

# Coordinated Planning Method Considering Flexible Resources of Active Distribution Network and Soft Open Point Integrated with Energy Storage System

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## Abstract

Faced with the uncertainty of wind and photovoltaic power output and load fluctuation caused by the increase of new energy penetration in active distribution network, the demand for operational flexibility and the construction demand for flexible resources of distribution network are gradually increasing. The flexible operation of active distribution network can be realized by coordinated planning of the soft open point integrated with energy storage system (ESOP) and flexible resources. Firstly, the flexibility resource adjustability evaluation and margin indicators are proposed for the response model of typical flexibility resources. Secondly, a two-stage distributionally robust coordinated planning model considering the coordination planning scheme of distributed generation, flexibility resource and ESOP as well as the comprehensive norm uncertainty of wind power and photovoltaic outputs multi-operation scenarios is established with the distribution network construction cost, annual operation cost and annual power sales revenue as the objective functions meanwhile the investment and flexibility resource operation as constraints. Finally, the column constraint generation algorithm is used to solve the problem, and the effectiveness of the proposed model is verified by the modified IEEE33 node system.

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