Multi-objective Capacity Estimation of Wind - Solar - Energy Storage in Power Grid Planning Consideration Policy Effect

Jiajia Huan[1], Xiaohui Zhang[2], Yu-Ling He[3], Kai Sun[4], Zhicheng Han[3], and Haipeng Wang[3]

[1]Guangdong Power Grid Corp
[2] Guangdong Power Grid Corp Guangzhou, Guangdong, CN
[3]North China Electric Power University - Baoding Campus
[4]North China Electric Power University Department of Mechanical Engineering

April 21, 2024

Abstract

In order to maximize the promotion effect of renewable energy policies, this paper proposes a capacity allocation optimization method of wind power generation, solar power and energy storage in power grid planning under different policy objectives. Firstly, based on the policy quantification, grey relation analysis is used to calculate the correlation degree of the policy indicators on the planning capacity of renewable energy. Further, a multi-objective capacity estimation model is comprehensively presented. Some highly correlated policy indicators are transformed into the special constraints. And the economy and the stability of the power grid are integrated as the objective function. Meanwhile, the carbon trading and punishment for wind power and solar power abandonment is considered. Finally, the proposed model is solved by NSGA-II-PSO algorithm. The novelty of the algorithm is that the crossover operation of NSGA-II is replaced by the position updating of particle swarm. The calculation result of the case study can effectively evaluate the optimal planning capacity of renewable energy under different policies, while ensure the economic and the stability of the power system. The paper can provide the reasonable basis and the valid analytical method for the policy formulation and the renewable energy development.

Hosted file

Multi-objective Capacity Estimation of Wind - Solar - Energy Storage in Power Grid Planning Consideratio available at https://authorea.com/users/632358/articles/740544-multi-objective-capacity-estimation-of-wind-solar-energy-storage-in-power-grid-planning-consideration-policy-effect