

PJM ENERGY STORAGE RESOURCE MODEL ENHANCEMENTS

As of November 2025, PJM's interconnection queue has over 3.5 GW of energy storage under construction, ~1.2 GW in Transition Cycle 1 and over 9 GW in Transition Cycle 2¹. Even if only a portion of these projects become operational, PJM can expect a significant increase in battery storage on its system. As its penetration grows, PJM needs to ensure that its market rules can effectively manage these limited duration resources.

PJM Implemented the Energy Storage Resource (ESR) Participation Model in December 2019 in compliance with FERC Order 841. The PJM ESR Model allows energy storage resources to participate in PJM's capacity, energy, and ancillary service markets in a manner that recognizes the physical and operational characteristics of these resources (example: allows modes of operations such as charge mode or discharge mode).

Several aspects of the model, however, warrant review. For example, this model is currently a self-commit model, where participating resources must self-schedule into PJM's energy market, but can make themselves available for dispatch along an offer curve. The self-schedule model requires the market participant to fully manage state-of-charge and provides little flexibility for them to do that efficiently.

PJM does have an outstanding compliance directive under FERC Order 841 for 2026 implementation to "account for state-of-charge". PJM's implementation of this directive would still require market participants to fully manage state-of-charge; with the incremental improvement that PJM would not give the resource an infeasible schedule.

A simple display of what this means:

- Status Quo: A 40 MW four-hour storage resource with 40MWh of discharge available (assume no charge cycle for this example) could make available 40MW across multiple hours and get a 40MW energy commitment for multiple hours. This would provide the resource with an infeasible schedule, where more energy is requested from the resource than available.
- Account for State-of-Charge: A 40 MW four-hour storage resource with 40MWh of discharge available (assume no charge cycle for this example) could make available 40MW across multiple hours and *only* get a 40MW energy commitment for one hour. This will ensure that the resource does not get an infeasible schedule.

While an update to the PJM ESR Model to account for state-of-charge would be an enhancement, PJM is concerned that this design—together with an inability to reflect opportunity cost in the cost offer—does not go far enough to efficiently operate a fleet of batteries on the PJM system. Other ISOs, with higher penetration of storage assets participating in their markets, have recognized the importance of managing state-of-charge of these resources and reflecting the opportunity cost for dispatch decisions.

With the expected increase in battery storage in PJM, there is an opportunity to review the ESR Model for enhancements to state-of-charge management and capturing the opportunity costs of limited duration resources in PJM's commitment and dispatch software. Additionally, after ~5 years of experience with the ESR Model, the opportunity should be taken to discuss broader enhancements to PJM's markets to encourage more efficient use of energy-limited resources. These include, but are not limited to, energy must offer obligations, offer structure, and intraday offer rules.

¹ [PJM - Planning](#)