SVC Systems for E.ON in Lübeck-Siems

The Static Var Compensator (SVC) is supplied by Siemens with new control and protection equipment.

PTD is supplying transformers and a Static Var Compensator system for the German utility company E.ON Netz GmbH, in order to stabilize the supply voltage in the Lübeck area.

The HVDC Baltic Cable (with a transmission capacity of +/-600 MW) was constructed more than ten years ago to link the power systems of Germany and Sweden. To ensure optimum dynamic operation of the transmission line it was originally planned to connect the converter station to the 380 kV grid of E.ON. Changes in the European power market meant that this connection, along with other grid expansion projects, was abandoned. The HVDC transmission link was consequently connected to the Lübeck district’s existing 110 kV network, which is inadequately dimensioned in terms of necessary system impedance. Only a short 380 kV link was ever installed between the HVDC converter station Herrenwyk and the Siems transformer substation (380/110 kV).

Based on a network study, ref. fig. 1, performed by E.ON, various extensions to the existing grid will be completed by the end of 2004. For instance, a 10 km long cable will connect the Siems substation to the 220 kV transformer substation in Lübeck. Siemens has already received an order from E.ON to supply the 380/220 kV transformer (rated at 350 MVA) destined for the Siems substation. A Static Var Compensation system will additionally be installed to ensure voltage quality.
According to the highly dynamic behavior of the central component (i.e. the HVDC converter station), the power factor correction must meet similar requirements at a very minimum. To stabilize system voltage it must respond to any variations in the amount of power being transmitted through the HVDC cable by supplying an equivalent amount of reactive power. To ensure fast control processes, the power factor correction equipment must be designed using high-speed electronics. E.ON placed an order for the SVC (Static Var Compensator) with Siemens on November 1, 2003.

The SVC is to be installed on a 3,600 m² plot on the former site of the Lübeck-Siems power plant (Fig. 2 shows the future location as little more than a waste dump at present).

Once completed, the electrical components of the SVC will essentially comprise a three-phase transformer (400/18 kV) for connection to the transmission network at the Siems substation and four branches (2 thyristor controlled and 2 filter branches) to be installed on the 18 kV secondary side. The SVC’s reactive branches are designed to provide a control range of +200 to -100 MVar. The layout of the SVC - system is shown in fig. 3.

One of these four branches is a Thyristor Controlled Reactor (TCR). The TCR provides linear reactive power control through its entire reactive power range. Therefore the SVC has linear reactive power control through the entire reactive power range from +200 to -100 MVar.

The second branch is a Thyristor Switched Capacitor unit (TSC) which can be switched in and out using thyristors for stepwise control of reactive power.

The two other branches are fixed filter banks which are also a source of capacitive reactive power. The filter banks are designed to absorb harmonic currents produced by the TCR so that they are not allowed to enter the network.

A service building will house the thyristor equipment and the control and protection system required for SVC operation. This is provided with the first-ever implementation of the new highly reliable control and protection system from Siemens based on SIMATIC TDC, a proven industrial hardware design. It is remarkable to consider the entire project time, scheduled from signing of contract to PAC, of only 14 months.
For noise damping reasons, the components most likely to “offend” will be enclosed in suitable noise reducing enclosures. In particular, these are the power transformer and the reactors for inductive current control.

The project is timed so that the system will be ready to enter full service by the end of 2004. Essential foundation and construction work is scheduled to commence in spring of 2004 as soon as the building and environmental authorities have approved the documentation. Although sections of the existing power plant foundations are suitable for the new structures, the ground works nevertheless pose a challenge. Due to the site’s proximity to the River Trave, some of the foundations will have to be reinforced with piles to a depth of up to 18 meters.

On completion of commissioning, the SVC and the revised subnetwork of the E.ON grid will be put through their paces when they are in normal operation in conjunction with the Baltic Cable HVDC (starting on January 1, 2005).