

Major Scientific and Technological Innovation in Green Transformation



Focus

- We examined technological, market, and policy pathways to rapidly scale up mature renewable energy solutions, such as wind, solar, and storage, while ensuring grid stability.
- We identified and analyzed near- and medium-term innovations in power grids, energy storage, and low-carbon technologies to accelerate China's transition toward a clean and carbon-free future.

Findings

- Wind and solar technologies have achieved significant efficiency, cost reduction, and large-scale deployment gains, but key areas like deep-sea wind power and thin, perovskite solar cells still need more research and demonstration.
- Building a flexible, renewable-friendly power grid is essential to increase clean energy integration. This requires faster deployment of cross-regional transmission, active distribution networks, and intelligent microgrids.
- Diverse energy storage technologies and applications are enhancing the flexibility and reliability of energy systems, yet long-duration and seasonal storage still face technical and economic challenges.

Recommendations



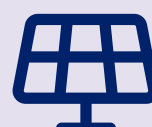
Accelerate the construction of a coordinated grid system (including main, distribution, and micro grids) to better integrate renewables at a large scale.



Promote high-quality demonstration projects and strengthen collaboration between industry, academia, and the international community.



Promote breakthroughs in wind and solar technologies, build a renewable-based energy system, and advance full-lifecycle recycling.



Expand the energy storage system with diverse technologies to enable a high and efficient use of renewables and maintain power system stability.