DC Voltage Control for Fault Management in HVDC Transmission System

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1. Introduction

Offshore wind energy: Promising renewable energy source.

➢Challenges concerning **integration** and **transmission system** options.

➢Different approaches can be found combining **functionality**, **reliability** and **investment cost** factors.

➢**VSC – HVDC** is considered to be the best available choice.

2. Objectives

✓Modelling of VSC – based point – to – point DC system for dynamic simulations analysis of HVDC networks.

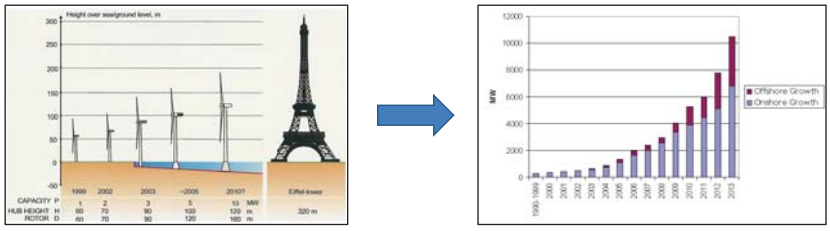
✓New control approaches to facilitate Fault – Ride Through.

✓Research on DC voltage control, as it is considered decisive factor in increasing security of supply and reliability of transmission system.

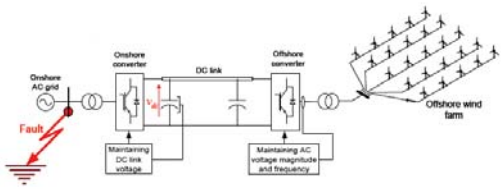
Major Contribution

✓Novel proposal of a DC voltage control strategy for fault management.

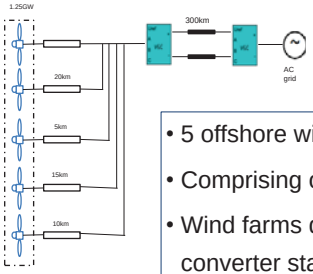
3. Wind energy development



4. Main Components of an HVDC system

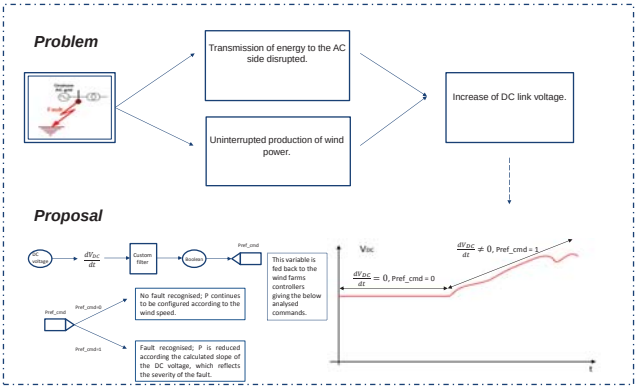


5. Test network implemented in Matlab/Simulink

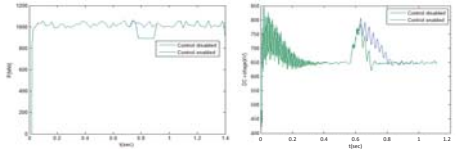


- 5 offshore wind farms, 250MW each.
- Comprising of fully rated synchronous generators.
- Wind farms dispersed in distances 0-20km from the converter station.
- HVDC link with line length 300km.

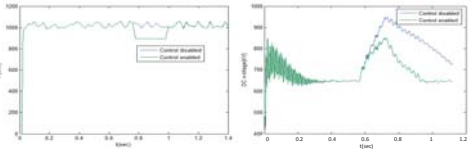
6. DC voltage control for fault management



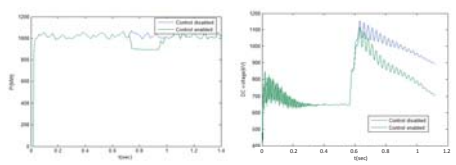
7. Simulation results *(High wind power penetration)*



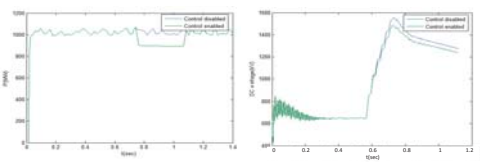
Single – phase to ground fault for 80msec



Single – phase to ground fault for 200msec



Three – phase to ground fault for 80msec



Three – phase to ground fault for 200msec

8. Conclusions

Type of fault	Active power output (MW)	DC voltage (kV)		Response of the system
		Control disabled	Control enabled	
Normal operating conditions	1050	650	N/A	N/A
Single – phase to ground for 80msec	900 during the fault (control enabled).	810	780	Returns faster to initial value.
Single – phase to ground for 200msec	890 during the fault (control enabled).	950	840	Returns to initial value at half time.
Three – phase to ground for 80msec	900 during the fault (control enabled).	1150	1100	Faster return
Three – phase to ground for 200msec	890 during the fault (control enabled).	1560	1450	Same response

Benefits

✓Limitation of DC voltage increase.

✓Faster return to the initial condition after the fault is cleared.

✓Stability is maintained in the system.

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