Good Connections between Sweden and Germany

Quality recording in static VAr compensators SVC

The company

The shareholders in Baltic Cable AB, founded in 1991, are the Norwegian power supply company Statkraft, the E.ON energy services group, and the Swedish company Sydkraft.

The starting situation

Since 1994, Baltic Cable has exchanged electricity between Germany and Sweden by means of a 250-kilometer-long (160 miles) direct-current link. The 450 kV high-voltage, direct-current transmission system (HVDCT) has one converter station in Kruseberg and one in Herrenwyk. The HVDCT system was designed with a transmission capacity of ± 600 MW. Contrary to original plans, however, the system is now linked to the 110 kV power system, because of changes in the European energy market. In order to guarantee dynamic operation of this transmission cable, despite the considerably lower short-circuit power at this voltage level, E.ON is undertaking various expansions based on a network study.

The corresponding 400 kV transforming station, in direct proximity to the HVDCT converter station, connects to the 220 kV transforming station in Lübeck via a 10 km long cable. E.ON ordered a 380/220 kV transformer with a rating of 350 MVA from Siemens, which is required for the Siems station.

The concept

A static VAr compensator (SVC) is being installed to guarantee the voltage quality. Since the HVDCT converter station has a high dynamic performance, the compensation system needed to have at least the same dynamic performance. To stabilize the system voltage in case of a change in the power transmitted over the HVDC cable, the system had to provide equivalently high inductive (voltage reduction) or capacitive reactive (voltage increase) power. In order to implement these regulating processes quickly, the SVC relies on high-speed power electronics systems.

When completed, the SVC will consist of a three-phase 400/18 kV transformer, which links to the transmission system at the Siems transformer station, and four subcomponents installed in the 18 kV area.

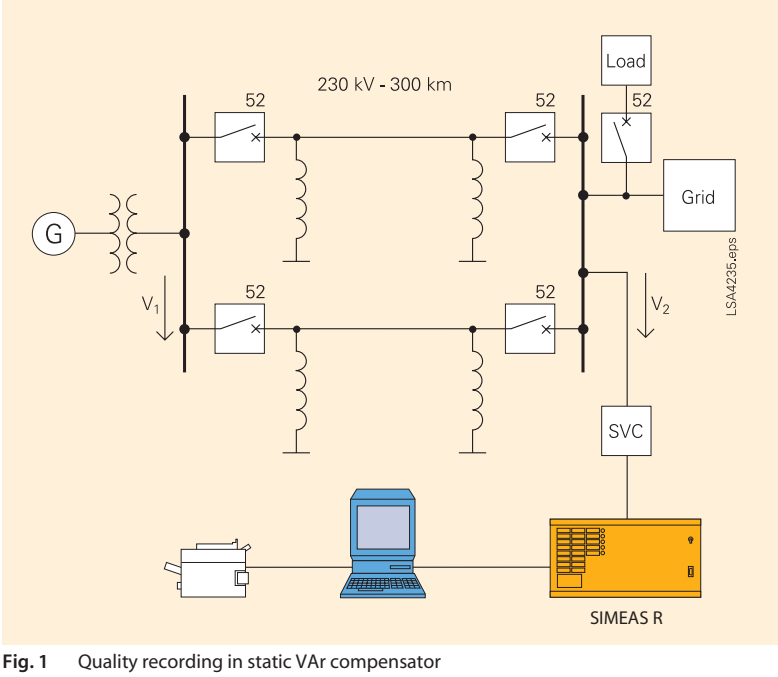

Fig. 1 Quality recording in static VAr compensator

The special advantages

The four subcomponents of the SVC system cover a control range from +200 to -100 MVar for the voltages and times described in the specification.

Inductor is infinitely variable

One of the four medium-voltage components is a power-thyristor-controlled reactor. The reactor (reactance coil) generates an inductive current. Since the reactor is the only infinitely variable unit connected to the power electronics system, it is designed to cover the entire control range of the SVC system, from +200 to -100 MVar.

Capacitor unit generates reactive power

The second component is a capacitor unit. The system section can be switched in or disconnected via the connected power electronics system so that leading reactive power can be generated if needed.

Reactive power generator serves dual functions

The third and fourth units are leading reactive power generators. They also double as filters in order to avoid any harmonic feedback in the SVC, and are therefore permanently connected.
An equipment building houses the power electronics system and the control and protection equipment that operate the system.

SIMEAS R guarantees reliable voltage quality

In order to log the correct functioning of the SVC system with the corresponding power system requirements and to determine the cause of any fault, the protection and control concept includes a SIMEAS R quality recorder. The availability of the SVC system is a condition of the commercial contract, and Siemens had to provide proof of availability. At the same time, a high degree of recording accuracy is important, since the SVC control is designed to operate at an accuracy of better than 0.5 % in order to guarantee the voltage quality.

The quality recorder provided in the Siems SVC records the primary voltage and currents on the 400 kV side. It also records the reactive power and the harmonic voltages on the primary side, the voltage on the transformer secondary side, the currents of the individual medium-voltage components, and various protection and control signals.

Data analysis and archiving

For analyzing and archiving data, an evaluation station is connected to the SIMEAS R. The substation includes a PC equipped with OSCOP P software and a printer.

■ *Conclusion*

Quality recording in the SVC documents the power quality. Due to the recording of the correct functioning of the SVC, it is possible to easily and quickly locate a fault and its cause.
The data base of the SIMEAS R is the basis for the commercial contract. It serves as a proof for the availability of the plant.

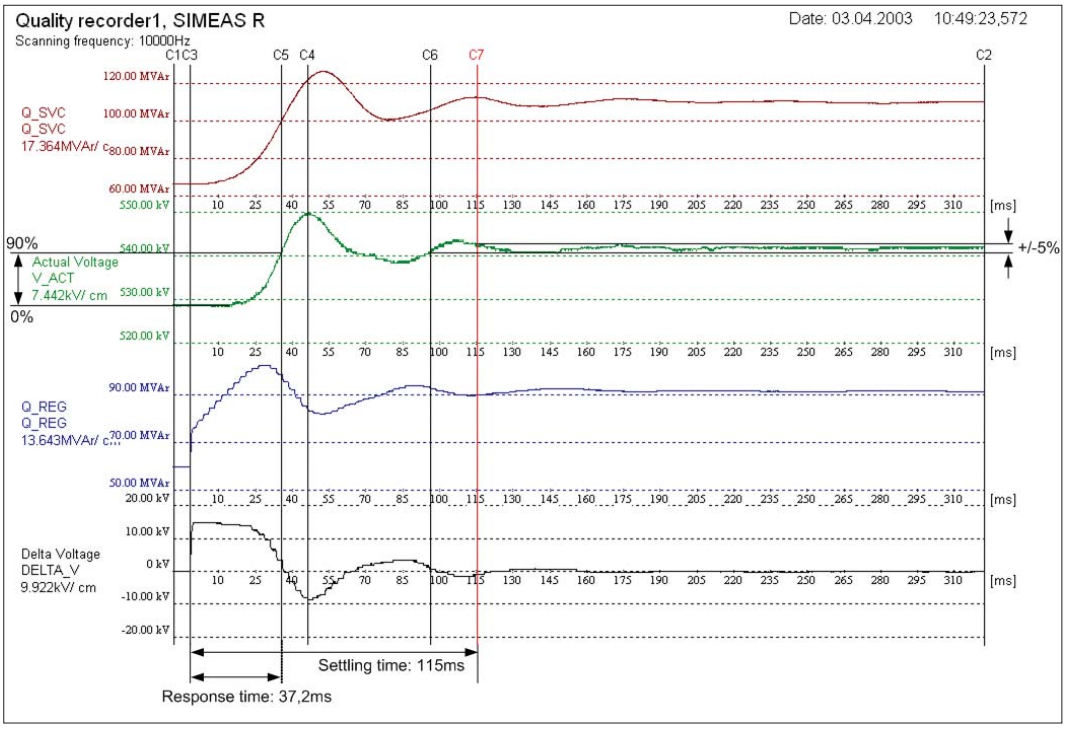

Fig. 2
Example of a quality record

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