Coal Power in China's Net-Zero Future: A Strategic Transition

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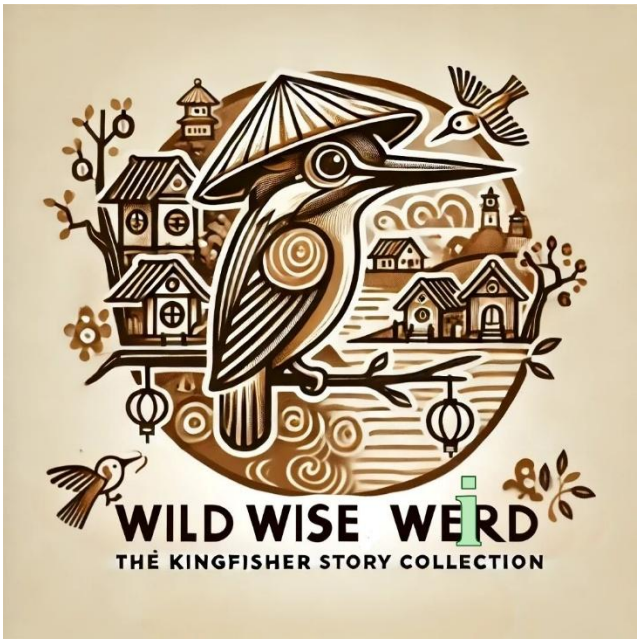

"The fish, indeed, grow very fast. If there isn't enough feed, the two birds will bring back any suitable grass and veggies. Occasionally there might be crickets and worms, giving the fish some much-needed protein. In no time, the fish multiplied several times."

In "Joint Venture"; *Wild Wise Weird* [1]

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China, the world's largest coal power producer, faces the significant challenge of transitioning to a net-zero emissions power sector while maintaining energy security and economic stability [2]. With coal-fired power plants accounting for a significant share of China's energy mix, a complete phase-out is neither immediate nor straightforward. Instead, repositioning coal power as a flexible resource rather than a baseload provider offers a pragmatic approach to decarbonization.

Reconfiguring coal power to support variable renewable energy (VRE) integration presents a viable solution to China's energy transition [2]. While renewables such as wind and solar are crucial for reducing emissions, their intermittent nature poses challenges to grid stability [3]. Leveraging coal plants with enhanced flexibility can mitigate these challenges by providing backup capacity, thereby facilitating the integration of additional renewable capacity while minimizing the risks of supply shortfalls. Studies indicate that allowing coal power plants equipped with carbon capture, utilization, and storage (CCUS) to supply up to 20% of electricity could reduce power shortages by 9% and lower overall system costs [4].

Despite the declining costs of renewables, integrating them into the power grid incurs expenses related to balancing, profile, and grid expansion due to their variability and unpredictability [3]. At lower penetration levels, these integration costs remain modest, but as reliance on renewables increases, maintaining system stability necessitates greater flexibility, increasing overall costs. A strategic transition that retains a controlled level of flexible coal power could help reduce transition costs by as much as $176 billion [2].

Policy measures should prioritize incentivizing flexible coal dispatch, retrofitting existing plants with CCUS, and ensuring the orderly retirement of outdated facilities. While a long-term shift towards a fully renewable energy system remains the ultimate goal, a transitional phase where coal serves as a stability-enhancing resource is essential for ensuring an economically viable and secure energy transition.

Given China's unique energy landscape and economic imperatives, a hybrid approach—combining aggressive renewable expansion with adaptive coal utilization—can bridge the gap between current reliance on fossil fuels and a sustainable, low-carbon future. This strategy not only aligns with China's net-zero ambitions but also offers a model for other coal-dependent economies navigating the energy transition.

References

[2] An K, et al. (2025). Repositioning coal power to accelerate net-zero transition of China's power system. *Nature Communications*, 16, 2311. https://www.nature.com/articles/s41467-025-57559-2

[3] Heptonstall PJ, Gross RJK. (2020). A systematic review of the costs and impacts of integrating variable renewables into power grids. *Nature Energy*, 6, 72-83. https://www.nature.com/articles/s41560-020-00695-4

[4] Fan JL, et al. (2023). A net-zero emissions strategy for China's power sector using carbon-capture utilization and storage. *Nature Communications*, 14, 5972. https://www.nature.com/articles/s41467-023-41548-4