Evaluation Method of New Energy Accommodation Capacity Based on Time Series Production Simulation

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ACSE 2023

The 2023 International Conference on Advances in Computer Science and Engineering Technology(ACSE 2023)

Introduction

The "double carbon" target has been fully implemented, making carbon reduction one of the primary strategic areas of power production, and intermittent new energy sources like wind power and photovoltaics have developed rapidly. The combined new installed capacity of solar and wind power in China is expected to exceed a total of 125 million kilowatts in 2022, surpassing a total of 100 million kilowatts for three straight years. Future coal-fired electricity is anticipated to be replaced by wind and solar energy, which will then dominate the energy ecosystem.

The explosive growth of intermittent new energy installed capacity will bring a series of accommodation problems. Wind and solar accommodation is mainly affected by the following factors. First, the source side is affected by the fluctuation and randomness of wind and solar output. Second, the load side is affected by load characteristics, flexible capacity, etc., resulting in the inability to consume a large amount of new energy in special periods. Third, China's new energy distribution is uneven and difficult to consume locally, and the massive distribution of new energy is restricted by factors such as cost. Based on the aforementioned elements, a fair evaluation of the power system's ability to consume new energy has significant practical implications for the sane design and operation of the new energy electrical system.

Methodology

S1:A time series production simulation model of power system is proposed, which takes the minimum abandonment rate of new energy in the optimization period as the objective function

S2:On the basis of step S1, the power balance constraint, system reserve capacity constraint, conventional unit output constraint, outgoing power constraint, new energy output constraint and energy storage constraint are comprehensively considered

S3:Using the historical data of wind power, photovoltaic and load in a certain area, the optimization software CPLEX is called by Matlab and Yalmip to solve the annual time series production simulation model proposed in this paper, and the accommodation simulation is carried out

References

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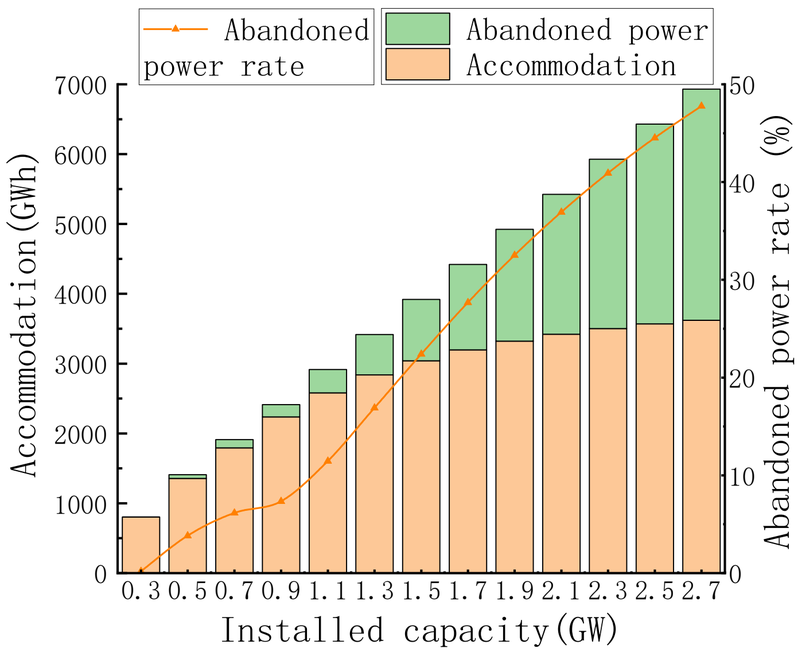
Results

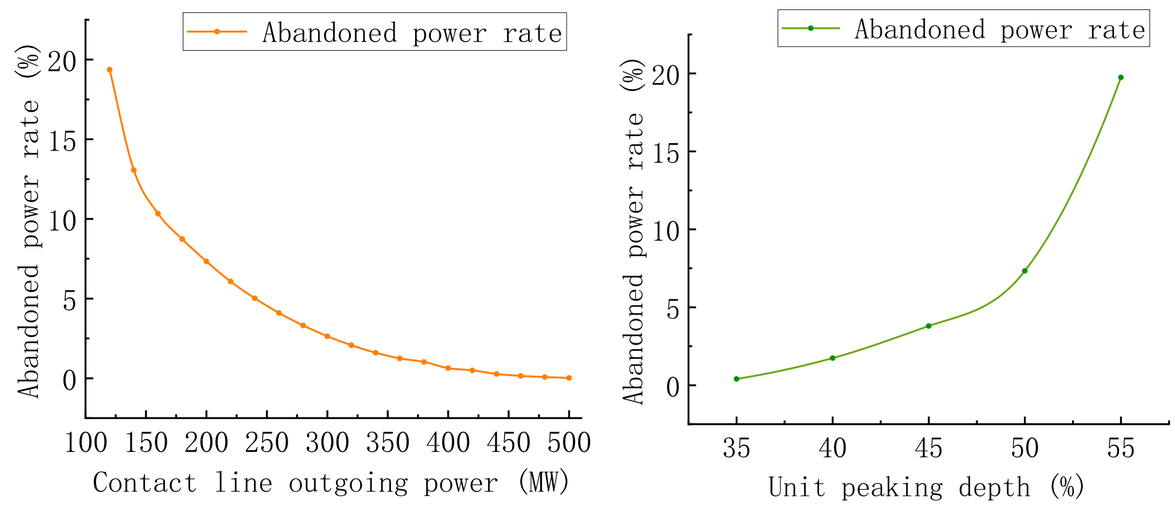
Comparison of two methods of new energy accommodation assessment results

Method	Typical day analysis method	Time-sequential power system production simulation
New energy accommodation /MWh	2063602.29	2236265.38
New energy abandoned power /MWh	267569.84	177020.14
New energy abandon ratio/%	11.48	7.34
New energy power generation utilization hours/h	2292.89	2484.74
Thermal power cost / billion yuan	2.25	1.65

The relationship between new energy accommodation, power abandonment, power abandonment rate and installed capacity



Analysis of the Influence of Evaluation Model Parameters on Accommodation Capacity



Conclusion

- The time series production simulation method's calculation results for the new energy accommodation capacity index are closer to those of the actual operation than the conventional daily analysis method.
- It can be determined that the new energy accommodating capacity has "saturation characteristics" by examining the limit of the new energy accommodation capacity under the current power planning situation. Unreasonable installed capacity planning will result in a significant number of abandoned wind and light projects. This strategy can therefore be applied to power planning decisions.
- In order to maximize the proportion of the power structure in the system and the design of the outgoing channel, it is demonstrated that the evaluation method described in this paper can be used to analyze the impact of the tie line's outgoing power and the unit's peaking depth on the capacity of the power grid for accommodating new energy.