

Paris Session 2022



Which design and technology aspects must be considered for multi-terminal HVDC transmission systems?

Study Committee C1
Preferential subject 2

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Group Discussion Meeting

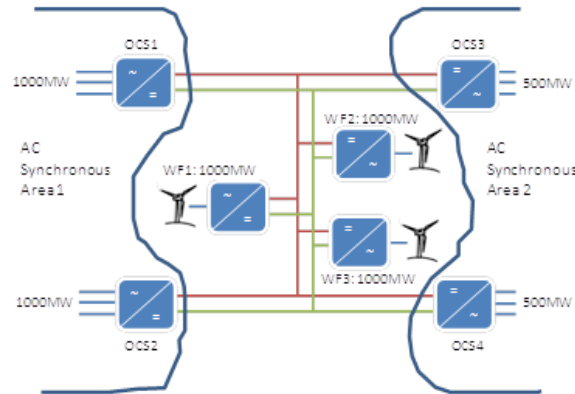
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What did DC breakers ever do for us?

With no DC breakers:

- Faults can be cleared at the AC side or by converter blocking
- Need sufficient rating of diodes until fault is cleared
- All infeed would be lost from the affected DC grid

No DCCB: too much loss of infeed to area 1

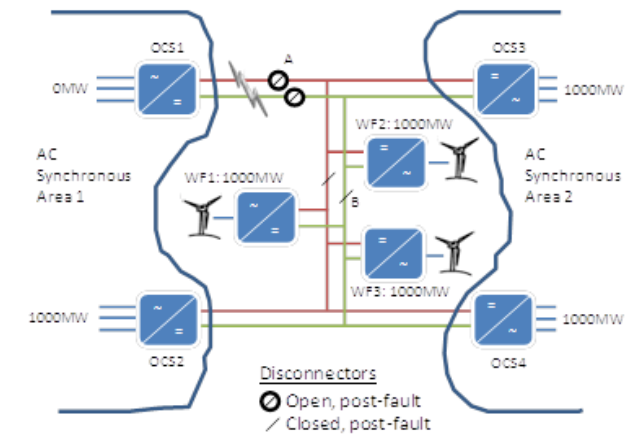
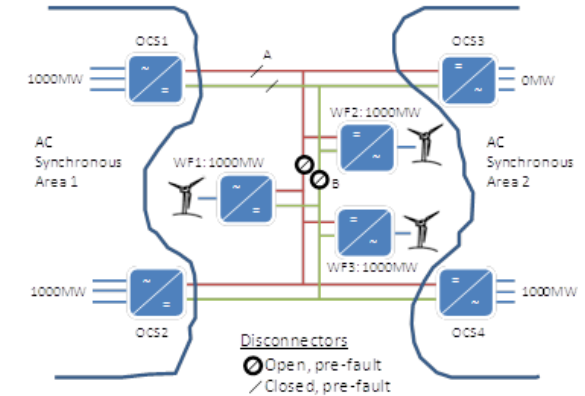


The same DC grid with a split introduced at point B but still no DC breakers

- Fault between OCS1 and A cleared by blocking current through OCS1, OCS3 and WF2 converters.
- Loss of infeed to Area 1 is only 1 GW
- The fault location is isolated by opening disconnectors at point A.
- Close disconnectors at B and resume operation
- Note: the fault location still needs to be identified!

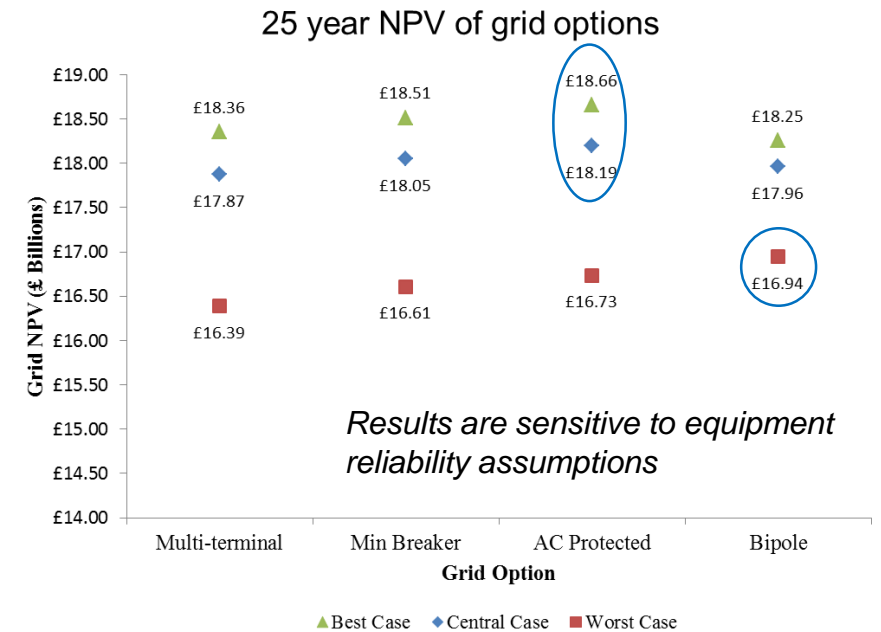
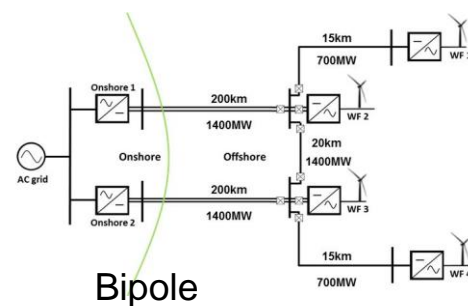
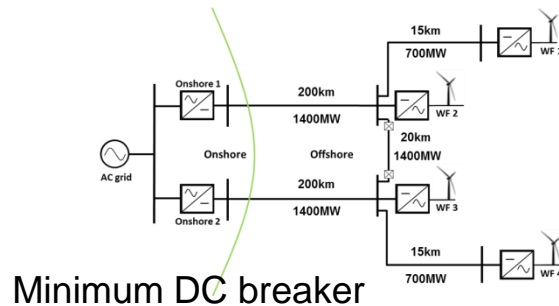
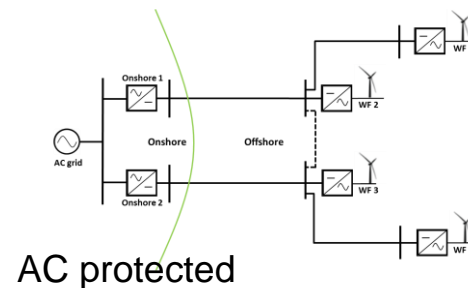
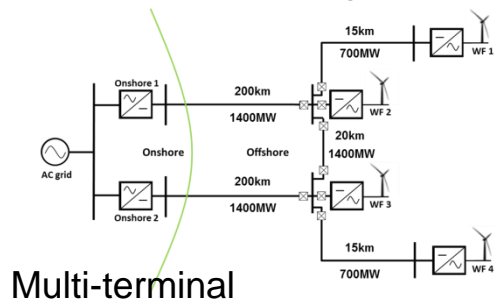
Example case:

- 3 GW offshore:
 - 2 GW to area 1
 - 1 GW to area 2
- Area 1 loss of infeed limit = 1.5 GW



Costs and benefits of HVDC breakers

- What do DC breakers cost?
- What is their benefit in reducing the volume of offshore that can't be sold?
- What is the value of multiple paths to shore?
- Assessment should take account of
 - probabilities of faults
 - repair time including influence of sea conditions
 - wind conditions and how much energy could have been produced
 - other ways of restoring a path from generation to shore, e.g. reconfiguration



Maclver, Bell and Nedic, "A Reliability Evaluation of Offshore HVDC Grid Configuration Options", *IEEE Trans on Power Delivery*, April 2016.