



The HVDC Centre held the annual HVDC Operators' Forum on 10-11 June 2026; many thanks to all who attended, and especially to the presenters, panelists and exhibitors.

We have compiled all of the presentations that can be shared from this event. These presentations, the agenda and the group photo, can be downloaded here:
www.hvdccentre.com/library-category/operators-forum-2026/

Simon Marshall

Opening & Setting the Scene

Ben Marshall kicked-off, setting the scene of our collective challenges over the coming years, and the role the HVDC Centre has in support of HVDC projects. This session was both a look back at the scale of development of the Centre since its inception as a Network Innovation Competition winner in 2013 through to a dramatically growing Centre over the next 5 years of RIIO-T3.

Next year is the Centre's 10th anniversary and the year that Simon Marshall, whose leadership has taken the Centre thus far, takes a well-earned break across a sabbatical year.

Dave McKay followed this, describing the scale of HVDC developments now underway, seizing the opportunities ahead in Scotland and GB more widely along the way.



Ben Marshall



Dave McKay (Network Director, SSEN Transmission) opened the event, with a perspective from SSEN Transmission's HVDC ambitions.

Session 1: Big Picture Strategic Planning

Session 1 set the tone for the forum by exploring the strategic context for HVDC development and the key challenges and opportunities shaping the future beyond 2030. The session brought together perspectives from policy, resilience, technology, and academia to frame the scale and complexity of the transition ahead.

Laura Schade (DESNZ) – Clean Power 2030 and Beyond.

Laura provided a policy-led perspective on the UK's ambition for clean power, outlining the direction of travel towards a decarbonised system and the critical role HVDC will play in enabling this transition.



Robert Keast (Carbon Trust) – Big Picture Resilience

Robert explored system resilience in the context of increasing electrification and converter-based generation, highlighting the need to rethink resilience frameworks as system complexity grows.



Ben Marshall (The National HVDC Centre) – HVDC Technology: International Trends and Opportunities.

Ben presented a global view of HVDC development, highlighting key technology trends and the opportunities emerging from increasing deployment, innovation, and international experience.

Mike Barnes (University of Manchester) – VSC HVDC Controls – Gaps and Possible Ways Forward

Mike provided an academic perspective on the evolution of VSC HVDC controls, identifying key gaps in current approaches and outlining potential research directions to support future system requirements.

Several common themes emerged across the session:

- **Scale and pace of change** – Delivering system-wide transformation to meet 2030 and beyond targets requires a step change in both deployment rates and coordination across stakeholders.
- **Growing system complexity** – Increasing reliance on converter-based technologies is fundamentally changing system behaviour, creating new challenges for control, resilience, and operability.
- **Need for innovation in control and system design** – Both industry and academia highlighted gaps in current approaches, particularly in VSC controls and system-level coordination.
- **Importance of strategic alignment** – Strong alignment between policy, technology development, and system operation will be essential to deliver a secure and resilient future network.



Thank you to all presenters for their insightful contributions and for setting a strong strategic context for the forum. Their perspectives provided a valuable foundation for the more detailed technical discussions that followed.

Ben Gomersall

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Session 2: Technology Developments

Session 2 explored how HVDC technology must evolve to meet future GB system needs. Discussions focused on multi-terminal and multi-vendor HVDC, interoperability, HVDC converter control and protection, HVDC grid protection, and the role of HVDC in supporting increasingly converter-dominated power systems. A common theme across the session was that many of the technical building blocks already exist, but challenges remain around implementation, governance, regulation and commercial frameworks.

Biljana Stojkovska examined the barriers to deployment of multi-terminal and multi-vendor HVDC networks. While the technical feasibility of meshed DC grids has largely been demonstrated, regulatory uncertainty, unclear ownership models, governance arrangements and investment risk continue to slow progress. She highlighted the need for pilot projects, clearer regulatory frameworks and better alignment between policy makers, system operators and industry.

can be achieved in realistic testing environments and practical deployment. However, successful delivery of the next generation of multi-terminal HVDC interoperability projects requires clear ownership of system design, early agreement of interface specifications and a stronger role for asset owners in defining system behaviour and performance requirements.

Alberto Bertinato presented recent work investigating superconducting fault current limiters as an alternative to conventional reactor-based HVDC grid protection concepts. The technology offers the potential to reduce system footprint, losses and protection costs while limiting fault currents in future HVDC grids. The results present promising new technology developments in terms of HVDC grid hardware for protection enhancement, and future work intends to address integration challenges and coordination with converter controls.



Li Zou discussed GE Vernova developments in HVDC converter control and protection to meet future AC system stability needs and improve the selectivity of DC fault isolation in multi-terminal grids. The presentation highlighted GE Vernova's synchronous grid-forming control concept and the application of its constrained implementation, before discussing the principles of a fully autonomous and selective protection scheme for multi-terminal HVDC systems. Overall, presenting a clear direction of vendor technology developments towards advanced HVDC control and protection in preparation for the future power system.

Frederick Page presented lessons from a range of innovation and real-world projects including PROMOTioN, Aquila and InterOpera, as well as the Shin-Shinano and Kii Channel HVDC links. The balance of Mitsubishi's interoperability experience across innovation and real-world projects demonstrate that multi-vendor control, protection, and interoperability

A panel Q&A concluded the session involving all presenters together along with Diptargha Chakravorty from Siemens Energy. A central topic was the gap between the success of innovation projects and demonstration programmes and the lack of real-world multi-vendor, multi-terminal deployments. Several panellists highlighted the need for a pilot project to demonstrate commercial viability and create sufficient incentive for vendors to invest in interoperable solutions. However, the strongest consensus was that the principal barriers are regulatory rather than technical. Topics including the OFTO regime, asset ownership models, project risk allocation and the absence of clear specifications from transmission owners and system operators were all identified as obstacles to deployment. The discussion reinforced a clear message from the session: technical progress is being made, but delivery frameworks must evolve if multi-terminal and multi-vendor HVDC systems are to move beyond demonstrations and into mainstream deployment.

Adam Scott

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Session 3: Lessons from Owner Operators

Session 3 focused on the challenges of delivering, operating, and managing HVDC assets in practice. Speakers from six HVDC owner operators shared practical experience from projects at different stages of the lifecycle.

The importance of operational readiness during construction was emphasised by **Ian Reed** from NeuConnect, with processes, systems and teams needing to be in place well before energisation.

Vahid Sabzpoosh from Mutual Energy presented lessons from the Moyle Interconnector, highlighting issues such as cyber security, outage planning, upgrades, and an expanding role in providing system services including frequency response. This reflects how HVDC links are becoming more critical in system operation.

Cameron McHardy of SSEN Transmission shared recent experience from the Caithness Moray Shetland multi-terminal scheme, noting the challenges in coordination of maintenance and responding to unexpected events. Robust processes and a clear understanding of system behaviour are critical to maintaining availability.

A recurring theme was the need for strong lifecycle management. **David Monkhouse** from National Grid Ventures shared experience from life extension activities at the IFA1 interconnector, noting challenges with obsolescence in various technologies.

Matthew Gibson and **Diarmid Murphy** shared insights from the Greenlink interconnector, showing how software is a key driver of availability, with patching and hardware obsolescence becoming central concerns. In modern HVDC systems, the digital layer is increasingly defining the reliability of the asset.

Finally, **Chris Smith** presented on RWE's experience from the Sofia offshore wind connection, which highlighted the complexity of project delivery and some of the technologies that are helping deliver improvements and efficiencies.

The concluding panel discussion underlined the value of sharing real-world experience across the HVDC community; something we will continue to support at The National HVDC Centre. Thanks to all presenters for their valuable contributions.

Colin Foote



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Session 4: System Integration at Scale

Session 4 focused on the challenges of de-risking HVDC integration at scale. As increasing numbers of HVDC converters, battery energy storage systems, STATCOMs, wind farms, and solar generation schemes are connected to power grids, the large-scale integration of power-electronic converter-based resources is becoming an increasingly significant challenge.

While these technologies enable greater renewable energy integration and enhanced power transfer capability, they also introduce new risks that must be carefully understood and mitigated. Managing these risks requires a whole-system perspective that goes beyond the simple aggregation of individual components.

Sébastien Denetière from RTE International and **Treisa Sahaya** from EirGrid presented the latest developments in EMT (Electromagnetic Transient) model requirements for plant connections in the EirGrid (transmission system operator for Ireland) and SONI (System Operator for Northern Ireland) systems, as well as their experience of integrating these models into wider-area network studies. They emphasised that model requirements must be correctly interpreted and applied according to the specific study purpose.

Diptargha Chakravorty from Siemens Energy presented his latest innovation initiative on model reduction for interaction analysis with large-scale EMT network models. He noted that, with the industry trend towards EMT modelling of large-scale power networks, model reduction techniques remain necessary because limitations in computing capability and data availability are inevitable. A key area for further investigation is the preservation of large-signal dynamics during model reduction, supported by suitable metrics to quantify model fidelity.

Afshin Pashei from National Grid Electricity Transmission (NGET) shared his experience of modelling the integration of power-electronic resources into a large power network. He noted that simulation results obtained using root-mean-square (RMS) network representations are no longer sufficient to capture the fast transients associated with power converters. Given the coupling effects between converters and the surrounding grid, at least the network in the immediate vicinity should be represented using EMT modelling.

Ankur Majumdar shared the National Energy System Operator (NESO) perspective on feasibility studies for the Westlink 2 project. In collaboration with The National HVDC Centre, the dynamics of various operating scenarios for a three-terminal bipolar offshore HVDC network, including offshore HVDC-connected wind farms, were simulated on a real-time digital simulator with full EMT representation. The presentation highlighted the crucial role of supervisory control in de-risking system integration.

Finally, **Gumin Kwon** from Korea Electric Power Corporation (KEPCO) Research Institute shared recent developments in optimising wide-area operation of the Korean power system by coordinating multiple back-to-back HVDC links in real time. He emphasised the unique role of control hardware replicas and real-time digital EMT models in the validation process, while also highlighting key challenges for practical deployment, including data quality, control coordination in close proximity, and interoperability across control policies, communications, and cyber security.

Overall, Session 4 showed that de-risking HVDC integration at scale requires more than converter design. It depends on whole-system readiness, disciplined EMT modelling, real-time validation, effective model reduction, and coordinated control across multiple stakeholders. As power systems become increasingly converter-dominated, conventional study methods must evolve to capture fast dynamics and interactions across complex networks. The session also highlighted the importance of operational preparedness, robust data exchange, clear model requirements, and control hardware replication before energisation. Treating HVDC delivery as a full lifecycle challenge will be essential for delivering large-scale infrastructure safely, efficiently, and with confidence.

Dong Chen



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