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CONSEIL INTERNATIONAL DES GRANDS RESEAUX ELECTRIQUES
INTERNATIONAL COUNCIL ON LARGE ELECTRIC SYSTEMS

STUDY COMMITTEE D2
INFORMATION SYSTEMS AND TELECOMMUNICATION

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Preferential Subject N° - PS1

Security Assessment & System Optimization platform for grid stability control

A.BEREZIN
OOO PSI, Head of Energy department
Germany
ABerezin@psi.de

Closure of large power plants in Europe, the rapid development of distributed energy generation accompanying with shortage of construction of new and reconstruction of old power lines caused a range of problems with the modern power systems stability. A significant increase of "bottlenecks" caused a corresponding increase in the number of unplanned corrective regime mode actions. This, in its turn, forces to significantly reduce the time for development and analysis of the corrective regime mode actions at ever-increasing complexity of electrical calculations. In such a situation, the responsibility for making decisions on the dispatching electric grids is increasingly passes from a human being to a computer.

PSI EnergyEE has developed and tested the innovative R&D platform SASO (Security Assessment & System Optimization) in order to solve the problems of the voltage levels and reactive power control in modern power grids with a large number of DERs. SASO allows determining the optimal composition of control actions on the available voltage levels and reactive power regulating devices for the considered deviation, simulating the effects of regulation on the stability of the electrical grid with a contingency analysis methods, and presenting the results of the analysis to the dispatcher for a final decision.

The main difficulty in the implementation of SASO in modern power systems is a significant number and variety of available voltage levels and reactive power regulating devices, as well as a number of combinations of their joint using during the regulation. SASO carried out the optimal solution of the problem by studying the set of available regulators and methods of the voltage levels and reactive power regulation for each specific situation and selecting the optimal composition of methods with the formation of the so-called "sensitivity matrix", simulating of the sequence of the chosen regulation methods, analysis of the results of possible impacts of regulation taking into account the interdependence of control actions, resolution of potential conflicts and the resulting multicriteria optimization of the selected variants with the usage of fuzzy logic algorithms.

Another issue that also managed to be solved within SASO, was the development of new generation of the visualization tools, which would ensure the analysis results representation to operational staff in the most convenient and easily perceived form.

The next step in the development of SASO should be the transformation from adviser to an autonomous electrical grid control without human participation (autopilot). Evolution of the system will also be the development of new algorithms for early detection of the grids critical states, for the



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on-line dynamic stability analysis of the grid, for the calculation of the limits of power lines transmission capacity, as well as searching new forms of visual representation of information for the users.

The report presents the results of the SASO working in a large power grid company, analysis of the possibility of applying similar technologies for the various grid companies and models of the electrical industry deregulation.