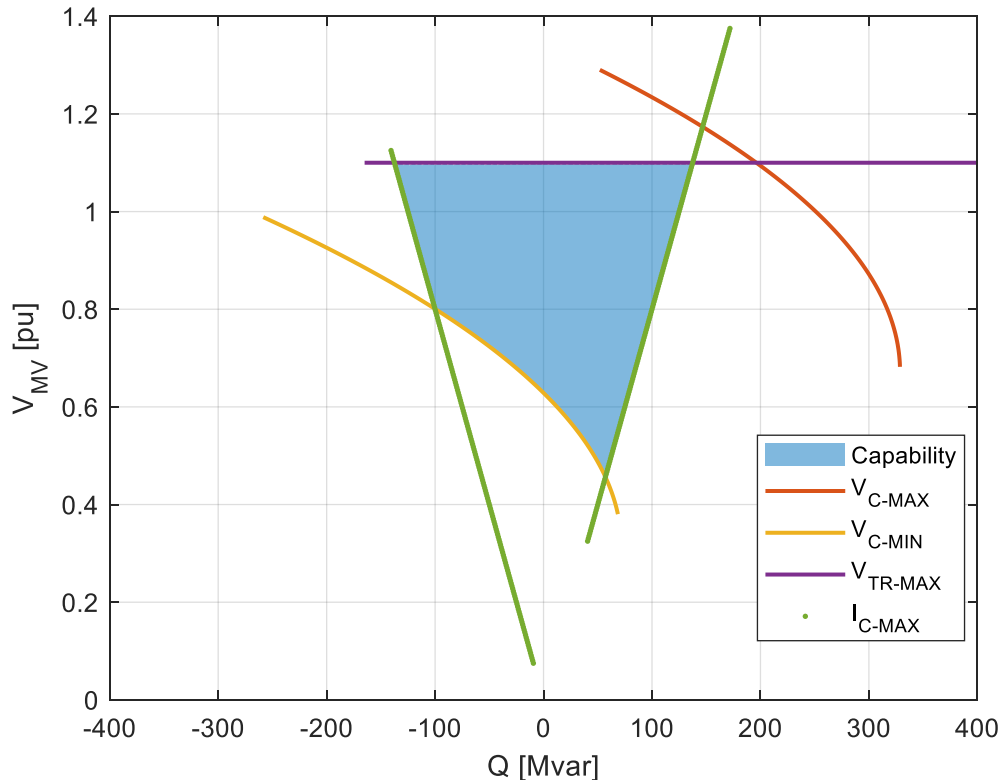


What are the criteria to decide between STATCOM and SVC in your network/country?

Although SVCs guarantee high dynamic performances, its maximum reactive power supplied/absorbed is a function of square voltage at the connection point. In addition, harmonic filters are needed if 12-pulses SVC solution is considered, increasing the required footprint in substation.

Whitin the normal voltage range of operation, STATCOM can deliver its rated current in over and under-excitation. As visible in the following capability curve, the STATCOM maximum current constraint leads to a linear boundary in the QV plane. This means that the maximum STATCOM output varies linearly with the voltage at its MV terminals.



Converter valves technologies, based on the well-known Modular Multilevel Converter (MMC) with full bridge topology, allows harmonic emission below the Grid Code constrains (i.e. no harmonic filters).

Do STATCOMs and SVCs have a comparable performance regarding RAM in your network? Do they require the same or similar O&M practices?

Italian transmission system has not SVCs technology in service.

During the design process, STATCOM suppliers performed a RAM study. According to Terna technical specification, the expected availability must be equal or higher than 98,8%. O&M practices and spare parts are, therefore, defined by each supplier.

The procurement contract also includes 20 years of warranty and maintenance.

When an SVC needs refurbishment work, does your utility consider replacing it with a STATCOM? Do the SVC's degraded operation modes impact this decision?

Italian transmission system has not SVCs technology in service.

What is the utility's experience in specifying the IGBT valves' redundancy in STATCOM converters?
To achieve high availability values, Terna carried out a preliminary evaluation of the expected failure rates of IGBT sub-modules with the major manufacturers.

Although, the minimum number of redundancies of sub-modules is a result of RAM studies to fulfil Terna requirements, at least one redundant sub-module per arm (hot reserve) will be installed and 6% of the total sub-modules will be kept as spare parts on site.

Due to the inherently higher failure rate of IGBT sub-modules if compared to thyristor valves (as for previous TERNA and formerly ENEL projects in south America) we expect a failure rate higher than 0.6%/year.

Does the overvoltage inductive cycle specified in your network for SVCs/STATCOMs come from simulations or technical guidelines?

Insulation coordination study of STATCOM has been carried out according to IEC 60071 standard, considering both inductive and capacitive coupling of 400 kV/35 kV step up transformer.