Optimizing storage operations in medium- and long-term power system models

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Abstract-

In this paper, we propose a new methodology to formulate storage behavior in medium- and long-term power system models that use a load duration curve. Traditionally in such models, the chronological information among individual hours is lost; information that is necessary to adequately model the operation of a storage facility. Therefore, these models are not fully capable of optimizing the actual operation of storage units, and often use pre-determined data or some sort of peak-shaving algorithm. In a rapidly changing power system, the proper characterization of storage behavior and its optimization becomes an increasingly important issue. This paper proposes a methodology to tackle the shortcomings of existing models. In particular, we employ the so-called system states framework to recover some of the chronological information within the load duration curve. This allows us to introduce a novel formulation for storage in a system states model. In a case study, we show that our method can lead to computational time reductions of over 90% while accurately replicating hourly behavior of storage levels.

Index Terms- Demand blocks, power system models, renewable integration, storage, system states.

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Citation:

Wogrin, S.; Galbally, D.; Reneses, J. "Optimizing storage operations in medium- and long-term power system models", Optimizing storage operations in medium- and long-term power system models, vol.31, no.4, pp.3129-3138, July, 2016.