Newsletter

Issue 23: January 2021

The National HVDC Centre

Welcome to the Winter edition of our newsletter; as snow covers the Centre, work on the extension continues, and are continuing to work with Covid-19 restrictions. In this newsletter we are excited to share our plans for events in 2021, and our latest developments on Phasor-based monitoring, supporting the Shetland multi-terminal extension, Composite testing and Coordinated offshore development.

2021 Webinars, Events & Training

Below are the Webinars, Events and Training Courses we are planning for 2021. Please contact us at info@hvdccentre.com for more information, or visit hvdccentre.com for the latest details.

January

- **Training Course: Introduction to HVDC:** 0.5 day course on the fundamentals of HVDC - Led by the HVDC Centre.

February

- **Training Course: Introduction to HVDC:** 0.5 day course on the fundamentals of HVDC - Led by the HVDC Centre.
- **TAB: Technical Advisory Board Meeting:** 1 day meeting of the Centre's TAB – Invitees only.

March

- **Webinar: Evaluation of HVDC with Synchronous Condenser impact on AC Protection:** Hosted by the HVDC Centre & the University of Strathclyde.
- **Webinar: COMPOSITE Testing of HVDC-connected Offshore Wind Farms:** Hosted by the HVDC Centre & RTE International

April

- **Webinar: Adaptive Damping of Power Oscillations using HVDC:** Hosted by the HVDC Centre & EPRI.
- **Webinar: Stability Assessment and Mitigation of Converter Interactions (Phase 2):** Hosted by the HVDC Centre & the University of Strathclyde.

May

- **Webinar: Offshore Transition Project (sequential build-up of multi-staged offshore networks):** Hosted by HVDC Centre in association with industry and research partner
- **Webinar: Protection Performance Overview and Validation in Low Strength Areas:** Hosted by the HVDC Centre & Manitoba Hydro International

June

- **Event: Formal Opening of the New HVDC Centre.**
- **Annual HVDC Operators' Forum:** 1.5 day knowledge sharing event for owners and operators of HVDC schemes connecting to the GB network.
- **Webinar: Phasor Based Monitoring for HVDC:** Sharing the knowledge from the NIA project - Hosted by the HVDC Centre, SSEN Transmission & GE.

July

- **Training Course: Introduction to RTDS Training Course:** 2.5 day course on the practical use of RTDS and RSCAD - Led by the HVDC Centre.
- **Seminar: Protection Coordination Seminar:** 0.5 day seminar sharing experience of HVDC protection - Hosted by the HVDC Centre.
- **TAB: Technical Advisory Board Meeting:** 1 day meeting of the Centre's TAB – Invitees only.

August

- **Seminar: Integrated Offshore Seminar:** 0.5 day seminar on the technical challenges of an integrated approach to offshore development - Hosted by the HVDC Centre.
- **Conference: CIGRE Paris conference, paper publication:** Multi-vendor extension of existing HVDC Schemes - Presented by the HVDC Centre.

September

- **Training Course: DigSilent Training:** 2 day course on using the DigSilent software - Led by DigSilent.

October

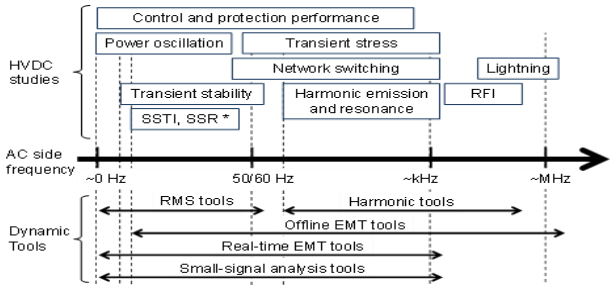
- **Training Course: RTDS advanced training:** Integrating RTDS with various hardware controls - Led by the HVDC Centre.

November

- **TAB: Technical Advisory Board Meeting:** 1 day meeting of the Centre's TAB – Invitees only.

Composite Project Outcomes informs our GreenDeal Proposal

The Problem: Numerical simulation tools such as RMS and EMT tools are used by power system engineers and researchers to conduct various dynamic studies. The increasing installations of power electronic devices (PED) on the transmission system requires the increased use of EMT tools. The main reasons are because PEDs have faster dynamic and more complex behaviour that cannot by captured or properly analysed with RMS approach tools. The figure here shows the applicability of the different power system simulation/analytical tools across the different network phenomenon.



EMT real-time simulation offers a complementary solution respect to the offline EMT and RMS simulation, because the computation time of the simulation is lower than the real-time, and it is possible to consider more complete representation of protection and control than offline models are generally capable of containing.

Approaching Interoperability: The ability to interconnect physical external (control and protection) devices to perform hardware-in-the-loop (HIL) represents a significant benefit to **interoperability analysis** - an area of growing interest across the industry as PED based solutions become more extensive in scale or increase in complexity, one example of this being future scales of potentially multi-terminal or parallel HVDC connected offshore wind to the onshore transmission system. In HIL analysis, simplification of PED control function and structure, and compatabilities between compiled code no longer exist, and the challenges of managing IP confidentialities can be managed. The **Composite project** approaching completion**,** highlights examples where the actual controls (or hardware Replicas) are essential to verify the exact behaviour of controls in areas where an offline model provided by the manufacturer cannot because of control simplification and/or the tracking of control version update.

Addressing interoperability: The Composite project shows that each simulation tool has pros and cons; for each studied phenomena the adequate tool should be used, and that the right tools should be used in the right ways at the right times in a projects development - and if this is done, HIL can be used to effectively de-risk project interoperability. Understanding the key steps enables efficient future approaches. Bringing these findings to our **GreenDeal proposal**, a key part of our proposal is to develop and demonstrate on site new innovative approaches for using EMT simulation facilities, flexible replicas of real controllers of HVDC schemes and mobile tests to enhance interoperability analysis across a project.

Ian Cowan

Shetland Extension Support Activities at the HVDC Centre

As the Shetland extension of the Cathines-Moray-Shetland (CMS) multi-terminal project continues across its implementation phase, The National HVDC Centre is undertaking Hardware-in-the-loop (HIL) studies involved in the integration of AC protection schemes in the Shetland Island's converter-dominated low short circuit level network.

The initial implementation of the Shetland Island's AC network model in RSCAD and HIL test setup to study the performance of AC protection is underway at the HVDC Centre. We expect a busy year ahead with lots of de-risking studies, preparation for CMS multi-terminal Factory System Testing and project support activities for the Shetland HVDC extension, which is Europe's first multi-terminal VSC-HVDC project.

Bharath Ponnalagan

To find our more, please contact us to discuss or to arrange a visit:
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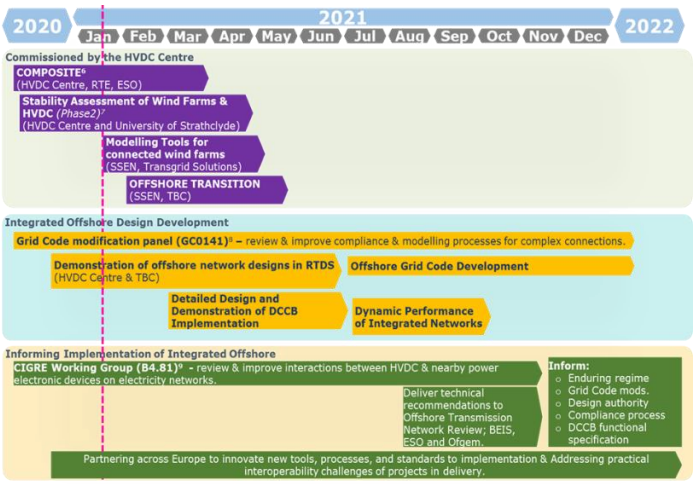
A Technical Perspective on Implementing Coordinated Offshore in GB

The next 12 months will be critical for de-risking the delivery of integrated offshore networks in GB, as highlighted in the UK Government's 10-point plan for green recovery and Energy White Paper (published November and December 2020). To inform the wider Offshore Transmission Network Review, the HVDC Centre has developed a roadmap of the technical analysis required.



The diagram above illustrates the technical workplan indicating ongoing work already commissioned by the HVDC Centre (in purple), proposed offshore network design and analysis work that the HVDC Centre is undertaking and supporting (in amber), and opportunities for collaboration with key technical authorities internationally (in green).

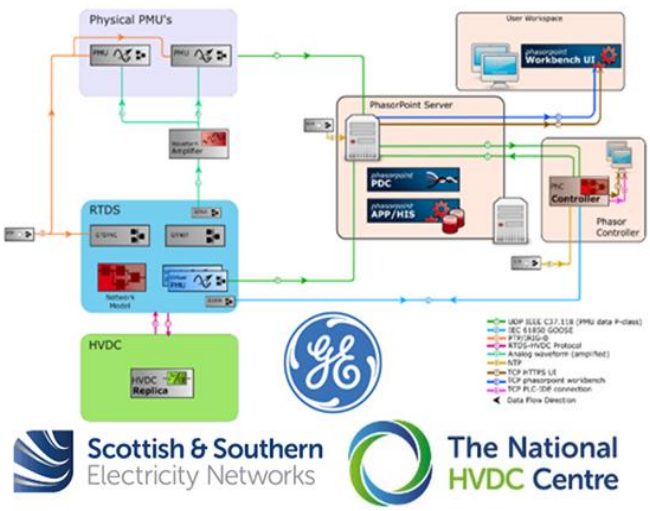
Addressing these technical challenges, the HVDC Centre has commissioned 4 projects recently of note:

1) The COMPOSITE project (with RTE International) will be presenting in the spring of 2021 practical guidelines and best practices for composite testing and compliance of complex connections, leveraging experience of multi-vendor and multi-device testing.
2) The Stability Assessment – Phase 2 (with the University of Strathclyde) is assessing the stability of wind farms and classic HVDC converters using the impedance modelling tools and small signal analysis techniques (developed in Phase 1) for VSC-HVDC schemes, developing high granularity open models, together with these techniques.
3) We have initiated a collaborative project with TransGrid Solution, to develop GB code relevant real time simulation models of various components devices and wide area controls expected to be relevant to HVDC-connected when interacting with Island and mainland AC networks.
4) The Centre is also developing an Offshore Transition project which focuses on the technical approaches for de-risking shared assets in incrementally constructed coordinated offshore transmission networks.

These technical de-risking activities combined with the Centre's own parallel detailed analysis of Bipole VSC-HVDC arrangements will inform technical designs, codes, specification and compliance processes that can support the implementation and delivery of coordinated offshore connections in GB.

Oluwole Daniel Adeuyi

Phasor-Based Monitoring with HVDC Control *(NIA funded project)*



The HVDC Phasor Based Monitoring project is part of SSEN's Innovation Program; where SSEN, GE and the HVDC Centre are project partners. This project aims to evaluate the electricity network system strength using the Phasor Point Wide Area Monitoring System (WAMS) to potentially support the stability of the large embedded HVDC links (for example Caithness-Moray located in the north of Scotland).

As part of this project, HIL (Hardware-In-the-Loop) testing of the WAMS along with the physical and simulated PMUs (Phasor Measurement Units) will be undertaken to ensure accurate measurement data collection takes account of the differences across real devices . This project will then demonstrate how wide area PMU data can be used to calculate system strength in real-time platforms in order to inform the ideal HVDC converter operating states as the conditions of the onshore network.

Habibur Rahman

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