Allocation of synchronous condensers for restoration of system short-circuit power

Modern power systems, employing an increasing number of converter-based renewable energy sources (RES) and decreasing the usage of conventional power plants, are leading to lower levels of short-circuit power and rotational inertia. A solution to this is the employment of synchronous condensers in the grid, in order to provide sufficient short-circuit power. This results in the increase of the short-circuit ratio (SCR) at transmission system bus-bars serving as points of interconnection (POI) to renewable generation. Evaluation of the required capacity and grid-location of the synchronous condensers, is inherently a mixed integer non-linear optimization problem, which could not be done on manual basis considering each type of machine and all bus-bars. This study therefore proposes a method of optimal allocation of synchronous condensers in a hypothetic future scenario of a transmission system fed by renewable generation. Total cost of synchronous condenser installations in the system is minimized and the SCRs at the POIs of central renewable power plants are strengthened. The method has potential for application on larger grids, aiding grid-integration of RES.