Aquila Lite

Unlocking full power of interoperable HVDC networks

Energy Innovation Summit

November 2025

The National HVDC Centre

Scottish & Southern Electricity Networks TRANSMISSION

Presenters

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Project Overview - NIA Funded Project

Evaluating a new method for achieving reliable multi-vendor interoperability by:

WP 1 - Multi-Vendor Multi-Terminal (MVMT) Interoperability development:

- Generic modelling, generic specification and control development
- Vendor and TSO engagement, review and critique of approach
- Demonstration, and patent protection of interoperability methods to control and monitor performance
- Virtual replicas delivered from vendor to prove interoperability with generic models

WP 2 - Commercial Readiness

- Gap analysis
- Liabilities between different parties
- JV Interactions with other TOs connected to the system and legal implications

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Problem Statement – Multi-Vendor Interoperability

Lack of Interoperability:

- Current industry solutions do not support seamless integration across multiple vendors.

Vendor Lock-In Risk:

- Heavy reliance on a single vendor creates dependency and limits flexibility.

Negative Market Impact:

- Reduced competition
- Potential for monopolistic practices
- Slower pace of innovation

Operational Vulnerability:

- Increased risk of service disruptions due to single-vendor dependency.

Industry Need: Development of an interoperable framework to:

- Enable multi-vendor integration
- Enhance competition and innovation
- Improve reliability and resilience
- Reduce risks associated with vendor lock-in

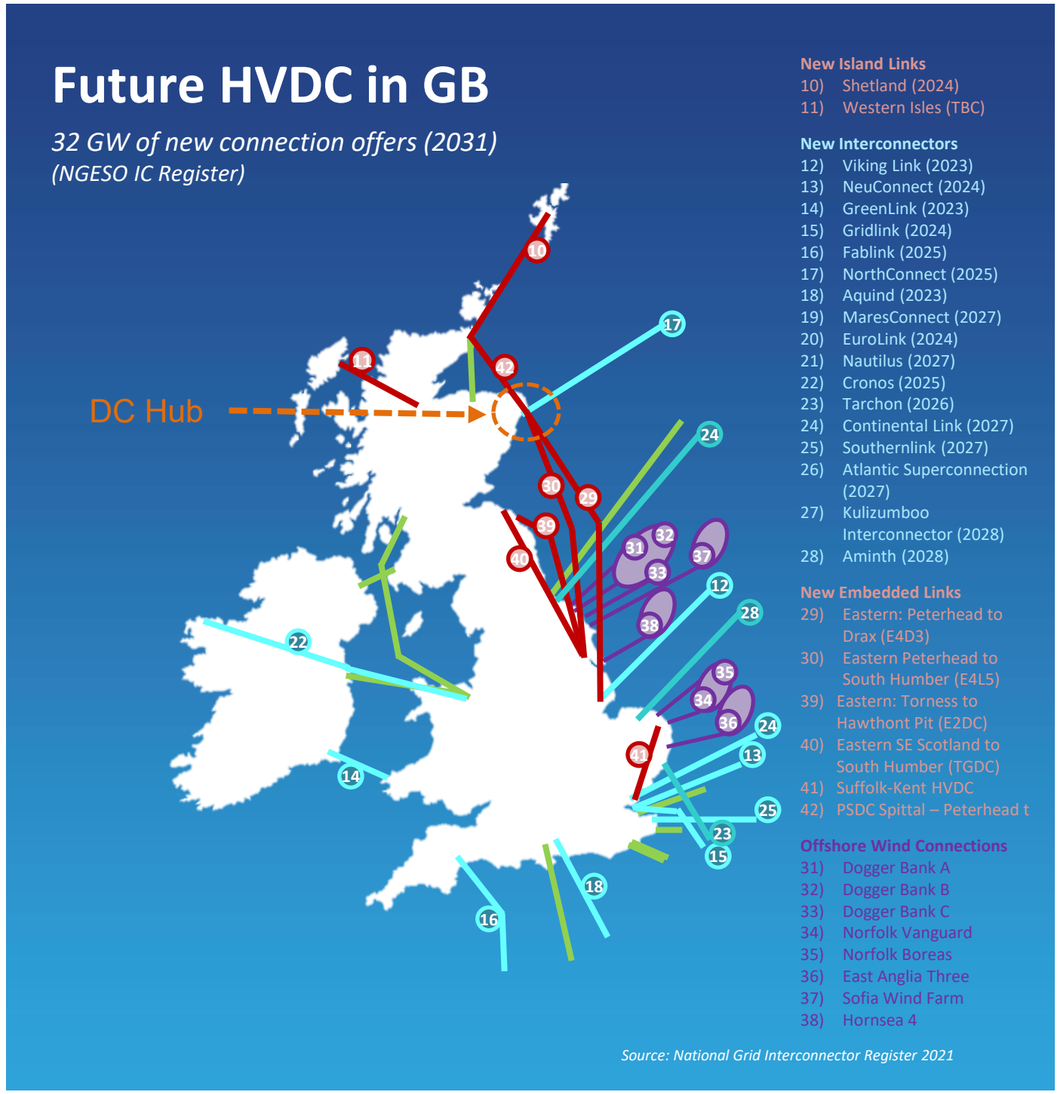
Aquila Background

Context

- “Net-zero” with Offshore wind power
- Multi-Terminal HVDC network
- De-risk supply chain → Multi-Vendor

Objective

- De-risk development and operation
- Interoperability with control interactions
- Tender spec and grid code
- Simulate benchmark



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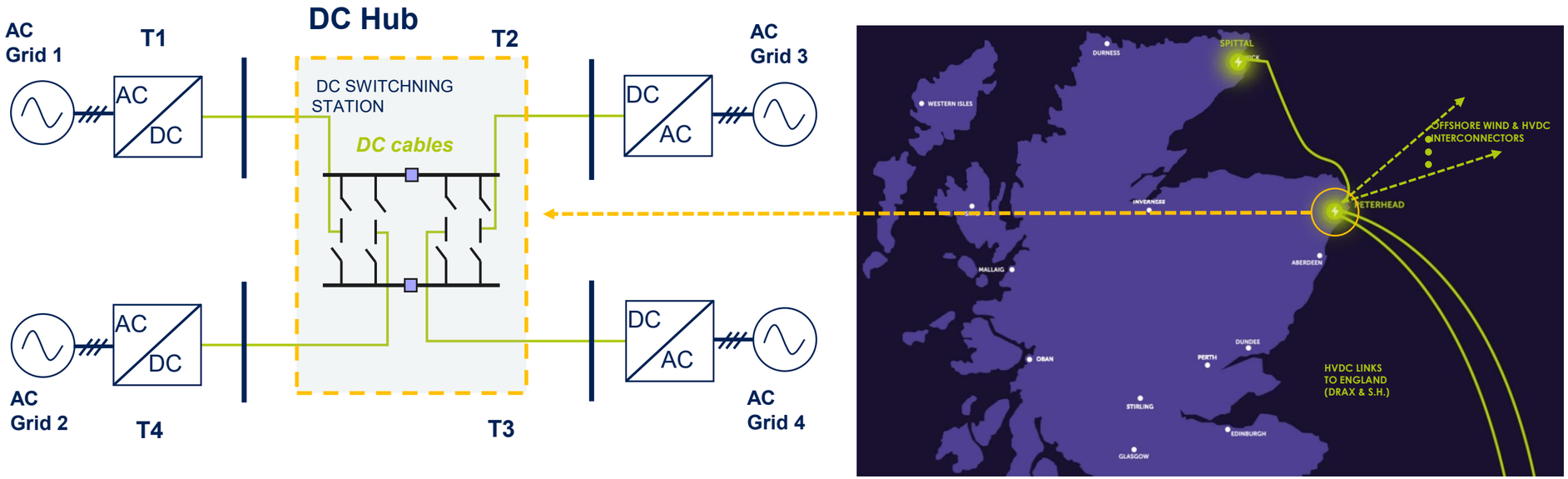
WP1 - DC Hub – Safe to Fail



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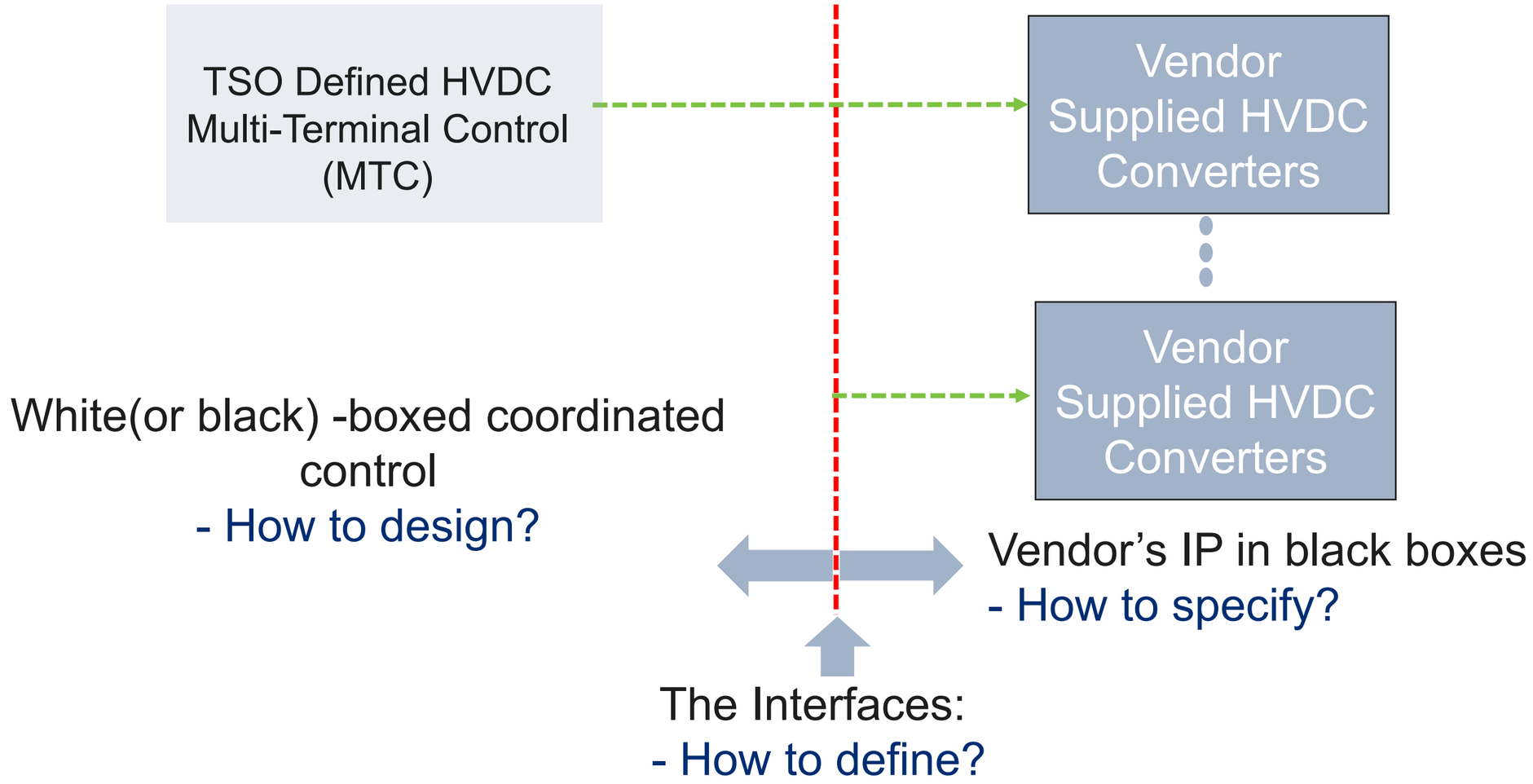
1st Questions to Answer towards HVDC Interoperability



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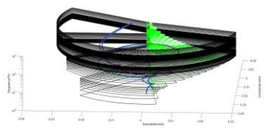
Example of Converter Specification

- to prevent undesirable interactions between converters

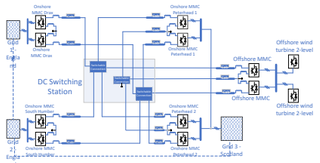


Compliance test by measurements with each standalone equipment (converter)

Test Procedure of Aquila Project

Modelling

Upload



1st Public MV Live Demo in Mar 2025, Birmingham (IET AC/DC 2025) with reps of GEV and MELCO

Operate

Monitor and Analysis

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

Swap benchmark control with vendor's control solution

Inform Eng Team of Specification Methodologies

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WP2 - Commercial Readiness Summary

Objective

Robust Framework Development

- Develop a commercial and legal framework supporting interoperable HVDC system implementation with multi-vendor integration.

Stakeholder Alignment

- Align Transmission Owners, vendors, and regulators by defining roles, responsibilities, and performance standards for HVDC systems.

Risk Reduction for Innovation

- Reduce risks in HVDC technology innovation to enable smoother grid transition toward interconnected and flexible energy systems.

Learning from Past Initiatives

- Incorporate lessons from EU-funded projects like PROMOTioN, Ready4DC, and InterOpera to enhance project success.

Key Findings

Contractual Framework Gaps

- Significant gaps exist in contracts regarding vendor interdependence, shifting roles, procurement, and cybersecurity risks.

Warranties and Insurance

- Effective risk management requires vendors to provide warranties and evaluation of insurance feasibility and costs.

Grid Project Interactions

- Standardised frameworks are essential to ensure compatibility and reduce disruptions with existing and future grid projects.

Regulatory Support and Standards

- Regulatory backing and Aquila Lite’s role are key to developing industry standards for interoperable HVDC systems.

WP2 - Commercial Readiness Mitigation and Next Steps

Safe-to-Fail Architecture

- The project uses a 'safe-to-fail' design enabling fallback to point-to-point operation to avoid system-wide failures.

Contractual and Regulatory Frameworks

- Frameworks define clear responsibility boundaries and emphasise regulatory engagement to support innovation and finance.

Advancing Standards and Procurement

- Developing industry standards and advanced procurement mechanisms helps reduce costs and de-risk early investments.

Research and Collaboration

- Ongoing collaboration with academia and EU-funded research addresses governance and legal challenges long-term.

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Thanks for listening.

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