

Paris Session 2022



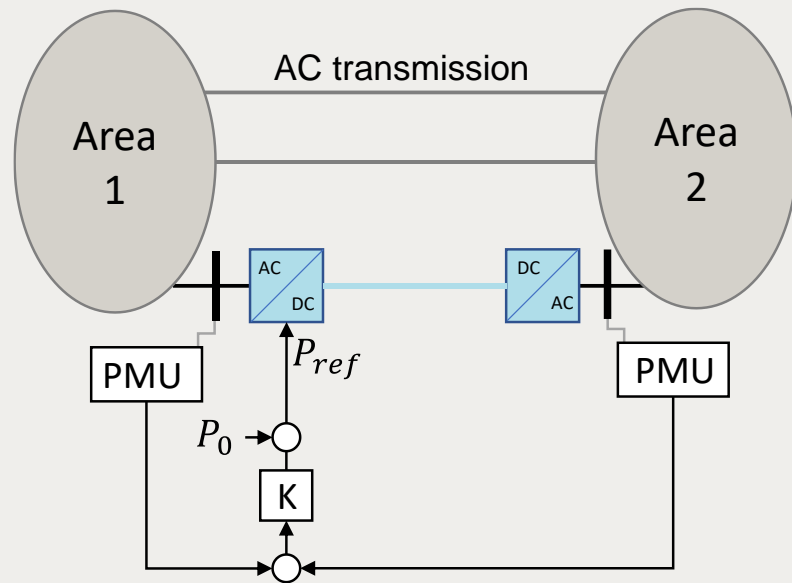
The role of power flow controllers in managing power flows in hybrid AC/DC networks

B4 PS1-6 DC Grids. Question 1.10: Power flow control in large DC networks will require new technologies to control the power flow. What is the best control method to manage power flow in DC Grids from operational and planning perspectives?
Juan Carlos Gonzalez-Torres, France

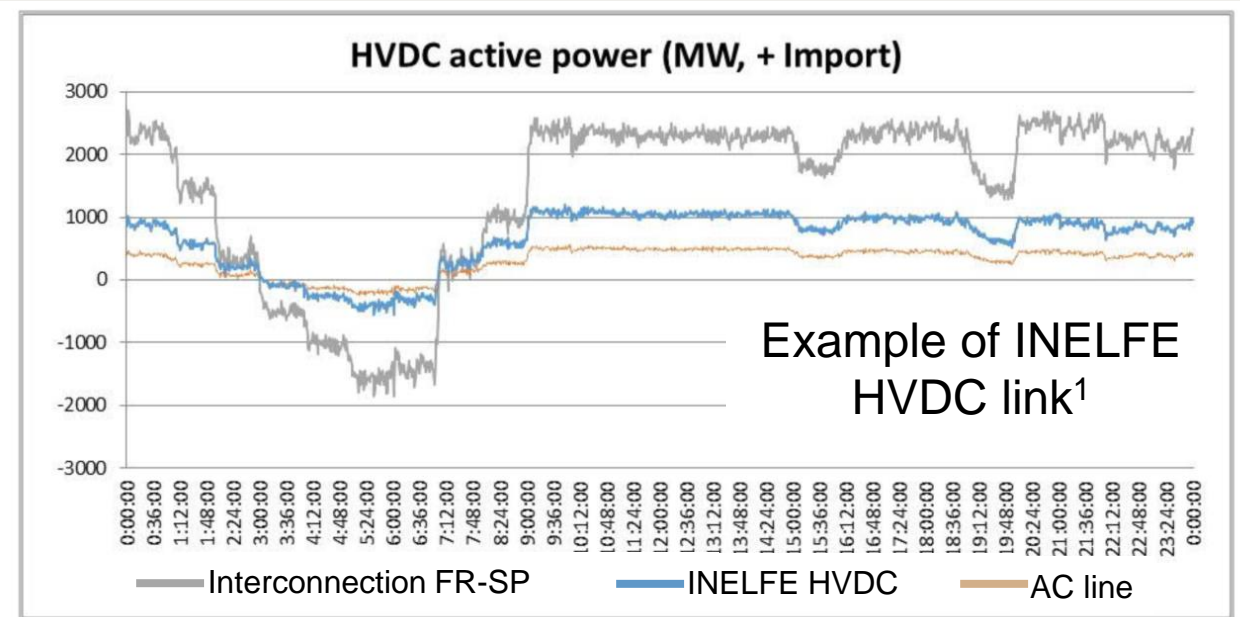


Solutions for embedded HVDC power dispatching

- 1 **Manual dispatch** of power set-points based on operation schedule
- 2 **Supplementary control** for automatic dispatch (e.g., Angle Difference Control – ADC)
 - Notably simpler real-time operation
 - The HVDC follows the natural power-flow pattern of the AC grid, avoiding power loop flows
 - The HVDC power changes according to changes in load/generation and grid topology



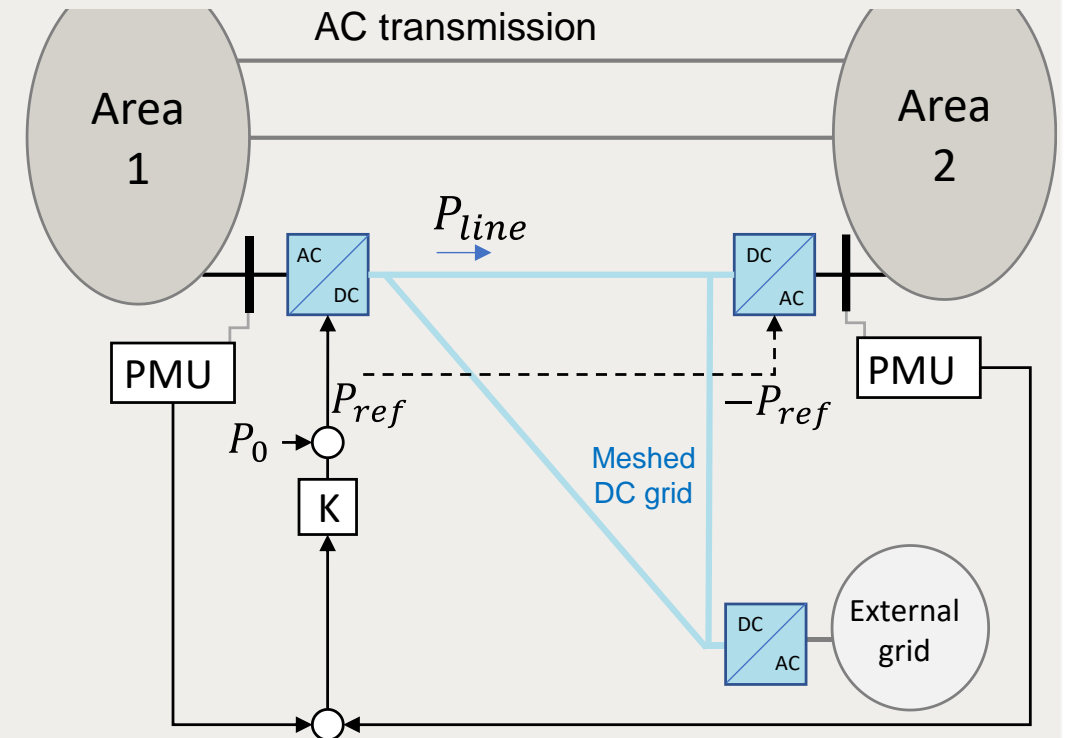
Angle Difference Control (ADC) =
AC line emulation



¹ Source: L. Coronado, C. Longás, R. Rivas and S. Sanz, J. Bola, P. Junco and G. Pérez "INELFE: main description and operational experience over three years in service". AEIT conference 2019

Challenges for the implementation on MTDC grids

- Challenge 1 : The ADC can be used in MTDC grids, however, the **coordination** of the power references via communication is necessary to avoid interactions with the DC voltage droop control.
- Challenge 2 : In meshed systems, power flowing through every conductor can not be controlled. However, the overloading conductors' constraints must be respected in each operating point:
 - The MTDC needs to be ready to securely operate in any operating point given by the ADC



Role of PFCs in managing power flows in hybrid AC/DC networks

- PFCs provide an extra degree of freedom that allows :
 - Redistribute the power-flows inside the DC grid.
 - Respect the overloading DC conductors' constraints for any set of power set-points given by the ADC.
 - Extend the range of the MTDC operating points.

PFCs represent an attractive solution to manage DC grid power flows in a secure manner, in an MTDC that actively supports the AC transmission grid to supply the electrical demand.

