

Stochastic battery valuation considering multiple value streams – Benjamin Böcker, Christoph Weber and Rüdiger Kiesel

In future energy systems with a high share of renewables, matching electricity demand and supply becomes increasingly challenging. The resulting need of flexibility changes on the path from short-term scheduling to real-time system balancing. While different storage technologies can participate at the existing short-term markets, system balancing sets high technical requirements, in particular ramping and response time behavior. Especially battery systems are able to meet these high requirements, which allows not only to generate revenues on different markets but also provide different system services.

The developed model bases on the Least-Square Monte Carlo method, which allows to determine the value of the battery under uncertainties. The classical approach with typically one uncertainty and a predefined set of decision variables is extended to consider the ability to generate revenues on different markets (multiple uncertainties) considering mutually dependent decision variables. Simultaneous provision of additional services are also foreseen.

Technical characteristics of storage systems and the application are usually well-known, but in the case of batteries nevertheless challenging. Aging of a battery is a very complex underlying electrochemical process, highly dependent on an uncountable number of different cell configurations. In this model, a simplified aging model is derived from existing studies including both calendar and cyclic aging effects.

Preliminary results underlines that the value of the battery system strongly increases considering multiple value streams, but also the coordination effort between different market participations. Additional advantages of this model are shown in a selected application. Overall, the developed stochastic valuation approach allows a better utilizing of battery system capabilities.