Asset Fleet Optimization for Increased Generation Flexibility

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Abstract

The power industry is going through unprecedented changes that reflect fundamental transformation of the underlying energy eco-system. Industry restructuring, along with its frequently accompanying wholesale competition for the power generation sector, introduced a paradigm shift in utility business practices. Traditional generating company's right to generate are increasingly replaced by having to compete for opportunities to generate. This paradigm shift signals the arrival of ever increasing volatility that confronts generation operation. Baseload generators, for example, are likely to encounter needs to cycle more frequently and to ramp more rapidly to accommodate intermittent generation and volatile market prices. Improving power plant flexibility is of strategic importance for power companies to address their volatility challenges.

Improving generation flexibility may be achieved at individual plants by: (a) having up-to-date information about each power plant through real-time equipment condition monitoring and performance analysis. This allows up-to-date assessment of plant operating characteristics and limits, such as unit maximum/minimum generation, maximum ramp-rates, that affect operational flexibility; and (b) being able to expand plant flexibility through advanced analysis and/or simulation to predict the O&M impacts of specific operating scenarios in terms of added cost and EOH (equivalent operating hour).

Because of different flexibility parameters associated with different plants, it is possible to create significant further improvement in fleet-wide generation flexibility with a portfolio-based approach. This takes advantage of different plants' varying flexibility capabilities to meet the overall system service requirements for energy, reserves, regulation, etc.

The technology for fleet-wide generation dispatch and scheduling requires systematic modeling and mathematics analysis in the formal optimization framework. By incorporating other energy resources, such as Demand Response (DR) and Energy Storage (ES), it is possible to analyze, quantitatively, physical and financial performance of the fleet in wide range of operating scenarios. As more DR and ES resources become available to counter-act intermittent renewable generation, one can expect thermal generators responding differently to the scenarios with different types of value-driven services.

Sample results from optimal fleet scheduling application are presented to illustrate the points described above.