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Modeling and Optimization of Coordinative Operation of Hydro-wind-photovoltaic Considering Power Generation and Output Fluctuation

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Coordinative operation of hydro-wind-photovoltaic is the solution of mitigating the conflict of power generation and output fluctuation of new energy and conquering the bottleneck of new energy development. Due to the deficiencies of characterizing output fluctuation, depicting grid construction and disposal of power abandon, the research of coordinative mechanism is influenced.

In this paper, the multi-object and multi-hierarchy model of coordinative operation of hydro-wind-photovoltaic is built with the aim of maximizing power generation and minimizing output fluctuation and the constraints of topotaxy of power grid and balanced disposal of power abandon. In the case study, the comparison of uncoordinative and coordinative operation is carried out with the perspectives of power generation, power abandon and output fluctuation. By comparison from power generation, power abandon and output fluctuation between separate operation and coordinative operation of multi-power, the coordinative mechanism is studied. Compared with running solely, coordinative operation of hydro-wind-photovoltaic can gain the compensation benefits. Peak-alternation operation reduces the power abandon significantly and maximizes resource utilization effectively by compensating regulation of hydropower. The Pareto frontier of power generation and output fluctuation is obtained through multiple-objective optimization. It clarifies the relationship of mutual influence between these two objects. When coordinative operation is taken, output fluctuation can be markedly reduced at the cost of a slight decline of power generation. The power abandon also drops sharply compared with operating separately.

Applying multi-objective optimization method to optimize the coordinate operation, Pareto optimal solution set of power generation and output fluctuation is achieved.