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Next-Generation Large-Scale AI Model for Renewable Power Forecasting Launched by Shenzhen Energy and Huawei

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A groundbreaking AI-driven model for renewable power forecasting is launched by Shenzhen Energy and Huawei in June 20, 2025, signaling a decisive step forward in the integration of artificial intelligence with clean energy.[1] Officially unveiled at the Huawei Developer Conference, the system addresses one of the most pressing challenges in renewable energy utilization: the profound uncertainty inherent in wind and solar power generation. By combining Huawei's cutting-edge Pangu-weather model with Shenzhen Energy's operational data, the solution delivers short- to medium-term forecasts of wind and solar power generation with unprecedented accuracy. This advancement not only promises significant economic gains for renewable operators but also enhances the stability and security of the power grid, paving the way for smoother integration of renewables into China's rapidly expanding electricity system.

The context of this development is closely tied to China's ambitious energy transition targets. The country has pledged to reach peak carbon emissions by 2030 and achieve carbon neutrality by 2060. As part of this roadmap, China aims to install 1,200 GW of solar and wind capacity by 2030. Meeting these goals requires a rapid and sustained expansion of renewable capacity. However, the high intermittency and fluctuations of wind and solar has long limited their role in electricity markets and dispatch systems.[2] On a clear day, photovoltaic output can soar, while on cloudy days it plummets. Similarly, even minor fluctuations in wind speed can drastically affect wind power generation. These variations destabilize supply and demand, affecting generation revenues, energy pricing, and, critically, grid security. Accurate power forecasting is therefore no longer an auxiliary tool, it has become essential infrastructure for building a reliable, low-carbon electricity system.

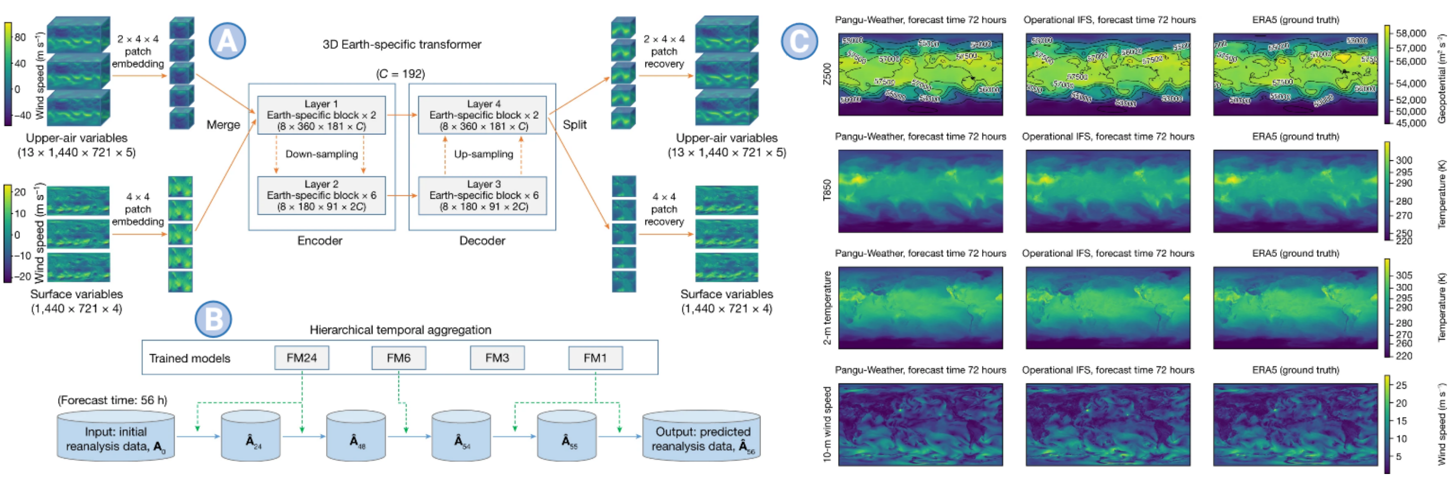

Figure 1. The Pangu-weather model in renewable power forecasting[3] (A) 3D earth-specific transformer; (B) Hierarchical temporal aggregation; (C) Visualization of forecast results.

What makes the Shenzhen Energy–Huawei model stand out is its ability to tightly couple high-resolution meteorological forecasting with massive streams of real-world plant operation data. Traditional approaches, whether grounded in physical principles or statistical models, often struggle under rapidly changing weather or in complex terrain. The new model leverages Huawei's expertise in foundational AI architectures while drawing on Shenzhen Energy's operational datasets. This synergy enables the system to detect patterns across diverse energy types and weather scenarios. The result is improved forecast precision and a model adaptable to multiple sites and environmental conditions. Early trials across four pilot plants operated by Shenzhen Energy—Sihong, Gaoyou, Jiuquan, and Xinsumo—demonstrated promising results: meteorological forecast accuracy improved by around 15%, wind power forecasting accuracy by roughly 10%, and solar power forecasting accuracy by about 2%. While modest at first glance, these gains translate into substantial operational and economic benefits when scaled across large renewable clusters.

At the heart of the breakthrough lies the Pangu-weather model, which embodies a leap in AI-powered weather prediction.[3] Built on a three-dimensional neural network architecture, Pangu is designed to process complex, nonuniform atmospheric data efficiently, as shown in Figure 1. Unlike conventional numerical weather prediction, which relies on solving large systems of differential equations, Pangu incorporates physical mechanisms into deep learning frameworks, reducing error accumulation during iterative calculations and enhancing long-range stability. It is the first AI-based model to consistently outperform traditional numerical systems such as the European Centre for Medium-Range Weather Forecasts' (ECMWF) IFS model, delivering superior accuracy across time horizons from one hour to seven days. Its computational speed is equally impressive: Pangu can generate global forecasts in seconds, more than 10,000 times faster than conventional models. The system offers horizontal spatial resolution of 0.25° × 0.25°, hourly temporal resolution, and coverage across 13 vertical atmospheric layers, capturing fine-grained meteorological features. This granularity transforms weather uncertainty into quantifiable and actionable inputs for renewable operations.

Globally, AI is increasingly being explored as a solution to renewable forecasting, but most projects remain at limited scales or confined to controlled testbeds. Many of these initiatives rely on adapted statistical methods or site-specific datasets and often lack large-scale, real-world validation. In contrast, the Shenzhen Energy–Huawei model integrates vast datasets and foundational AI training, moving beyond laboratory research into practical deployment. Its application in live operational environments forms a closed loop, from data collection to AI training to deployment, ensuring forecasts directly inform grid dispatch, storage optimization, and electricity trading. This makes the system not only a scientific achievement but also a commercially valuable tool for renewable integration at scale.

The performance improvements, while expressed in percentage points, translate into measurable benefits for the energy system. For instance, a 10% gain in wind power forecast accuracy can reduce curtailment, minimize reliance on backup thermal generation, and improve market bidding efficiency. For solar, even a modest 2% improvement can yield significant financial advantages in markets where photovoltaic penetration is high. More accurate meteorological forecasts also enable better alignment of energy storage deployment with renewable output, reducing the need for costly reserve capacity and enhancing the economics of grid-scale batteries. These practical advantages underscore the broader system value of AI-enhanced forecasting, making it a cornerstone technology for the next stage of renewable integration.[4,5]

The future trajectory of this model will depend less on incremental improvements in AI architectures than on its integration into the wider energy ecosystem. To achieve long-term impact, the system must maintain consistent accuracy across diverse weather and terrain conditions, seamlessly connect with market operations, and support higher penetration levels of renewables without jeopardizing grid reliability. If these goals are met, the Shenzhen Energy–Huawei model will demonstrate that the fusion of digital technology and clean energy is not merely conceptual but a concrete pathway toward building reliable, low-carbon power systems.

In the broader landscape of energy innovation, the release of this forecasting model marks a significant milestone for China's digital and intelligent energy applications. As renewable installations expand at record pace, digital intelligence is reshaping how electricity systems predict, dispatch, and optimize power flows. By integrating meteorology, artificial intelligence, and operational data at scale, Shenzhen Energy and Huawei have shown how interdisciplinary innovation can yield tools of real practical value. Their project provides valuable reference points for policymakers, researchers, and industry leaders worldwide as they grapple with the challenges of scaling up renewable energy while maintaining stability and affordability. In this sense, the model is not only a technical achievement but also a harbinger of how digital-physical convergence will shape the clean energy transition in the decades to come.

REFERENCES

1. Huawei. (2025). Huawei Developer Conference 2025. DOI:developer.huawei.com/home/hdc/hdc2025.html
2. Wang J., Chen L., Tan Z., et al. (2023). Inherent spatiotemporal uncertainty of renewable power in China. *Nat. Commun.* **14**:5379. DOI:10.1038/s41467-023-40670-7
3. Bi K., Xie L., Zhang H., et al. (2023). Accurate medium-range global weather forecasting with 3D neural networks. *Nature* **619**:533–8. DOI:10.1038/s41586-023-06185-3
4. Li Y., Ding Y., He S., et al. (2024). Artificial intelligence-based methods for renewable power system operation. *Nat. Rev. Electr. Eng.* **1**:163–179. DOI:10.1038/s44287-024-00018-9
5. Zhang Y., Shen J., Li J., et al. (2024). A new lightweight framework based on knowledge distillation for reducing the complexity of multi-modal solar irradiance prediction model. *J. Clean. Prod.* **475**:143663. DOI:10.1016/j.jclepro.2024.143663

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DECLARATION OF INTERESTS

Xingying Chen is the Editor-in-Chief of Energy Use and was blinded from reviewing or making final decisions on the manuscript. Peer review was handled independently of this member and their research group