

Challenges and key technology for S2S forecasting in China

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Background



Growing crisis of energy depletion and climate change



Renewable Energy for Carbon Reduction



Carbon neutral goals: 2050 for Europe; 2060 for China

Renewable-dominated power system



From 2021 to 2060, the proportion of renewable energy will increase from **11.7% to 55% in China**.



Randomness and Volatility



Challenges for forecasting



Solution: Renewable Power Forecasting Technology



S2S Challenges in China



Poor Weather Predictability



Complex Climate





Stronger Weather Volatility and Randomness

Extreme Weather Conditions



Vulnerable Power Supply Capacity

S2S Challenges in China



New-Built Farms •







Few-Shot Wind Power Forecasting

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Regional Wind/Solar Clusters



Integrated Wind Power Forecasting

Challenges for forecasting



Solution: Renewable Power Forecasting Technology









Challenge and Possible Solution





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Key Tech – High-resolution weather prediction



- AI-based Weather Prediction (AWP) method is presented using 3D CNN algorithm.
- AWP model is trained by mimicking the modelling process of traditional Numerical Weather Prediction (NWP) as well as incorporating the initial field, meteorological parameters and topography data, etc.



Key Tech - High-resolution weather prediction



RMSE: AWP error is **2.43m/s**, while the **NWP** error is **2.48m/s**.

NWP correction model: wind speed prediction error is further reduced by 0.93m/s.



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Challenge and Possible Solution





Key Tech - Integrated Wind+Solar Power Forecasting



- A deep multi-to-multi (m2m) mapping Neural Network model is established to produce deterministic and probabilistic forecasts on region/plant/turbine-scale.
- Integrated model structure can improve the forecasting accuracy and reduce the cost of model updates.



An integrated forecasting model

Power correlation map of wind farms

Key Tech - Integrated Wind Power Forecasting





The integrated system is using in **Jiangxi province** and **Inner Mongolia (40 plants in total).**





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2.06%-8.58% 个

Challenge and Possible Solution



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85

83

81

79

73

71

72.6

Accuracy

Forecasting 77 75



FSWPF methods can achieve high forecasting accuracy with small historical data.



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Aiming at the three challenges in renewable power forecasting, we focused on the following research:

- Inputs
- AI-based Weather Prediction (AWP) method → The AWP error is 2.43m/s, while the NWP error is 2.48m/s
- Models
- An integrated forecasting model based on multi-to-multi (m2m) mapping → Accuracy is improved by 2.06%-8.58%, 3.92%, 9.41%-11.58%, 1% under 1-minute scale, 4-hour scale, 1-day scale and 1-year scale.
- Data
- Few-shot wind power forecasting → Accuracy is improved by 8.44% with only a small volume of historical data



