Memo

Shetland HVDC Link - Impact of higher power rating

ABB Power Grids Sweden AB

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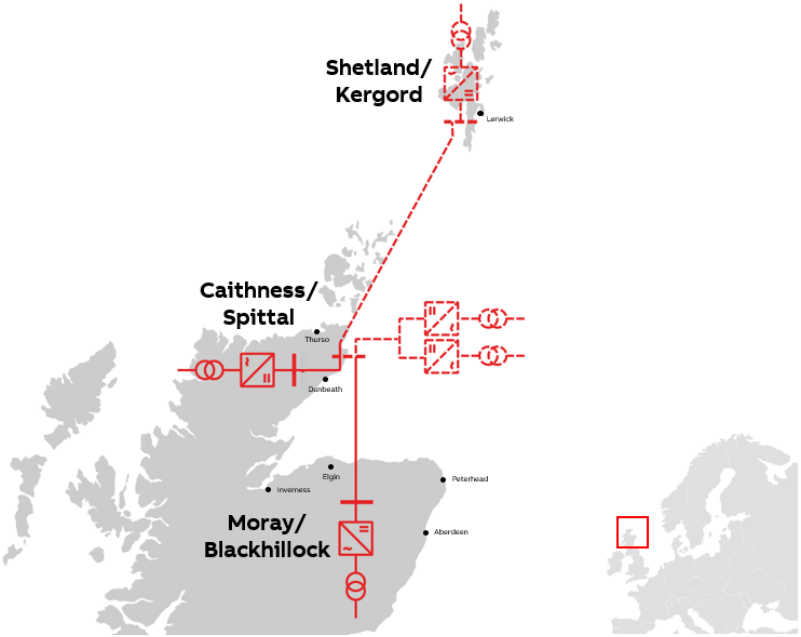
1 Overview of HVDC scheme

To be ready for future HVDC extensions, the Caithness Moray HVDC link was designed and tested as a five-terminal HVDC system, but will be built in steps, starting with a two-terminal system on the north Scottish mainland in Caithness and Moray. The finalised scheme will consist of the initial two land-based HVDC terminals, a third HVDC terminal on the Shetland islands and two off-shore HVDC terminals; and a DC switching station on the north east Scottish mainland at Noss Head, a hub in the system to which all HVDC terminals will be connected with DC cables, see the figure below. 2019 the initial Caithness Moray two-terminal system was commissioned and set into operation.



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2 Power rating of existing design

The Caithness-Moray HVDC link has the symmetric monopole configuration, i.e., the converter stations output a DC voltage of positive and negative polarity, +/-320kV. The power ratings of the existing design for the five HVDC terminals are as follows:

Blackhillock in Moray	1200 MW
Spittal in Caithness	800 MW
Kergord on Shetland	600 MW
Future A offshore	800 MW
Future B offshore	800 MW

3 Increased power rating

Currently there is a discussion on increasing the planned power rating from 600 MW to 800 MW for the Kergord converter station on the Shetland Islands.

Increasing the rating of the Kergord converter station from 600MW to 800MW, for the future extension to the Caithness Moray HVDC link may have an impact on the design of the currently operating two-terminal system even though the total infeed of active power from the wind power parks on Shetland and the off-shore platforms will remain the same. There may be influence on the surge arresters and the DC chopper together with its resistor. Hence the Transient Overvoltage and DC chopper studies for Caithness-Moray need to be redone.

The yet not built Kergord converter station is to be considerably re-designed as described in [1]. Basically all system studies and equipment specifications need to be redone, but since the major change is the increased power rating, this would be a rather straight forward engineering task.

The only impact on the Noss Head DC switching station might be the energy rating of the DC cable surge arresters which will be checked in the TOV studies.

The converter valve at Kergord will probably remain the same but the capacity of the valve coolers are to be increased. The dimensions of equipment connected in series will increase 10-15 % and the number of parallel surge arrester columns will probably also increase due to increased power. However, as said in [1] no major enlargements of the converter building are foreseen since there are already some margins. Possibly the height of the transformer and reactor hall need to be increased somewhat though.

The settings of the DC grid master controller as well as control systems at Spittal and Blackhillock are to be changed and re-tested due to the increased power of Kergord.

4 References

1. Mott McDonald company, Technical Note “Review of Kergord Converter Station Upgrade from 600MW to 800MW”, 02-Oct-2018