

# Paris Session 2022



## DC-DC converters for DC networks

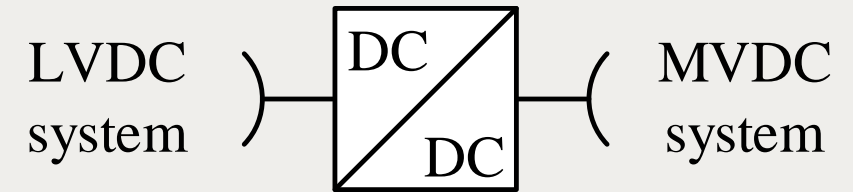
B4 PS1/2 Question 1.17: DC-DC converters are gaining significance and new types are being proposed. How do DC-DC converters compare with other types of AC-DC converters in terms of power losses? How do they compare to AC-DC converters in terms of harmonic emissions?

Piotr Dworakowski, France



## DC-DC converters for DC networks

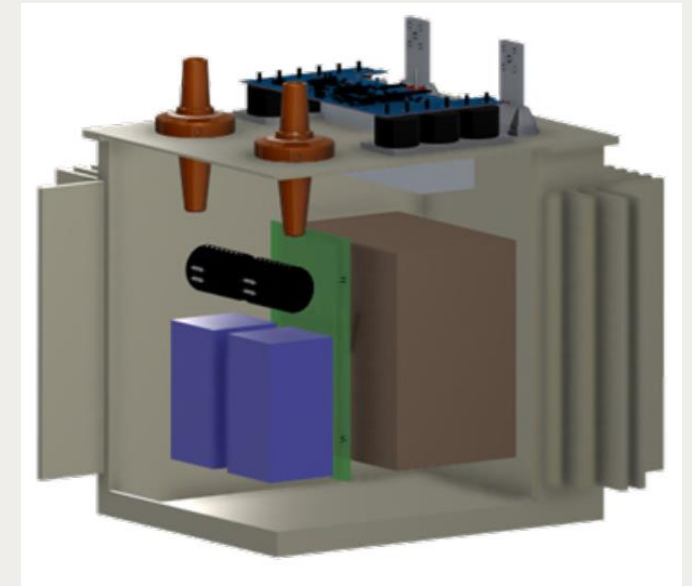
- Enabling technology for the future DC networks
  - interfacing LVDC, MVDC and HVDC
- Role
  - to adapt the voltage between two DC systems - similar to the transformer in AC networks
  - to provide power flow controllability and fault current blocking (or limiting)
- Types
  - bidirectional or unidirectional (step up or step down)
  - isolated or non-isolated
  - monolithic or modular



## DC-DC converters for DC networks

- Power losses
  - HVDC isolated IGBT ~98%
  - HVDC non-isolated IGBT >98%
  - MVDC isolated SiC ~99% - top figure
  - LVDC isolated SiC >99% - bottom figure
- Harmonics
  - HVDC equal or lower than MMC DC side harmonics
  - MVDC/LVDC very low harmonics thanks to medium frequency operation ( $\gg 1$  kHz) enabled by SiC

20 kV 250 kW prototype



1 kV 100 kW measurement

