The 14th International Workshop on Electric Power Control Centers
Wiesloch, Germany, May 14-17, 2017

Operational Aware Investments in Transmission Systems: Scenarios Generation, Security Analysis, FACTS Devices Installations for System Reinforcement

Vladimir Frolov[2], Priyanko Guha Thakurta[2], Janusz Bialek[2],

Scott Backhaus[3], Michael Chertkov[3]

(2 – Skoltech, Moscow, 3 – LANL, Los Alamos, NM)

Abstract

The Transmission System Operators (TSOs) plan investments into their transmission grids based on the projected future system loads, among other factors. New operational aware planning methodology was developed to take future power system operations into account during the planning phase. Considering build capacities of new equipment as additional degrees of freedom together with already available allows to reduce investment costs and obtain cheaper future operational costs. Planning is resolved for multiple future representative scenarios of the projected economic growth (of loads) minimizing sum of capital and operational expenditures for a given planning horizon. Multiple time frames are incorporated into optimization framework considering also the most general AC power flows modeling.

Developed methodology is applied for placement and sizing of Flexible Alternating Current Transmission System (FACTS) devices, thus allowing delaying or avoiding much more expensive transmission expansion. These devices can utilize the existing transmission grid more flexibly. However, the locations and sizing of future FACTS devices must be carefully determined during the planning phase. Non-linear, non-convex, multiple scenario and multiple time frames optimization is resolved via efficient heuristics, consisting of a sequence of Quadratic Programming and AC-PF solutions to maintain feasible (for initial exact problem) scenario states during iterations. Optimality, scalability and benefits of the approach in comparison with more traditional planning is illustrated on IEEE 30-bus and 2736-bus Polish systems.

There are several topics for a discussion. The first, data to be stored to improve investment decisions and ways of collection of data. The second, data analytics to create limited number of representing future scenarios taking uncertainty/fluctuations into account. The third, incorporation of security analysis into the planning framework. The fourth, practical applications of the developed tools.