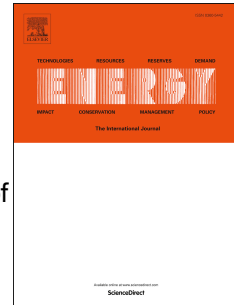


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Comparison of seven methods for determining the optimal statistical distribution parameters: A case study of wind energy assessment in the large-scale wind farms of China

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24 **Abstract**

25 Evaluation and analysis of wind energy in large-scale wind farms is the pivotal  
26 link with regard to the wind farm's siting and economic benefit evaluation. For  
27 numerous years, several statistical distributions have been utilized to assess and  
28 analyze wind energy. However, the determination of the optimal distribution for the  
29 effective evaluation and analysis of wind energy is still a difficult and challenging  
30 task. In this study, the selection strategy is developed for the establishment of the  
31 optimal statistical model for wind energy assessment and analysis on the basis of the  
32 root-mean-square error, and the best outcome is obtained through simulation  
33 calculations based on the Weibull distribution. To further improve the fitting accuracy,  
34 three artificial intelligence algorithms—namely, the grey wolf optimizer, particle  
35 swarm optimization, and cuckoo search algorithms—and four numerical methods, are  
36 utilized to ascertain the optimal parameters for the Weibull model. The experimental  
37 results indicate that the grey wolf optimizer algorithm presents the most efficient and  
38 accurate methodology for the estimation of the Weibull distribution parameters.  
39 Therefore, the grey wolf optimizer algorithm is particularly suitable for the  
40 assessment and analysis of wind energy in large-scale wind farms.

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43 **Keywords:** *Weibull distribution; Optimization algorithm; Parameter estimation;*  
44 *Statistical analysis; Wind energy resources.*

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