

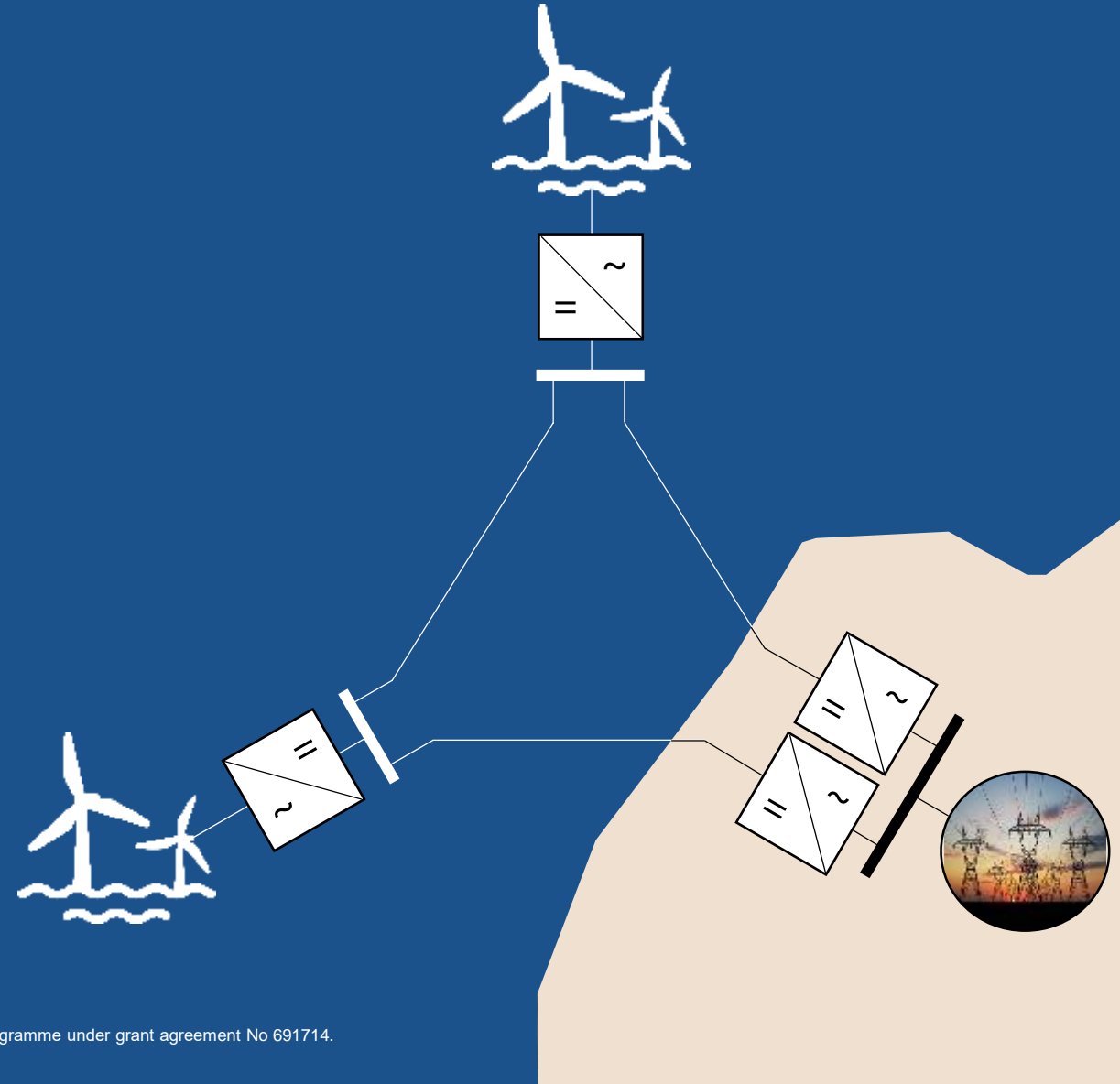
Progress on Meshed Offshore HVDC Transmission Networks

21st of November 2019 | Arnhem | Converter controller model validation demonstration | Cornelis Plet (DNV GL)

Progress on Meshed Offshore HVDC Transmission Networks

Enabling the North Sea power house

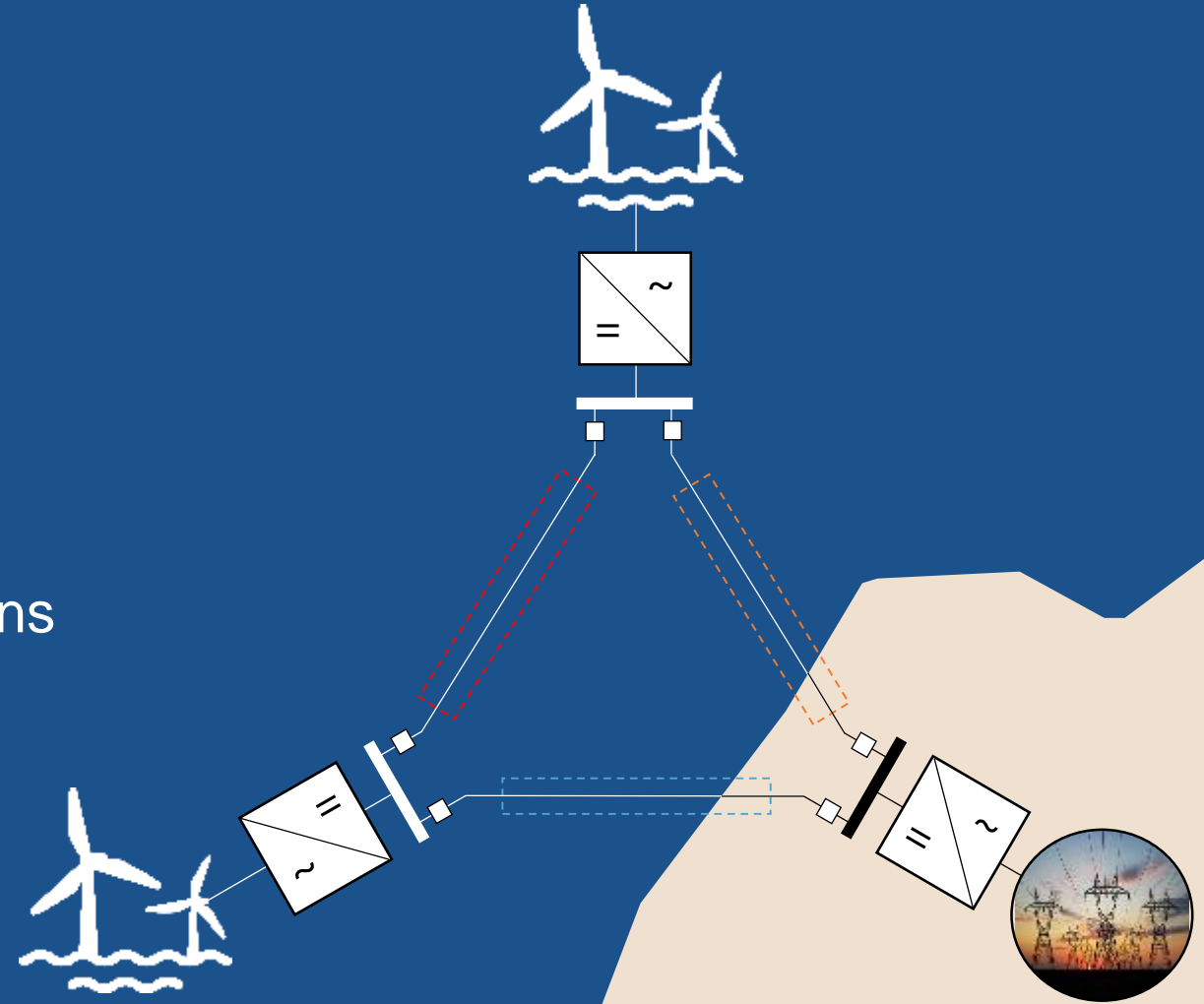
- Improve capacity utilisation by combining:
 - Offshore wind export
 - Interconnection
 - AC grids reinforcements



Progress on Meshed Offshore HVDC Transmission Networks

Enabling the North Sea power house

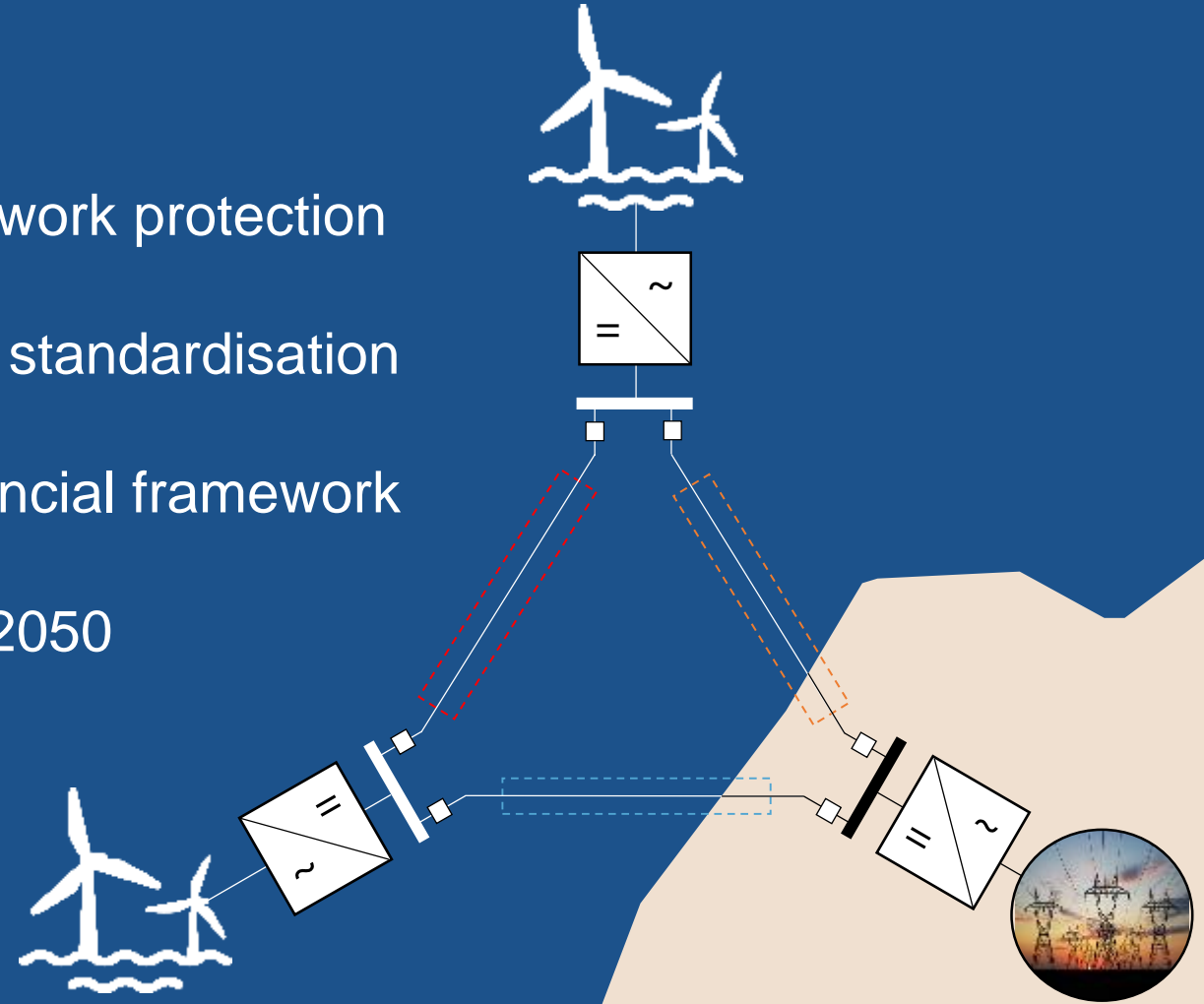
- Improve capacity utilisation by combining:
 - Offshore wind export
 - Interconnection
 - AC grids reinforcements
- Connect on the DC side
- Benefits compared to point-point connections
 - Better availability
 - Lower CAPEX
 - Lower OPEX



Progress on Meshed Offshore HVDC Transmission Networks

Enabling the North Sea power house

- Develop cost effective & reliable HVDC network protection
- Work towards technology interoperability & standardisation
- Recommendations for EU regulatory & financial framework
- Deployment plan for implementation up to 2050
- Full scale technology demonstrations



Statistics



33 partners



11 countries

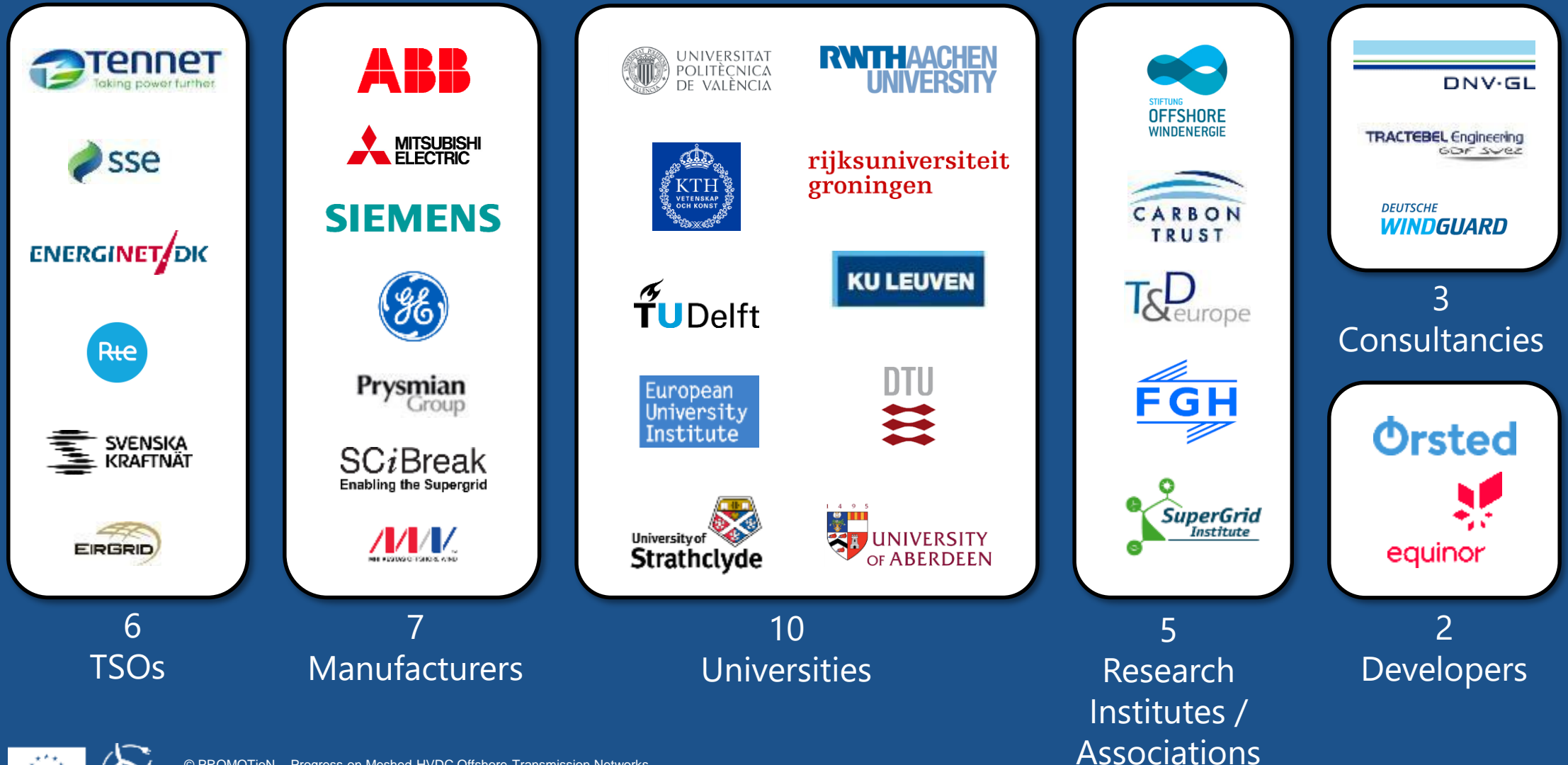


4,5 years



42 million EUR

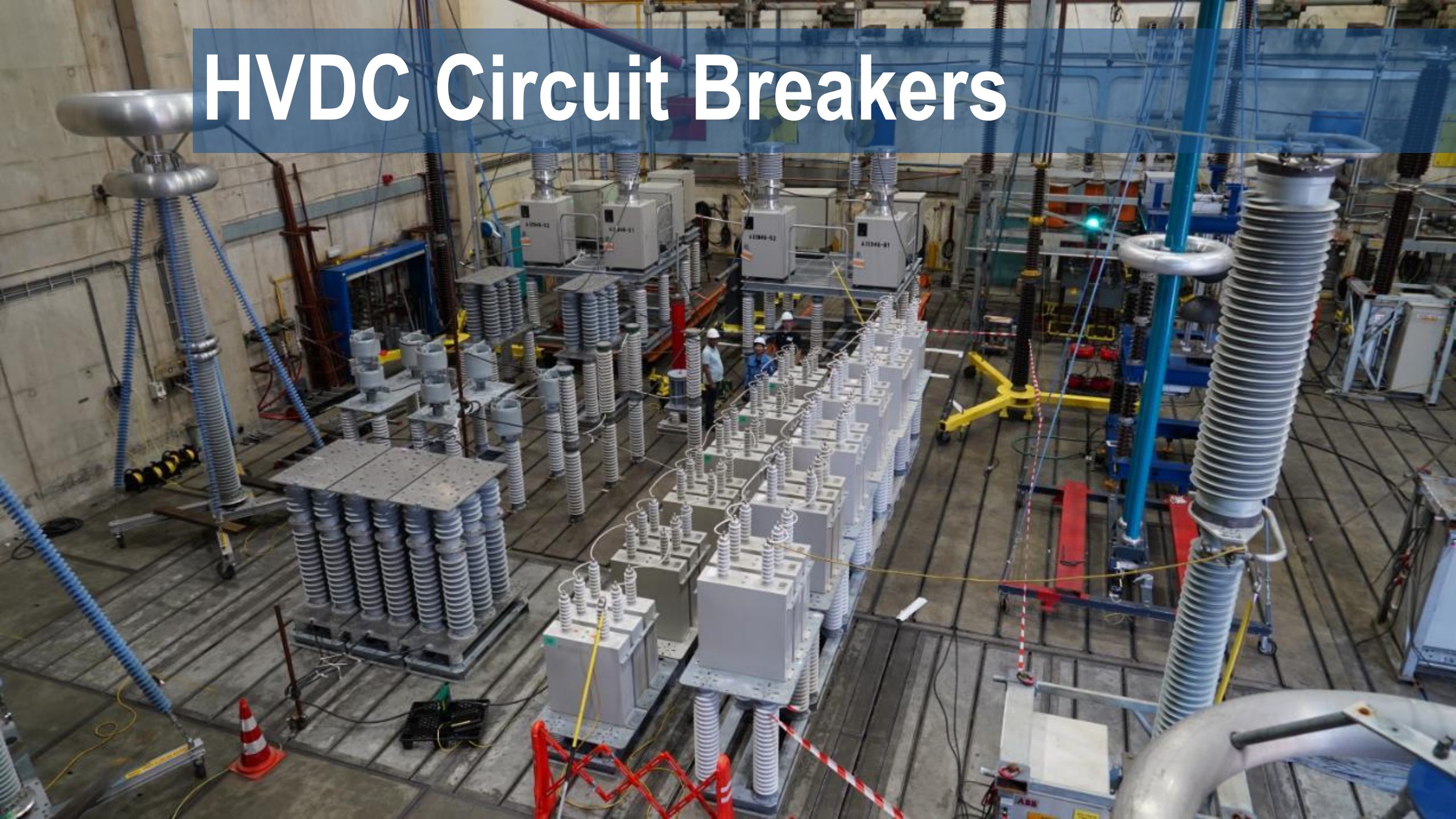
The Partners – Covering the Offshore Grid Value Chain



Meshed HVDC grid technology is real

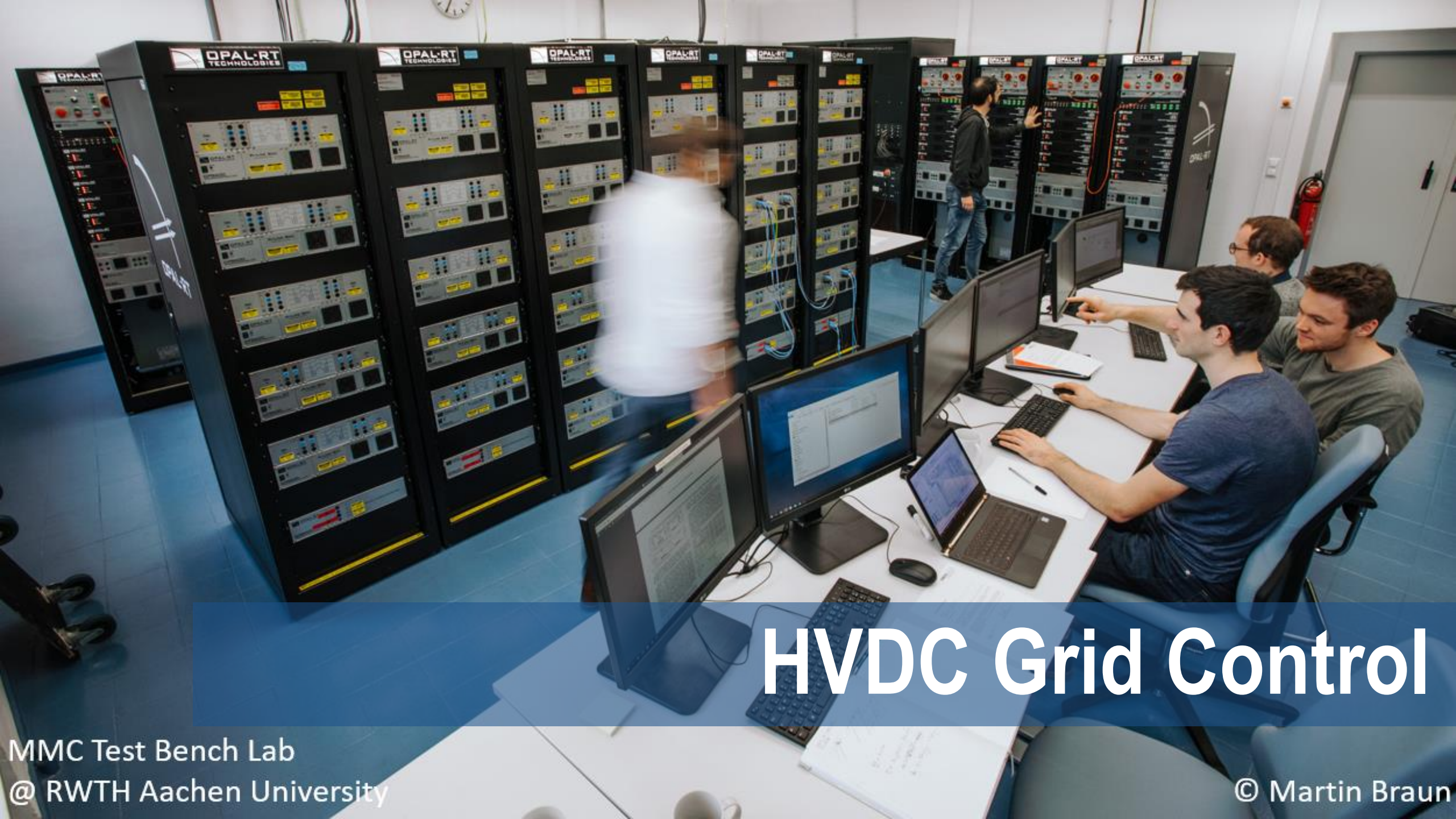


HVDC Circuit Breakers



HVDC Gas Insulated Systems





HVDC Grid Control

MMC Test Bench Lab
@ RWTH Aachen University

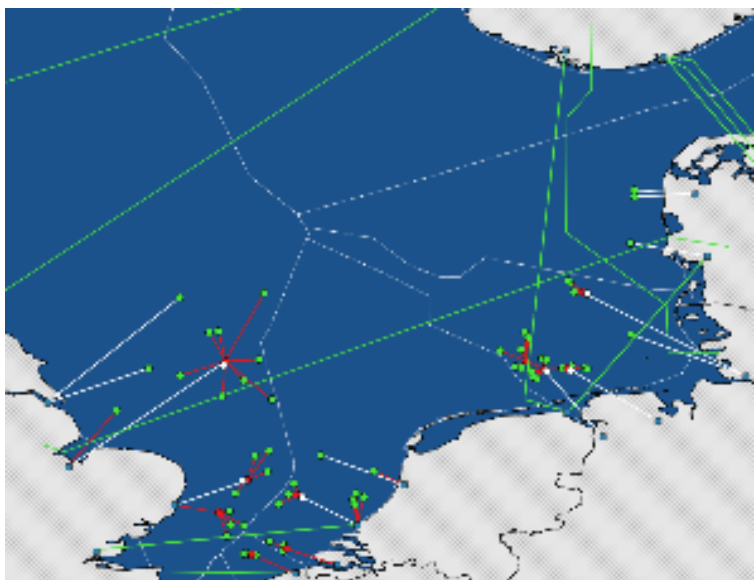
© Martin Braun



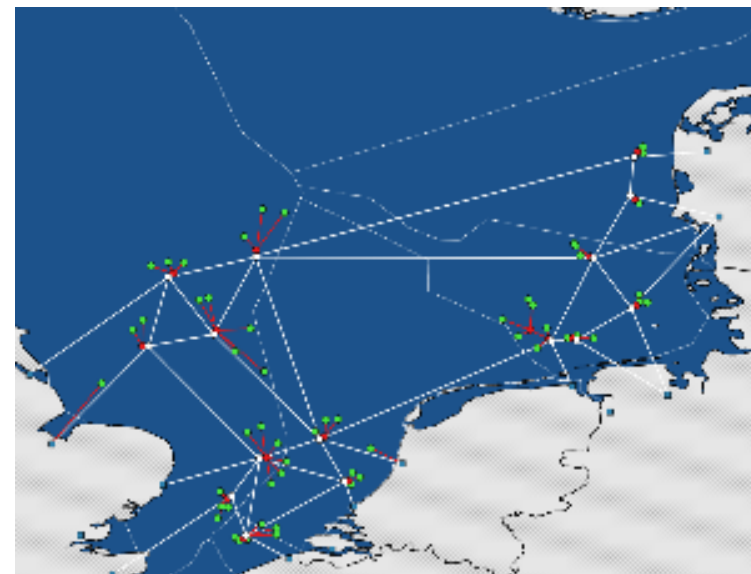
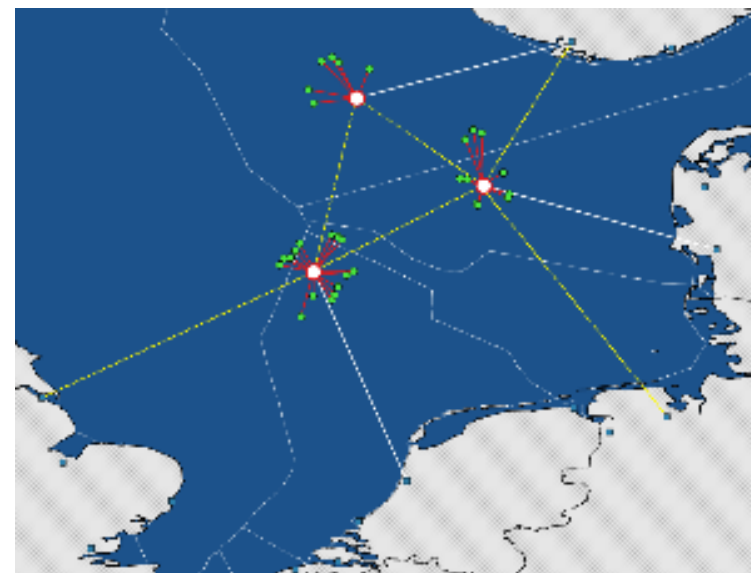
HVDC Grid Protection

Multi-terminal HVDC grids will develop incrementally





?

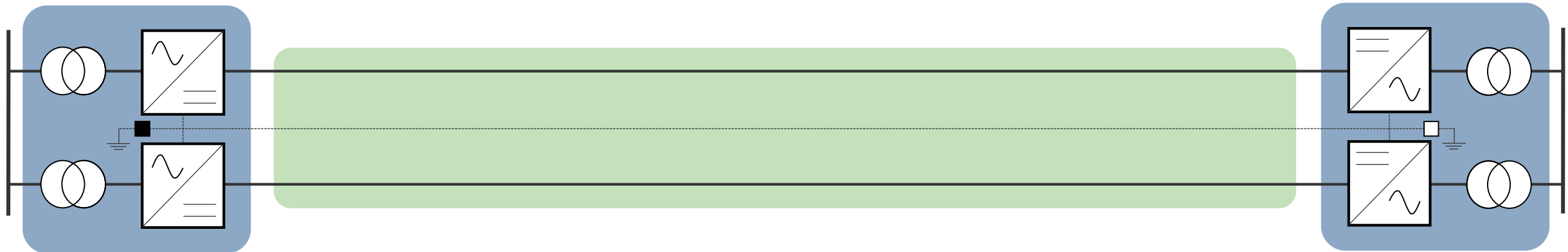


Who integrates the HVDC system?



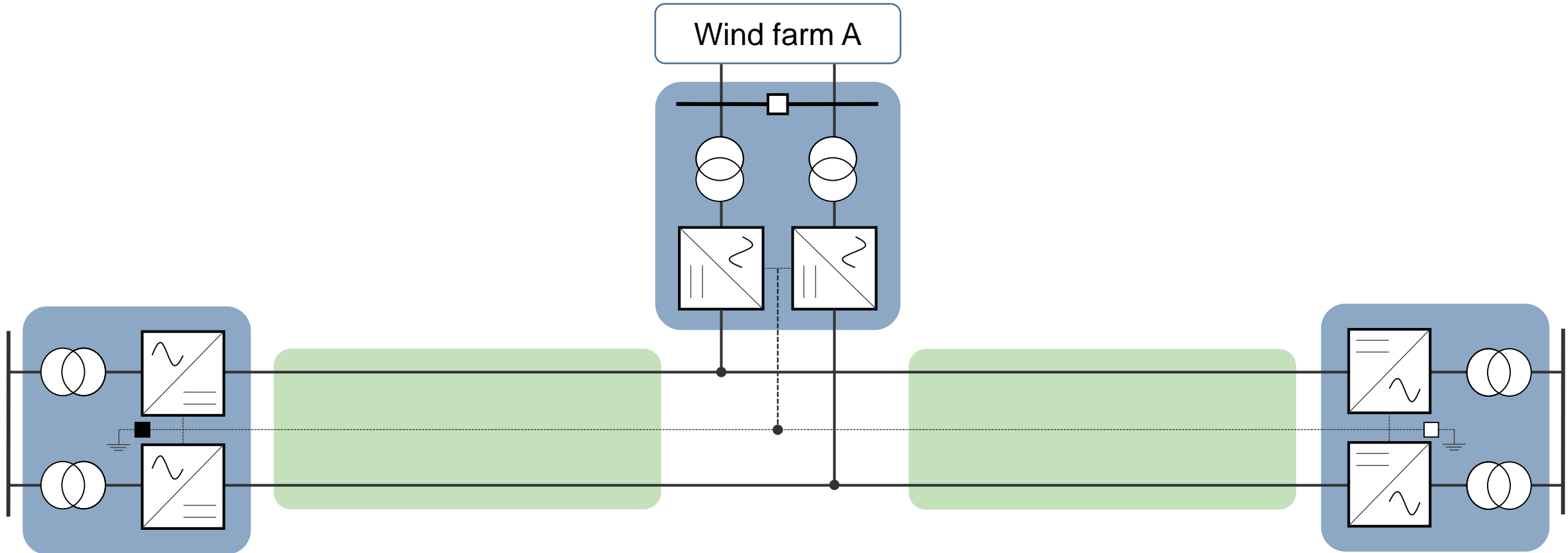
Manufacturer A

Manufacturer B



Manufacturer A

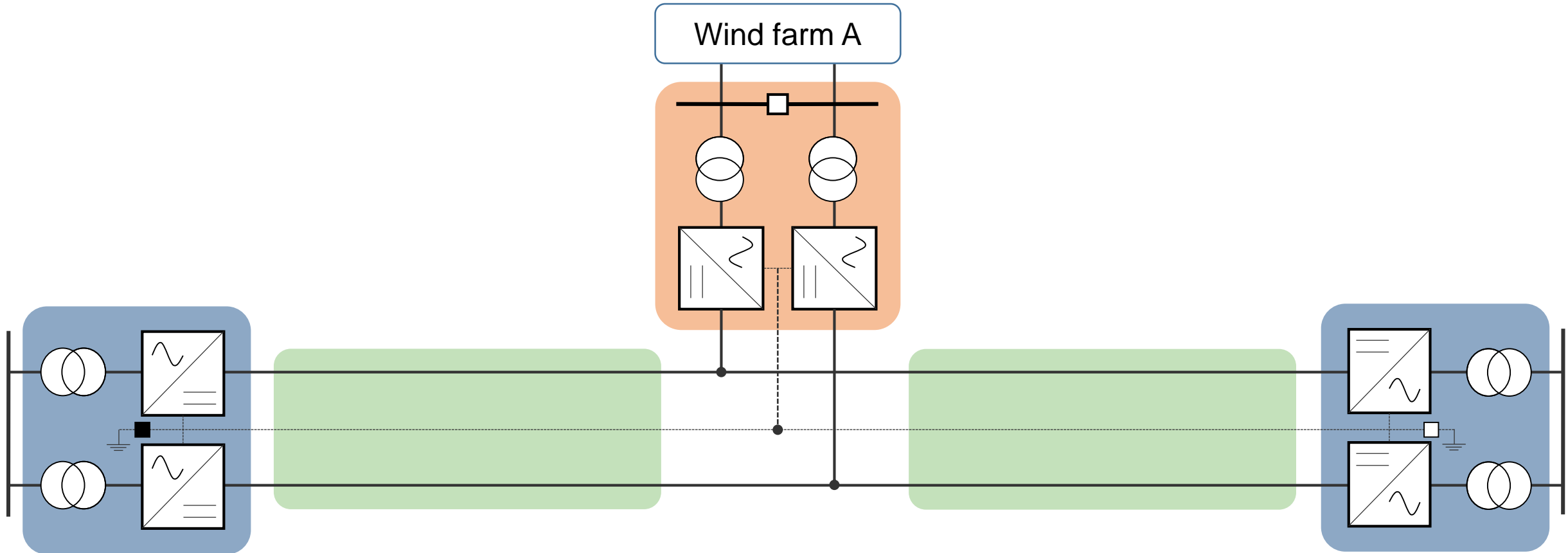
Manufacturer B



Manufacturer A

Manufacturer B

Manufacturer C



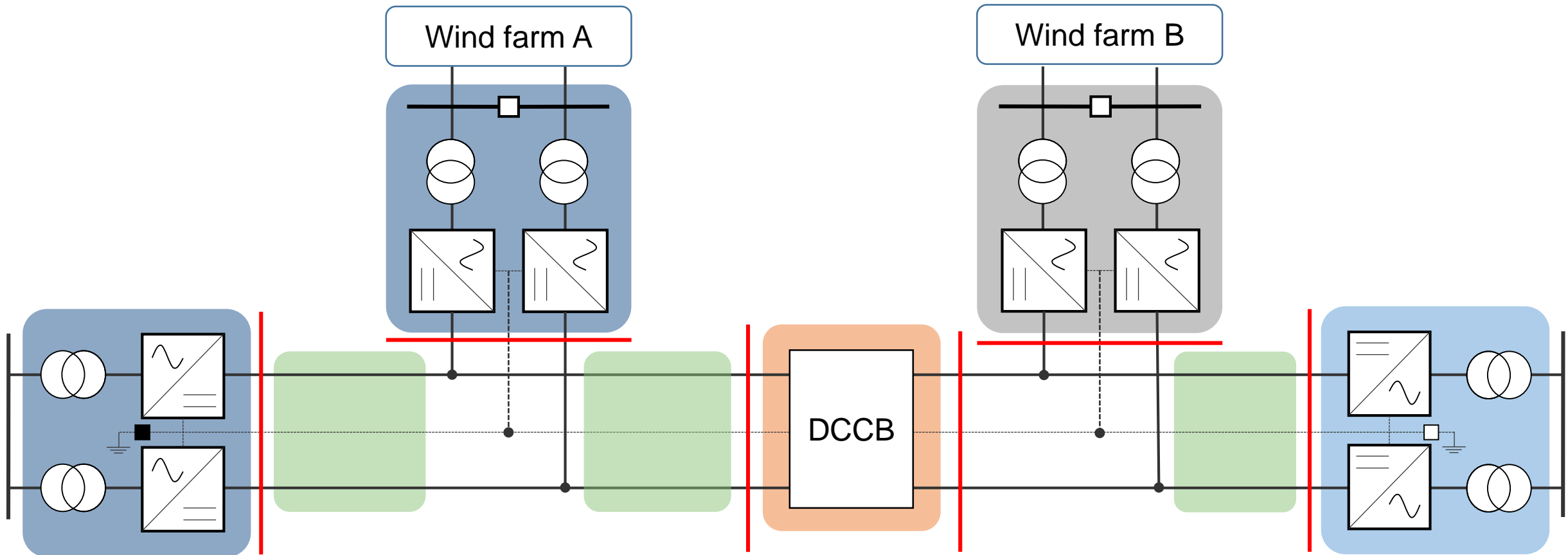
Manufacturer A

Manufacturer B

Manufacturer C

Manufacturer D

Manufacturer E



Need for Standardised Interfaces



Harmonize HVDC system characteristics



Google

Google
Maps

Wikipedia

News

Popul

**This accessory may
not be supported.**

Dismiss

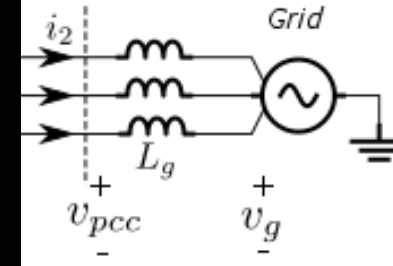
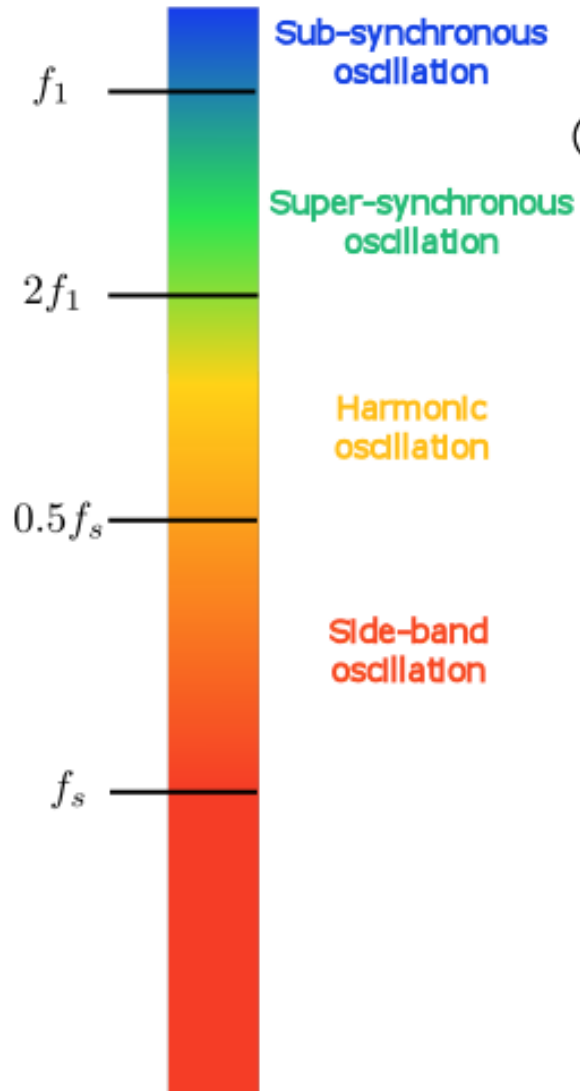


Harmonisation
&
standardisation

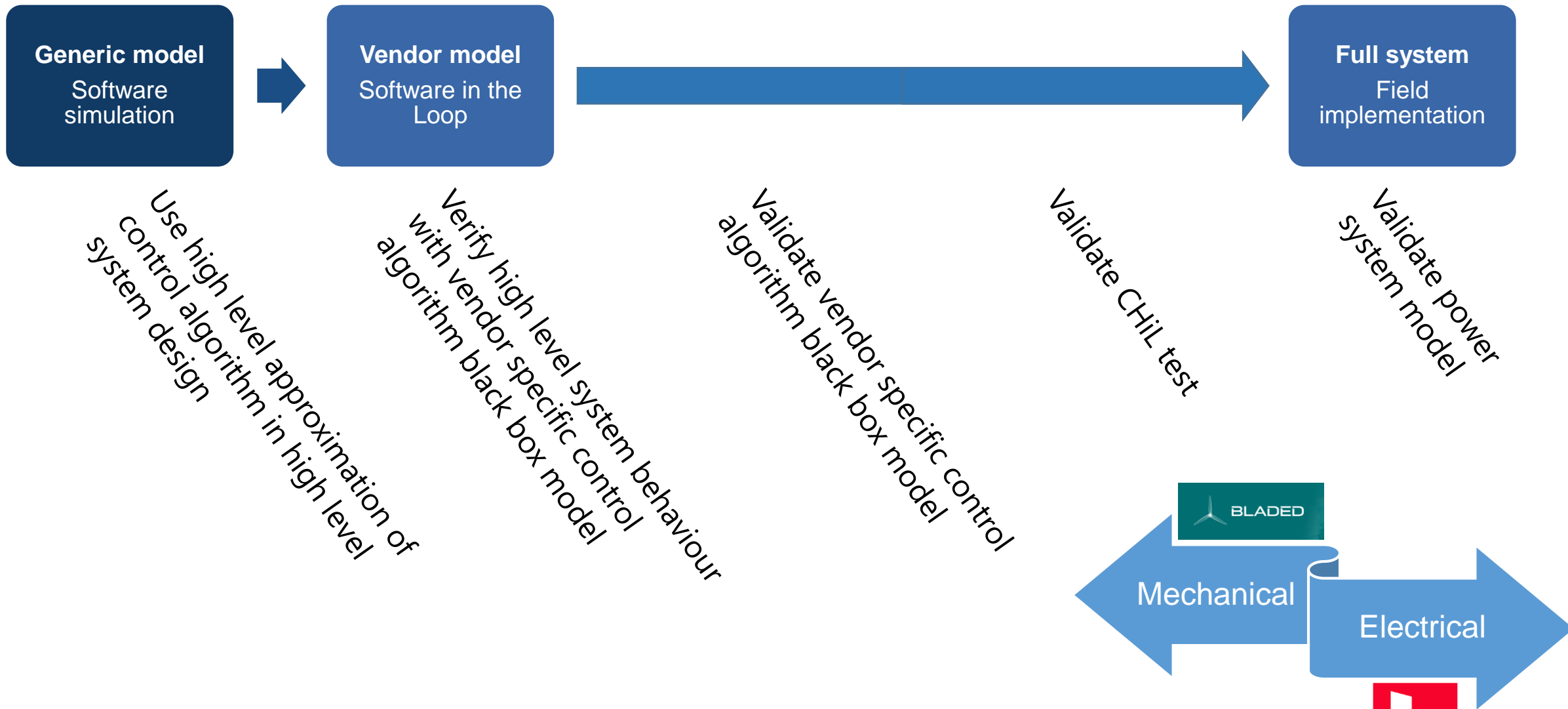


Validate controller models





Unvalidated black-box
(RMS) model



Conclusions

Ingredients for HVDC multi-terminal grids are ready...
...but HVDC system integration remains key challenge:

- Requires change in responsibilities
- Need for further harmonisation & standardisation
- Need for controller model validation





PROMOTioN

PROGRESS ON MESHED HVDC
OFFSHORE TRANSMISSION
NETWORKS

www.promotion-offshore.net/newsletter



© PROMOTioN – Progress on Meshed HVDC Offshore Transmission Networks
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691714.

APPENDIX

DISCLAIMER & PARTNERS

COPYRIGHT

PROMOTioN – Progress on Meshed HVDC Offshore Transmission Networks
MAIL info@promotion-offshore.net WEB www.promotion-offshore.net

The opinions in this presentation are those of the author and do not commit in any way the European Commission

PROJECT COORDINATOR

DNV GL Netherlands B.V.
Utrechtseweg 310, 6812 AR Arnhem, The Netherlands
Tel +31 26 3 56 9111
Web www.dnvgl.com/energy

CONTACT

Cornelis Plet

cornelis.plet@dnvgl.com
+31 6 115 240 83

PARTNERS

DNV GL Netherlands B.V., ABB AB, KU Leuven, KTH Royal Institute of Technology, EirGrid plc, SuperGrid Institute, Deutsche WindGuard GmbH, Mitsubishi Electric Europe B.V., Affärsverket Svenska kraftnät, Alstom Grid UK Ltd (Trading as GE Grid Solutions), University of Aberdeen, Réseau de Transport d'Électricité, Technische Universiteit Delft, Statoil ASA, TenneT TSO B.V., Stiftung OFFSHORE-WINDENERGIE, Siemens AG, Danmarks Tekniske Universitet, Rheinisch-Westfälische Technische Hochschule Aachen, Universitat Politècnica de València, SCiBreak AB, Forschungsgemeinschaft für Elektrische Anlagen und Stromwirtschaft e.V., Ørsted Wind Power A/S, The Carbon Trust, Tractebel Engineering S.A., European University Institute, Iberdrola Renovables Energía, S.A., European Association of the Electricity Transmission & Distribution Equipment and Services Industry, University of Strathclyde, ADWEN Offshore, S.L., Prysmian, Rijksuniversiteit Groningen, MHI Vestas Offshore Wind AS, Energinet.dk, Scottish Hydro Electric Transmission plc, SCiBreak AB

