EXPERIENCE WITH IMPLEMENTING SIMULTANEOUS CO-OPTIMIZATION IN THE MIDWEST ISO ENERGY AND OPERATING RESERVE MARKETS

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Midwest ISO

The Midwest ISO will operate a Day-Ahead Energy and Operating Market, a Reliability Assessment Commitment process and a Real-Time Energy and Operating Reserve Market. The Day-Ahead Energy and Operating Reserve Market is a financially binding market that clears energy, regulating reserve, spinning reserve and supplemental reserve on an hourly basis. The Reliability Assessment Commitment (RAC) process is a process to commit resources, schedule regulating reserve on committed resources and/or release emergency operating ranges on resources when appropriate on an hourly basis for use in the Real-Time Energy and Operating Reserve Market. The RAC process can be executed on a multi-day, day-ahead and/or intra-day basis. The Real-Time Energy and Operating Reserve Market is a financially and physically binding market that clears energy, regulating reserve, spinning reserve and supplemental reserve on a five-minute basis. The Midwest ISO will utilize a simultaneously co-optimized Security Constrained Unit Commitment (SCUC) algorithm and a simultaneously co-optimized Security Constrained Economic Dispatch (SCED) algorithm to operate the Day-Ahead Energy and Operating Reserve Market. The simultaneously co-optimized SCUC algorithm is used in the Day-Ahead Energy and Operating Reserve Market to commit resources, schedule regulating reserves on committed resources and/or release emergency operating ranges on resources in the Day-Ahead Energy and Operating Reserve Market. The simultaneously co-optimized SCED algorithm is used in the Day-Ahead Energy and Operating Reserve Market to clear and price energy, regulating reserve, spinning reserve and supplemental reserve on an hourly basis. Demand curves are utilized to price Energy and Operating Reserve during times of scarcity.

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The Midwest ISO will utilize a simultaneously co-optimized Security Constrained Unit Commitment (SCUC) algorithm to implement the RAC process and a simultaneously co-optimized Security Constrained Economic Dispatch (SCED) algorithm to operate the Real-Time Energy and Operating Reserve Market. The simultaneously co-optimized SCUC algorithm is used in the RAC process to commit resources, schedule regulating reserves on committed resources and/or release emergency operating ranges on resources for the Real-Time Energy and Operating Reserve Market. The simultaneously co-optimized SCED algorithm is used in the Real-Time Energy and Operating Reserve Market to dispatch and price energy, regulating reserve, spinning reserve and supplemental reserve on a five-minute basis. Demand curves are utilized to price Energy and Operating Reserve during times of scarcity.

The SCUC algorithms used in the Day-Ahead Energy and Operating Reserve Market and the RAC process incorporate Mixed Integer Programming (MIP) solvers to commit resources, schedule regulating reserve on resources and release emergency operating ranges on resources (minimum or maximum) when inadequate capacity exists to meeting energy demand plus operating reserve requirements. The SCED algorithms used in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market use Linear Programming (LP) solvers to clear and price energy, regulating reserve, spinning reserve and supplemental reserve in a manner that minimizes production costs.

In both the Day-Ahead and Real-Time Energy and Operating Reserve Markets, reserve requirement constraints are modeled against cumulative reserve requirements to ensure operating reserve pricing is consistent with operating reserve priority for each of the three operating reserve products. Reserve Zones are also utilized to ensure dispersion of operating reserve throughout the market in a manner that allows for deliverability and good utility practice. Reserve zones are established quarterly and reserve zone requirements are updated daily based on the results of off-line studies.