

Markets for ramp products (called “flexiramp” in the California ISO and “ramp capability” in the Midcontinent ISO) have been proposed to address the need for generator flexibility due to increased renewable penetration. Flexiramp is committed capacity reserved to meet unexpected ramps in net load. We evaluate flexiramp market designs by comparing solutions of 1) an ISO real-time market simulation (a deterministic real-time unit commitment (RTUC) model with flexiramp requirements) with 2) a stochastic RTUC model, used as a baseline for evaluating flexiramp solutions. The flexiramp constraint improves the expected performance of ISO real-time markets, but is inefficient compared to stochastic RTUC. Flexiramp markets are inefficient in part because the deterministic model disregards the possibility of higher than anticipated energy production by capacity reserved for ramp. Thus, for instance, capacity with low commitment costs but high running costs might be overcommitted, increasing energy costs under high ramp outcomes. The amount of flexiramp acquired strongly affects costs. Too little results in under-commitment of generators and high price fluctuations and even demand curtailment; too much leads to over-commitment, inflating production costs. Hence, careful design of the ramp market and consideration of the use of full stochastic dispatch and commitment models is recommended.