

Review of the Visit at National Grid's Sellindge Substation on the 10th of December, 2013

Jorge Gonçalves & Marc Cheah

National Grid's Sellindge Substation is the British terminal station of the HVDC Cross-Channel. This is the name given to the two different High Voltage Direct Current connections operate under the English Channel between the continental European and British electricity grids.

The connection was updated during since its commissioning and now operates as two independent bipoles of 1000 MW each.

The visit was preceded by a video, courtesy of National Grid, in which most of the operation details of the connection were clearly explained. The field visit after the video followed the energy flow from National Grid's 400 kV AC transmission network connection up to the beginning of the DC cables that connect the British and French electricity grids.

The first point of the visit consisted in the arrival of the 400 kV AC lines from the transmission network. Given the high reactive power needs by thyristor-based HVDC links like the Cross-Channel one, Static Var Compensators (SVC's) were connected between the 400 kV AC lines and the AC switchgear substation. The substation buses were insulated with SF₆ using Gas Insulated Switchgear (GIS) and the visit followed to the AC filters and AC switchgear. The key point was the size and quantity of filters needed to mitigate the high quantity of harmonics produced by thyristor-based HVDC links.

The thyristor valves were connected to the AC switchgear through individual monophasic transformers. The valves must be cooled, which was achieved by the use of a mixture of water and glycol in this substation. Due to the cooling system, it was possible to lower the valves temperature and keep the temperature in the valve room around 50-60 °C. In order to understand the physical disposition and connection of the valves, a detailed visit to a training module was provided, contributing to thoroughly understanding of the physical construction of a thyristor-based converter.

The power flows from the thyristor converters to the DC cables through DC smoothing reactors, were used to mitigate DC current ripple. Additionally, there were also DC filters used to eliminate unwanted harmonic components on the DC side.

The communication between the British and French substations was achieved through a low-frequency Power Line Carrier-based (PLC) component injected on the DC cables. This component is removed in the other substation before the point of measurement and control in order to avoid additional disturbances.

The overall substation is controlled from a control room with a 24/7 operator that receives and monitors the operation of the whole HVDC connection, e.g. operational safety limits are power flow reversals. Next to the control room there were the PLC's responsible for the control of the converters.