Electricity is an integral part of our lives. We depend on it for everything from lighting to running elevators, sophisticated computers, hospitals, transportation equipment - and so much more. At the same time utilities are being forced to move away from fossil fuel generation, as large percentages of renewable energy sources are integrated into grids around the world. Power flow stability is becoming a real challenge for network managers.

Utility **Static VAr Compensator**

**ALSTOM'S SVC SOLUTIONS FOR IMPROVED POWER QUALITY**

Disturbances can be caused by network line switching, line faults and non-linear components, such as thyristor controls, rapidly varying active or reactive loads, unbalanced phase voltages, or the introduction of inherently unstable renewable energies. Aging AC transmission systems were not designed for these changes and must be adapted to a more ecological approach while remaining highly efficient and financially viable.

Utility Static VAr Compensators (SVC) offer solutions to these challenges, increasing power quality and offering a quick return-on-investment.

Stabilised voltage levels and reactive power compensation improve the overall system stability, increasing transmission line power transfer capabilities and thus providing a seamless power flow to end-users.

**CHALLENGES RESOLVED WITH ALSTOM SVC**

- Harmonics
- Rapid changes in reactive power
- The need for additional reactive power
- Voltage fluctuation
- Flicker phenomena
- Unbalanced loads
- Power oscillation

**CUSTOMER BENEFITS**

- Improves quality of older AC transmission systems
- Integrates renewable energies into networks
- Balances reactive power
- Quick return-on-investment

±100 MVar 230 kV New Zealand

-60/+100 MVar 345/15 kV 60 Hz
Campos, Furnas Centrais Eléctricas SA, Brazil

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UTILITY SVC - TAILORED TECHNICAL SOLUTIONS...

Systems parameters determining SVC design
Each network has its own power supply quality requirements, so each SVC must be tailor-made. SVC design depends on the fault level and load parameters. In case of high fault levels, the main parameter of the SVC design might be reactive power compensation, while flicker and harmonic reduction are major concerns for low fault levels.

REDSUCING HARMONICS
Non-linear loads generate harmonic currents. The harmonic currents load the network and lead to voltage distortions. Distorted voltage may cause end-user malfunctions: for example, in sensitive computerised devices and other process control equipment.

The filter circuit of a utility SVC system is designed to absorb harmonics generated by charge as well as by Thyristor Controlled Reactors (TCR). The total harmonic distortion (THD) and individual harmonic voltages are limited to below specified levels, thus offering a more fluid power flow.

POWER TRANSFER CAPACITY INCREASES
Reactive power transmission can lead to significant voltage drops and current

FLICKER REDUCTION
Rapidly varying reactive power causes voltage fluctuations at the common coupling point. The human eye perceives this frequency of voltage fluctuations as flickering lights. The addition of an SVC into the network reduces the flicker.

VOLTAGE STABILISATION, UNBALANCED LOADS
Loaded non-transposed lines can create voltage unbalance causing reduced efficiency, overheating, noise, torque pulses and speed pulses to motor operations. The utility SVC operates in single-phase control mode, thus balancing the voltage.

FIXED OR RELOCATABLE
SVC locations can be fixed or relocatable. While outdoor equipment is usually built as fixed structures, indoor equipment is often situated within an easily relocatable container. It is also possible to use a modular SVC design, making transportation, installation and commissioning fast and easy.
...OFFERING YOU IMPROVED POWER QUALITY

Network design and simulation

REAL TIME DIGITAL SIMULATOR (RTDS®)
No two SVC installations are alike. The scope of an SVC installation depends on the technical and economic requirements of the individual network. Our Real Time Digital Simulator (RTDS®) tool designs and simulates your electrical network. Based on Nokian Capacitors technology, the system has two RTDS® simulation racks and can handle and design 100 network nodes.

The measured data or simulated model is run on the RTDS®. The simulation model and control system parameters are adjusted to give maximum performance. Simulations may be used to optimise installation cards, losses and performance. In some cases, the SVC power is reduced to minimise losses while also increasing performance. RTDS® is also a powerful tool in line fault situations.

DIGITAL CONTROL & PROTECTION AT THE HEART OF PERFORMANCE
The digital control system measures changes in reactive power consumption and initiates corrections to either generate or consume reactive power. The control system software and hardware - based on commercial circuit boards - is designed by Alstom Grid engineers. The control system communicates easily with the utility’s other systems.

The SVC control system is based on three Motorola CPU powered PC boards in a virtual machine environment (VME) rack.

The units are: the master board, that calculates the SVC output; the slave board, that manages Program Logic Control (PLC) operations; and the communication interface that transfers data between the VME rack and the Human Machine Interface (HMI) computer. The operations of the SVC are controlled via the user interface screen.
ALSTOM GRID OFFERS GLOBAL SVC TECHNOLOGY

Alstom Grid has been manufacturing state-of-the-art, high quality equipment for over half a century. Our global competence centres in Tampere, Finland, and Philadelphia, USA are recognised as the leading manufacturers of high and low voltage capacitors, capacitor banks, air core reactors and control & protection systems for capacitor installations and Static VAR Compensation (SVC) equipment.

Research and development
Alstom Grid Ltd., in Tampere, Finland is our FACTS Worldwide Excellence Centre and is responsible for global design and production procedures for all static VAR compensation equipment. As part of our continuous improvement policy, this FACTS excellence centre is responsible for future technological advances in all the product lines - from SVC for utilities and industries to series compensation equipment and the famous SVC MaxSine for all voltage ratings.

Static VAR Compensators are manufactured in Finland and other Alstom Grid production sites around the world.

Experts at your service
Services range from analysis and design and SVC delivery to after-sales services. We also carry out tests and reactive power / distortion measurements to ensure that the SVC performance levels are met, as determined during project design.

Long-term maintenance contracts are available on all our equipment to ensure that your SVC is always functioning up to design standards and to guarantee that it remains safe for your personnel.

Quality systems
Alstom Grid, as well as all the SVC production sites around the world, are managed by strict quality management systems - including our own Alstom Grid methodology - fulfilling the requirements of ISO 9001:2000, environmental standards, ISO 14001 and OHSAS 18001.

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