Title: Combining Intra-Real Time Dispatch and Enhanced Automatic Generation Control (AGC) for Online Power Balancing

Duration: 2013-2014

Sponsor: Currently non-funded

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Description:

This project focuses on combining intra-real time dispatch and enhanced AGC to reduce power imbalances caused by generator uncertainties. Traditionally, generators are scheduled in economic dispatch stage to meet predicted demand, while AGC acts in real-time to compensate imbalances between supply and actual demand. However, in today's deregulated electricity market, generator can fail to follow the scheduled generation in economic dispatch stage due to gaming and physical limitations, which creates supply-demand imbalance in real-time.

To solve this problem, a unified framework is developed, which consists of (1) a predictor of generator's behavior; (2) a robust optimizer for intra-real time dispatch; and (3) enhanced AGC. The predictor intelligently learns the behavior pattern of generators from historical data and predicts the likely deviations of generators; the robust optimizer schedules generators taking into consideration the recovery cost; enhanced AGC is applied in real-time to compensate for imbalances left. Our simulations show that the system operator can significantly reduce the cost and complexity of recovering from imbalances caused by generators' uncertainty by applying this framework.

Moreover, current electricity market structure fails to account and optimally allocate the cost incurred by generator uncertainties. Novel market mechanism is being developed so that electricity market can operate in more fair and economically efficient way in presence of generator uncertainties.

The next major challenge is obtaining real-world data by working with interested Independent System Operators (ISOs), and others. We proactively solicit such collaborators.