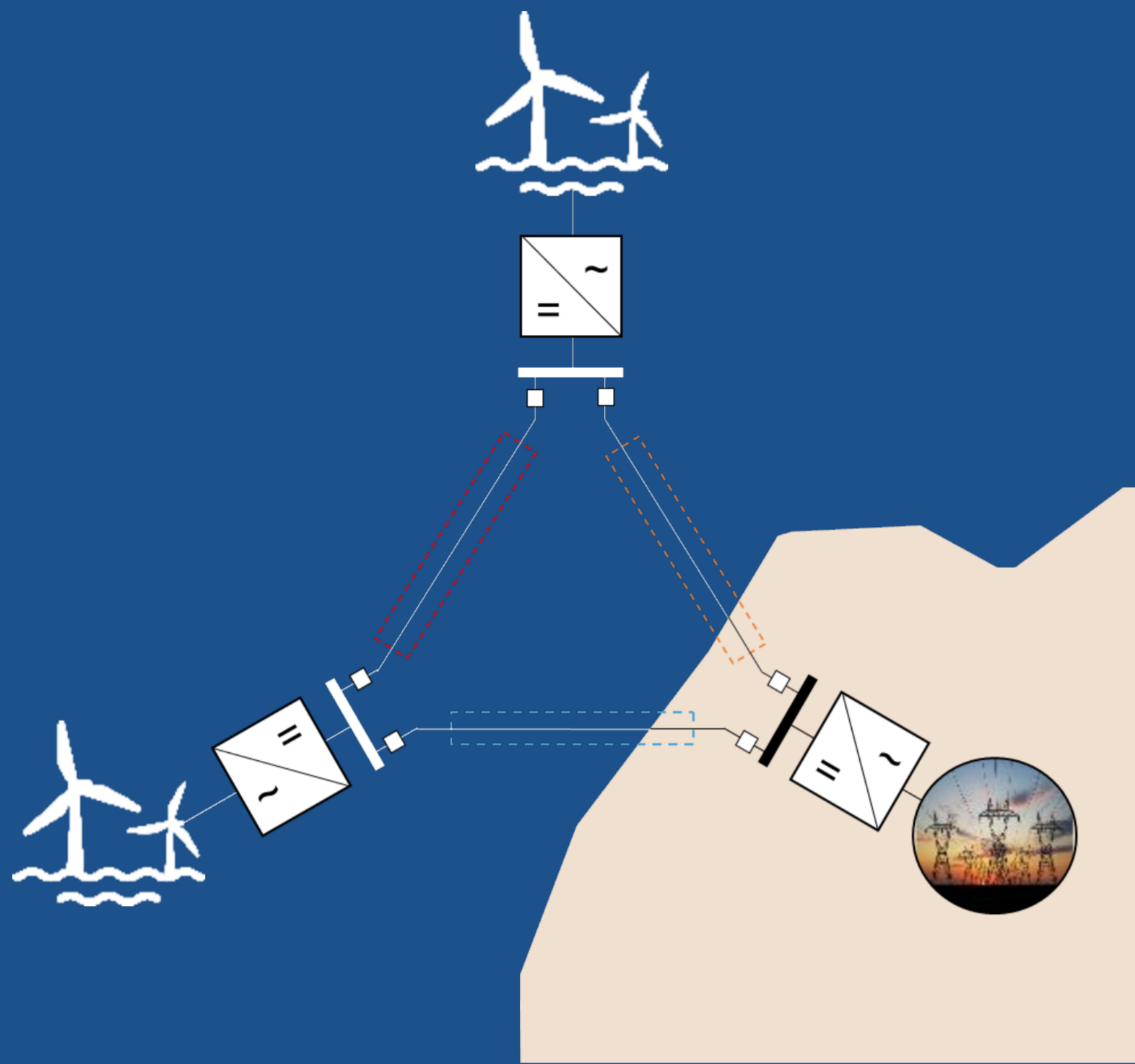


# WP1 – PROMOTioN Hypothesis: HVDC connection is required for efficient evacuation of offshore wind

## Multi-terminal or meshed HVDC grids increase efficiency of evacuation



↑ Existing HVDC interconnectors and offshore wind farm export connections are all dedicated point-to-point links.

Objective is to improve availability and utilisation by combining functions with connection on the DC side:

- Offshore wind export
- Interconnection
- AC grids reinforcements

Benefits compared to point-point connections

- Better utilisation
- Better availability
- Lower CAPEX
- Lower OPEX

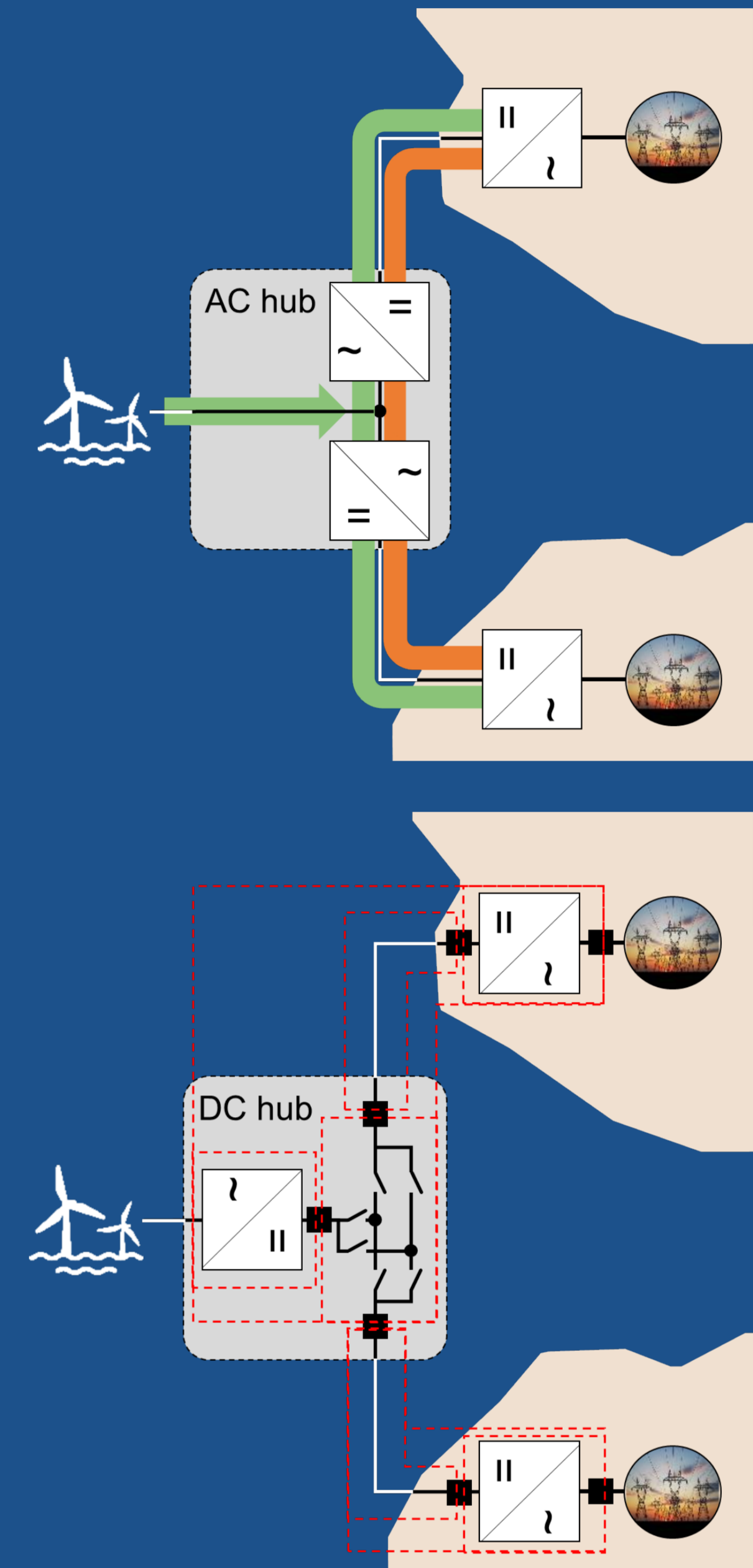
When a hub is created using DC technology and multi-terminal HVDC links to shore, the advantages are:

- Lower interconnection losses
- Lower converter CAPEX
- Better availability
- Smaller space requirement

The disadvantages are:

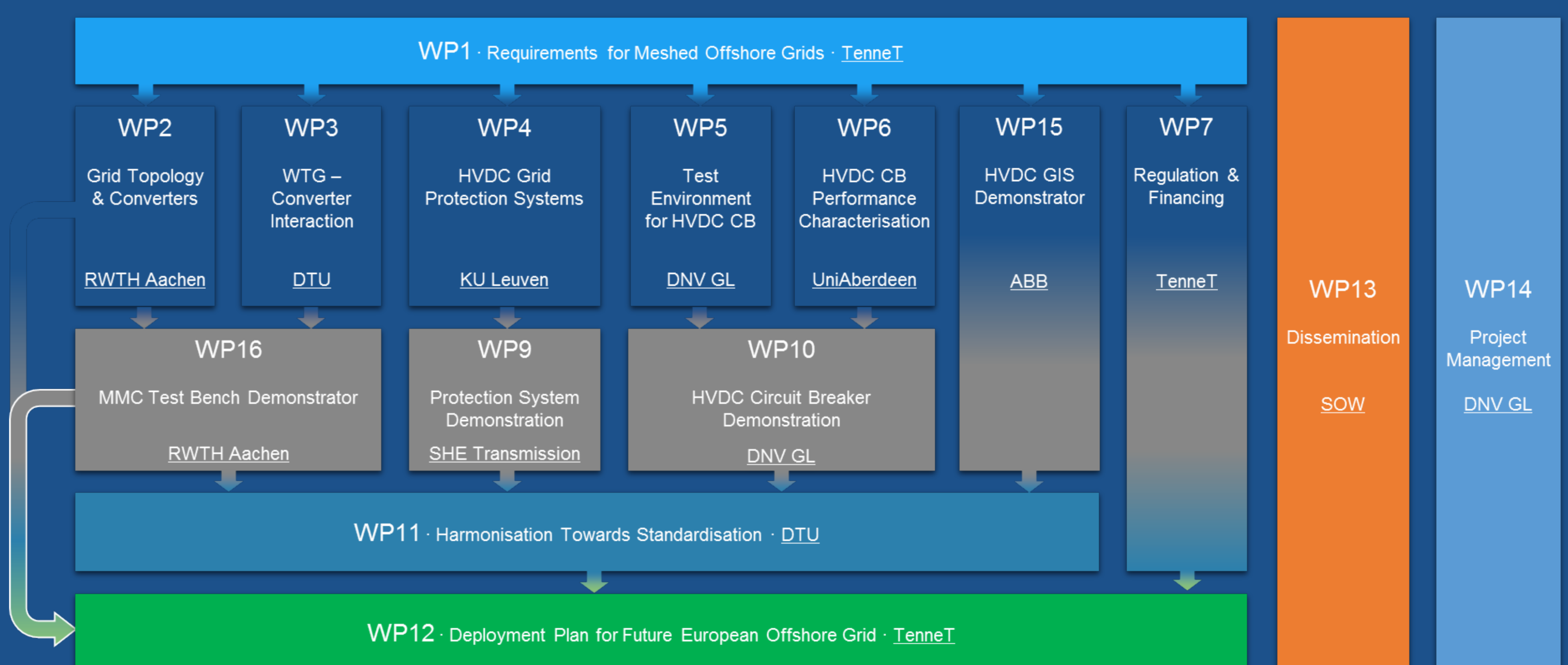
- Grid integration: New technology, no standards & grid code
- Multi-vendor converter control operability
- Unknown procurement models

Issues: Protection, Topology, (Converter) Controls and (vendor) Interoperability



## PROMOTioN addresses barriers to deployment of meshed grids

Economic/Financial	Legal & Regulatory	Technical
Financing of offshore grids and investor/stakeholder expectations	Long-term planning of onshore grids	Operation and control of offshore grids
Design & development of Market structures and business models	Regulation of grid development and build	Protection of offshore grids
Market interaction between the North Sea and European onshore Bidding Zones	Coordination and control of standards and Grid Codes	Test environment for HVDC circuit breakers
		Use of DCCBs in Offshore grids
		Integration of DRU (direct rectifier unit) technology in offshore grids to improve cost efficient converter solutions
		GIS leak testing and alternative gas tests



WP 12 developed 3 wind generation location scenarios and performed a cost-benefit analysis on 4 different concepts in order to test different axes (12 Concept-Scenarios):

- Business as Usual and base for all axes is (radially) connected wind farms
- Axis 1 extends from radial hub connection to allow meshed and multi-terminal grids;
- Axis 2 relaxes constraint on Smaller (2 GW) hubs allowing energy islands up to +/-30 GW; and
- Axis 3 relaxes grids constrained within national EEZ borders to ones where European cooperation allows landing power outside the home EEZ.