

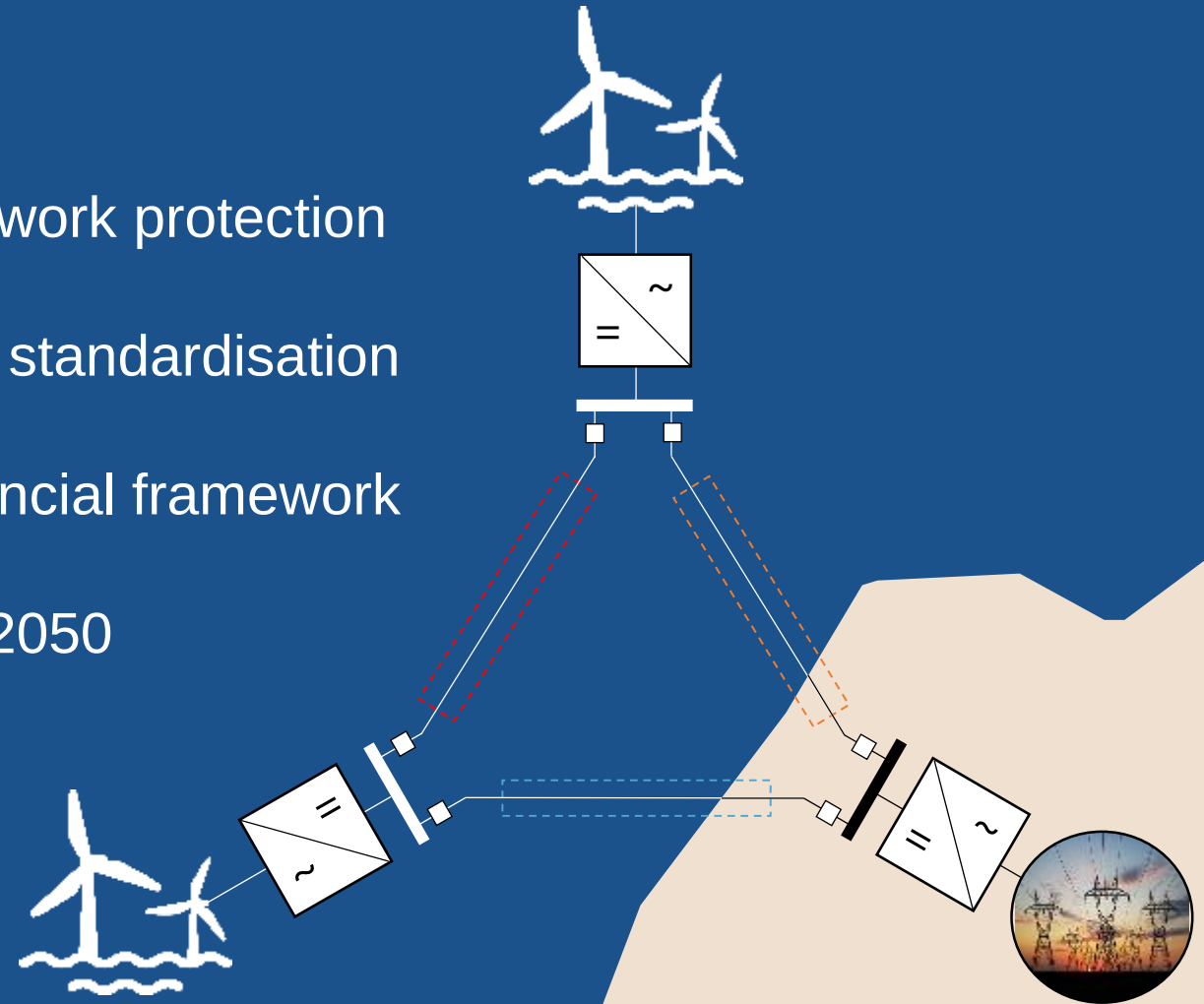
System Integration of Offshore Wind

24th of September 2019 | Amsterdam | Cornelis Plet (DNV GL)

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

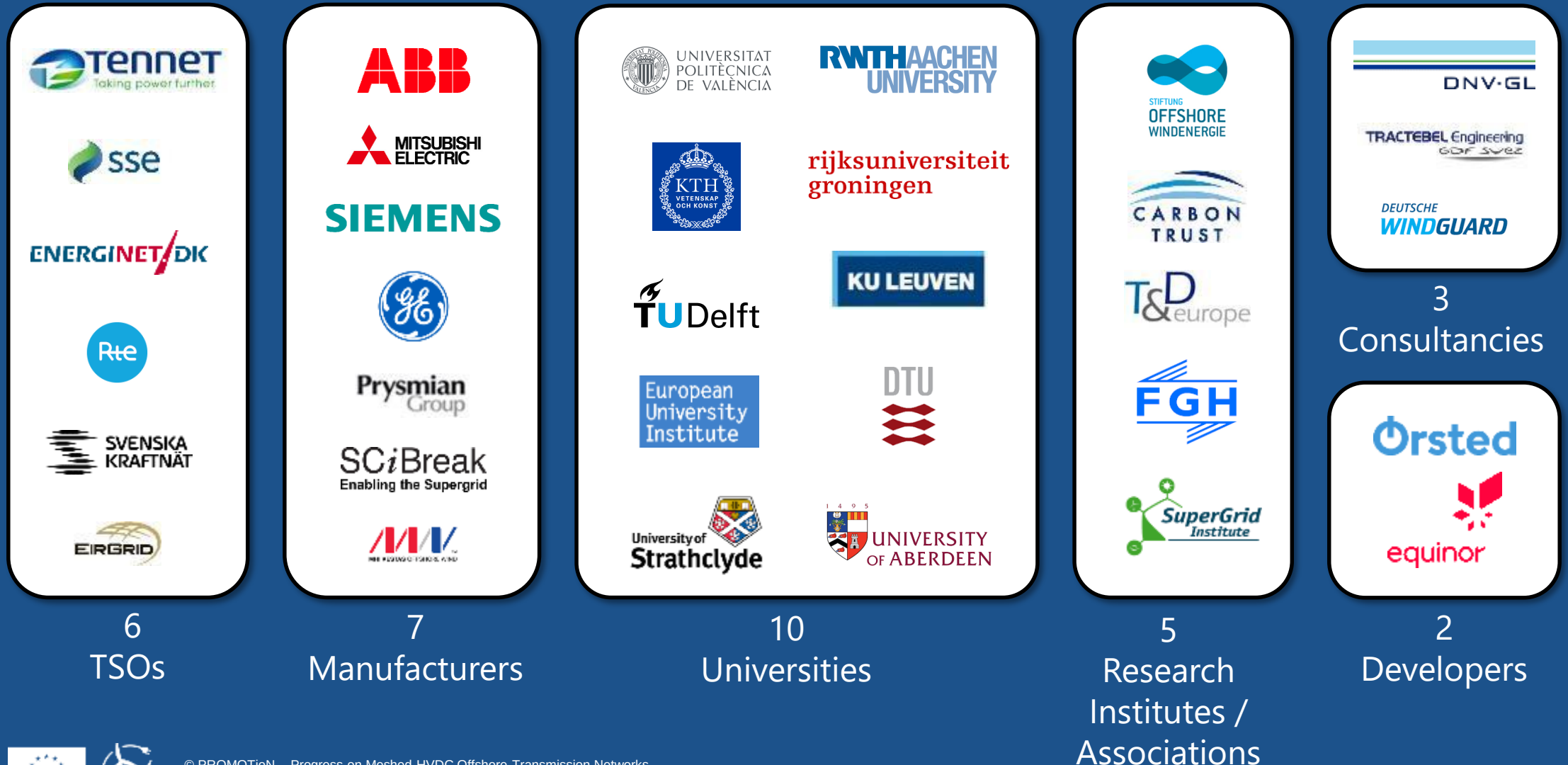


4,5 years



42 million EUR

The Partners – Covering the Offshore Grid Value Chain



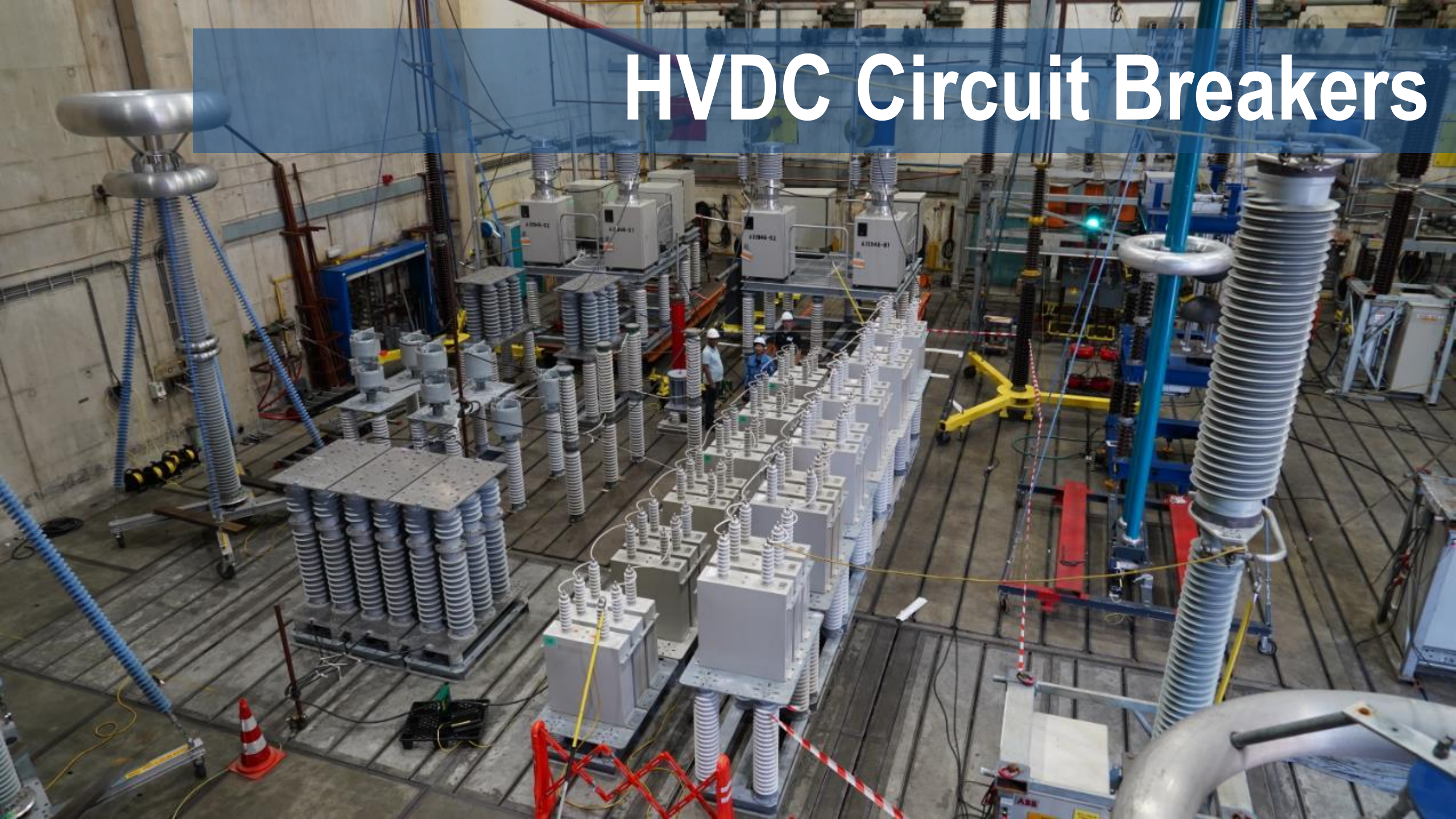
Where are we now?



Meshed HVDC grid technology is here today

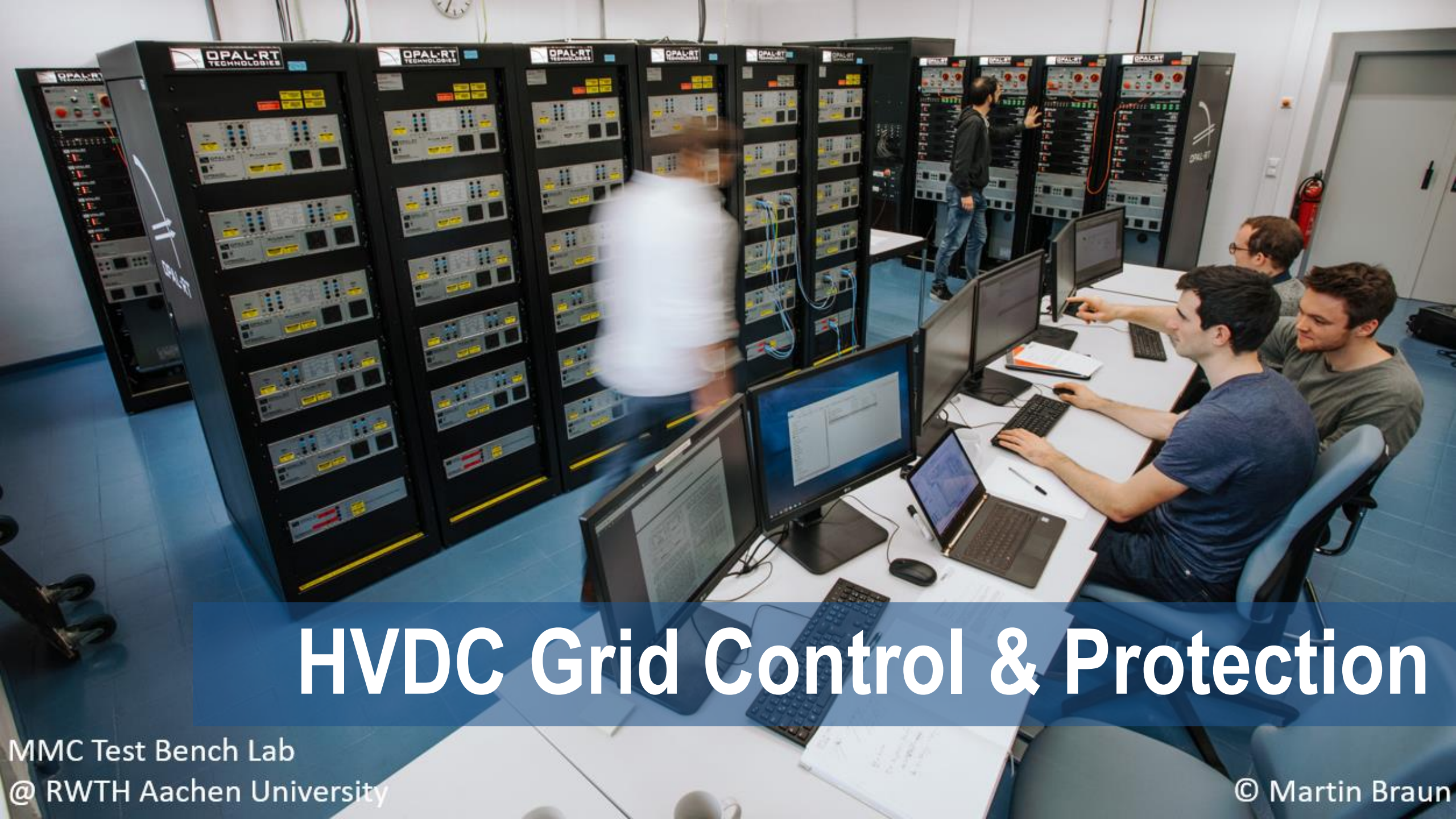


HVDC Circuit Breakers



HVDC Gas Insulated Systems





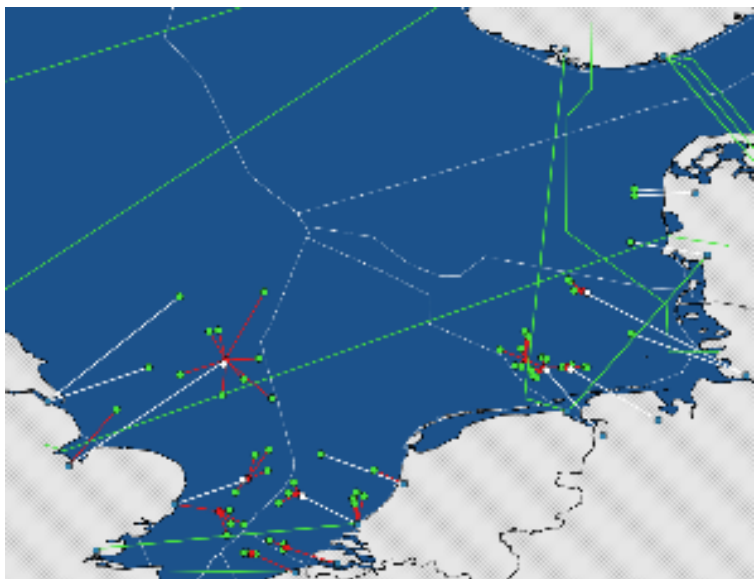
HVDC Grid Control & Protection

MMC Test Bench Lab
@ RWTH Aachen University

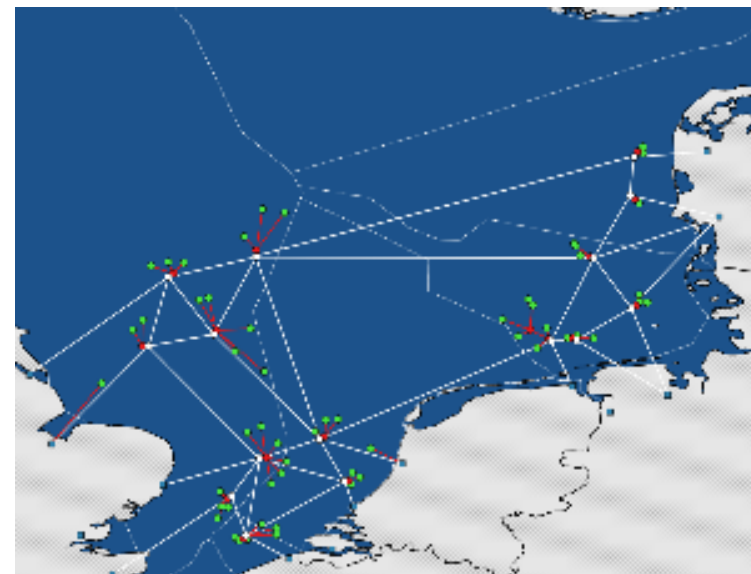
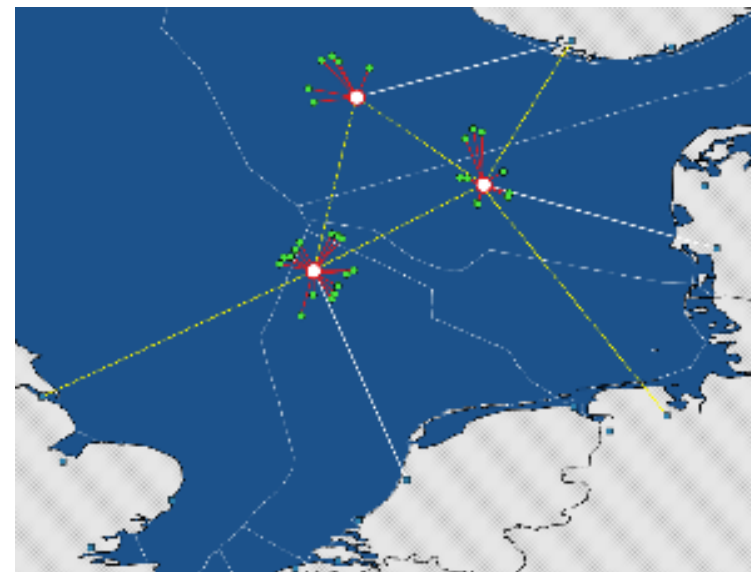
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Multi-terminal (meshed) HVDC grids will develop incrementally





?

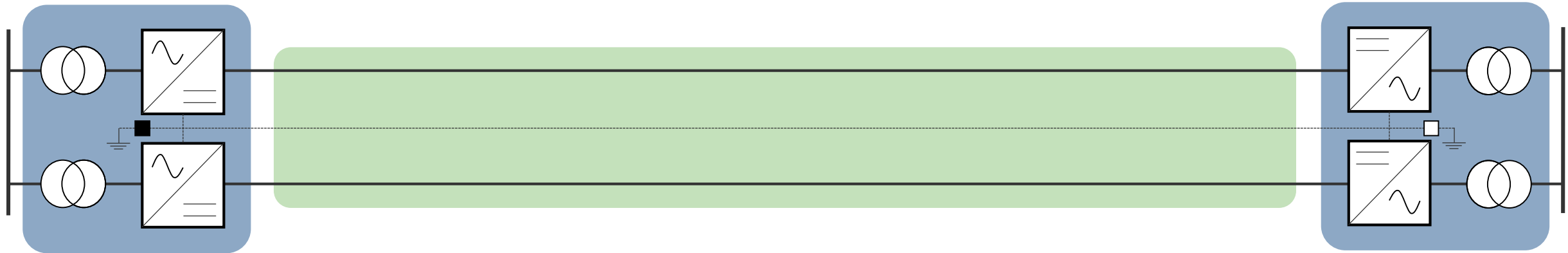


Who integrates the system?



Manufacturer A

Manufacturer B

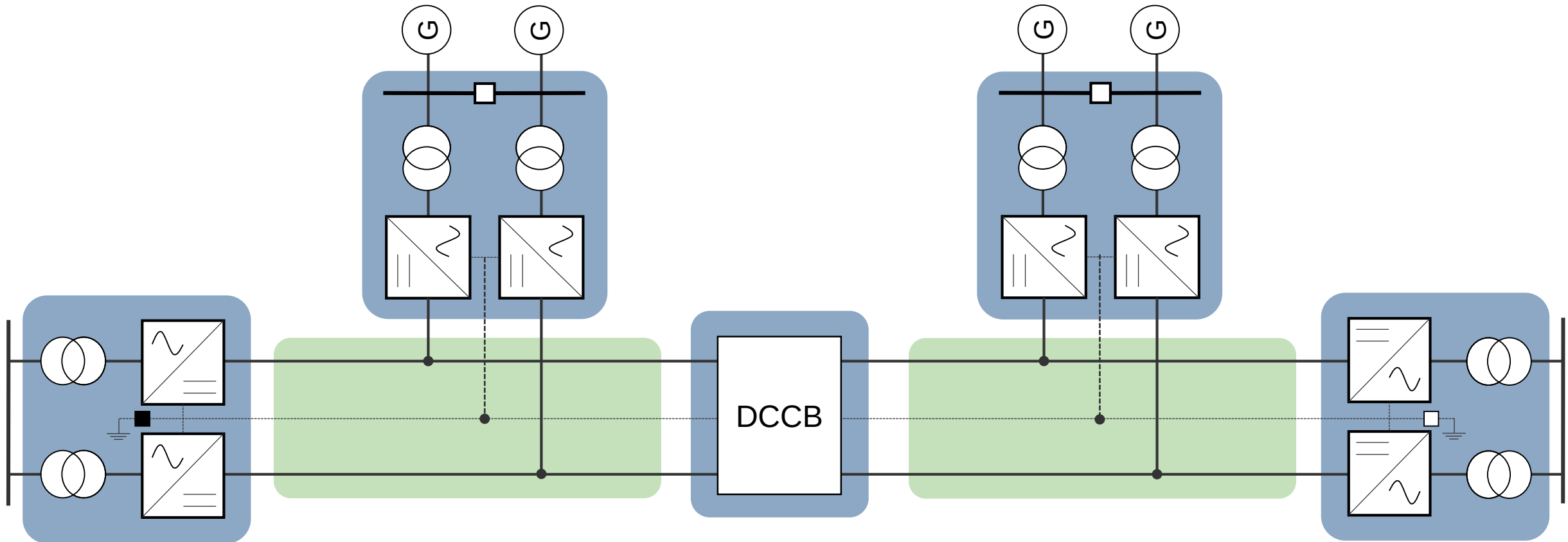


Today



Manufacturer A

Manufacturer B



Today



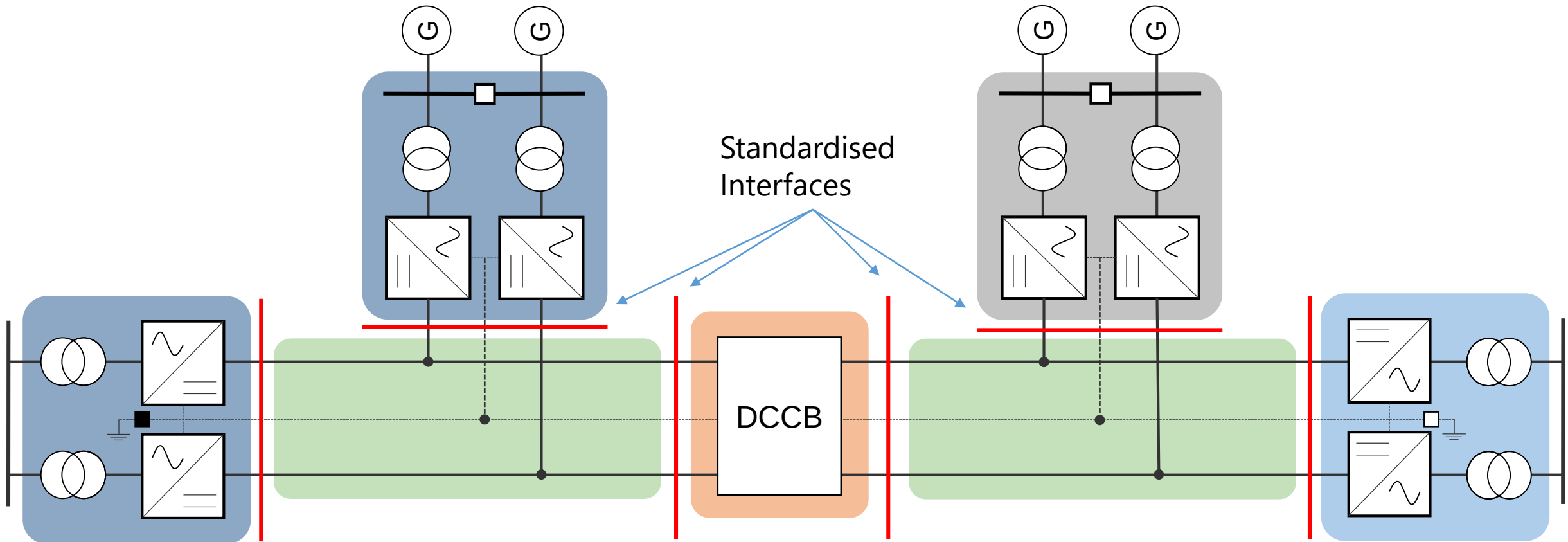
Manufacturer A

Manufacturer B

Manufacturer C

Manufacturer D

Manufacturer E



Tomorrow?



Standardisation of HVDC system characteristics is key



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Google
Maps

Wikipedia

News

Popul

**This accessory may
not be supported.**

Dismiss

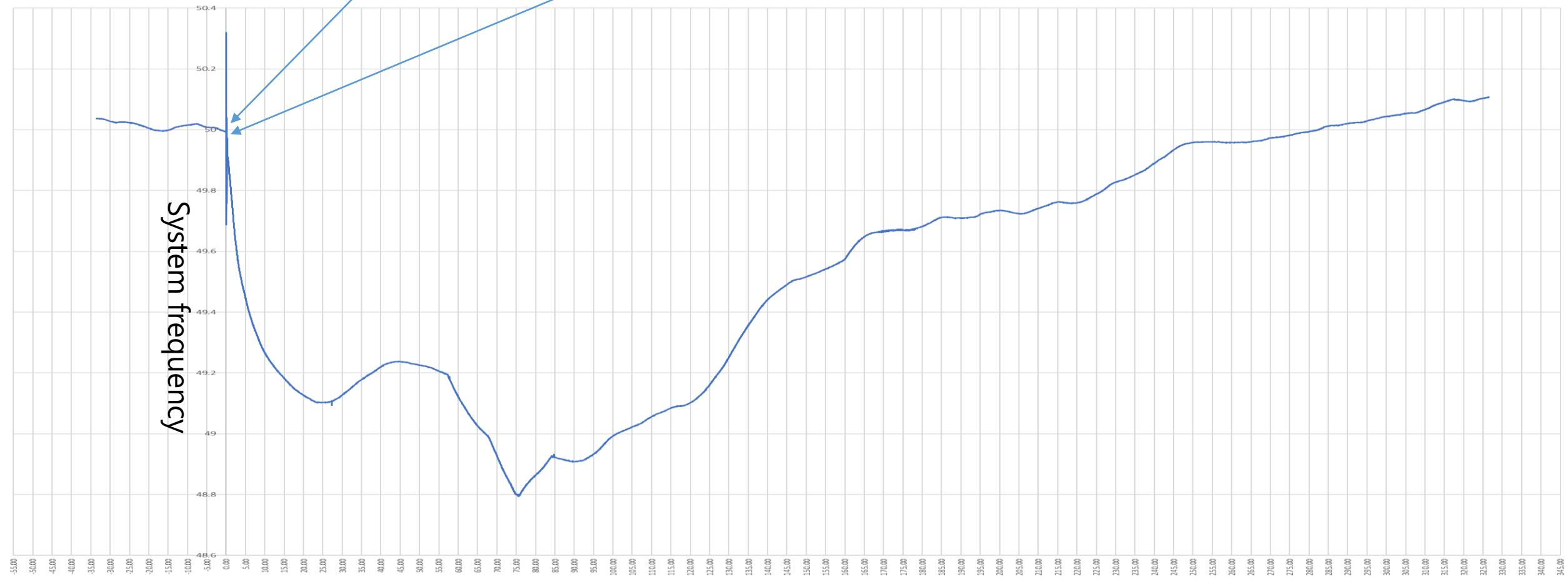


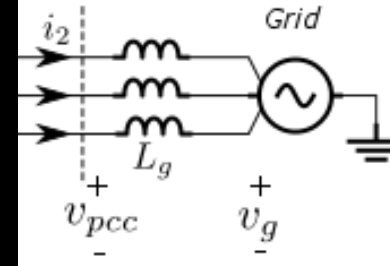
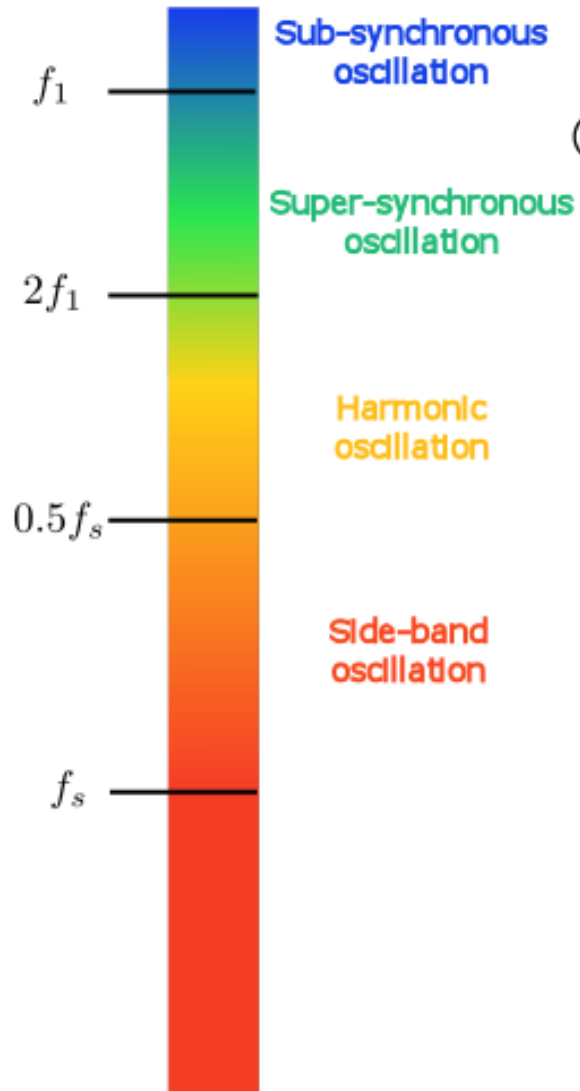
Need for controller model verification & validation



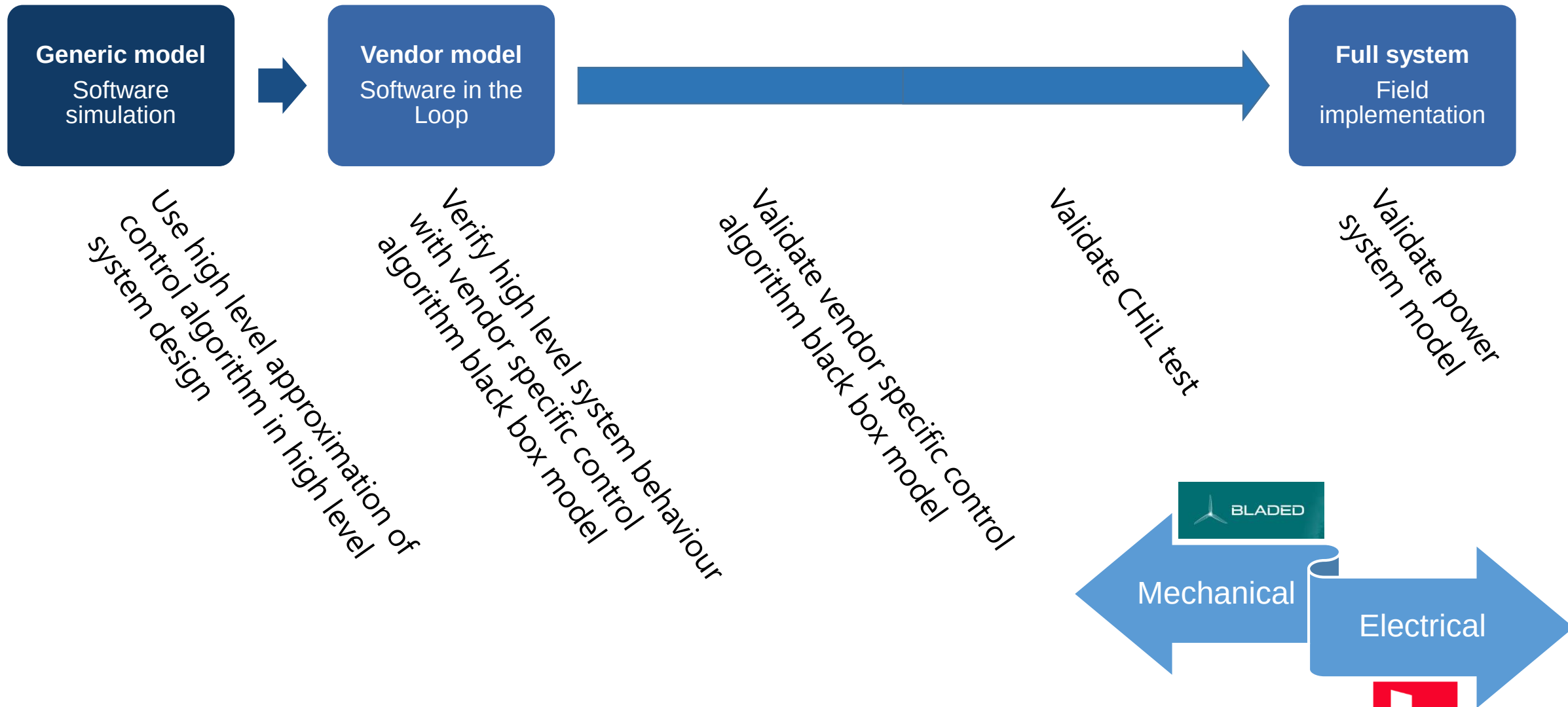
Lightning strike Wind farm trip

System frequency



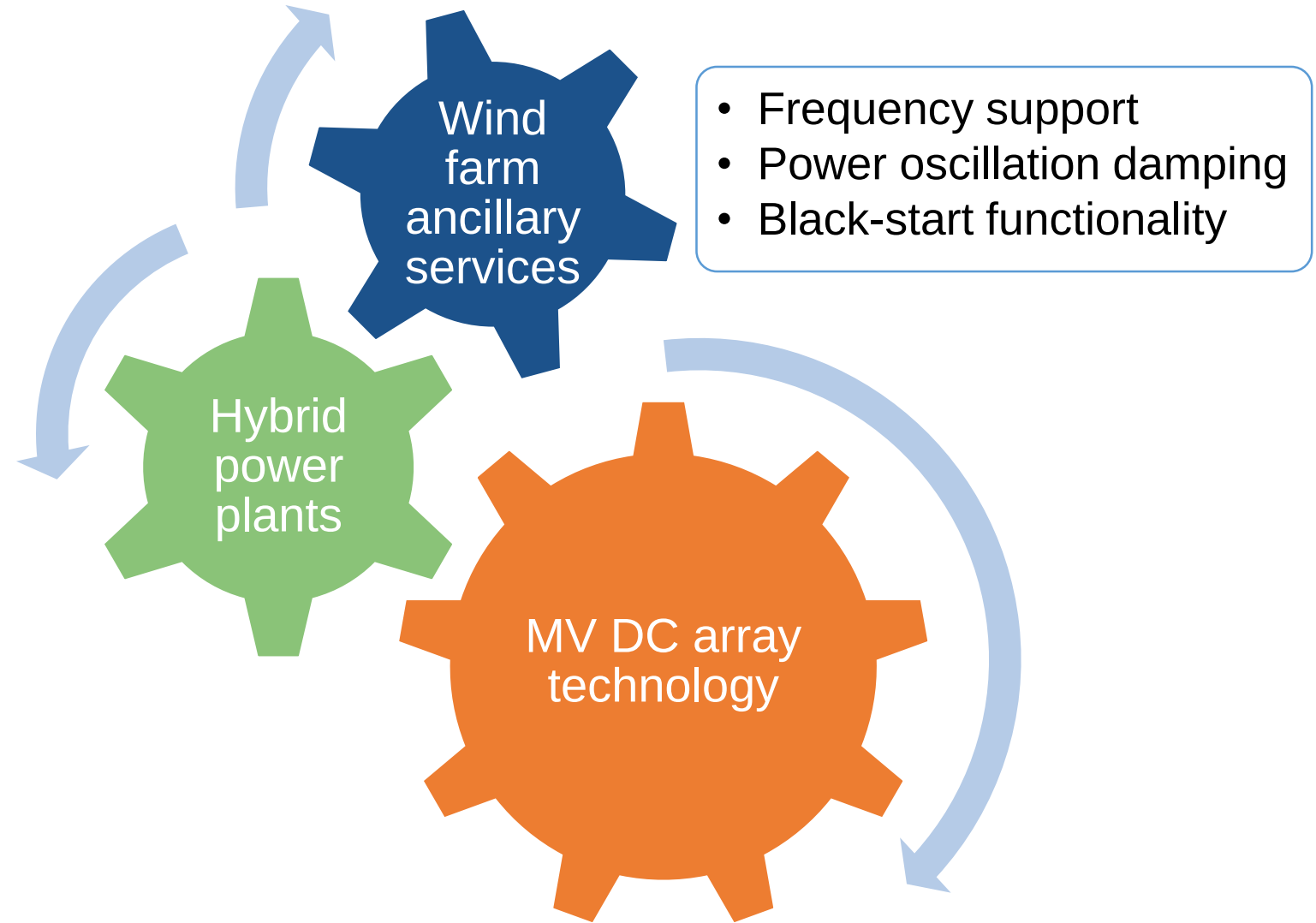


Unvalidated black-box
RMS model



What next?





Conclusion



Conclusions

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

- Requires change in responsibilities
- Need further standardisation
- Need for sufficiently detailed validated high-fidelity models
- Requires novel validation & verification methods





PROMOTioN

PROGRESS ON MESHED HVDC
OFFSHORE TRANSMISSION
NETWORKS

www.promotion-offshore-net/newsletter



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APPENDIX

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

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