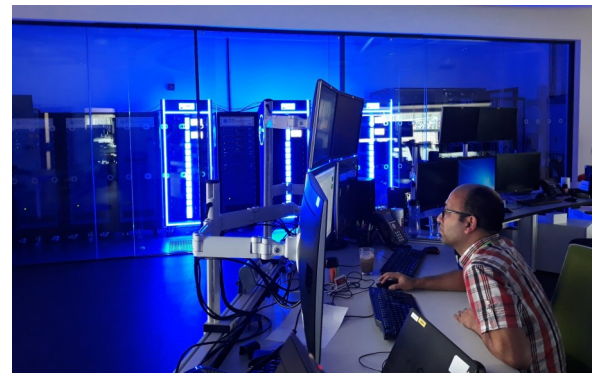


Replica HVDC controls provide pre-commissioning, training, and grid integration support at GB's National HVDC Centre

### User Profile: A collaborative real-time simulation facility with tools and expertise

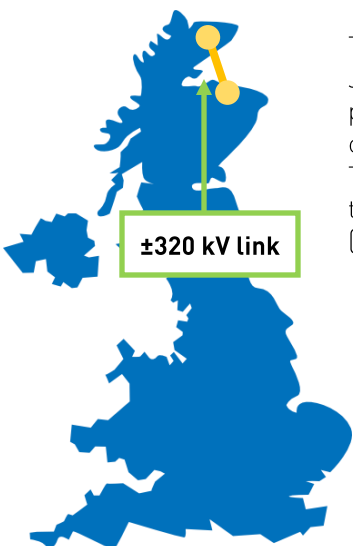
Great Britain, like many regions worldwide, will see a massive increase in HVDC projects over the next decade. Planned HVDC construction and expansion will lead to over 20 new links in that timeframe, many of which are geographically and electrically close. In this landscape, the integration of point-to-point and multi-terminal systems involving equipment and controls from many vendors will be a highly complex process requiring very high standards of design and testing.

The National HVDC Centre is a collaborative real-time simulation facility which will support the feasibility, specification, testing, operation and maintenance of HVDC transmission systems as they continue to be deployed and operated in Great Britain. The Centre is part of Scottish & Southern Electricity Networks and is funded through Ofgem.



*The RTDS® Simulators at the heart of The Centre*

### Project Focus: A safe, flexible environment for testing Caithness-Moray link operation



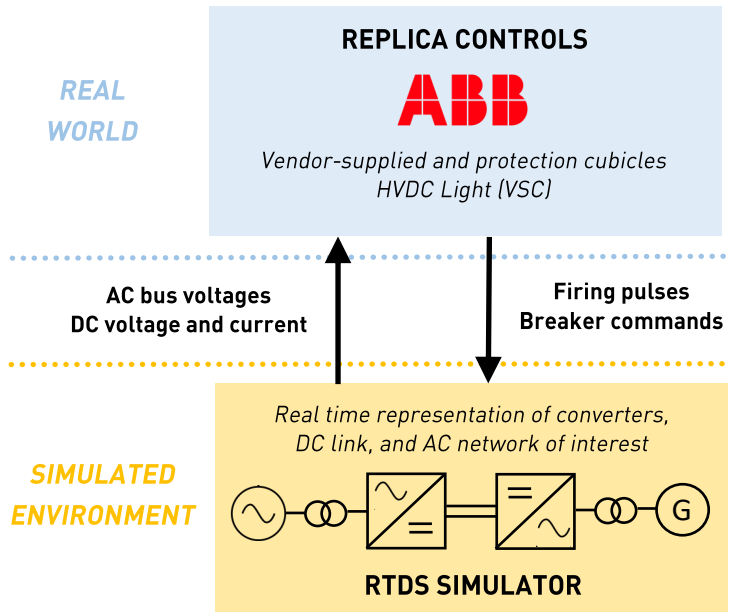
The Caithness-Moray (CM) HVDC project was completed and energized in January 2019, on time and within the approved budget allowance. The project will transmit up to 1200 MW of power through a 113 km subsea cable between the Caithness and Moray regions in the north of Scotland. The CM project, the most significant investment in northern Scotland's transmission system since the 1950s, will transmit renewable power (including both off- and on-shore wind) to load centres.

The first phase of the CM project is a point-to-point link, but the project is designed to be expanded to three, four, or five terminals to accommodate the connection of additional renewable power in the Shetland isles and other locations.

The RTDS Simulator allows The National HVDC Centre to simulate the converter stations, DC link, and AC network of interest and use the safe, flexible digital simulation environment to test the link's operation and control.



### Replica Controls: A lab-housed copy of installed controls, specifically for testing



The RTDS Simulator uses dedicated parallel processing hardware to represent complex power systems and power electronics in real time. Signals can be sent into and out of the simulated environment in order to interface the simulation with external hardware.

For this HVDC project, the manufacturer (in this case, ABB) used the RTDS Simulator to perform Factory System Testing on the control and protection cubicles for the project, which were eventually installed on the project site. Additionally, they performed the same set of tests on a set of replica cubicles which were then delivered to The National HVDC Centre.

The replica controls are connected to the simulated network in a closed-loop interface. This allows the simulation experts at The Centre to safely subject the controls to a huge variety of power system conditions, operational strategies, and control modifications in order to analyze the response prior to implementing changes on the real power grid.

Real time simulation technology and expertise allowed Great Britain’s National HVDC Centre to provide a variety of services and support for the Caithness-Moray HVDC project:

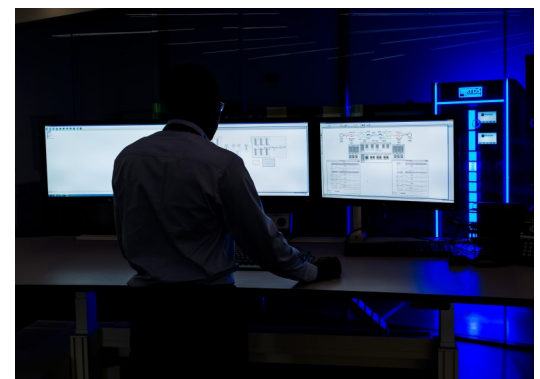
- Grid integration risk analysis and mitigation studies
- Grid code compliance demonstration
- AC system interaction studies

- Pre-commissioning testing
- Commissioning event diagnostics
- Control operator training

### Outcomes and Looking Ahead: An asset for the nation

The combination of specialized tools and expertise at The National HVDC Centre supported the timely, on-budget, and technically sound commissioning of the CM project. The successful completion and energization of this project marks a milestone for The Centre. Moving forward, they will continue to serve as a collaborative asset for de-risking HVDC deployment in Great Britain. As the HVDC and FACTS network becomes more complex, additional capabilities of interest will include:

- Pre-implementation control modification testing
- FACTS device integration studies
- Multi-scheme interaction studies and risk mitigation
- Training of new personnel



Running a simulation in The Centre’s control room

Learn more about HVDC controls testing at [www.rtds.com/applications](http://www.rtds.com/applications)