An ABB static var compensator (SVC) with a total rating of 340 Mvar was commissioned in 1987 in the Nebo 275/132 kV substation of Powerlink, Queensland, Australia. The decision to install this equipment came as a consequence of the electrification of the Central Queensland heavy haulage railroads. The compensator was installed by ABB as a turn-key commitment.

Nebo is a major substation in east Central Queensland which supplies power among other things to large mining areas where an important part of the loads consists of single-phase coil trains. Control of negative phase sequence voltage is therefore a key task for the SVC in question. A sophisticated logic scheme provides different levels of priority for the operating of the compensator, with load balancing of 275 kV and/or 132 kV having the highest priority and voltage control of 275 kV coming as number two.

The SVC performs four different tasks by means of the same equipment:

- Compensation of unbalanced railway loads by control of negative-phase sequence voltage
- Voltage control during the daily load cycle including the switching of existing shunt reactors and control of voltage fluctuations induced by draglines
- Providing a fast acting reactive reserve to support the transmission system under contingency conditions.
- Damping of power oscillations

Nebo is approximately half way between the Central Queensland power stations and the North Queensland load centers. Over this distance, more than 850 km, there are no generating or dynamic reactive sources. A main benefit from the Nebo SVC is the deferring of costly transmission reinforcement to Nebo by increasing the transmission capacity.

The main components of the compensator are one 170 Mvar Thyristor-Controlled Reactor (TCR), one 170 Mvar Thyristor-Switched Capacitor (TSC) and 90 Mvar Harmonic Filters. The reactive power range is thus 80 Mvar inductive to 260 Mvar capacitive. The compensator is connected to 275 kV via a step down transformer.

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**Single-line diagram**

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The regulator equipment consists of one main system and one back-up system. The circuits are provided with a slow acting Q regulator keeping the output power of the compensator within set limits, thus keeping a reactive power reserve for contingency situations. The main system is provided with single-phase voltage regulators and can control and balance the voltage. The back-up system has a three-phase voltage regulator for control of the voltage.

Switching between the two control systems is possible with the SVC in operation. The system which is not regulating the SVC can be connected to a network simulator allowing fault tracing/checking of this system with the SVC still in service.

The Nebo SVC is part of a large-scale undertaking by ABB into the network of Powerlink which all in all comprises ten SVC installations plus a number of harmonic filters, all linked one way or another to the electrification programme of Queensland Railways.

Layout

![Diagram of Nebo SVC layout]

Technical data

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