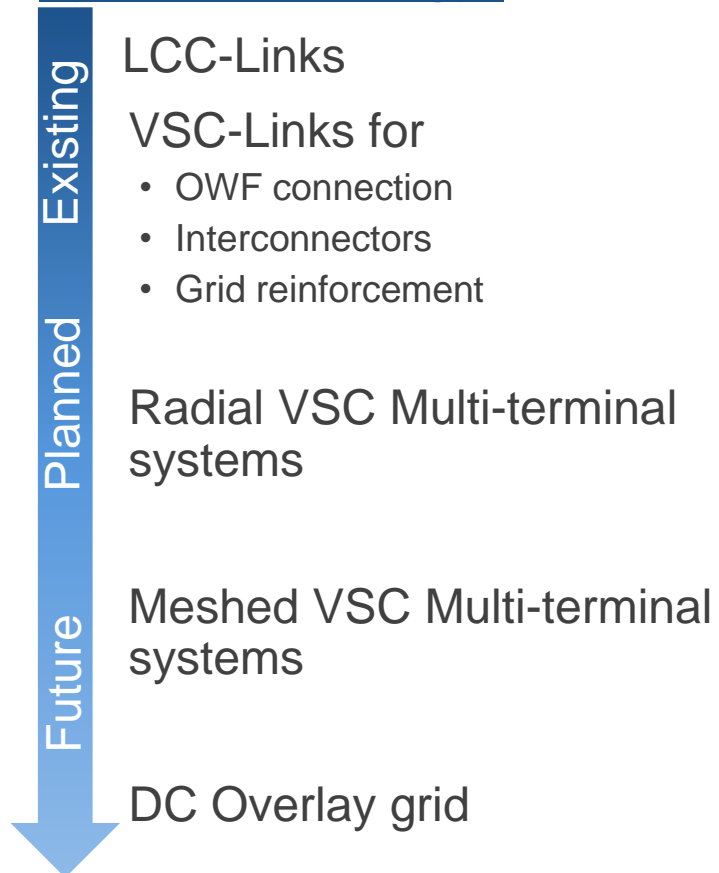


How to export offshore wind using DC grids?

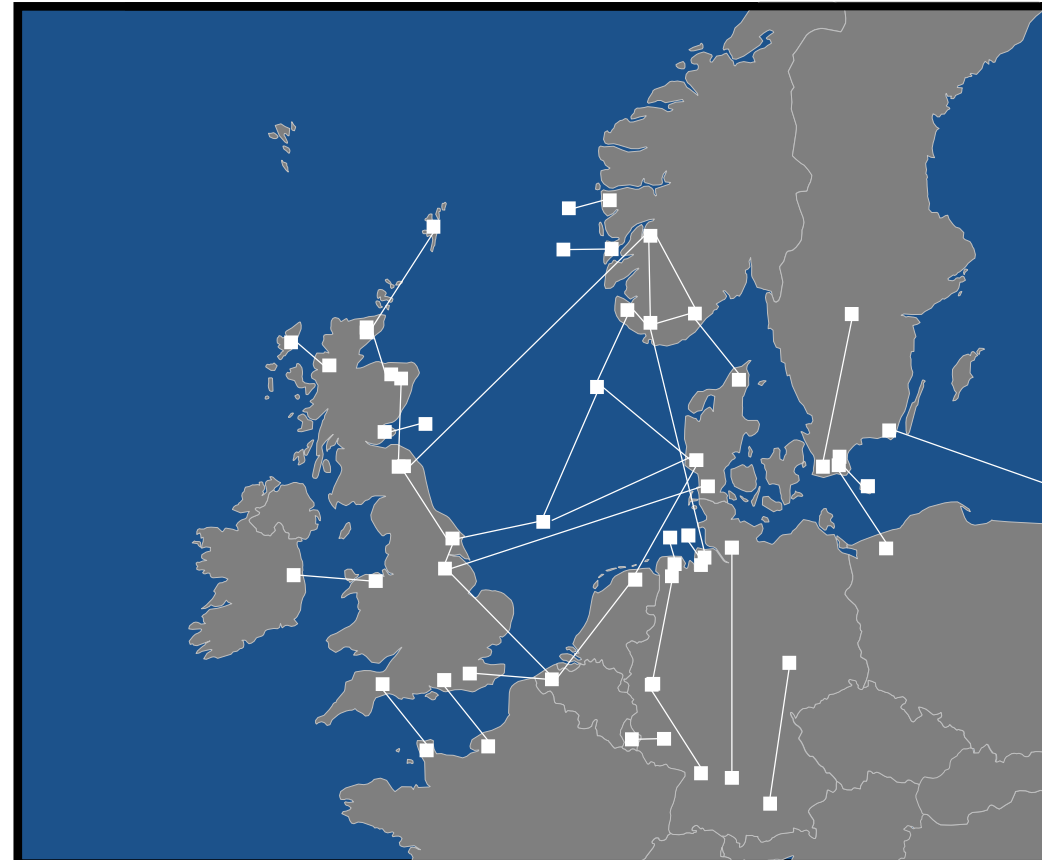
WindEuropeOffshore – 27 November 2019 – Christina Brantl – RWTH Aachen University

Evolution of HVDC topologies in Europe

Type of topology:



Schematic representation: VSC based HVDC systems



Design considerations for the development of multi-terminal HVDC grids

Normal Operation & System Design

- DC voltage level
- DC configuration
- Operational strategy
- Interoperability

DC side faults and contingencies

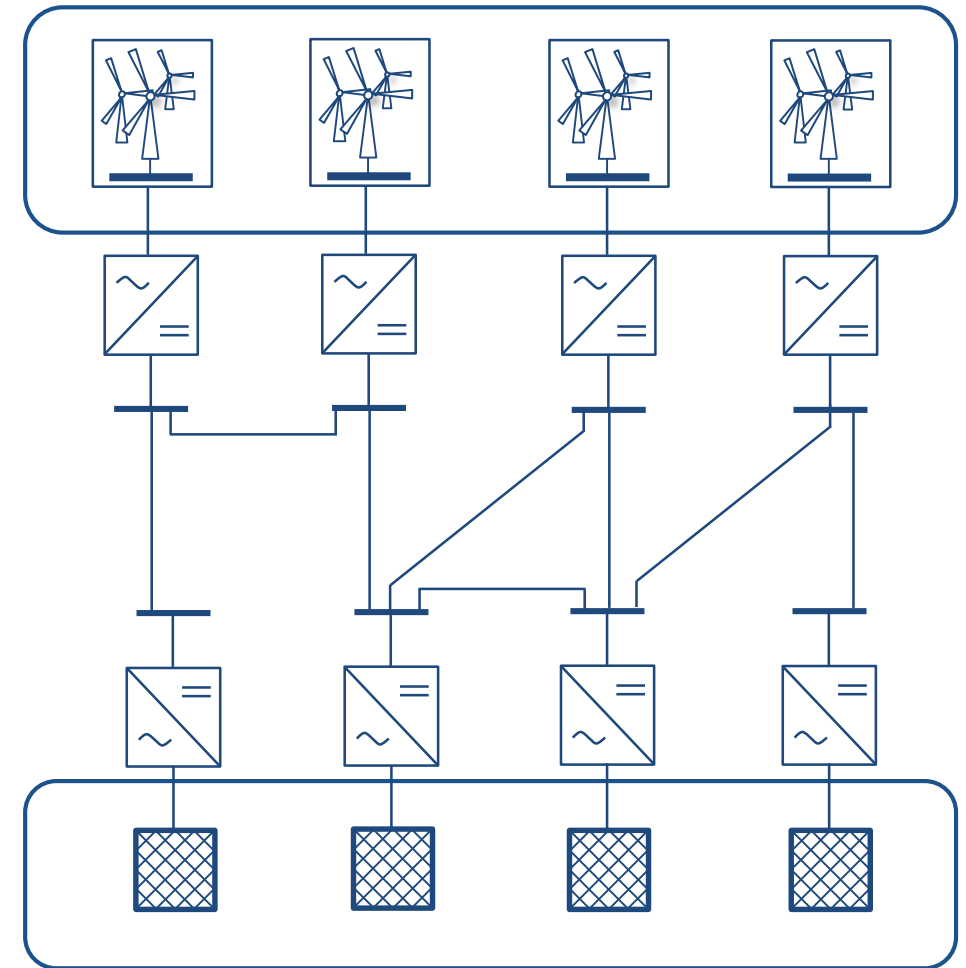
- Reliability and availability criteria
- Impact of faults and fault clearing strategies

Control of Offshore Wind Farms

- Use of control capabilities for AC and DC FRT
- New requirements
- DRU integration

AC system dynamics

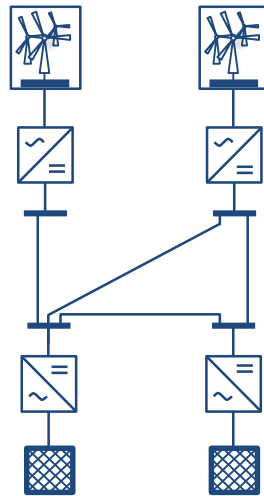
- Provision of ancillary services
- AC FRT of the overall system
- Respect the different frequency reserves



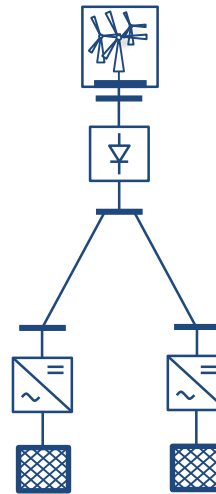
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Technical solutions for control of DC grids and offshore wind farms in PROMOTioN

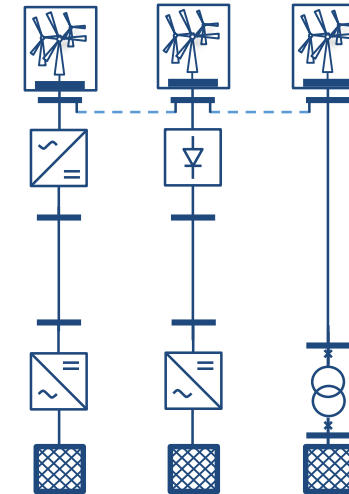
Trade-off analysis of different topologies



Interconnection of VSC and DRC systems



Control concepts to ensure interoperability



To define recommendations on onshore and offshore power systems for existing grid codes

Exemplary Findings

Interoperability of DRUs in VSC systems

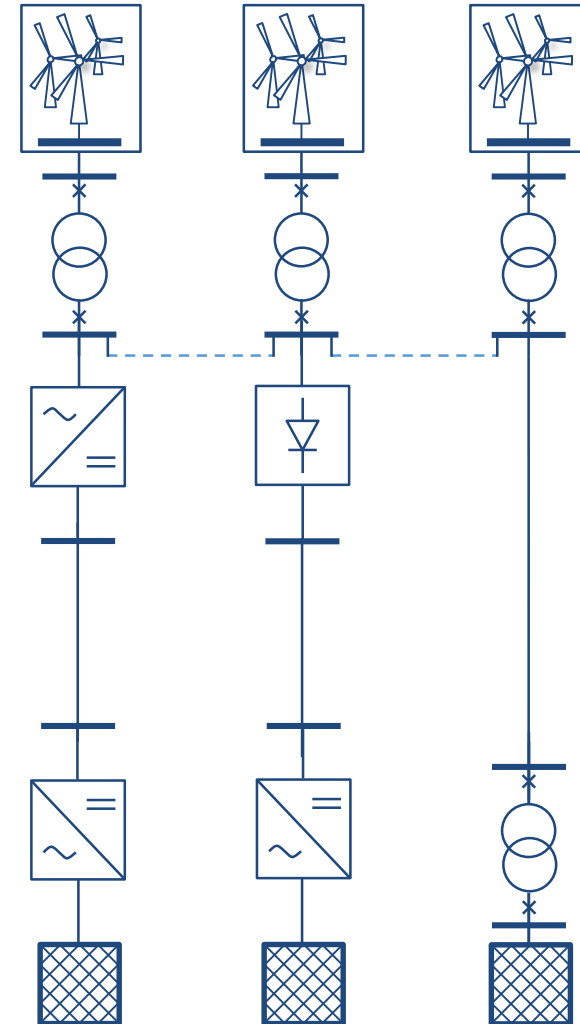
- Integration of DRU into different system topologies is feasible
- AC FRT using windfarm controls for DRU is achievable

DC fault handling

- DC FRT of wind farms for different fault clearing strategies lead to different requirements on the wind farms
- Development of enhanced WPP controls

AC system dynamics

- Supply of frequency support and frequency reserve sharing is possible



How to export offshore wind using DC grids?

Thank you for your attention!



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