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A Day-Ahead Regional PV Generation Forecast Applied to Micro EMS

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Abstract

In this paper, we present an effective operation of power system to deal with uncertainty based on the method presented in [1]. The proposed method utilizes both probabilistic and deterministic models for uncertainties. The former is a combined method of the probabilistic load flow and dynamic economic load dispatching (DELD) based on photovoltaic generation forecasting. The latter method is to specify confidence intervals (CI) of uncertain parameters to guarantee the power system security for all the parameter values inside the specified CI. We refer to the robustness of the system in this context as "Robust Power System Security."

In this presentation, we mainly discuss the former probabilistic approach as below. We have developed a micro EMS, which consists of load forecast including Photovoltaic (PV) generation outputs, a-day-ahead unit commitment, real-time control with LFC, and frequency simulator. PV forecasting is carried out in local area using the neural networks. We improve the accuracy by using a weather clustering method. A covariance matrix of PV outputs is calculated, which will be used for the probabilistic load flow. We specify CI of the PV forecasting, which will be used in the calculation of the feasible operation regions. CI is also used in the robust power system security approach in [1]. The feasible operation regions are computed for the individual generators taking into account upper and lower bounds and ramp rate of generators. We calculate the region from the present operation point to a specified time ahead in real-time. We perform the DELD calculation using the feasible operation region to avoid transmission overload stochastically.
Finally, we discuss the impact of PV forecasting error on the system operation.

Reference:
[1] Naoto Yorino, Yutaka Sasaki, "Monitoring of Robust Power System Security - Computation of Feasibility Margin of Power System Operation against Uncertainties," EPCC13 Day1 Session #2 Super Grids, May, 2015