VHVDC3 Model

WECC MVS Meeting 05/24/24

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New VSC HVDC model development - VHVDCx



GFM control on converter with active power control





GFL control on converter with active power control



Chopper circuit







GFL reactive power control





Active and reactive power limiters



Voltage dependent active power limiter



D-curve based reactive current limits

if I > Imax

$$Id_{lim} = \frac{Id \times Imax}{\sqrt{Id^2 + Iq^2}}, and$$
$$Iq_{lim} = \frac{Iq \times Imax}{\sqrt{Id^2 + Iq^2}}$$

Grid forming current limits

Fault close to HVDC terminal of the embedded HVDC (GFL/GFL)









T (sec)

Fault close to HVDC terminal for non-embedded HVDC (GFL/GFL)



T (sec)



Loss of last synchronous generation in remote system with HVDC (GFM/GFL)



Offshore wind with HVDC (GFM/GFL) inverter side fault













Offshore wind with HVDC (GFM/GFL) inverter side fault



Open Items

- Current limiter for GFM mode of operations: Need to finalize whether we use circular limiter, virtual impedance or D-curve similar to GFL
- Dc chopper: Chopper has been implemented but an energy dissipationbased tripping is not yet implemented
- VSCDC1 issues with current clamping to 0 during HVDC blocking in the absence of at least one classical generator model needs to be addressed



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