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Summary

We begin with an introduction to Electric Power Systems (EPS) Operation Fundamentals, real as well as reactive power flows, and power losses in transmission lines. The need for reactive compensation of lines is explained. An efficient way to achieve this is with the Flexible AC Transmission Systems (FACTS) technology. Reference is made to the modern FACTS devices: Thyristor-controlled phase-angle regulator, Thyristor-controlled Phase Shifting Transformers (TCPSTs), Static VAr Compensators - shunt connected, Thyristor-controlled Series Compensators, Static Synchronous Compensators: STATCOM (shunt connected), Unified Power Flow Controllers (UPFCs), HVDC VSC: Voltage-Sourced Converter. FACTS technology was established in principle for the first time by N.G. Hingorani, of EPRI, in the eighties. Since then, an impressive amount of theoretical as well as applied studies have been conducted and presented internationally, and large *Technology Vendors* have produced the aforementioned FACTS *devices* and have made them available to interested *Power Companies*.

We then examine the STATCOM devices operating in the EPS of Crete. There are two identical STATCOMs operating in parallel as *one master* and *one slave* with normally equal loading. Their total capacity is ± 64 MVAr. Each STATCOM has 42 IGBT (*Insulated-Gate Bipolar Transistor*) Semiconductor Valves/phase controlled by means of programmable digital controllers. Their location is in the Substation "Iraklio III". The STATCOMs are shunt connected to the transmission line via its *coupling transformer* (three-phase) and one *tie reactor* per phase, which connect the *Voltage-Sourced Converter* (VSC). The selected *mode of operation* for the STATCOM in the EPS of Crete is the *Automatic Voltage Control Mode* therefore, it supports Voltage and VAr in the System [1]. For greater security, and for keeping conditions within prescribed constraints (e.g. cooling of valves, etc) each STATCOM is contained in a metal container. The STATCOM coupling transformer has a transformer ratio of 150/20 kV, and is rated at 68 MVA. Has windings Wye-to-Delta connected. It adapts the line-connection voltage to the volts for the power electronic converter. Has one part of the *connection reactance*. The STATCOM tie reactors are arranged outside in two rows of 3 + 3. They connect each one phase of AC for each STATCOM. The *tie reactors* complement the *coupling reactance* of the coupling transformer, between the *converter* and the AC line. They protect the valves against short circuits.

Last, we make reference to the forthcoming HVDC power link of the EPS of Crete with the mainland interconnected Greek EPS. Rating: HVDC: bi-pole at ± 500 kV, total: 1 GW. The two undersea cables, each with length 335 km from Korakia (Crete) to Pachi – Megara, weight: 40 kg/m (total ca 14 ktonnes). With additional ground cables. The total interconnection length is 400 km. Maximum sea depth 1200 meters. Voltage-Sourced Converters (VSCs) rated each at 500 MW. The converter Station, on Crete, is near the village of Damasta.

Reference:

[1] Thales M. PAPAZOGLOU et. al., CIGRE Working Group C2.13, *Voltage and VAr Support in System Operation*, CIGRE Technical Brochure 504, August 2012