

Modeling storage systems in electricity markets with high shares of renewable generation: a daily clustering approach

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Abstract-

In the energy transition towards a carbon-free society, the continuous changes that energy systems are experiencing, the increasing penetration of renewable generation, and the incorporation of short-term storage technologies such as batteries have increased the effort to model and predict its development and operation. In this context, power system models play a relevant role. However, to be suitable for the decision-making process, these tools should not require a massive computational effort. To overcome this challenge, this paper proposes a new methodology that reduces the temporal dimension of the problem while maintaining accurate results. This methodology is specially designed for medium-term operation of real-size power systems with a significant presence of renewable generation and storage systems. By means of a two-stage clustering algorithm, the proposed approach transforms the temporal structure of the model's input parameters into different levels of time aggregation. This arrangement makes the problem manageable and computationally tractable. In addition, together with the newly incorporated model formulation, this methodology allows capturing at the same time the short- and medium-term variability present in power systems.

Index Terms- Clustering; Energy storage systems; Optimization; Power system modeling; Temporal aggregation

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