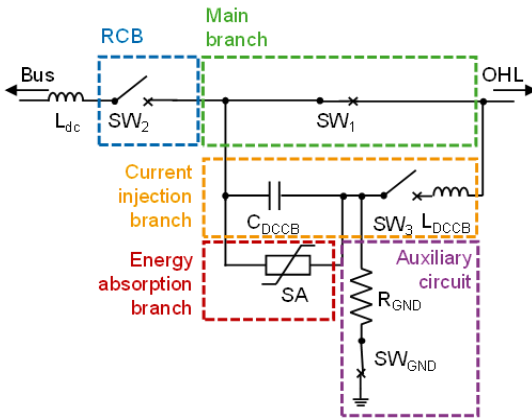




OHL pre-energization module for DCCB

Reliable low-cost auto-reclosing method minimizing disturbances in MTDC grids

CONTEXT



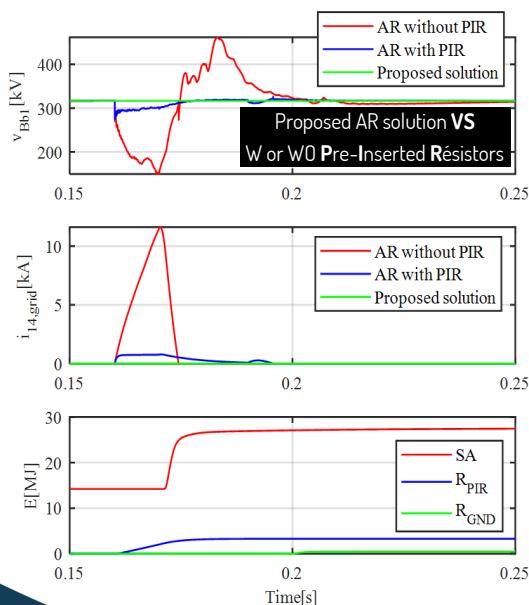
The following solution is applicable to a **multi-terminal HVDC (MTDC)** system where **overhead transmission lines (OHL)** are installed. An OHL (a bare conductor suspended in mid-air) is prone to higher fault rates than an underground or subsea cable. Most of these

faults are non-permanent, allowing the line to be reconnected after dielectric recovery. A reliable **auto-reclosing (AR)** procedure in HVDC systems is a technical challenge since multiple restrikes are possible within a short period of time. The solution we propose here is to enable the use of an **auxiliary circuit** located inside a DC Circuit Breaker (DCCB) – installed at both ends of the **DC OHL** – for line **pre-energization** purposes. This solution increases the **reliability** of the auto-reclosing procedure while reducing the

TECHNOLOGY DESCRIPTION

Inside a compatible **DCCB**, an auxiliary circuit in charge of the **pre-energization** process consists simply of one grounding switch, **SWGND**, and one grounding resistance, **RGND**, in series. They are connected to the current injection branch, in-between the capacitor, **CDCCB**, and the switch, **SW3**, creating a charging path for **CDCCB** as depicted in the figure. In this way, the energy stored in the

capacitor during the current interruption stage can be used afterwards to create **one or several recharging attempts**. Only if the overhead line voltage successfully reaches a value close to its rated voltage, a reconnection through the switch **SW2** is allowed. The **AR** becomes **seamless** to the system (in green), unlike the classic pre-inserted resistors (PIR) method (in blue).



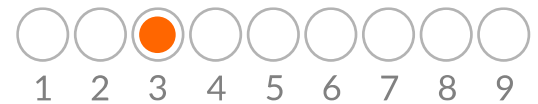
APPLICATION DOMAIN

- Multi-terminal HVDC networks with overhead line sections.
- HVDC protection.

ADVANTAGES

- Additional DCCB function with only standard AC switches.
- Low energy absorption, recycling energy from the fault.
- The MTDC grid operation is not affected by the pre-energization process.
- Multiple recharging attempts while the OHL is disconnected from the grid, lowering restrike risk of the auto-reclosing system.

TRL SCALE



Proof of concept

DELIVERABLES

- PATENT FR3113334, WO2022/029379
- System topology and algorithms design reports
- EMT simulation studies
- Technical support and advisory

SCIENTIFIC REFERENCE

P. Torwelle et al., "Pre-Energization Concept for Overhead Lines in MTDC Grids Using DCCB Internal Capacitor," in IEEE Transactions on Power Delivery, vol. 37, no. 1, pp. 155-164, Feb. 2022, doi: 10.1109/TPWRD.2021.3054599.