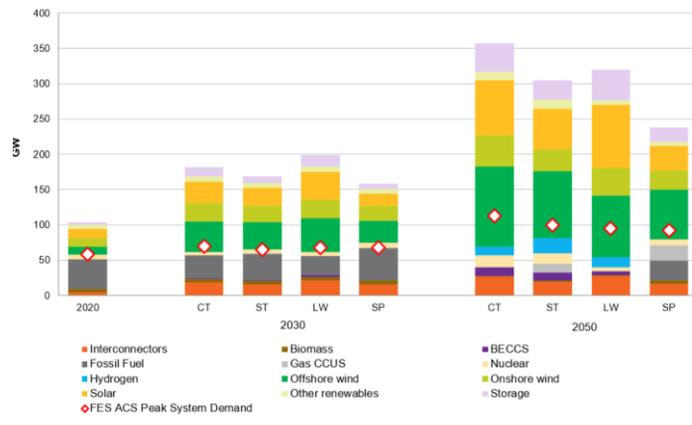




Welcome to the Summer edition of our newsletter, where we highlight two reports we have published on the HVDC R&D Strategy and Supply Chain Review for coordinate offshore (commissioned by BEIS and Ofgem). We also share our progress on protection testing for Shetland, Distributed ReStart studies, and a PhD opportunity that we are jointly supporting; and welcome Linda to our team (p.s. that's me flying in the photo). *Simon Marshall*

VSC is the Future

The Future Energy Scenarios (see figure below) show as much as 38GW of total HVDC interconnectors between GB and European TSOs. Across the North and Irish Seas Offshore Wind capacity targets upwards of 450GW by 2050 are under discussion, with up to 113GW in GB by then.



VSC-HVDC will be the key technology for such interconnector and offshore wind connection. It provides the capacity and long distance integration required for Offshore wind, the flexibility to co-ordinate across multiple projects (consolidating infrastructure requirements on and offshore), the capability to support and secure these networks with the appropriate control capabilities and co-ordination, and is the backbone of Multi-Purpose Interconnector approaches.

However, VSC-HVDC technology will require co-ordination across Europe as we all drive towards our Net Zero futures.

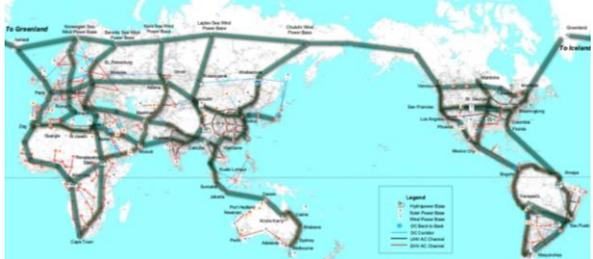
Ben Marshall

European Collaboration... And Beyond!

The Centre continues to collaborate and support a range of European initiatives, these include:

- GB representative within the European Commission's HVDC working group - shaping European R&D and policy initiatives;
- Member of five CIGRE workgroups covering HVDC, its de-risking, modelling, Testing and Wide Area Control, together with IET and Global-PST consortia workgroups in these areas; and
- Collaborating with European TSOs and research/testing institutions on specific projects, including HORIZON 2020 research proposal.

Internationally, the HVDC Centre disseminates its learning across international technical bodies and organisations. The illustration of a trans-national HVDC spine (see figure below), as proposed by the former China state grid CEO, hints towards the opportunities for collaboration and shared learning as 2050 approaches.



Whether GB, European or broader; the core challenges of scale, pace and increasing complexity of requirements in HVDC are common. By sharing lessons learned, innovating existing processes and techniques, we can collectively lead the way to de-risked Net Zero targets.

Ben Marshall

HVDC R&D Strategy & Supply Chain Review to meet Net-Zero

The National HVDC Centre was commissioned by the department for Business, Energy and Industrial Strategy (BEIS) and Ofgem, to conduct a review into two key areas to enable the delivery of a coordinated approach to offshore renewables connections to meet the 2030 and 2050 net zero targets.

The output of this work are two reports which we have published on our Website (links below):

- 1) HVDC R&D Strategy (Coordinated Offshore); and
- 2) HVDC Supply Chain Overview (Coordinated Offshore).

The HVDC R&D Strategy proposes a Strategy which has the potential to: increase cost savings from offshore coordination, further mitigate environmental impacts in the delivery of offshore growth, and overcome the delivery challenges.



The HVDC Supply Chain Overview report provides a high-level overview of the HVDC supply chain required to deliver the transmission capability required to meet the 2030 and 2050 offshore wind targets (assuming a coordinated approach to offshore development is progressed).



These reports have been published on our Website:

- o www.hvdccentre.com/wp-content/uploads/2021/07/Offshore-Co-Ordination-RD-Strategy-v2.0.pdf
- o www.hvdccentre.com/wp-content/uploads/2021/07/Offshore-Co-Ordination-Supply-Report-v2.0.pdf

They provide a useful starting point and context in these two areas as they evolve over the coming decade.

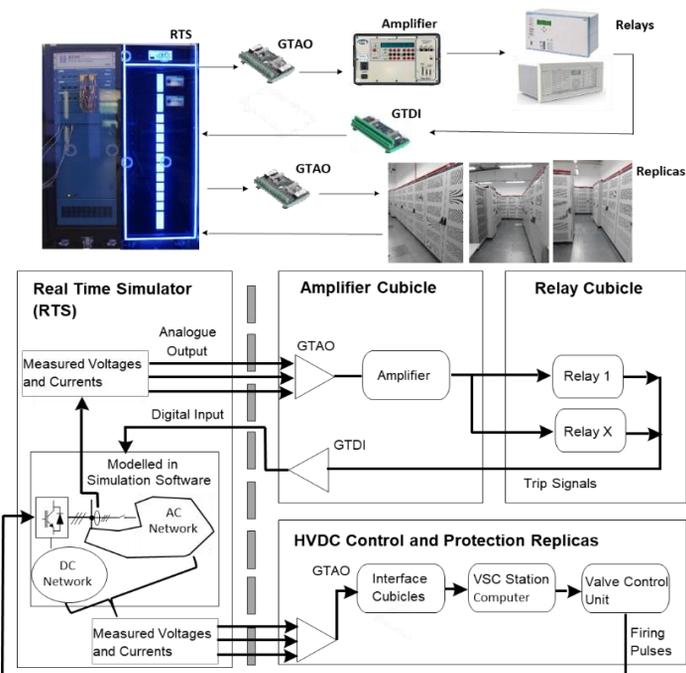
Ian Cowan & Ben Marshall

Shetland AC Distribution Protection Testing

Our support of the Shetland extension of the Caithness-Moray (CM) HVDC project continues. We were recently joined by protection engineers in charge of the Distribution network on the island. Simulating the key scenarios for the new powering of the island from the mainland via the HVDC link we are able to ensure the continued reliable performance of the protection system on the island's Distribution network.



By bringing together the Replica of the CMS control scheme with actual protection relays (pictured above) with our extensive real-time model of the island's network, we can thoroughly test the robustness of the overall system during fault conditions.



Our work continues to check a wider range of scenarios for complete peace of mind.

Ian Cowan

To find out more, please contact us to discuss or to arrange a visit:

01236 687240 | info@hvdccentre.com | hvdccentre.com

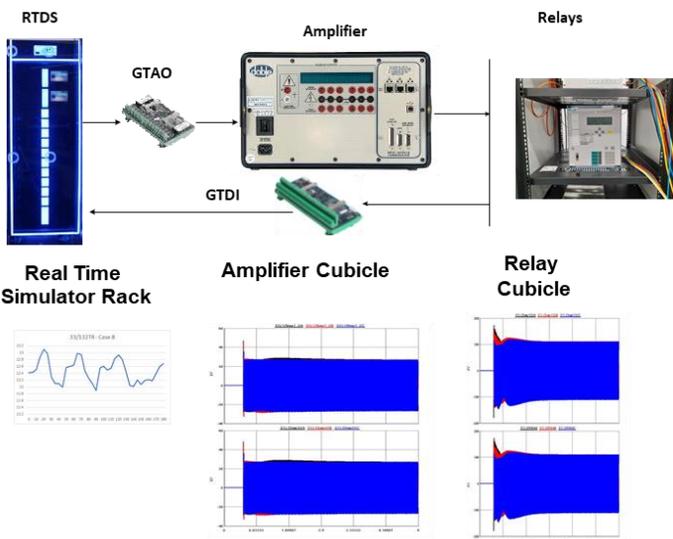
Distributed ReStart

Distributed ReStart is a NIC (Network Innovation Competition) project led by Scottish Power Energy Networks (SPEN) along with National Grid ESO and TNEI. The National HVDC Centre has been supporting this project by performing Real Time Simulation studies and HIL (Hardware in Loop) studies with protection relays to de-risk the black start field trials using a distribution connected generator.

The studies performed by the HVDC Centre have provided key insights to the project team by investigating: raises in voltage at the generator terminal, reactive power changes at the generator terminal and the performance of generator protection for various black start scenarios in Scottish Power's Distribution network in the Chapel cross region.

In our recent activity for the project, we verified the generator's over-voltage behaviour (which is paramount in the investigation) using Real-Time EMT studies, mainly because all the generators have AC protections designed to detect and trip for over-voltages, and in the case of convertors, inner DC controls and protections are also relevant and act even faster. In this case the RTDS-HIL protection study confirmed that the generator would be able to maintain connection following the over-voltages expected when black start energising a Distribution network.

Overview of Hardware in the loop Setup



The HVDC Centre is performing further Real-Time HIL tests for the innovative black start controller in the upcoming months to complete the final stage of this project at the Centre.

Bharath Ponnalagan

PhD Studentship Opportunity

An exciting PhD studentship opportunity is available at the University of Strathclyde in collaboration with the HVDC Centre and the University of Edinburgh. A 3½-year full-time PhD studentship which will be supported by Energy Technology Partnership (ETP) and the HVDC Centre.



PhD Project Title: "System Modelling and Stability of Net-zero Power Grid"

The increased integration of renewable sources and HVDC transmission links is significantly changing the characteristics of the GB network. These changes, resulting in reduced system inertia and frequent operating condition variations in the GB network, could potentially lead to oscillations across a wide frequency range. Therefore, these may cause to system instability, system separation and widespread outage.

This project mainly focuses on developing models, tools and methodologies to analyse and improve stability of future GB electricity network to ensure the integrity and security of the grid. This work represents the final stage of our small signal stability work; which will lead to a GB tool for the screening of converter interaction.

The project will be supervised by **Prof. Lie Xu** at University of Strathclyde, with co-supervision of **Dr Michaël Merlin** at The University of Edinburgh and **Benjamin Marshall** at The National HVDC Centre.

Further details are available in the following link or by directly contacting Prof. Lie Xu (lie.xu@stath.ac.uk):

- [System Modelling & Stability of "Net-zero" Power Grid | University of Strathclyde](#)

Md Habibur Rahman

Welcome to Linda

We are delighted to welcome Linda Rowan to our team. She joins us as our Technical Project Officer, having worked for TÜV SÜD for 20 years where she managed projects ranging from performance testing of wind turbines to construction of multi-million pound test rigs.



To find out more, please contact us to discuss or to arrange a visit:

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