Alstom commission the world’s first SVC with a main reactor - providing voltage control and dynamic system support

SSE maintains electricity networks, supplying electricity to over 3.7 million homes and businesses across central southern England and north of the Central belt of Scotland.

It owns one transmission network and two electricity distribution networks, comprising 106,000 substations and 130,000 km of overhead lines and underground cables across one third of the UK.

Key benefits of patented SVC with main reactor
- Superior harmonic performances
- Increased availability of grid network
- Improved power quality with lower power losses
- Compact design with reduced footprint compared to classic SVC

SUCCESS STORY: FACTS

SHE TRANSMISSION
World’s first Static VAr Compensator with a main reactor at Beauly Substation

Country: ........................................ United Kingdom
Project: ........................................ Beauly
Customer: ................................. SHE Transmission
Scope: ........................................ Alstom’s patented SVC with main reactor, turnkey scope with installation and commissioning
Rating: ........................................ ±150 MVar, 275 kV
Commercial operation: ........ 2013

CUSTOMER CHALLENGE
In 2013 alone, Scottish Hydro Electric Transmission (SHE Transmission) part of the SSE group integrated 300 MW of renewable energy into Scotland’s grid network, and 1,530 MW during the previous 10 years. The rise of renewable energy, coupled with increasing demand, has driven the need for more adequate infrastructures and reinforcements. SHE Transmission is thus investing around £2 billion in the next five years to respond to the needs of large-scale electricity generators.

The Beauly Substation, owned by SHE Transmission, is a key strategic node in the existing transmission network built in the late 1960s.

As part of the company’s aim to ensure sufficient network capacity for renewable generation, the substation was newly redeveloped to facilitate the installation and operation of a new 400 kV overhead transmission line between Beauly and Denny.

The proposed expansion required the installation of a new Static Var Compensator (SVC) to help operate the electrical transmission system within quality standards, in anticipation for the connection of large quantities of renewable energy generation. Alstom’s innovative SVC configuration with a main reactor was selected for this project.
A NOVEL IDEA, SUPERIOR PERFORMANCE

In 2013, Alstom officially commissioned the world’s first SVC configuration with a main reactor for SHE Transmission’s Beauly Substation. The main purpose of the Beauly SVC is to provide voltage control and support the 275 kV transmission system under dynamic conditions.

The advantage of this newly patented SVC configuration with a main reactor is its straightforward approach to reducing costs, while considerably improving power quality and system availability for utility customers. The superior performance is enabled by adding an additional layer of impedance, i.e. resistance, via the main reactor to help reduce harmonics. This concept ultimately isolates harmonics in a two-way manner, from the SVC to the network and from the network to SVC, even in demanding network conditions, thus limiting power losses. Depending on any particular scenario, harmonics can be reduced anywhere from 40% to 60%. As demonstrated in Fig 1, the main reactor was able to significantly reduce harmonics for the Beauly Substation.

Because of the improved harmonic performance, fewer harmonic filters are necessary, optimizing the layout to a compact configuration.

Relative harmonic current values at SVC feeder branch (PCC) with and without main reactor (MR) included

The Beauly SVC project began at the end of 2010 and was delivered 3 months ahead of contractual schedule, thanks to a concerted effort by project and client teams. Based on the data of the Beauly Substation given during the tender phase, a conventional SVC would have failed to pass the harmonic requirements. The main reactor SVC’s combination of performance and cost-efficiency has made it a successful reference for future SVC projects alike.

CUSTOMER TESTIMONIAL

“The project was designed and executed by Alstom to our satisfaction. We very quickly built an excellent working relationship with their engineers throughout the design process, and site works were completed without any major problems. The "Main Reactor” concept was an innovative one to deal with particularly challenging harmonic issues at the substation, but its advantages were clear to us, and we have experienced no issues with its operation.”