



Case Study: Caithness-Moray Project

The Caithness-Moray HVDC Project (CM Project) is the first HVDC scheme in the north of Scotland, and represents a £1.1bn capital investment by SHE Transmission in the electricity network.

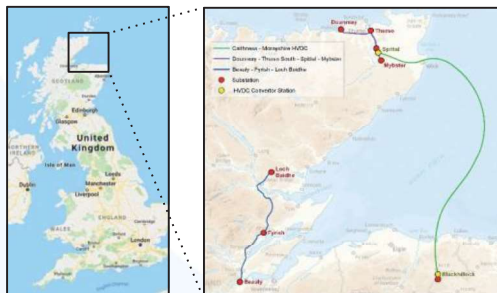
The first phase of the project links Spittal (in Caithness) and Blackhillock (in Moray) with $\pm 320\text{kV}$, 113km submarine HVDC cables. However, the scheme is designed as a three, four or five multi-terminal scheme allowing for future extension to connect the Shetland isles and other renewable generation.

The Caithness-Moray HVDC Project is a landmark project for developing the electricity network in Great Britain towards a low-carbon network; more specifically, the CM Project:

- Enables the export of electricity from one of the most productive renewables areas in Europe;
- Is the first multi-terminal designed project in Europe; and
- Demonstrates how a multi-terminal grid can be developed without the use of HVDC breakers.

However, it is also a technically challenging project:

- Connecting to a weak AC (275kV) network in the north of Scotland;
- Designed for multi-terminal operations; and
- Potential for multi-vendor extensions.



The HVDC Centre was able to help address these challenges and assure the delivery of this project through the use of Replicas of the control panels to test the operation of the system under a range of conditions, with a detailed representation for the AC network.

Furthermore, as the CM scheme is extended to multi-terminal operation, the HVDC Centre will have a pivotal role ensuring the operation of the complex multi-terminal controls, using the Replicas of all three terminals.

Support Provided by the HVDC Centre

The HVDC Centre has provided extensive technical support to the CM Project at each stage of the delivery of the project; and is able to provide the same services to any HVDC project.

The range of this support is represented in the diagram below.

Replica Control Hardware

Replicas Procurement	The HVDC Centre managed the procurement of the Replicas, from specification, supplier negotiation, Factory System Testing, through to delivery.
Replicas Installation and Commissioning	Following delivery of the Replicas, the HVDC Centre oversaw their installation, commission and testing.
Supported Replicas Hosting	Now that the Replicas are installed, the HVDC hosts and operates them in a secure environment, connected to our RTDS® system.

Training

Project Team Training	The HVDC Centre delivered training courses covering HVDC fundamentals, components and real-time simulation, followed by hands-on sessions where the attendees interacted the HVDC scheme in a simulated environment to build their understanding.
Control Room Training	The Centre enabled the control room team to train and practice the operation of the Caithness-Moray link, this aided their understanding HVDC control systems, and ensured a smoother and safer adoption of the scheme.

Grid Integration

Grid Integration Risk Management	The Centre has advised the CM project on identifying and mitigating grid integration risks, ensuring the security of the grid network.
Integration Compliance	The Centre supported the demonstration of grid code compliance of the CM scheme to the System Operator.
Interaction (& Fault) Studies	The HVDC Centre integrated the Replicas with a detailed real-time representation of the AC network (developed in-house) to test the operation of the HVDC scheme in conjunction with the AC network.

Specific Project Support

Controls Development	Prior to the CM project being commissioned, additional functionality was added to the scheme. The Replicas enabled this functionality to be fully tested at the HVDC Centre without delaying the commissioning of the scheme.
Commissioning Support	<p>The HVDC Centre supported the commission of the CM Project through:</p> <ul style="list-style-type: none"> • Pre-running commissioning tests on the Replicas, to show the results that should be anticipated; • Reviewing (on a daily basis) the outputs of the on-site commissioning tests, to provide in-depth analysis; and • Analysing and diagnosing faults and/or events that occur during commission.

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The Centre has been an invaluable partner in supporting the project and providing the technical assurance that all large projects require. The team are very knowledgeable and experienced in the area of simulation and bring significant expertise to the project.

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Richard Hanson, Head of HVDC Engineering and Operations, SHETransmission

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

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