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Electro Magnetic Transient Simulations for risks assessment of a live black start test of an HVDC VSC

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A large scale blackstart test has been performed in Belgium at the end of 2020 to assess the feasibility of the energization of an island containing large generators and load.

The blackstart included the new 1 GW HVDC VSC called ALEGrO that connects the east part of the Belgian transmission network and with the western part of the German network (under the control of Amprion) and a large HPP (6 x units with a total of 1GW of installed power) connected through a relatively long 380kV OHL system that has been islanded for the occasion.

As the blackstart test involved third party assets, the owner of the HPP and the vendor of the HVDC, a complete assessment of the risks and mitigation measures has been performed.

A key part of the assessment was the simulation, using EMT software of the whole blackstart sequence and of some incidents.

The EMT simulation has been fundamental to assess the risks of interaction between the energized network and the black started network.

In this study a more simplified model of the network would not have allowed a correct estimation of the risk:

- An RMS model would not have allowed represent oscillations at off- synchronous frequencies and transient overvoltages during some specific fault conditions.
- An EMT model without the geometric details of the OHL would not have allowed determining the unbalance that caused the oscillations (no interaction and no oscillations).
- An EMT model would not have allowed the correct simulation of the U/f mode and of the limitations of the HVDC interconnector (no blocking or trip).