Introduction:
Offshore wind energy will become an important energy source in the near future. On the other hand, the low efficiency of gas turbines or diesel engines at offshore oil & gas installations calls for alternative power supplies. Therefore, it is necessary and possible to integrate oil installations and offshore wind farms to the onshore grid by single transmission link. This poster presents an analysis and fault mitigation methods of grid integration of offshore wind farms and oil & gas installations using Voltage Source Converter (VSC) HVDC.

VSC HVDC offshore transmission

Offshore AC Frequency Control

The fixed frequency control strategy is used. First, it enables the VSC to absorb the fast changing wind power generation and achieve bi-direction power transmission. Second, the extra power control loop is not needed, therefore, fast offshore communication systems are not necessary.

Onshore grid fault:

Offshore AC grid fault mitigation: The exact design of the Vac versus Vvsc curve in below figure is depends on the detailed VSC design and how fast the wind generation recovers from faults, in order to reach the active power balance in the offshore AC grid.

DC link voltage control (DLVC):
An offshore AC grid voltage independent limiter is implemented in the ac voltage control loop via the modulation index (M) of the VSC:

Proposed DC Link Voltage Controller

With DLVC controller presence, the HVDC DC voltage, offshore AC voltage and offshore AC frequency (green solid curves in upper figure a and b) peak values are smaller than the configuration without DLVC controller.

Offshore AC Grid Fault Mitigation:

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References: