



RTDS SIMULATION AND AQUILA INTEROPERABILITY PROJECT

DONG CHEN

THE NATIONAL HVDC CENTRE, UNITED KINGDOM



WHO ARE WE?



- Part of Scottish Hydro Electric Transmission.
- Working together with Scottish Power Transmission, National Grid Electricity Transmission, and the Electricity System Operator (ESO) in GB Power System.
- Hosts detailed models and control/protection hardware from TOs/ESO.
- Undertake specialist studies to support the deployment of HVDC projects.
- Business in Great Britain and overseas.



ABB



Caithness



Moray



Shetland



PROJECT AQUILA

Context:

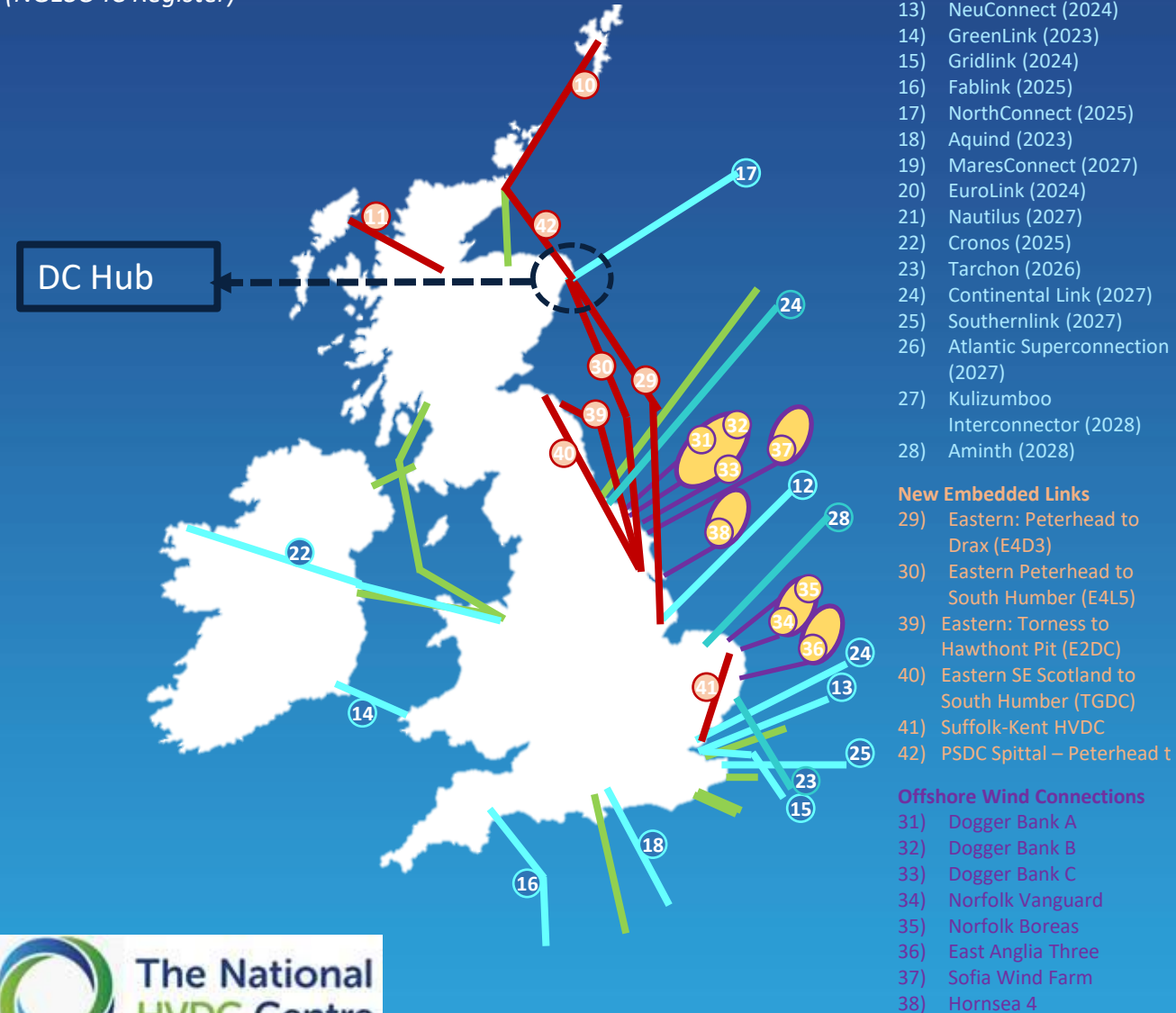
- Utilize massive wind power
- Offshore Multi-Vendor-Multi-Terminal (MVMT) DC network
- DC switching station

Objectives of Aquila Interoperability:

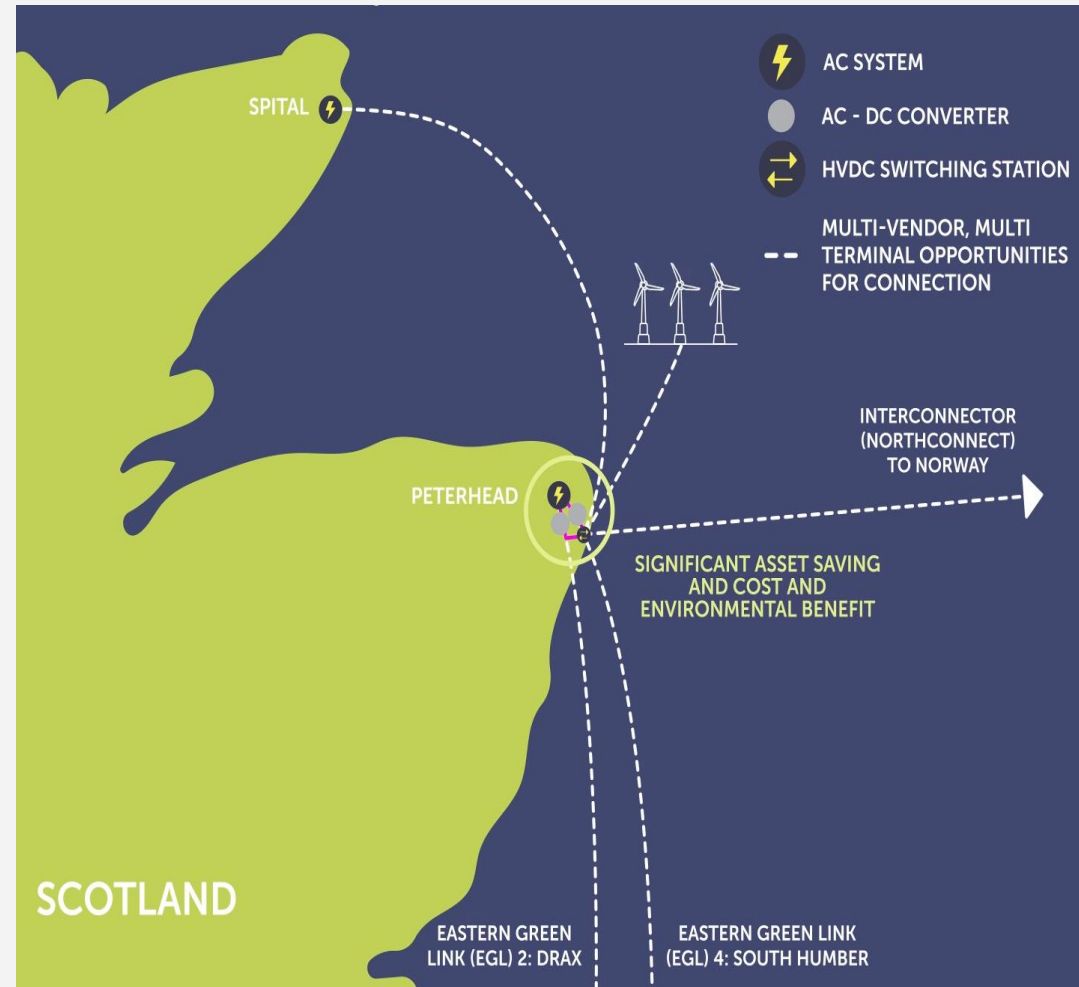
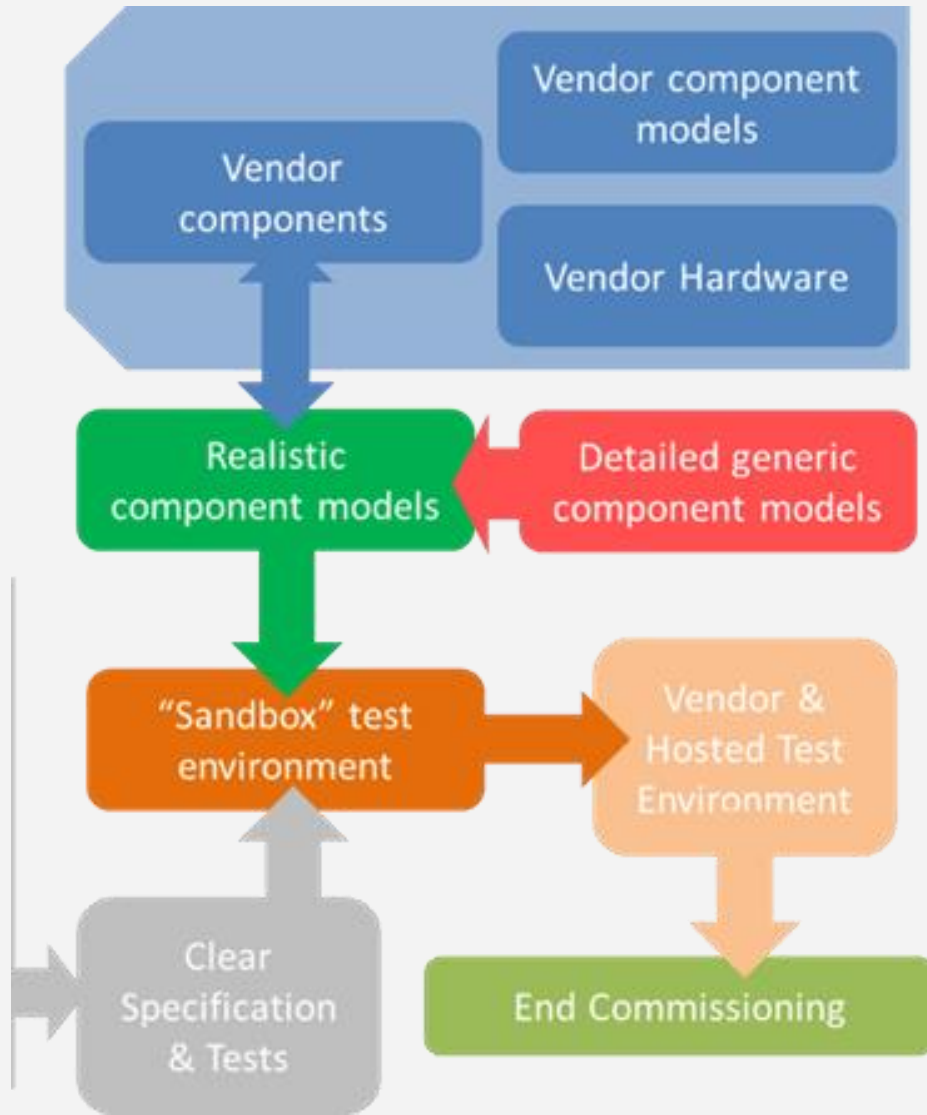
- Component model in RTDS
- De-risk supply chain of HVDC
- Proof of interoperability concept
- Leading to offshore grid code and TSO specifications

Future HVDC in GB

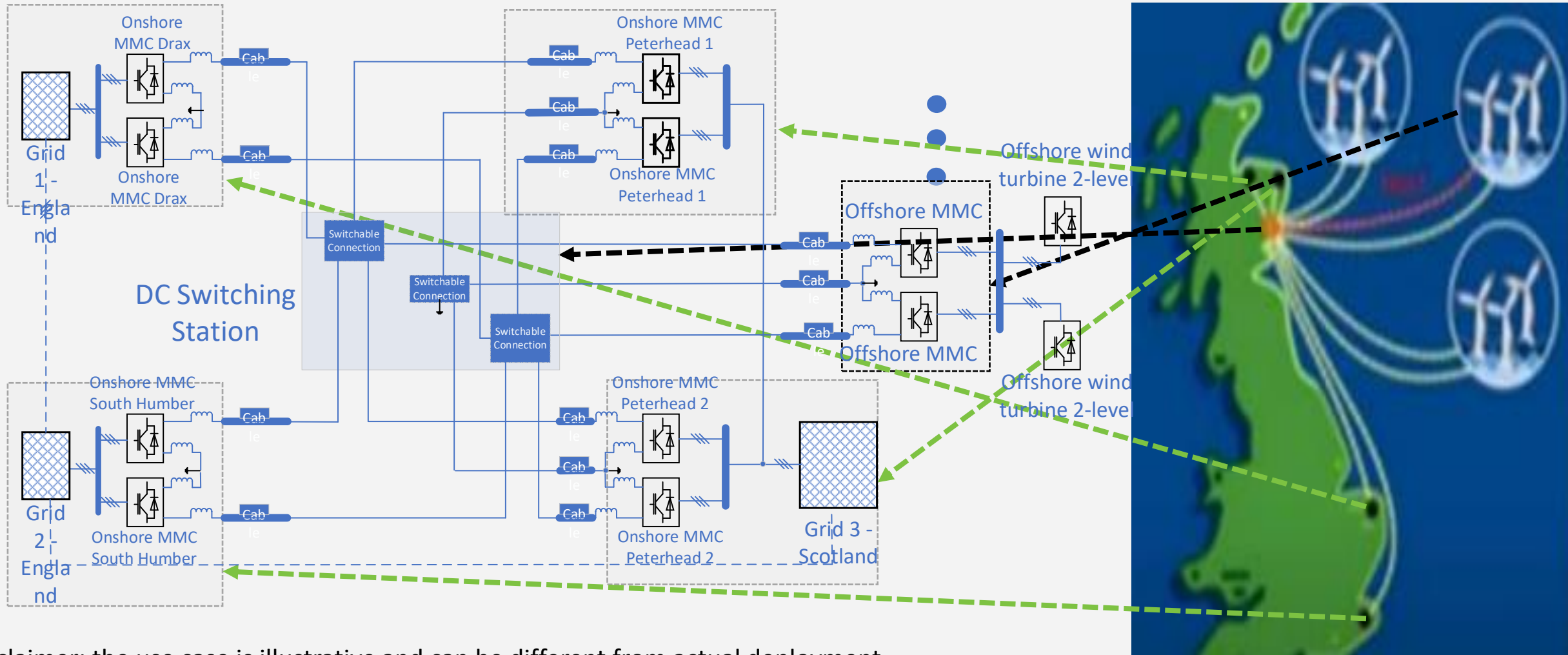
40 GW of new connection offers (2031)
(NGESO IC Register)



FUNCTIONAL DESIGN

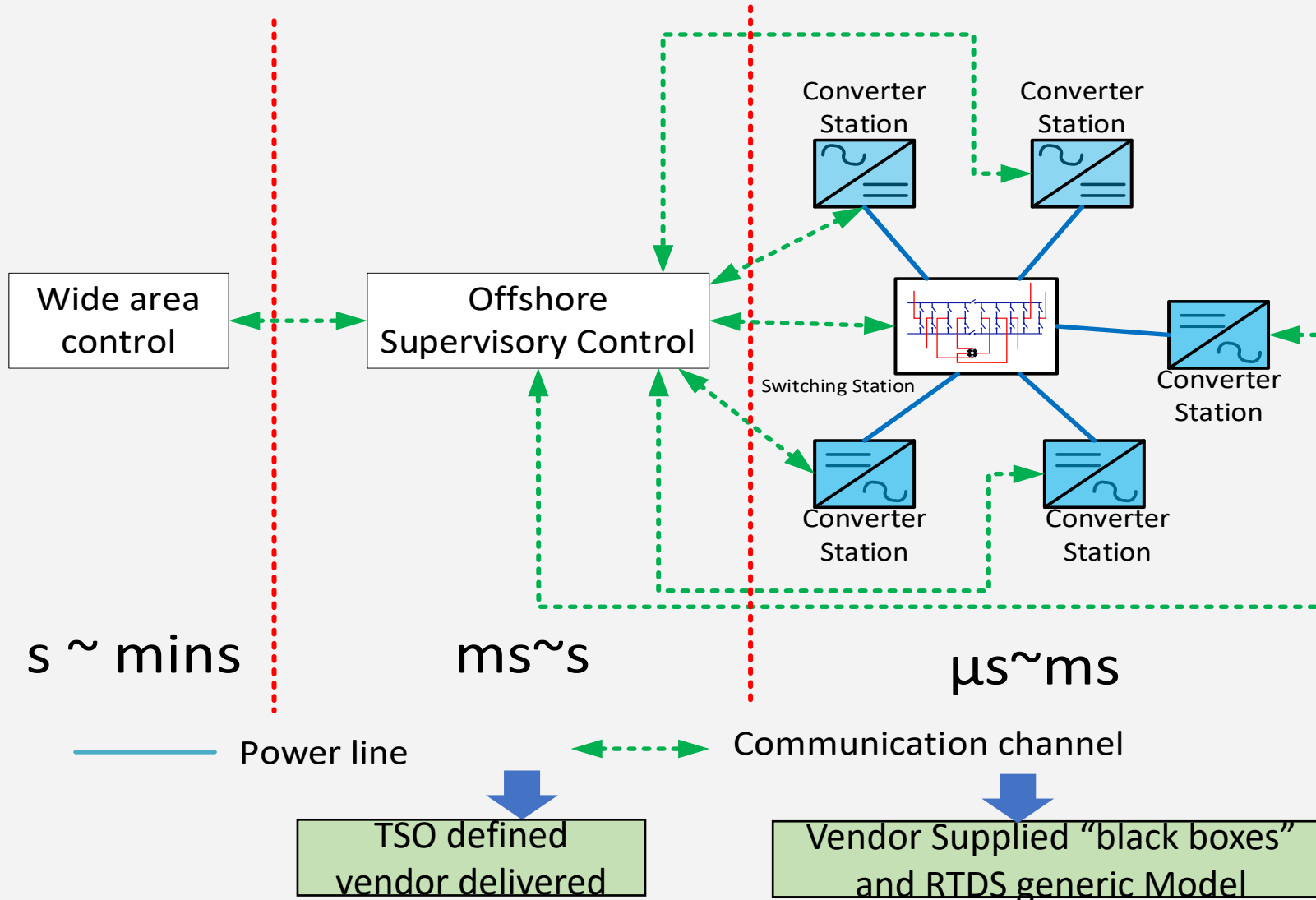


ILLUSTRATIVE SCHEMATIC OF HVDC GRID



Disclaimer: the use case is illustrative and can be different from actual deployment.

DC GRID CONTROL STRUCTURE - OVERVIEW



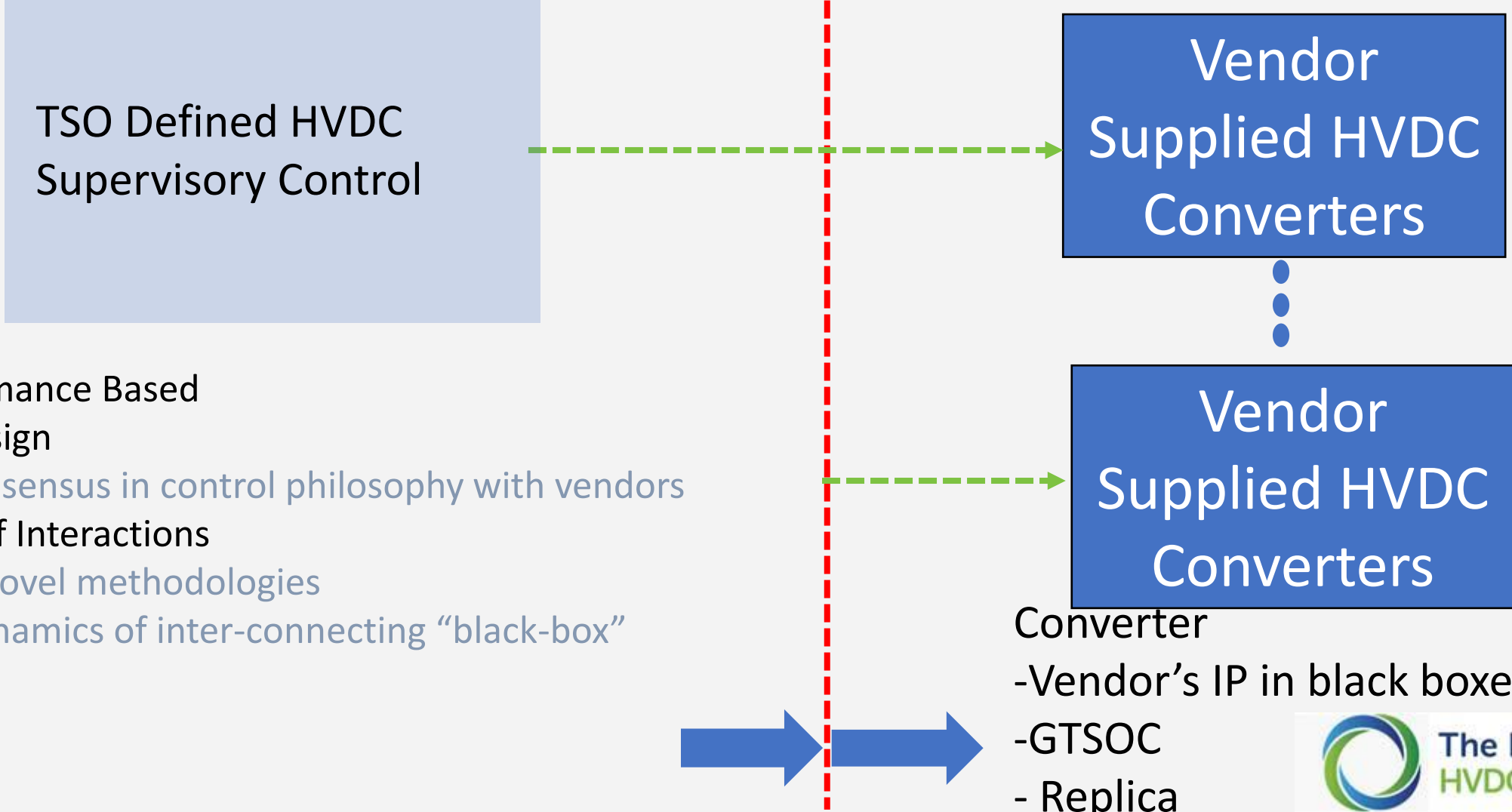
- ✓ Converter Control ($\mu\text{s} \sim \text{ms}$):
 - operate based on local measurements
 - respond to supervisory (Multi-terminal) control
 - sustainable when communications are lost
- ✓ Multi-Terminal Control ($\text{ms} \sim \text{s}$):
 - monitor
 - assess
 - optimize

The DC Grid should be sustainable and stable when

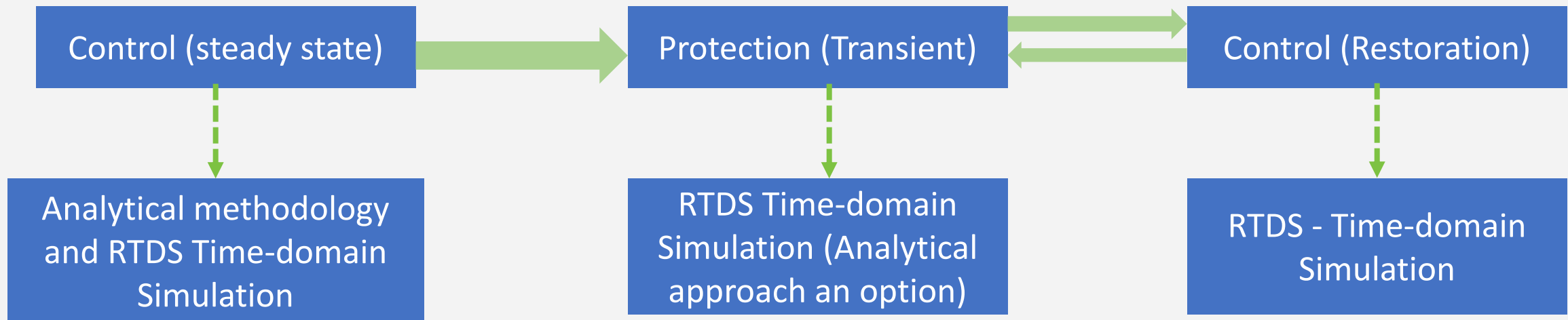
1. any number of communication channels are lost
2. any one power line/DC terminal is lost



ENABLING INTERPRETABILITY OF MULTI-TERMINAL-MULTI-VENDOR HVDC



OVERVIEW OF FUNCTIONAL DESIGN AND TEST

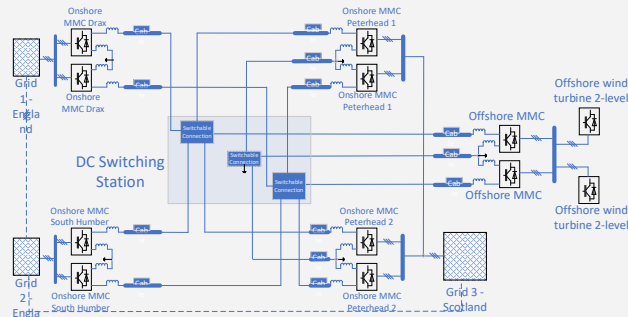


SIMULATION TEST OF AN MTMV-HVDC NETWORK

Modelling



Upload model



Operate

Swap generic model with vendor supplied black-boxes in real-time co-simulation

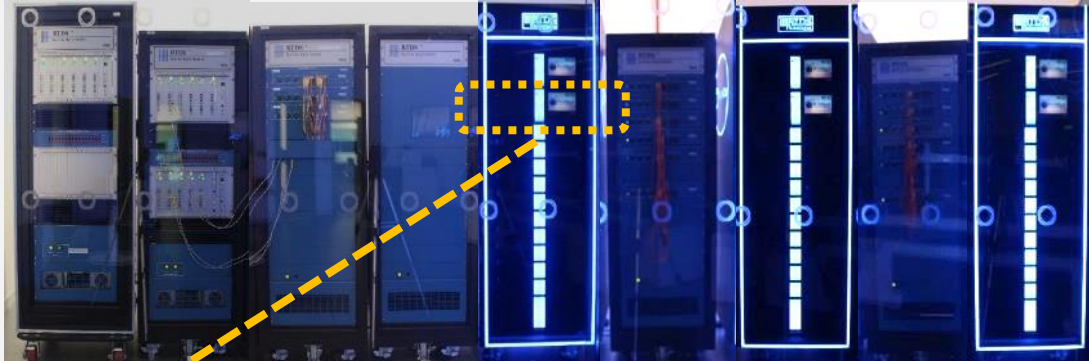


offline analytical assessment

Verify

Informing technical specifications of MVMT-HVDC (Aquila) project

Monitor and Analysis



Computing the model for 100,000 ~1000,000 times per second...



Thanks for listening.

Any questions, please?

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□ For further information, please visit www.hvdccentre.com ; OR email: info@hvdccentre.com



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HVDC Centre**

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