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Developing a grid-connected power optimization strategy for the integration of wind power with low-temperature adiabatic compressed air energy storage

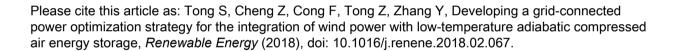
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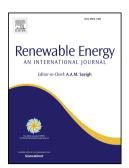
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- compressed air energy storage 3
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Abstract

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- Compressed Air Energy Storage (CAES) is considered as one of the key solutions to handle 12
- 13 intermittent and random wind power. However, limited energy conversion efficiency and
- high capital cost of energy storage have restricted significantly the integration of wind power 14
- 15 with CAES. In this study, a grid-connected power optimization strategy based on piecewise
- 16 averaging of real-time wind power and electricity price data is developed to ensure
- 17 continuous and stable power outputs to the grid using modified profit-maximizing algorithm.
- 18 Thermodynamic analysis on the performance of low-temperature adiabatic CAES, energy
- 19 conversion, and economic evaluation were carried out for a hybrid wind/low-temperature
- adiabatic CAES system. The proposed optimization strategy reduced the required capacity of 20
- 21 CAES and the levelized cost of electricity (LCOE) significantly with greater utilization of
- 22 wind power and operation profitability. The findings presented in this study is of significant
- 23 reference value to future development of large-scale wind power integrated with CAES.

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Keywords: Compressed air energy storage; Large-scale wind power; Grid-connected power optimization; Thermodynamic analysis; Levelized cost of electricity

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