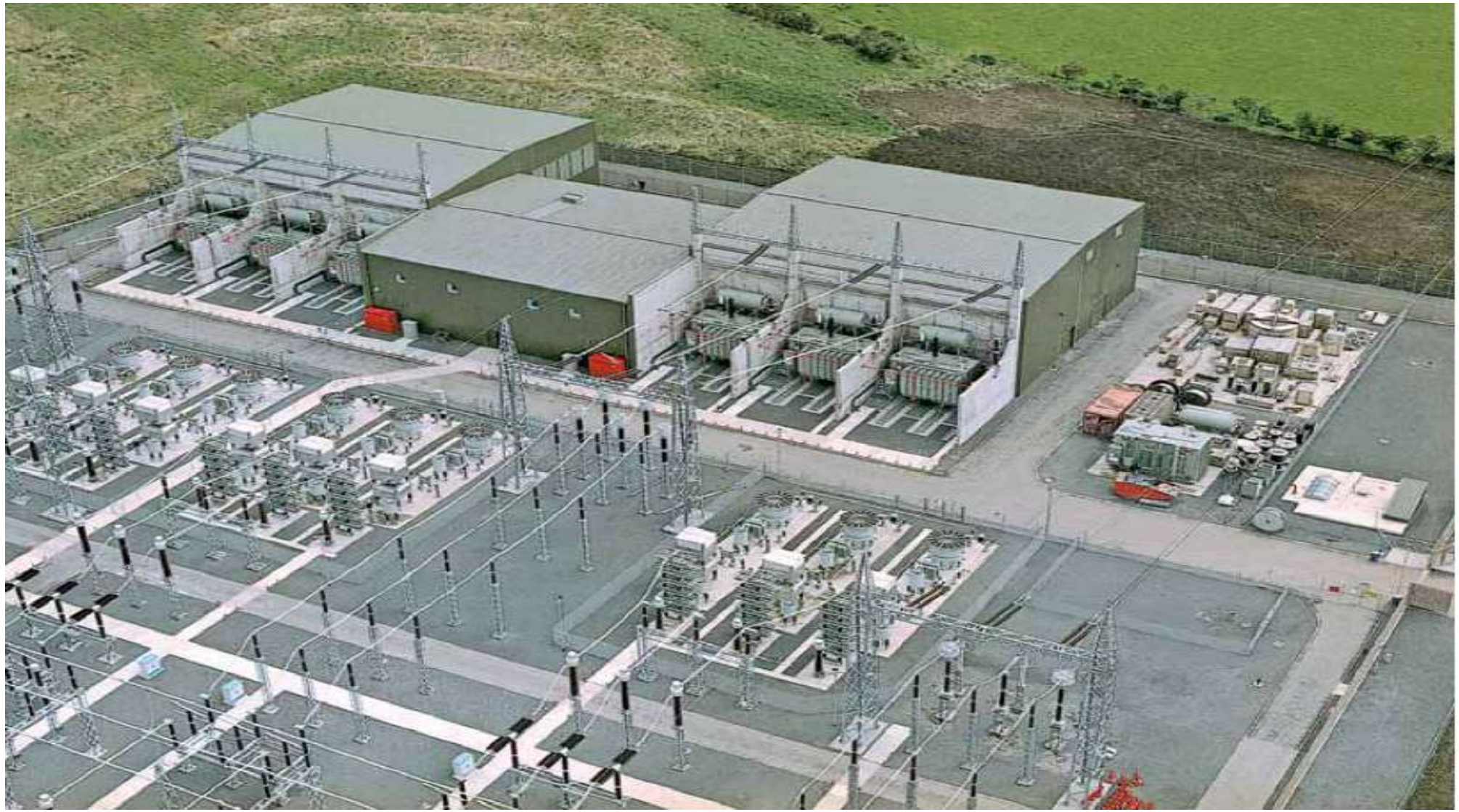


±800kV vs. 800kV AC

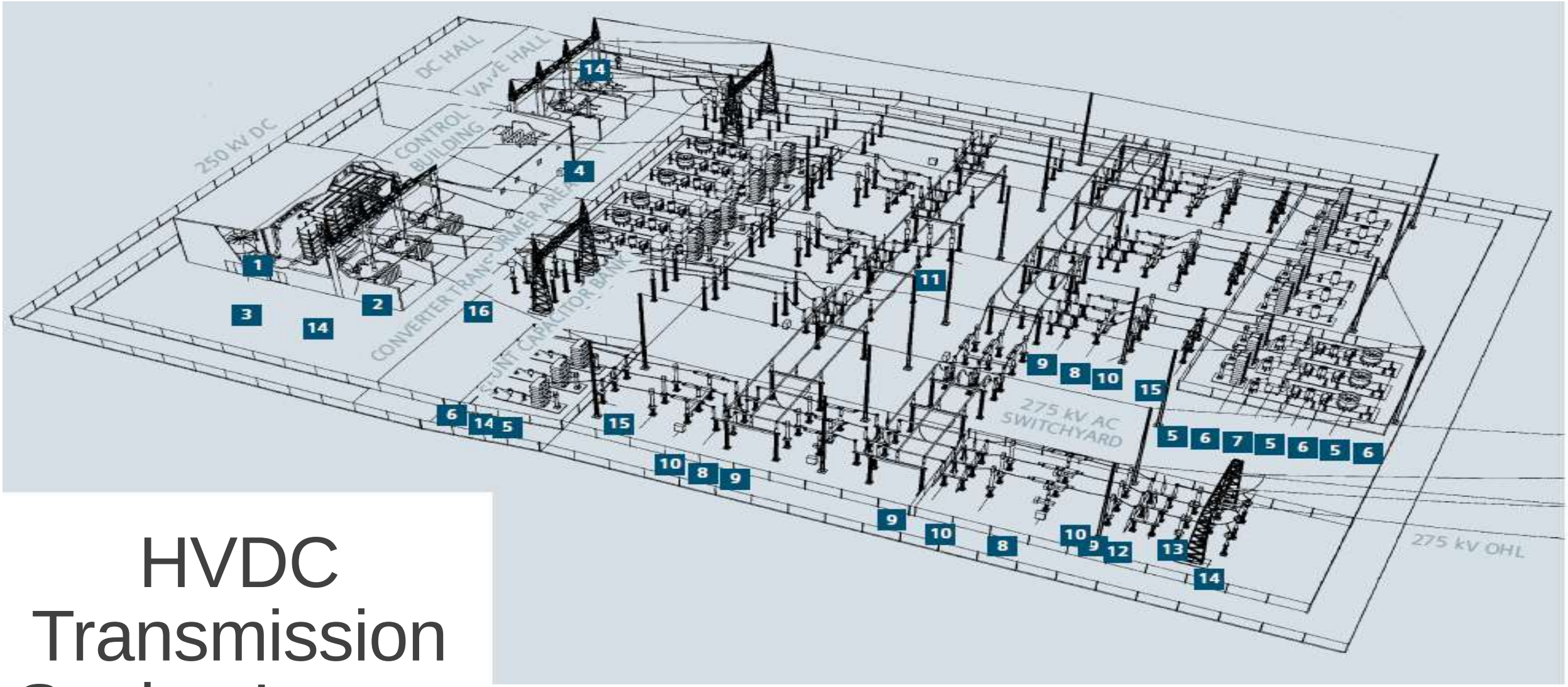
Underground Cable Construction



Inverter Station Layout



HVDC Transmission Station Layout



1 Quadruple Thyristor Valve
2 Converter Transformer
3 Air Core Smoothing Reactor
4 Control Room and Control Cubicle
5 AC Filter Capacitor
6 AC Filter Reactor
7 AC Filter Resistor
8 Circuit Breaker
9 Disconnector
10 Current Transformer
11 Voltage Transformer
12 Combined Current-Voltage Transformer
13 Capacitive Voltage Transformer
14 Surge Arrester
15 Earthing Switch
16 AC PLC Filter

Challenges

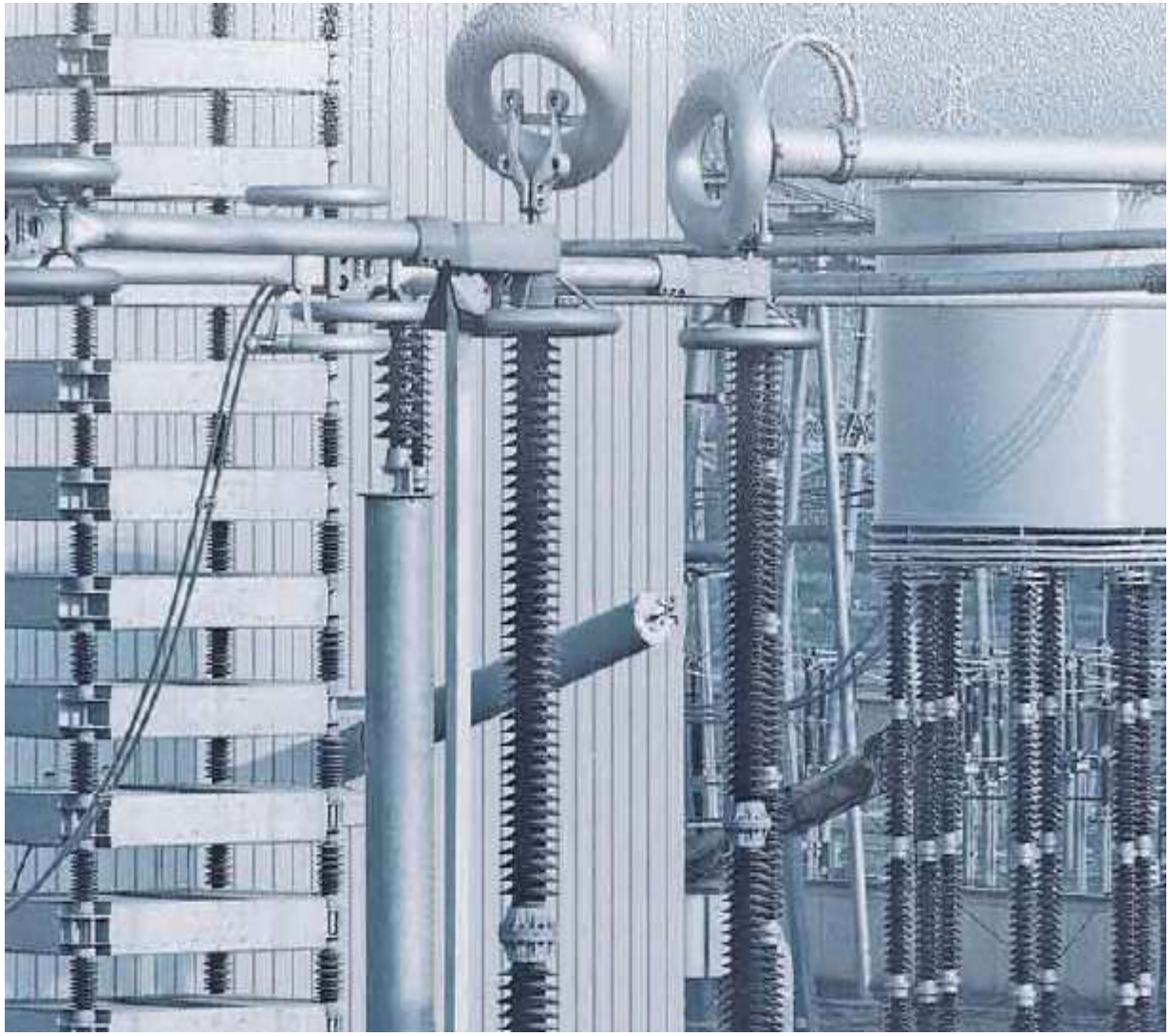
- Inverter Station Technology
- Thyristors Valves Construction
- Converter Transformers
- Harmonic Filters
- DC Filters

Thyristors

Converter Transformer

Harmonic Filters

DC Filters



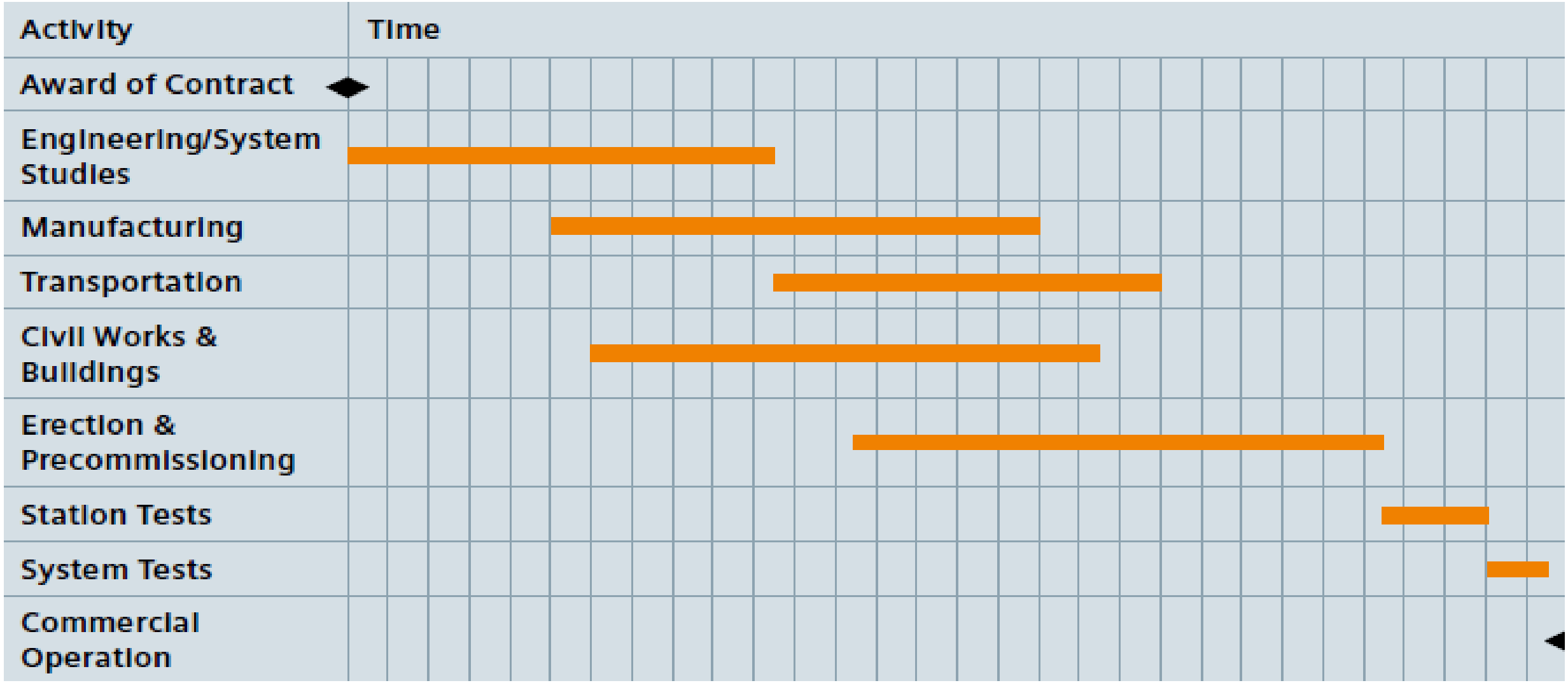
Project Sequence

- Planning
- Feasibility Study to evaluate preference of AC and DC systems based on energy capacity and distance
- Detailed design: inverter station & transmission line components
- Construction of the system
- Test trial and operation
- Dispatch and control centers
- Continuous maintenance

Training of Personnel for Each Phase

- Planning
- Designing
- Project Management and Construction
- Operational Maintenance
- Control Centre Operations

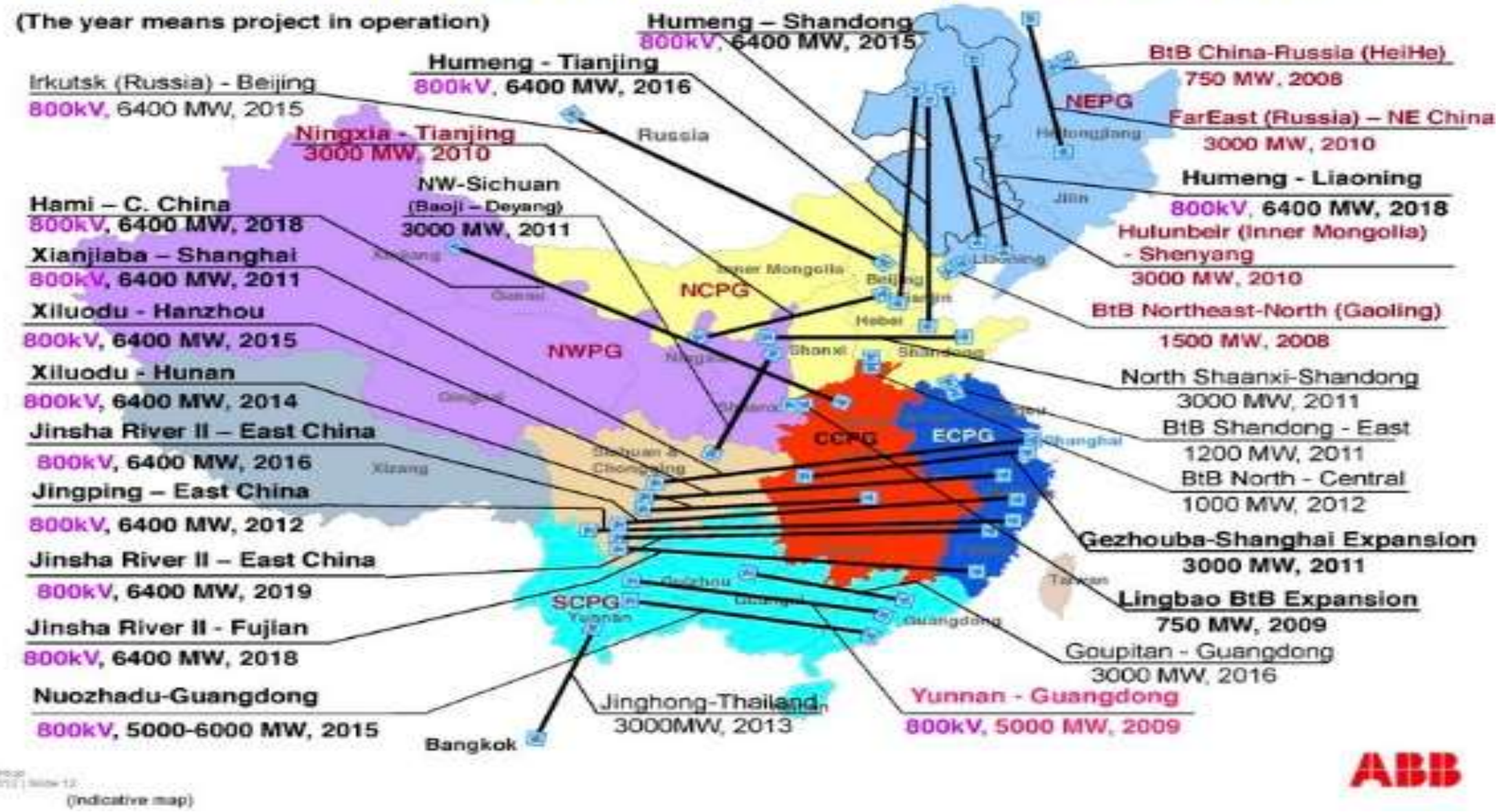
Schedule of Project



Training Strategy of NTDC Staff

- Experience of Germany and Sweden in design of inverter station and its components
- Experience of China in maximum number of HVDC projects
- Experience of USA and Canada in long distance interconnection of energy sources and load centers
- Japanese experience of connection 50 and 60 Hertz systems

Planned Future HVDC Projects by 2020 in China



Opportunity of HVDC Projects

- Thar Coal area to Punjab load centers
- Hydel generating stations in KPK in northern Pakistan and connection to central and south Pakistan
- 10,000 MW from South to North
- 20,000 MW from North to Central
- CASA 1000 from Central Asia to Pakistan

Getting the Best Deal for Pakistanis

- Competitive bidding between the leading technology suppliers
- Training of Pakistani engineers in Europe, America, Japan and China
- Long term and low cost loans from international donors to reduce energy costs to other countries in South East Asia


Thank You