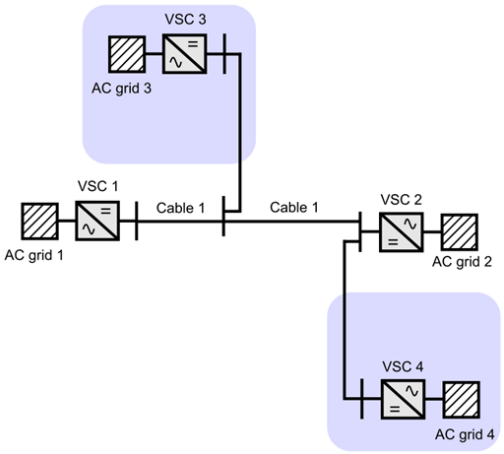
Current distribution balancing in parallel conductors

CONTEXT

When considering the expansion of a dc system, an installed cable or overhead line can become undersized.

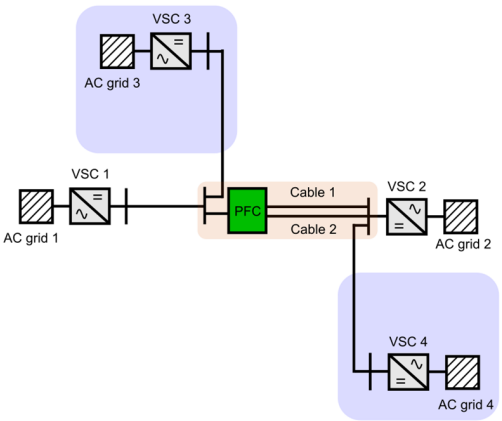
For example, let us consider the simplified case shown in the figure opposite. The cable 1 has been sized to transfer power from AC grid 1 to AC grid 2 and if a grid expansion leads to connection of VSC3 and VSC 4 to the system, a part of cable 1 will be undersized when power flows from AC grids 1 and 3 to AC grids 2 and 4 will be need. A grid reinforcement is would be required to avoid power curtailments. One option is to change the cable, another option is to add a second cable in parallel to the existing one. If both cables have different cross-sections, their electrical and thermal resistances will lead to uneven conductor temperatures. When one conductor reaches maximal temperature, the other is not at maximal temperature and is then not used at maximal current making the investment not optimal.



TECHNOLOGY DESCRIPTION

The proposed solution is process and embodiment to reduce the cross section of the added conductor by using a power electronic converter.

The power electronic converter is sized for medium voltage (voltages at its terminals in the range of conductor voltage drops) and is connected is series with the conductors. The power electronic converter is normally bypassed and activated when one of the conductors reaches the maximum rating. Then, it diverts the current to the underused conductor thus optimising the use of this conductor.



APPLICATION DOMAIN

DC system expansion

ADVANTAGES

Additional degree of freedom for the system expansion

Reduced cross-section of the added cable

TRL SCALE

1 2 3 4 5 6 7 8 9

DELIVERABLES

PATENT APPLICATION PCT/ EP2022/051682

Techno-economic studies

SCIENTIFIC REFERENCE

None