SSEN Transmission

The National HVDC Centre

Annual Report *(for reporting period April 2024 to March 2025)*

The HVDC Operators' Forum 2024 (13-14 June)

1 Executive Summary

Background

This report is the fourth annual report for The National HVDC Centre, as part of RIIO-T2.

- The Centre's business model for RIIO-T2 can be found here: https://www.ofgem.gov.uk/sites/default/files/docs/2020/07/hvdc_centre_future_business_model_public.pdf
- Ofgem's associated determination can be found here: www.ofgem.gov.uk/publications-and-updates/decision-future-operation-hvdc-centre-following-end-nic-funding-period
- The previous annual report, together with prior MTTE Project progress reports and can be found here: https://www.hvdccentre.com/library-category/progress-reports/

Context

The National HVDC Centre is Great Britain's simulation and training facility for HVDC, supporting the integration and successful operation of all HVDC schemes connecting to the GB network.

The Centre is also the national hub for HVDC knowledge exchange, expertise and innovation.

The Centre uses state-of-the-art simulators to model and resolve potential issues in real-time before they impact on the delivery (or operation) of HVDC projects, to ensure the integrity and security of the GB network.

As described in Ofgem's determination, the HVDC Centre's activities include:

1) Provide real-time and offline simulation to support the development and deployment of HVDC schemes.
2) Provide training programmes, for example specialist training courses for GB TOs, NESO, HVDC owners, developers and manufacturers to drive value across all areas of HVDC integration from a more informed stakeholder community.
3) Develop academic engagement projects to address key challenges to integration of HVDC projects into AC grids in collaboration with both the TOs and NESO.
4) Maintain a library of updated off-line and real-time simulation models, including all network components required to support the development and deployment of HVDC equipment. This includes FACTS devices deployed on the GB network.
5) Maintain models to facilitate system integration studies involving multiple equipment manufacturers whilst preserving Intellectual Property (IP) arrangements.
6) Proactively engage with industry groups and GB academic and research institutions to support the development of DC grids.
7) Continue to manage the HVDC Operators' Forum and hold periodic events.
8) Continue to maintain the HVDC Centre website and keep it up to date.
9) Publish reports into the outcome of project and other analysis activities on the HVDC Centre website (subject to Intellectual Property Rights (IPRs)).
10) Ensure the facility is appropriately resourced.

1 Executive Summary

Overview

This fourth year of the HVDC Centre operation within RIIO-T2 has seen the Centre deliver a wide range of projects across the industry, further establishing itself as the national centre of expertise for HVDC.

Over this time, we have expanded the team to 22 people, expanded our training offering, completed filings for the 3 interoperability patents, finalised our expansion plans, and hosted another successful industry-wide conference (the HVDC Operators' Forum).

Below is a list of the activities undertaken at the Centre over the past 12 months.

April 2024

- The Centre published its Spring Newsletter: https://www.hvdccentre.com/wp-content/uploads/2024/04/HVDC-Centre-Newsletter-Apr-2024-FINAL.pdf
- Training sessions delivered to the ESO and NGET in Warwick and Wokingham, with excellent feedback.
- Kicked off the new Carbon Trust project on grid forming converter support of Offshore Wind.
- HVDC-WISE held its first External Advisory Board meeting, the six-monthly review with UKRI was completed satisfactorily, and across various working meetings we continued to help steer the project consortium towards practical and useful activities in modelling and simulation.
- Over 160 people attended our training webinar on HVDC Basics, with positive feedback.
- Hosted the Ontario Teachers' Pension Plan Transmission Board members, highlighting the role of the Centre.
- Hosted Graham Simpson MSP at the Centre.
- Successful workshop with ESO operations team on Frequency Risk and Control Report over operability risks relating to converter behaviours across declining national inertia levels.

May 2024

- Held a 2-day knowledge sharing workshop with: NREL, Oak Ridge National Laboratories & DoE (from USA).
- Introduction to HVDC training and workshop on use of Centre's methods for scanning for interaction risk presented to SPT.
- Presented the project closing webinar of the Carbon Trust RES Project to OWA members.

June 2024

- Centre supported the commissioning of Caithness-Moray-Shetland (CMS) in 3-terminal mode; announced at the HVDC Operators' Forum.
- Webinar on small signal stability methods well received by industry.
- Hosted a visit from the Hong Kong operator CLP who are considering a mainland reinforcement using HVDC.
- The Centre published its Summer Newsletter, focusing on the HVDC Operators' Forum: https://www.hvdccentre.com/wp-content/uploads/2025/01/HVDC-Centre-Newsletter-Ops-Forum-June-2024-FINAL.pdf

July 2024

- Met with Summitomo Electric to discuss supply chain efficiencies in more standardised cable designs and to outline Centre data requirements for multi-terminal projects.
- Centre presented on Project Aquila, HVDC network development strategy and supported workgroups on grid-forming, protection and wide area control development at the IEEE PES GEM meeting.
- Participated at OPAL-RT workshop (new OPAL-RT hardware installed at the Centre later in the year).

1 Executive Summary

- Utilised the CMS replica for testing to support further site commissioning. Supported SSEN-Transmission and NESO operator training on CMS.

August 2024

- Models, guidance, user guide and scripts enabling a fit for purpose tool to be shared with NESO, SPT, SSEN Transmission and NGET. Positive feedback and incremental adoption by our partners.
- Abstracts for INCENTIVE and Network DC (with SSEN Transmission lead authors) and network strength representation papers submitted to ACDC 2025.
- Webinar on the AC Protection Project (NIA), well attended.
- Issued updated GB 12-node model to partners on the HVDC-WISE project.
- Centre supported CIGRE substantially; being involved in a HVDC WISE project presentation, presenting papers on multi-purpose interconnectors and special reports across workgroup B4 and attending/leading sessions within C4 and B4 workgroups. Coincident with the event the EU project InterOPERA held its first technical oversight meeting and the project READY4DC closed down- which were also both supported.

September 2024

- Visited the Moyle converter station at Auchencrosh.
- Delivered a training course to a diverse group (including Ofgem representatives).
- Hosted a visit by TEPCO from Japan.
- Workshop with TenneT beginning engagement on Project Aquila and Network DC methods.
- Completed INSIGHT closedown report.

October 2024

- The Centre published its Autumn Newsletter: https://www.hvdccentre.com/wp-content/uploads/2024/10/HVDC-Centre-Newsletter-Oct-2024-FINAL.pdf
- Finalised EJP submission for the HVDC Centre's RIIO-T3 expansion.
- The HVDC Centre team shortlisted for the 'Engineering Team of the Year' at SSE's Engineering Hub Awards.
- Welcome to Ben Andrews and Shashank Mupparam who joined the HVDC Centre team.
- Hosted a visit from NESO's Fintan Slye and Kayte O' Neill.

November 2024

- 'HVDC Replicas Explained' webinar held.
- Engaged with NESO on small-signal methods.
- Participated in the OPAL-RT24 conference in Edinburgh.
- Engagements on cyber security resilience testing methods across TSOs, NESO and universities.

December 2024

- Engagement with Danish TSO Energinet in a workshop, disseminating Project Aquila and Network DC methods.
- Network DC technical workshop at University of Edinburgh including the Centre and SuperGrid Institute in moving forward testing and de-risking approach for DC Circuit Breaker specification.
- First successful set of multi-vendor multi-terminal simulations under Project Aquila.

1 Executive Summary

January 2025

- The Centre published its winter Newsletter: https://www.hvdccentre.com/wp-content/uploads/2025/02/HVDC-Centre-Newsletter-Jan-2025-FINAL.pdf
- Successful training for over 30 people held at the Centre (both the introductory course and in-depth CMS replicas/simulation training).
- Presentation to NESO audience of over 200 people on the outcome of HND simulation work, informing codes and standards.

February 2025

- Successful annual review meeting with Moyle (whose replicas we host); they are very complementary on our work over the last year, and are commissioning future work next year.
- Excellent and well attended 'Academic Research Day' hosted at the Centre, where 5 academic research projects supported by the Centre shared their progress:
    - System Strength as a Service for Wide-Area Power Systems - Led by Imperial College London.
    - Multi-Terminal Control and Modelling of MVMT-HVDC Grid - Led by the HVDC Centre and University of Edinburgh, with support from the University of Exeter and the University of Strathclyde.
    - Converter Control Interactions in a Power System - Led by the University of Strathclyde, supported by the University of Edinburgh.
    - Optimisation of Power Flow for AC/DC Power Grids - Led by the University of Strathclyde, supported by the University of Edinburgh, and co-funded by Scottish Power Transmission.
    - Transient Studies of VSC-HVDC and Connected Offshore Windfarms - Led by the University of Edinburgh, supported by the University of Strathclyde.

March 2025

- The SSE Board visited the Centre, with very complimentary feedback; they were supportive of the Centre's expansion plans, and the breadth of the Centre's work.
- The Centre had a very high profile at the ACDC conference, as a keynote speaker, participation on panels, and presenting multiple papers.
- First demonstration to an external audience of multi-vendor multi-terminal interoperability at the ACDC conference tutorial and a keynote speech supported by GE Vernova, MELCO and Hitachi Electric.
- The NESO webinar, disseminating codes and standards findings resulting from simulations of HND project designs was well received (with 90 attendees).
- Hosted a visit from MELCO.
- Attended the 'SIF Community Forum' for BLADE, and the OPAL-RT conference on Cyber Security, both informative events which were presented back to colleagues.

2 Update on Project Delivery

Project Delivery

The Centre delivers projects to internal and external clients as listed below.

Project	Description	Link	Client(s)
Shetland Support	De-risking the first multi-terminal VSC-HVDC connection in Europe. A number of different activities undertaken in support of the new HVDC connection to Shetland.	https://www.hvdccentre.com/our-projects/support-for-the-shetland-extension-of-the-caithness-moray-hvdc-link/	SSEN-T
CMS PowerOn Installation	Implementation of PowerOn, as used in the Control Centre, into the simulator setup at the HVDC Centre.	https://www.hvdccentre.com/our-projects/scada-system-implementation/	SSEN-T
CMS Replica Hosting	As the CM scheme is extended to multi-terminal operation, the HVDC Centre supports the operation of the multi-terminal controls, using the replicas of all three terminals.	https://www.hvdccentre.com/our-projects/caithness-moray-project-support/	SSEN-T
Offshore Operations	NESO requested the HVDC Centre to model the HND offshore networks in real-time EMT simulation.	https://www.hvdccentre.com/our-projects/eso-offshore-network-operation-performance-and-technical-code-impact/	NESO
Western Link Analysis	NESO commissioned the HVDC Centre to derive a model of Western Link in the PSCAD software to support investigation of system disturbance events.	https://www.hvdccentre.com/our-projects/neso-western-hvdc-link-performance-analysis/	NESO
System Performance Support	Supporting SSEN-T's System Performance team in the construction of real time AC system models of the Scottish system for use with CMS and future ASTI projects.	https://www.hvdccentre.com/our-projects/system-performance-support/	SSEN-T
Core Industry Support	A variety of activities to support the four core partners (TOs & NESO) as a group, including development and support of small signal analysis tools, and supporting early-stage planning for replica hosting.	https://www.hvdccentre.com/our-projects/core-industry-support/	Core partners
Academic Engagement	Strengthening ties with UK academic institutions to foster a pipeline of HVDC engineers and promote awareness of HVDC technologies to future professionals in the sector.	https://www.hvdccentre.com/academic-engagement/	Various
HVDC-WISE	The Horizon Europe HVDC-WISE project aims to support further development of HVDC-based transmission grids by developing new reliability and resilience (R&R) oriented planning and analysis tools.	https://www.hvdccentre.com/innovation-projects/horizon-europe-hvdc-wise-project	UKRI

2 Update on Project Delivery

Project	Description	Link	Client(s)
Aquila	Aquila is a world-leading project developing Multi-Terminal, Multi-Vendor DC-hubs, establishing the foundations for DC-Grids in GB. DC-hubs reduce the need for onshore converter stations, thereby minimising costs, and environmental impacts.	https://www.hvdccentre.com/our-projects/aquila-interoperability-package/	SSEN-T
Network DC SIF - Beta phase	The Network DC project aims to advance the readiness for use of DC Circuit Breakers (DCCBs) on the GB system, to enable the development of offshore DC networks that require DCCBs.	https://www.hvdccentre.com/innovation-projects/network-dc-circuit-breakers/	SSEN-T
Incentive SIF - Beta phase	Incentive aims to de-risk the integration of increasing offshore wind capacity onto the GB network, by ensuring system stability is maintained as traditional synchronous generators are displaced from the system.	https://www.hvdccentre.com/innovation-projects/incentive-innovative-control-and-energy-storage-for-ancillary-services-in-offshore-wind/	SSEN-T
BLADE SIF - Beta phase	The Black Start Demonstrator (BLADE) project aims to bring black start and electricity system restoration from offshore wind to commercial reality by building the necessary cross-industry understanding. BLADE is enabling TO, NESO, offshore wind farm developer and OEM interaction to clarify the role of wind farms in restoration processes.	https://www.hvdccentre.com/innovation-projects/blade/	SSEN-T
SETTLE - NIA	The SETTLE project follows on from the INSIGHT alpha phase SIF project and aims to deliver a real-time alert and control system that could monitor and mitigate different types of oscillation events experienced on the network.	https://www.hvdccentre.com/innovation-projects/settle/	SSEN-T
Moyle Interconnector Replica Hosting	The HVDC Centre is hosting replica control and protection cubicles on behalf of Mutual Energy, enabling us to support the upgrade and ongoing operation of the Moyle Interconnector.	https://www.hvdccentre.com/our-projects/moyle-interconnector/	Mutual Energy
Impact of Grid Forming Capabilities on OWF Design and Operation	Investigating the practical capabilities and physical implications of designing and operating grid forming offshore wind farms.	https://www.hvdccentre.com/our-projects/grid-forming-support-for-offshore-wind/	OWF Developers
Energy Island	Investigate the performance of energy islands employing multiple half-bridge modular multilevel converter (MMC) based HVDC technology, in conjunction with offshore windfarms connected to several AC grids with varying short circuit level (SCL).	https://www.hvdccentre.com/our-projects/performance-analysis-of-energy-islands-with-multiple-interconnections/	National Grid Ventures (NGV)

2 Update on Project Delivery

Project	Description	Link	Client(s)
Offshore Coordination Project	Working to provide a coordinated offshore design for wind and network reinforcement for an international TSO.	https://www.hvdccentre.com/our-projects/coordinated-offshore-design-for-wind-and-network-reinforcement-for-an-international-tso/	An international TSO
HansaLink Feasibility Study	Working with WindGrid to conduct a detailed feasibility study for a multi-purpose HVDC interconnector between Germany and the UK.	https://www.hvdccentre.com/our-projects/feasibility-study-for-multiterminal-rigid-bipole/	WindGrid
GIL-GB Voltage Interaction Analysis	Analysis to support commissioning of the Greenlink interconnector. This includes time domain and frequency domain analysis of performance.	https://www.hvdccentre.com/our-projects/analysis-support-for-hvdc-interconnector/	Greenlink Interconnector Ltd (GIL)

3 Update on Activities

Dissemination Activity

A continual key focus of the HVDC Centre is on knowledge dissemination.

The Centre undertakes extensive engagement/ dissemination activity to ensure that we:

- Keep potential users of the Centre informed of our capabilities;
- Ensure that the work we undertake is developed in collaboration with relevant stakeholders; and
- Effectively disseminate the knowledge gained at the Centre to the right people.

We do this through a range of engagement activities:

- Workshops and hybrid events for the industry around specific topics and techniques developed at the Centre;
- Actively disseminated information, experience, and developed consensus, to interoperability though our Advisory Board roles in READY4DC and INTEROPERA work and contributions to their publications;
- Disseminated across the SIF projects and HVDC-WISE projects our outputs and learnings;
- Hosted a range of technical visits; and
- Supported Grid Code initiatives relevant to HVDC.

Our dissemination events are discussed further below.

Films

The Centre has produced a range of short films to communicate project learning in an accessible format, including recordings of all webinars hosted this year: https://www.hvdccentre.com/films-list/

Website

The Centre's website continues to be updated to support knowledge dissemination.

The website contains details of all the technical projects the Centre has undertaken, our innovation programme, and library of publications.

https://www.hvdccentre.com/

Newsletter

This year the Centre produced 4 quarterly newsletters and distributed to all our stakeholders, shared with our Linked-In followers, and published on our website.

https://www.hvdccentre.com/library-category/newsletters/

3 Update on Activities

Linked-In

The Centre uses Linked-In to share key outputs with a wide range of interested parties, with over 4,400 followers (up from 3,600 last year).

https://www.linkedin.com/company/the-national-hvdc-centre

HVDC Operators' Forum (annual)

The Centre has established this forum as a regular annual event, where HVDC projects in GB, relevant TOs and the NESO come together to share experience and lessons learnt.

The Centre's annual HVDC Operators' Forum was held on 12-13 June 2024; details of the event can be found in our special edition newsletter: https://www.hvdccentre.com/wp-content/uploads/2025/01/HVDC-Centre-Newsletter-Ops-Forum-June-2024-FINAL.pdf

This year's HVDC Operators' Forum is planned for 11-12 June 2025.

3 Update on Activities

Dissemination Events

The Centre's events, webinars and training inform and facilitate knowledge exchange on a variety of HVDC-related topics.

These events and webinars have been very well attended from across the industry and have been well received, the events include:

- Training: Introduction to HVDC and Project De-risking (18/04/2024)
- Demonstration of DC network control to NGET at the Centre (22/04/2024)
- Training: Introduction to HVDC and Project De-risking (24/04/2024)
- Training: Introduction to PowerFactory delivered at the HVDC Centre by DIgSILENT (30/04/24-02/05/24)
- Training: Introduction to PSS/E delivered at the HVDC Centre by Siemens PTI (14-17/05/24)
- Attended and participated at IET ACDC Europe 2024 (13-14/05/2024)
- Presented our IDCORE project at the 'All Energy' Conference (15/05/2024)
- Hong Kong CLP team knowledge exchange visit to the Centre (15/05/2024)
- OTPP (Transmission Board) visit and tour of the Centre (21/05/2024)
- HVDC RES Project Final Webinar (23/05/2024)
- Graham Simpson (MSP) Visit to the Centre (24/05/2024)
- Training: Introduction to HVDC and Project De-risking (28/05/2024)
- Participated in HVDC-WISE General Meeting (Delft, Netherlands) (28-29/05/2024)
- Visit by Ofgem Digital, Data and Security Services Team to the Centre (05/06/2024)
- Held the Annual HVDC Operators' Forum 2024 (12-13/06/2024)
- RTDS Development Engagement with RTDS Technologies (14/06/2024)
- Visit by Iberdrola Innovation Middle East (27/06/2024)
- Visit by SSE Interconnectors (SSE Enterprise) (01/07/2024)
- Attended IEEE Power & Energy Society General Meeting (21-25/07/2024)
- HVDC Centre Webinar: AC Protection Project (22/08/2024)
- Presented at CIGRE Paris Session 2024 (25-30/08/2024)
- Visited Auchencrosh Converter Station (Moyle) (28/08/2024)
- HVDC Centre Training: Introduction to HVDC and Project De-risking (04/09/2024)

3 Update on Activities

- HVDC Centre Webinar: SIF Project INCENTIVE (05/09/2024)
- Attended PSCAD European Transmission System Operator Workshop (10-11/09/2024)
- Attended Imperial Summer School on IBR-dominated Power Systems (02-06/09/2024)
- HVDC Centre Webinar: Aquila Interoperability Project Update (17/09/2024)
- Aquila, Network DC and HVDC Interoperability Workshop with TenneT (12&17/09/2024)
- Meeting with NEOM to discuss training opportunities (24/09/2024)
- Attended Renewable Energy Grid Integration Week (Wind & Solar Integration Workshop) (08-11/10/2024)
- Presented at RTDS European Users Group Meeting (09-10/10/2024)
- Attended the Interconnector Operators Group (14-18/10/2024)
- HVDC Centre Webinar: BLADE SIF Project – Outcomes of Alpha Phase (15/10/2024)
- NEOM knowledge sharing visit to the Centre (18/10/2024)
- Project INCENTIVE Close-out Meeting (22/10/2024)
- Kick-off meeting on ICASE funded project on AC stability metrics (11/11/2024)
- Presentation to NESO on HND and co-ordinated design code impacts (12/11/2024)
- OPAL-RT training on Commissioning, Training and RTDS Co-simulation Testing (11-15/11/2024)
- Attended HVDC-WISE General Meeting (13-14/11/2024)
- ETP PhD Project Meeting: AC-DC Power Flow Modelling (15/11/2024)
- HVDC Centre Webinar: HVDC Replicas Explained (19/11/2024)
- Formula Student (Edinburgh University) visit to the Centre (21/11/2024)
- Attended LCPE annual conference (21/11/2024)
- HVDC Centre Training: Introduction to HVDC and Project De-risking (26/11/2024)
- OPAL-RT Visit to the HVDC Centre (26/11/2024)
- Attended OPAL-RT's Regional Conference on Power Systems Real-Time Simulation (28-29/11/2024)
- Joint HVDC Centre/TOs/NESO Small-Signal Analysis Workshop (05/12/2024)
- Training on Small-Signal Analysis Tool (06/12/2024)
- INCENTIVE - Show and Tell Webinar (12/12/2024)

3 Update on Activities

- National Grid Ventures Visited the Centre (12/12/2024)
- Network DC: WP2 - Second Technical Workshop (17/12/2024)
- HVDC Centre Training: Introduction to HVDC and Project De-risking (13/01/2025)
- HVDC Centre Training: Introduction to Real-Time Simulation and CMS Replica (14/01/2025)
- SIF BLADE Beta Phase In-Person Kick-Off meeting at the Centre (16/01/2025)
- Held Quarterly TAB Meeting (14/01/2025)
- Senior NESO team Visit to the Centre (16/01/2025)
- Group of IDCORE EngD students visited the Centre (31/01/2025)
- Guest Lecture delivered to University of Strathclyde (11/02/2025)
- CMS Replica Stakeholder Annual Meeting (13/02/2025)
- Held HVDC Centre Researchers Forum (21/02/2025)
- WSP visit for SIF BLADE Beta WP8 Kick-Off (24/02/2025)
- Hosted Moyle Replica Annual Meeting (04/03/2025)
- Attended Workshop 'Securing the future: Advancing Grid Digitalization and Cybersecurity' (04/03/2025)
- Attended SIF Community Forum 2025 (04/03/2025)
- Delivered CMS Replica Training: HVDC Operations Team (06/03/2025)
- SSEN Distribution (SHEPD) Graduates & Network Design Visit (07/03/2025)
- Attended RTDS® Simulator Training Course (10-14/03/2025)
- Presented and delivered workshop at IET ACDC Conference 2025 (17-19/03/2025)
- Delivered Guest Lecture to University of Glasgow (17/03/2025)
- Webinar: Dynamic Performance of GB's Future Offshore Networks (21/03/2025)
- Hosted SSE Board Visit at the Centre (28/03/2025)

4 Financial Report

The table below details the spend (& revenue), against each category.

Table redacted in PUBLIC version.

5) TAB Update

Overview of the Technical Advisory Board (TAB) Meetings

TAB meetings across 2024/25 were held with an informal meeting at the HVDC Operators Forum (12-13 June 2024) and further meetings on 13 September 2024 and 14 January 2025. TAB meetings are a mixture of hybrid physical and virtual attendance. Meetings are normally 2.5-3.5 hours long and a typical agenda is:

- Introductions, actions from last meeting;
- Overview of past 6 months of activity (highs and lows);
- Centre resourcing and current commitments;
- Specific project updates;
- Specific topics for discussion needing new innovation/ new focus;
- R&D activities; and
- Actions, Recommendations, AOB.

The meetings serve as a strategic discussion to more routine project focussed discussions across the TAB organisations over the year. These are complemented with company-specific bilateral meetings on work planning with each partner, identifying and scoping new work and providing dissemination of best practice. This includes planned training which in the last year has included:

- Further training on centre-developed small-signal analysis approaches;
- Training on centre-developed approaches to multi-terminal DC network control, Project Aquila related learning and how operation of such networks can be simulated and understood across a range of situations;
- Modelling of future operational considerations, for example HND related offshore systems;
- Training on “Introduction to HVDC and project de-risking” (one session with NESO included 41 of their staff in a single 1-day course); and
- Webinars on key projects and their de-risking (for example on work related to DC circuit breaker analysis within Network DC).

Some key areas in which TAB moved the Centre’s work forward over 2024/25 include:

- Agreeing to the further scope of HND related work;
- Discussing and agreeing SIF and NIA application focus;
- Discussing and agreeing scope and direction for Centre expansion; and
- Developing plans bilaterally for the support of ASTI and taking related transmission classified HND work forward.

Relevant to the above, the Centre is now supporting all ASTI and HND transmission activities with technical advice, defined support analysis and replica specification, which in turn has informed the direction of Centre expansion needs. The Centre is also undertaking support to HVDC related innovation projects in NGET relating to HVDC overhead line design and onshore HVDC overlay (volt-expanse NIA led by NGET), SPT in relation to black start (SIF-BLADE), SSEN-T and NESO in relation to system strength measures and oscillation analysis (SIF project SYSMET and SIF/NIA work under INSIGHT/ SETTLE, respectively), and has commenced moving beyond the support of the offline PSCAD environment of TOTEM to the design of plans for a whole system real time digital twin, included in the Centre’s agreed expansion activity. The Centre has supported

5) TAB Update

ESO/NESO in the analysis of the original HND proposals and their refinement, together with supporting the analysis of the beyond 2030 proposals now published. Project Aquila has developed and patented 3 key areas of multi-terminal control, operation and stability assessment to support and protect the environment for multi-terminal multi-vendor DC networks to emerge and is now actively supporting a range of GB HVDC projects involving our TO partners seeking to use its approach.

Non-Networks Representative

We warmly thank Professor Tim Green from Imperial College, London for his support in the role as our non-networks representative in the previous year.

In April 2024 we welcomed Professor Mike Barnes, University of Manchester, to take on this role. His support, particularly around understanding GB's engineering skills gaps, has proved insightful.