The National HVDC Centre:

Low strength protection performance & Black Start operation

- NSL Case Study

30th October 2019

The National HVDC Centre *part of* Scottish & Southern Electricity Networks *together with* nationalgridESO, SP ENERGY NETWORKS, nationalgrid

The National HVDC Centre

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The National HVDC Centre at LCNI2019

The National HVDC Centre is an Ofgem funded simulation and training facility available to support all GB HVDC schemes.

AC Protection Coordination

12.00 on Day 1
(30th October)

Maximising HVDC for Black Start

15.30 on Day 1
(30th October)

HVDC Centre Impact

12.00 on Day 2
(31st October)

The National HVDC Centre *part of* Scottish & Southern Electricity Networks

together with

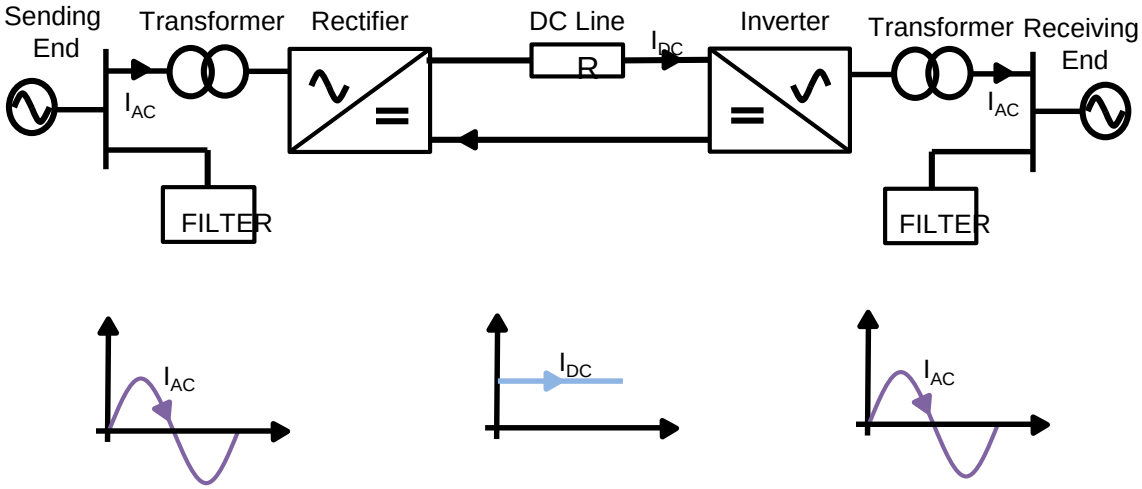
nationalgrid nationalgridESO

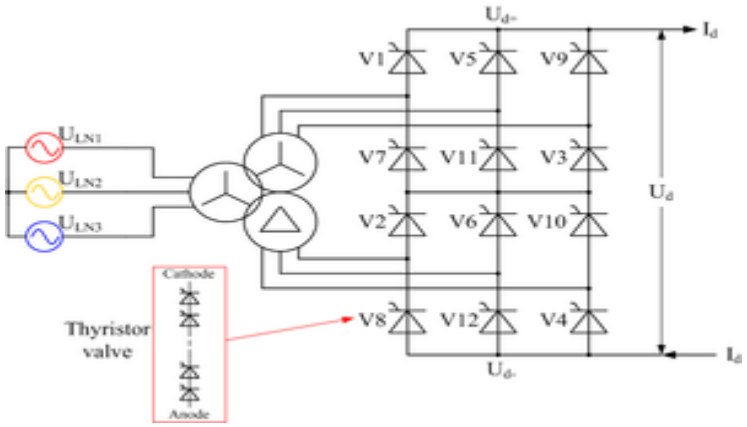
SP ENERGY NETWORKS

The National HVDC Centre is part of Scottish & Southern Electricity Networks and is funded through the Electricity Network Innovation Competition as the Multi-Terminal Test Environment (MTTE) Project. Scottish and Southern Electricity Networks is a trading name of Scottish Hydro Electric Transmission plc, Registered in Scotland No. SC213461, having its Registered Office at Inveralmond House, 200 Dunkeld Road, Perth, PH1 3AQ; and is a member of the SSE Group www.ssen.co.uk

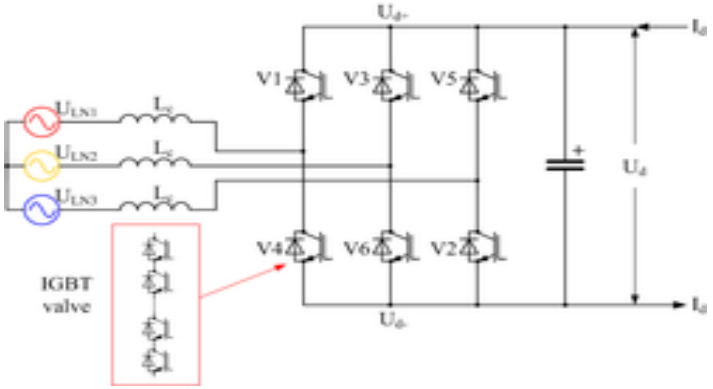
What is HVDC?

- HVDC is the most **efficient** way to transfer power over long distances.
- They support the Grid during instabilities and act as firewall between the various parts of the grid.
- Two main technology
  - LCC
  - VSC





LCC



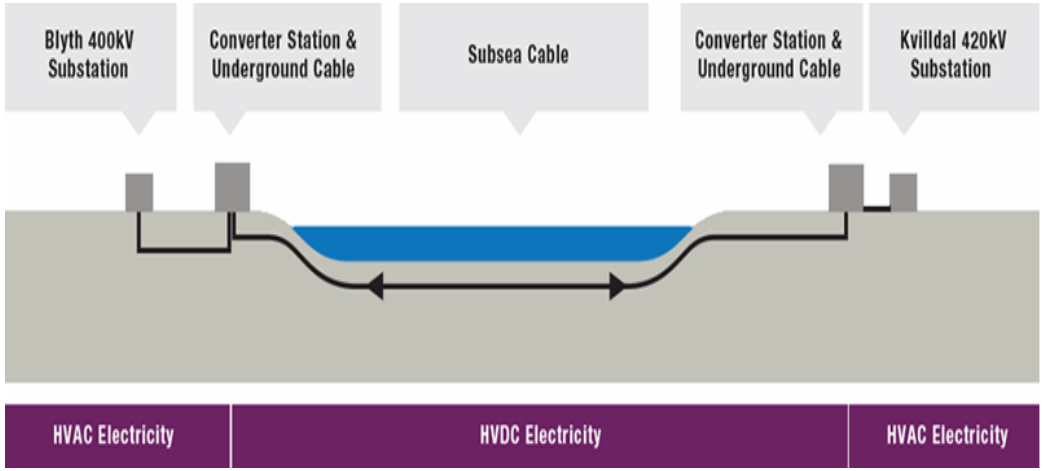
VSC

Source: https://en.wikipedia.org/wiki/HVDC_converter

NSL Overview

The North Sea Link (NSL) is a new HVDC interconnector connecting Blyth in the north east of England, to Kvilldal in Norway.

The NSL will have the capacity to transmit 1,400 MW of power at DC voltage ±525kV passing through Norwegian and British waters. The 730 kilometre link will be the world's longest subsea power interconnection, expected to enter commercial operation in 2021.



Source: http://northsealink.com/

Source: https://www.power-technology.com/projects/north-sea-link-nsl/

Projects at HVDC Centre

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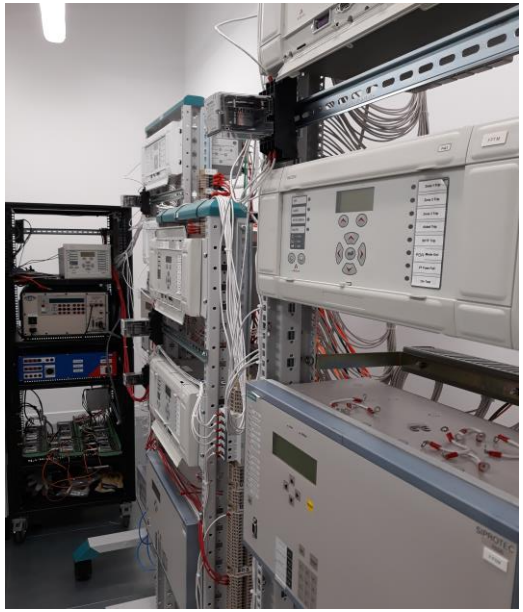
The National HVDC Centre is engaged in two projects related to the Impact of NSL on the AC Grid;



1. Eccles-Blyth-StellaWest 400kV circuit Protection Performance Studies.

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nationalgridESO

nationalgrid

2. Research Engagement with EPRI (Electric Power Research Institute) for Coordination of protection settings during energization of grid using HVDC grid forming mode.

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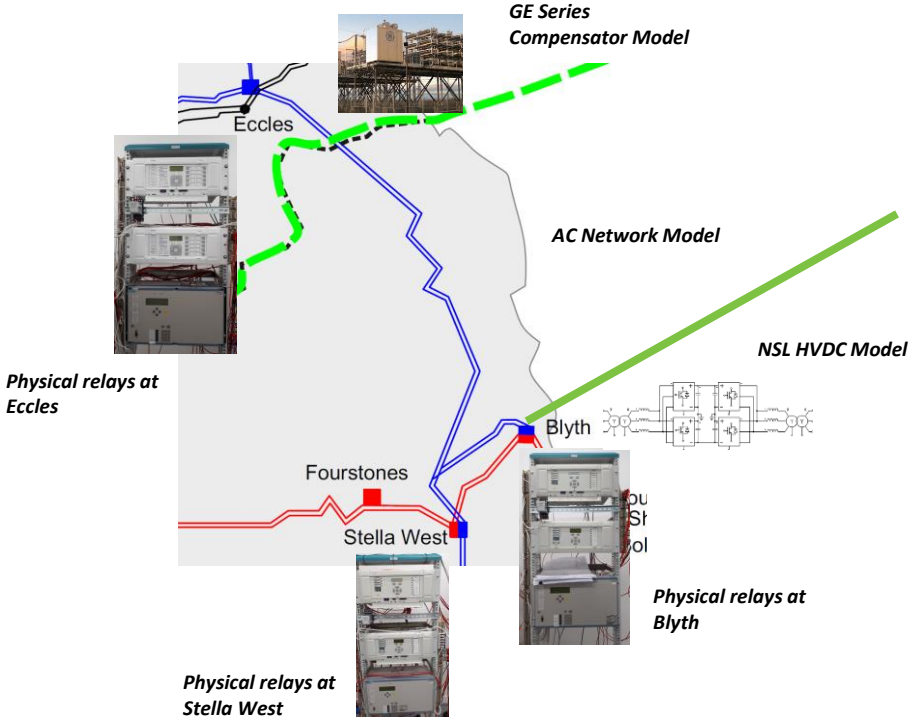
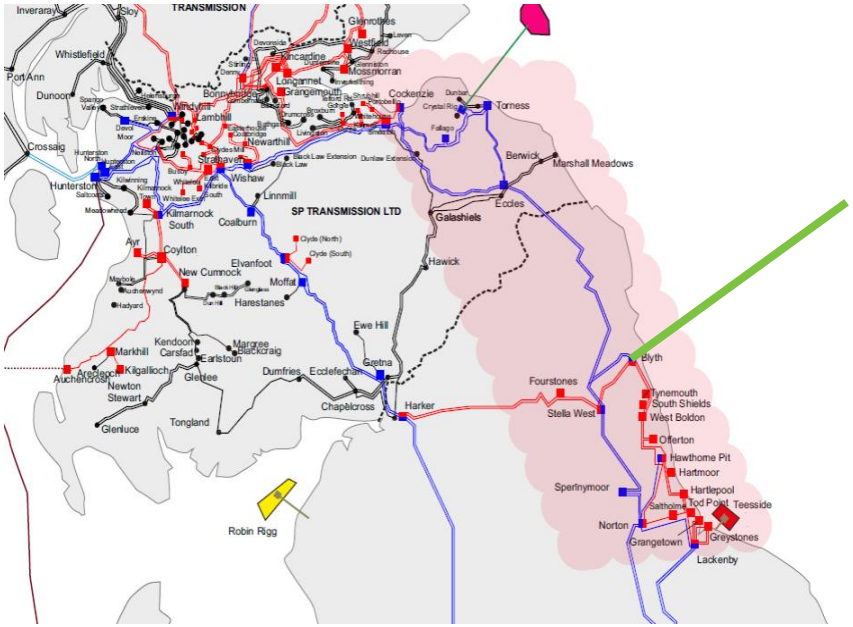
Overview of Eccles-Blyth-StellaWest 400kV Protection Performance Studies





Integration of various elements for the Studies

Focus area in the GB Grid

NGET and SPEN have commissioned the HVDC Centre to Test and Validated the protection performance.

Predicted Outcomes and Why?

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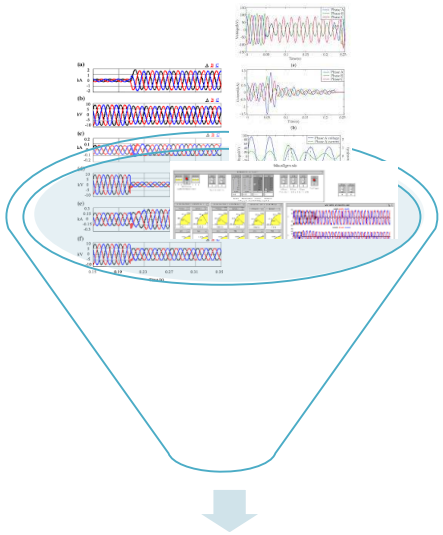
The output from these studies would be a set of recommendations on the function of protection and control within the reconfigured network.



Recommendation To TO's

To ensure the ***security and resilience*** of the GB electricity network as more HVDC links are connected.

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Updates by

EPRI
ELECTRIC POWER RESEARCH INSTITUTE

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HVDC Centre