Converter-breaker protection strategy

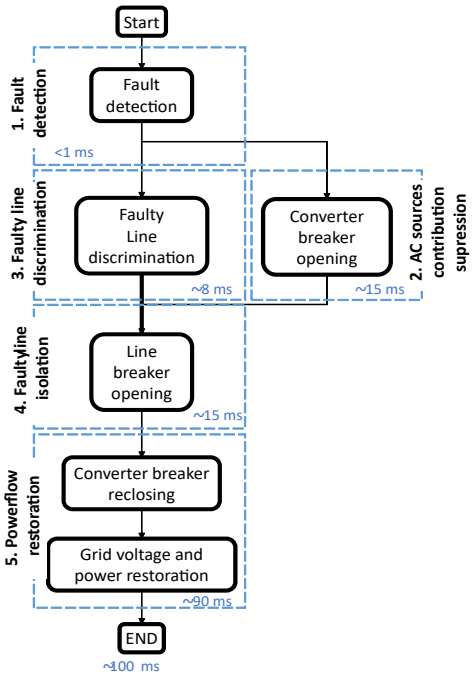
A robust DC grid protection strategy at an affordable cost

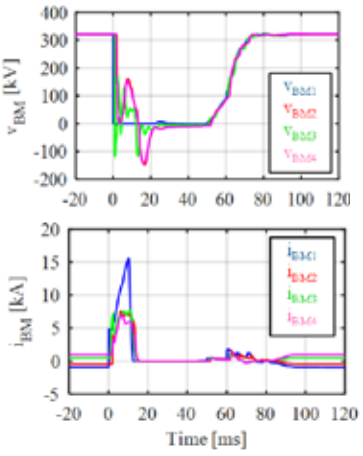
CONTEXT

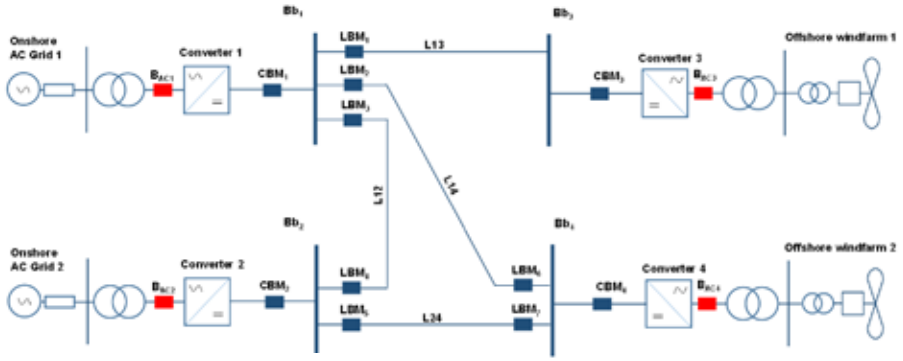
DC grid protection represents one of the main technical challenges that must be overcome to achieve future HVDC networks. It is a topic of intense research which is bringing to life several new possible protection concepts. The converter breaker strategy is an innovative, reliable and non-selective fault clearing strategy that appears to be acceptable even for large AC/DC system. It is considered to be an affordable strategy because it requires mechanical DC breakers with less constrained technical specifications.

TECHNOLOGY DESCRIPTION

The converter breaker strategy is a protection solution for multi-terminal DC grid based on low-speed DC circuit breakers. In this non-selective fault clearing strategy the priority is given to the suppression of the fault current by opening all the converter breakers. At the same time the faulty line is discriminated and, in a second phase, isolated by tripping the DC breakers of the faulty line. Thereafter the converter breakers are reclosed and power is restored in 10-20ms. Simulation studies have demonstrated that the time necessary to bring back the power to entire grid is limited to about 100ms.







CBM = DCCB + RCB + PIR

APPLICATION DOMAIN

- Multi-terminal DC grid
- Bipolar & monopolar configuration
- Cable system

ADVANTAGES

- Less constrained DC breakers requirements (i.e. 20kA -15ms - low energy absorption)
- DC line limiting reactors not required
- Efficient backups
- Multivendor
- Enable easy grid extensibility
- Reactive power support during fault clearing

TRL SCALE

1 2 3 **4** 5 6 7 8 9

Protection strategy tested on a virtual mock-up
Prototyped relays tested in HIL

DELIVERABLES

Patent WO2018042126 (A1)
Virtual mock-up, component models, MMC controls, protection algorithms
(DC test grid composed by 3-terminals - 320kV bipolar cable system in EMTP-RV, option: PSCAD or HYPERSIM)
Technical reports
Training, technical support

SCIENTIFIC REFERENCE

PROMOTiON Deliverable 4.2
D.S.Loume, A.Bertinato, B.Raison, B.Luscan , "A multi-vendor protection strategy for HVDC grids based on low-speed DC circuit breakers" IET ACDC conference, Manchester, UK, 2017.
A. Bertinato, J.C. Gonzales, et. al. "Development of a protection strategy for future DC networks based on low-speed DC circuit breakers" CIGRE Paris 2018.

Contact: sebastien.silvant@supergrid-institute.com