



Closing Panel Discussion

1. Integration of Offshore wind farms
2. Meshed HVDC, how can it be done reliably?
3. Where Next for HVDC?



Integration of Offshore wind farms with rating 100, 500 and 1000MW

- Is there a significant difference in the environmental impact of ac and dc submarine cables?
- What is the typical life time cost break even distance between ac and dc connections?
- Are there any new ac cable developments that will impact the break even distance?
- STATCOMs are being used on many land based wind farms, what is the operating experience? Are any other FACTS devices being used to integrate large wind farms?
- VSC HVDC is being used on several wind farm projects. Could LCC HVDC be used for this application? What is the feasibility of incorporating taps for wind farm connections on new and existing interconnections?



Meshed HVDC, how can it be done efficiently and reliably (20 x 5GW)?

- Is it clear that a HVDC Super Grid would be overall better than a 1100kVac Super Grid, perhaps with BtB schemes?
- What cable technology would be available for such Super Grids?
- VSC HVDC seem to be more suitable than LCC HVDC for multi-terminal/meshed systems. However, present VSC HVDC ratings are low. Could solutions be found to the LCC HVDC performance problems?
- Would HVDC grids have to be limited to cables rather than combined cables and OHL? How can a collapse of the total HVDC grid be prevented in case of a fault in the dc grid?
- What should be the target reliability and availability level for the stations and the links between them
- Will high speed inter-terminal communication be essential for satisfactory and efficient performance?



Where Next for HVDC?

- With 800kVdc capable of 9GW being planned, is there a need for even higher dc voltage?
- Are new semi-conductor materials being considered for LCC HVDC? Any new materials for cables for higher dc voltage?
- What kVdc and MW rating will be available for VSC HVDC within the next 10 years? What cable ratings will be available?
- VSC HVDC valve costs is near linearly dependant on voltage. Can VSC HVDC compete with LCC HVDC at high MW?
- Why not use generally available mass produced Power Electronic Building Blocks (PEBB) for VSC HVDC schemes? What would be the draw backs?
- Are their any potential breakthrough developments for LCC and VSC HVDC on the horizon?



Thank you for your Attention.

We appreciate the feedback and discussion during the
Panel Session!

Please consider joining CIGRE SC B4. We do lots of
interesting work in our Working Groups, and need
more volunteers!

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