



## SUMMARY OF CAPACITOR BANK SWITCHING STUDIES

Capacitor bank energizing transients are becoming increasingly more important with the growing number of capacitor bank installations in power systems. This is because capacitor bank switching is one of the most frequent utility operations, potentially occurring multiple times per day and hundreds of times per year throughout the system, depending on the need for system voltage/var support from the banks. There are a number of important concerns when capacitor banks are applied at the transmission system voltage level. Transient-related currents and voltages appearing on a power system associated with utility capacitor bank installations include:

- Voltage transients at the capacitor bank substation and neighboring substations. This may include phase-to-ground overvoltages, phase-to-phase overvoltages and overvoltages due to voltage magnification (i.e., exciting system resonances or dynamic overvoltages).
- Power quality impact on sensitive customer loads due to variations in voltage when energizing capacitor banks. This may also involve voltage magnification phenomena if there are capacitor banks on the lower voltage system in the vicinity of the switched banks.
- Capacitor bank energization inrush currents
- Capacitor bank outrush currents due to faults in the vicinity of capacitor banks

These transient voltages and currents can have an impact on equipment design and protection. In general, some of the equipment-specific design and protection issues include:

- Phase-to-ground and phase-to-phase insulation switching withstand to voltage stresses
- Controlled closing for circuit breakers (pre-insertion resistors/reactors or synchronous switching)
- Capacitor bank and substation circuit breakers ANSI/IEEE C37 requirements
- Current limiting reactor requirements
- Surge arrester energy requirements (including capacitor bank circuit breaker re-strike events)
- Secondary metering and control issues (usually associated with high frequency inrush currents)

**MEPPI has performed a wide variety of detailed studies. More information on specific analysis types is available upon request.**

