

# China's Power Transition Path

## Policies, Practices and Decarbonization

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# Agenda

**01**

## **China's Current Status of Power Transition**

Analyzing the economic growth imperatives and the current status of China's coal-fired power sector amid the transition.

**02**

## **China's Dual Carbon Policy & Transition Logic**

A deep dive into the top-level design, policy evolution, and the unique systemic logic underpinning China's national decarbonization strategy.

**03**

## **Energy Storage: Practices & Market Dynamics**

Exploring real-world industrial deployments, operational models, and the evolving market mechanisms that are scaling up energy storage solutions.

**04**

## **Low-carbon and Flexible Development Pathways for Coal-fired Power**

Accelerating energy-saving and carbon-reduction retrofits for coal-fired power units alongside upgraded indicator requirements for flexible coal power.

**05**

## **China's Quantitative Energy Transition Targets for 2030**

Defining the 2030 roadmap with specific benchmarks for energy mix optimization, emission cuts, and sector-specific goals.

**06**

## **Global & APAC Low-Carbon Energy Cooperation**

Fostering cross-border initiatives, regional partnerships, and collaborative frameworks to accelerate the global energy transition.

# 1. Overview of China's Power

From 2005 to 2025, China's total installed power generation capacity expanded from 517 GW to **3900 GW**, representing a more than six-fold increase.

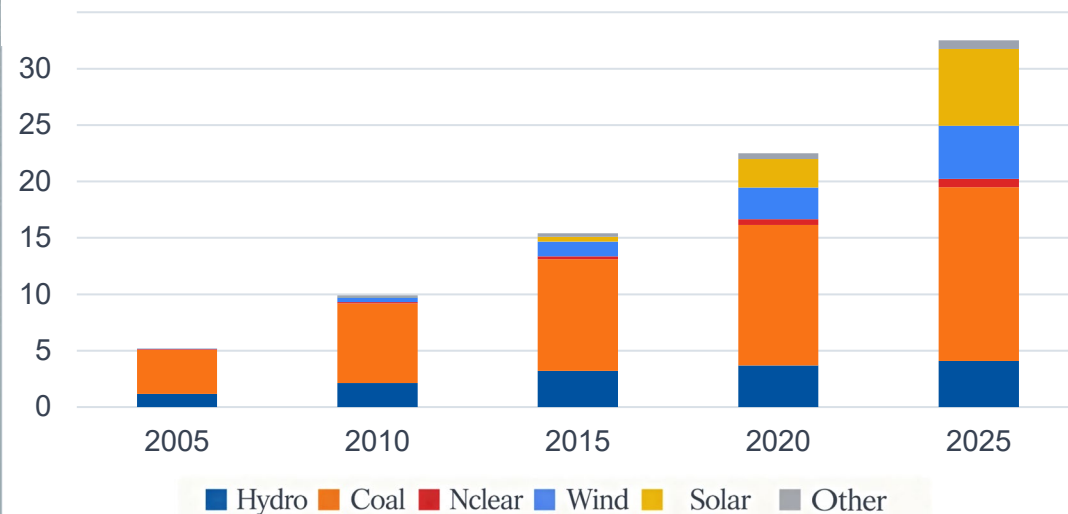
China's annual power generation rose from 2500 TWh to **10575 TWh**. By the end of 2025, the installed capacity of wind and solar power reached 1840 GW, accounting for 47.3 % of the total installed capacity, surpassing thermal power for the first time.

thermal power capacity grew from 391 GW to **1544 GW**, with its share falling from 75.7% to 39.6%. Thermal power generation increased from 2040 TWh to **6327 TWh**, and its proportion dropped from 81.8% to 59.8%.

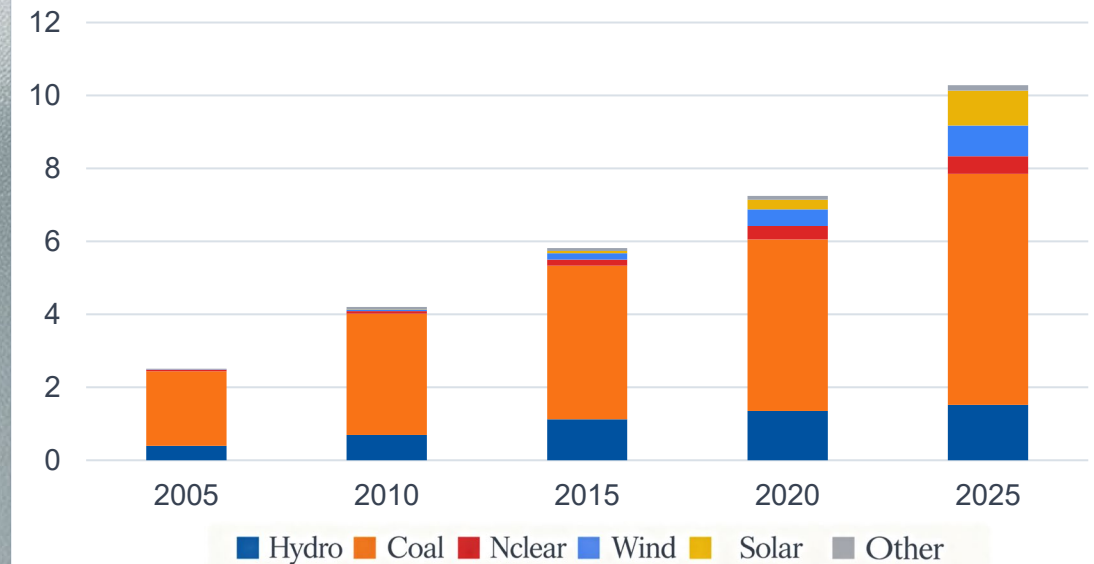
**Thermal power installed capacity and power output keep increasing, while their respective shares continue to decline year-on-year.**

Notable progress has been achieved in the clean transition of China's energy mix

**China's Installed Power Generation Capacity Mix, 2005-2025 (GW)**



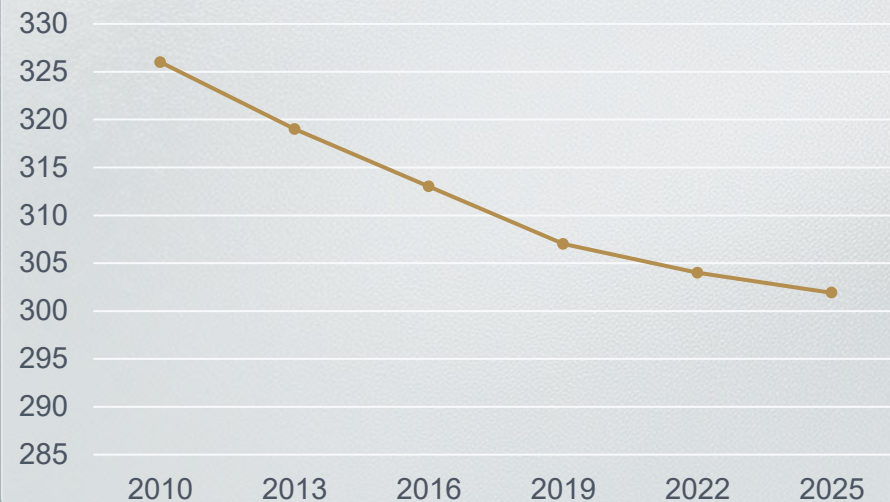
**China's Power Generation Mix, 2005-2025 (TWh)**



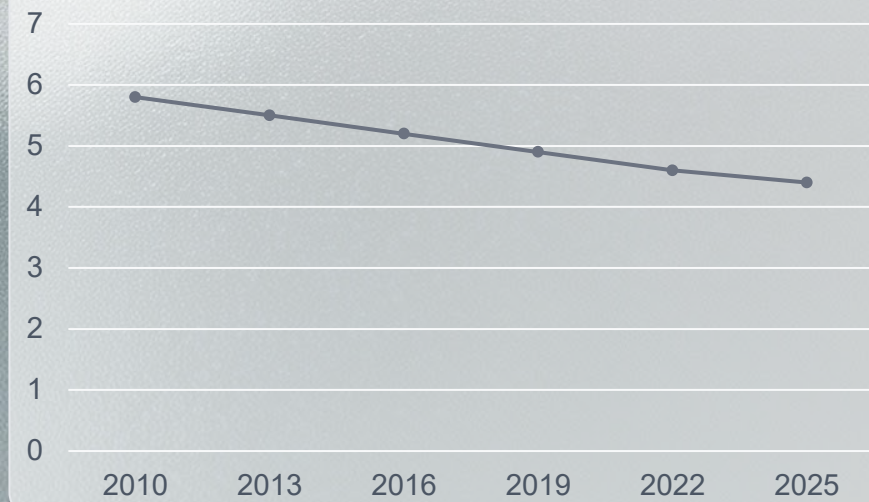
# Continuous Improvement in Power Energy Efficiency Governance

China's ultra-supercritical coal-fired power units lead globally in capacity, steam parameters, and efficiency. The "triple retrofiting" initiative and accelerated phase-out of outdated capacity have driven substantial progress. In 2025, power supply coal consumption reached 301.9 g/kWh, with auxiliary power consumption ranking among the world's most advanced for comparable power densities.

**Power Supply Coal Consumption  
(g/kWh)**



**Comprehensive Auxiliary Power  
Consumption Rate (%)**



Source from 2025 Statistics | All metrics show a steady downward trend indicating improved efficiency.

# Carbon Emission Intensity Trends in China's Power Sector

The carbon emission intensity of the power sector continues to decline, while that of thermal power has increased slightly due to operational adjustments.

## Thermal Power Generation

**~825** g/kWh (2025)

YoY Change  
**+0.24%**

vs 2005  
**-21.3%**

Reason: Increased flexibility regulation requirements for coal-fired power plants to ensure grid stability, leading to higher coal consumption per unit.

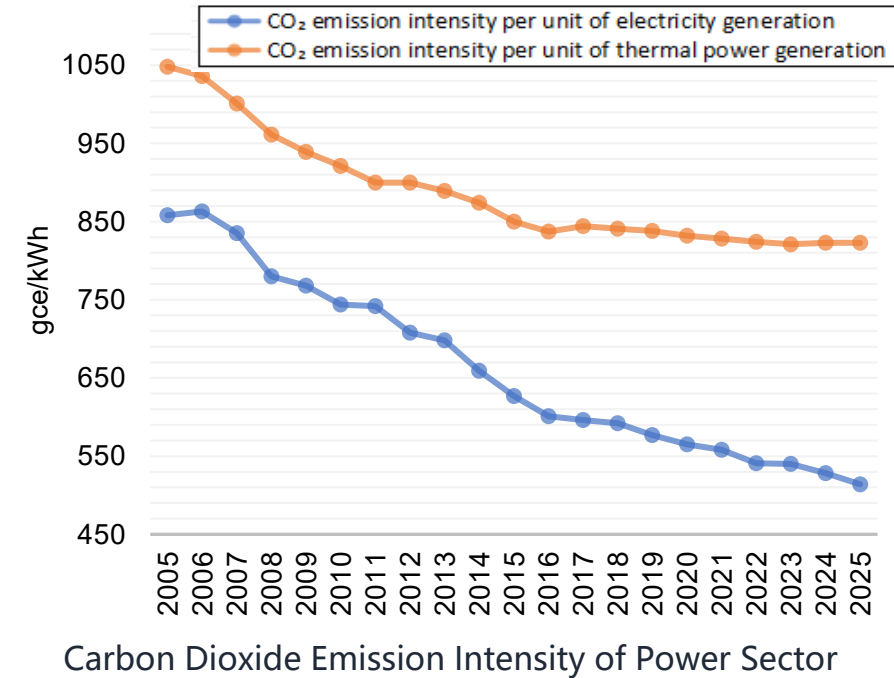
## Total Power Generation

**~514** g/kWh (2025)

YoY Change  
**-2.6%**

vs 2005  
**-40.1%**

Reason: Rapid growth in non-fossil energy (wind, solar, hydro) has significantly lowered the overall carbon intensity of the power mix.



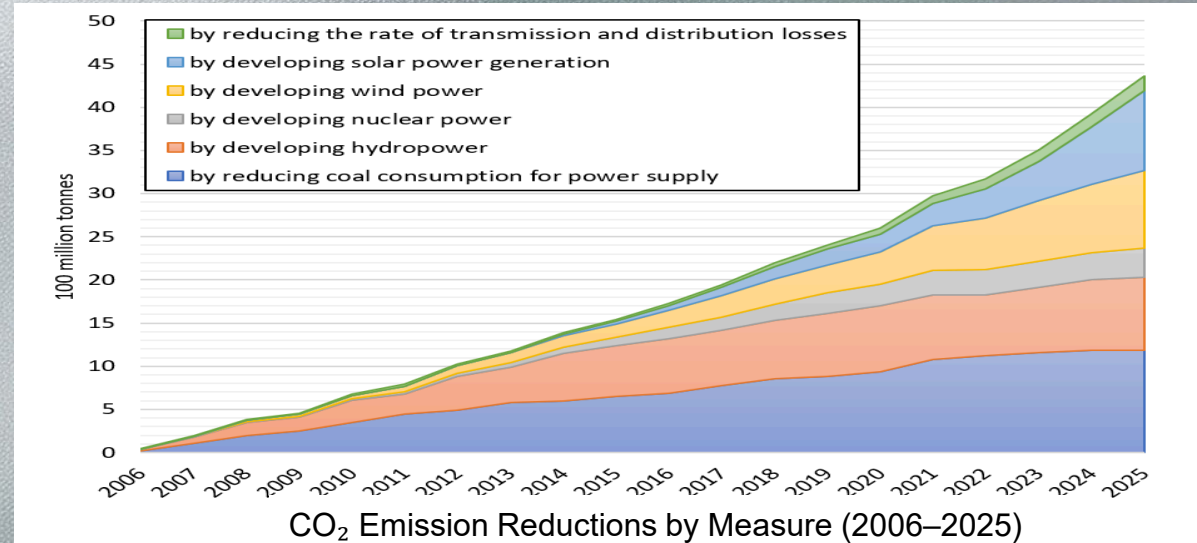
**Key Takeaway:** The clean transition of China's power sector is accelerating. Despite minor fluctuations in thermal power operations, the overall decarbonization trend remains unshakable due to the rapid expansion of renewable energy.

# Effective Curb on the Growth of Power Sector Carbon Emissions

Cumulative CO<sub>2</sub> Emission Reduction (2006-2025, using 2005 as the baseline year)

~36.5 billion tons

This represents a significant achievement in China's power industry, driven by structural optimization and efficiency improvements over the past two decades.



## Non-fossil Energy (60.1%)

Accelerated deployment of wind, solar, hydro, and nuclear power, fundamentally shifting the energy mix towards cleaner sources.



## Coal Efficiency (37.2%)

Upgrading thermal power plants to ultra-supercritical standards, significantly reducing coal consumption per unit of electricity generated.



## Grid Loss Reduction (2.7%)

Smart grid construction and technological upgrades minimize energy loss during transmission and distribution networks.

## 2. China's Transition Logic

China adheres to the core logic of " **building new systems before phasing out traditional fossil fuels** " in energy transition, avoiding radical coal phase-out to ensure a stable and secure shift towards a low-carbon future.

### **Balanced Strategy**

We expand renewables, flexible power, and low-carbon tech in parallel. This ensures energy security is not compromised while advancing decarbonization goals steadily.

### **Power Sector Focus**

As the source of over 40% of national emissions, the power industry is the core battlefield. Transforming it is key to unlocking economy-wide decarbonization.

### **Strategic Policy Design**

Policies balance short-term supply reliability, medium-term structural optimization, and long-term carbon neutrality, creating a stable and predictable transition environment.



The timeline visualizes China's three-step decarbonization journey: peaking carbon emissions by 2030, and achieving full carbon neutrality by 2060. This phased roadmap aligns climate action with national development priorities, ensuring a smooth transition for industries and society.

# China's Top-level Policy System

China has established a well-structured, multi-tiered policy framework to steer its energy transition, aligning national strategic goals with actionable implementation plans and robust supportive measures.

01. National Strategic Goals

Defining the overarching vision: achieving carbon peaking by 2030 and carbon neutrality by 2060, which provides the overarching direction for China’s energy and climate policies.

02. Core Implementation Blueprints

Two pivotal plans: the "15th Five-Year Plan " and the "New Power System Roadmap," detailing concrete pathways and milestones.

03. Enabling Policy Ecosystem

Comprehensive measures including new energy storage deployment, coal power flexibility upgrades, CCUS demonstrations, and integrated power-carbon market reforms.



**15th Five-Year Plan for the Construction of a New-Type Energy System**  
Issued by relevant national authorities under the State Council, this plan sets out a strategic roadmap to establish a clean, low-carbon, safe and efficient energy system by 2030, with priority given to large-scale integration of renewables and the modernization of energy infrastructure.



**Action Plan for Accelerating the Construction of a New-Type Power System (2024–2027)**  
Jointly issued by NDRC and NEA, this 2024-2027 plan accelerates the shift to a flexible, intelligent power system, focusing on grid resilience, market-oriented pricing, and the accommodation of high shares of renewables.

# The 15th Five-Year Plan for the Construction of a New-Type Power System

Power serves as the main driving force for energy transition, and the new-type power system acts as a critical pillar for the new-type energy system. Under this plan, it outlines three strategic pillars for coal-fired power: Energy Conservation & Carbon Reduction, Flexible Regulating Power Source, and Baseline Supply Security.

## 01. Energy Conservation & Carbon Reduction

Promote energy-saving retrofits for coal-fired units, maintaining peak-load regulation capacity above 25% under negative load. Launch pilots for low-carbon fuel co-firing and CCUS, prioritizing grid integration with renewables for unified dispatch and emission reduction.

## 02. Flexible Regulating Power Source

Upgrade coal-fired units for deep peak-shaving and fast-ramping capabilities, improving the peak-shaving pricing mechanism. By 2030, achieve a minimum stable output below 40%, enhancing flexibility via technological upgrades to ensure reliable heat and power supply.

## 03. Baseline Supply Security

Optimize the coal-fired power structure by phasing out outdated units. By 2030, increase the share of high-efficiency ultra-supercritical units ( $\geq 600\text{MW}$ ) by 10 percentage points. Strictly enforce environmental standards and advance the commissioning of planned projects to secure energy stability.

### 3. Energy Storage: Overall Industrial Practices



Qinghai Delingha PV-Hydrogen-Storage Integrated Project

A national benchmark for new energy integration

#### 01 Installed Capacity: Global Dominance

By the end of 2025, new energy storage capacity reached **136 GW** (over 40% of the global total), with pumped hydro storage at **60 GW**— ranking first worldwide, forming a robust dual-driven landscape.

#### 02 Deployment Across Multiple Scenarios

Strategically deployed across three key dimensions: wind-solar matching on the generation side, standalone storage on the grid side, and integrated source-grid-load-storage projects on the user side.

#### 03 Diversified Tech & Long-Duration Focus

Beyond lithium batteries, China is accelerating R&D of long-duration solutions including flow batteries, compressed air energy storage (CAES), and other innovative technologies to enhance system stability.

# Energy Storage: Market Mechanisms



A typical provincial Power Dispatching and Control Center showcases the sophisticated real-time monitoring and management systems essential for integrating large-scale energy storage into China's modern smart grid infrastructure.

## Capacity Tariff

Implemented for standalone storage, granting equal capacity revenue status to coal power and pumped hydro, ensuring a stable income base.

## Ancillary Services

Storage assets fully participate in peak shaving, frequency regulation, and reserve capacity markets to enhance grid stability.

## National Standards

CEC leads the formulation of unified national standards covering safety, performance metrics, and grid connection protocols.

# Energy Storage: Synergy with Renewables & Coal

Energy storage is not an isolated track, but a flexible hub connecting renewables and conventional power assets. It bridges intermittency gaps, enabling a more resilient, cost-effective, and sustainable energy ecosystem.

## Flagship Model: Integrated Wind-Solar-Storage-Flexible Coal Power Bases

### Storage's Stabilizing Role

Acts as a buffer to mitigate wind and solar output volatility, ensuring a steady power supply and significantly boosting the grid's ability to absorb renewable energy.

### Coal Power's Strategic Backup

Provides reliable baseload and emergency backup during peak demand, extreme weather, or low renewable output, safeguarding grid stability and energy security.

### System-Wide Cost Efficiency

Joint operation optimizes resource allocation, cutting overall flexibility costs. This replicable model balances rapid renewable expansion with uncompromised energy security.

# 4. Low-carbon Pathways

## Accelerating Energy-Saving and Carbon-Reduction Retrofits for Coal-fired Power Units



### 01. Improve Energy Efficiency

Raise the share of coal-fired capacity meeting efficiency benchmarks by 15 percentage points, driving overall fleet performance upwards.



### 02. Upgrade and Phase-out

Phase out eligible  $\leq 300$  MW inefficient units and implement ultra-(super-)critical upgrades for 600 MW-class units to optimize structural efficiency.



### 03. Deploy Low-Carbon Technologies

Support zero/low-carbon fuel co-firing and CCUS retrofits, targeting a  $\sim 10\%$  reduction in carbon emissions per kWh generated.



### 04. Promote Integrated Projects

Develop coal-gas-new-energy integrated projects to enable coupled peak-shaving and stable power delivery, enhancing grid flexibility.

# Low-carbon Pathways

## Upgraded Indicator Requirements for Flexible Coal Power



### 01 Deep Peak Shaving: Continuous Drop in Operating Load

The minimum output of existing units is reduced to 35% of rated capacity, new units strive to reach 25%, and the new generation of pilots proposes a challenging target of 20%, releasing more space for new energy grid connection.



### 02 Rapid Response: Significant Increase in Ramping Rate

The load-ramping rate of existing generating units ranges from 0.8% to 2.5% of rated power per minute. For new-generation coal-power pilot demonstration units, the load-ramping rate reaches 4% and 2% of rated load per minute in high-load and low-load intervals respectively, enabling rapid response and mitigating grid power fluctuations.



### 03 Comprehensive Capability: Comprehensive Upgrade of Auxiliary Services

Units are encouraged to enhance their primary frequency regulation capability by means of self-regulation or auxiliary regulation, and start-stop peak regulation has been upgraded to a hard indicator of 'safety and reliability', becoming a core support for ensuring the stability of the power system.

| 指标类型 |                 |            | 现役机组改造升级  |                                                     | 新建机组                                    | 新一代煤电试点示范                                                |                             |
|------|-----------------|------------|-----------|-----------------------------------------------------|-----------------------------------------|----------------------------------------------------------|-----------------------------|
|      |                 |            | 亚临界及以下    | 超(超)临界                                              |                                         |                                                          |                             |
| 高效调节 | 深度调峰最小发电出力 (Pe) | 烟煤         | 35%       |                                                     | 燃用烟煤的煤粉炉机组纯凝工况力争达到25%，根据机组煤质特性、炉型差异适当调整 | 20%                                                      |                             |
|      |                 | 褐煤         | 35%       |                                                     |                                         |                                                          |                             |
|      |                 | 无烟煤        | 35%       |                                                     |                                         |                                                          |                             |
|      |                 | 低热值煤 (CFB) | 25%       |                                                     |                                         |                                                          |                             |
|      | 负荷变化速率 (Pe/min) | 煤粉炉        | 50%及以上负荷  | 2.5%                                                | 2.2%                                    | 燃用烟煤的煤粉炉机组50%及以上、30%-50%负荷力争分别达到2.2%、1%，根据煤质特性、炉型差异可适当放宽 | 50%及以上负荷：4%<br>30%~50%负荷：2% |
|      |                 |            | 30%~50%负荷 | 1.2%                                                | 1%                                      |                                                          |                             |
|      |                 | W火焰炉       | 50%及以上负荷  | 2%                                                  | 1.5%                                    |                                                          |                             |
|      |                 |            | 30%~50%负荷 | 1%                                                  | 0.8%                                    |                                                          |                             |
|      |                 | CFB炉       | 50%及以上负荷  | 1.2%                                                | 1.2%                                    |                                                          |                             |
|      |                 |            | 30%~50%负荷 | 0.8%                                                | 0.8%                                    |                                                          |                             |
|      | 一次调频            |            |           | 鼓励通过自身调节或辅助调节方式提升一次调频性能                             |                                         |                                                          |                             |
|      | 启停调峰            |            |           | 鼓励具备条件的，通过实施适应性改造或针对性设计制造具备安全可靠启停调峰能力，CFB锅炉积极采用压火调峰 |                                         |                                                          |                             |

# 5. Strategic Targets for 2030: Energy Structure



## Renewable Capacity

**> 2.8 TW**

Wind & solar account for over 50% of total installed power generation capacity, solidifying their leading role.

## Non-fossil Generation

**50% Share**

Surpassing fossil fuels to become the primary source of electricity production nationwide.

## Primary Energy Mix

**25% Ratio**

Non-fossil fuels constitute a quarter of the nation's total primary energy consumption.

## Carbon Intensity

**↓ 17%**

Significant drop in carbon emissions per unit of GDP compared with 2025 levels.

# Strategic Targets for 2030: Flexible Assets



The Fengning Pumped Storage Power Station, a flagship project in China's clean energy transition, demonstrates how flexible hydropower assets act as a 'giant battery' to balance the variability of wind and solar power on the grid.

## New Energy Storage

**300 GW** Total Capacity

## Pumped Hydro Storage

**160 GW** Installed capacity

## Virtual Power Plants

**> 50 GW** Adjustable  
aggregated Capacity

## Coal Power Retrofits

**1 TW** Flexible Upgrades

## Grid Stability Goal

Fully supports the stable integration of **2.8 TW** of wind and solar capacity by 2030.

# 6. Global Low-carbon Energy Cooperation

Energy transition knows no borders; no single economy can deliver secure, affordable and efficient decarbonization independently. Adhering to open and inclusive cooperation principles, China proposes four key priorities for the world, especially Asia-Pacific economies:

## 01. Experience Exchange

Mutual sharing of policy frameworks, market mechanism designs, and best practices in low-carbon development to foster collective learning and policy coherence.

## 02. Joint R&D & Innovation

Collaborative research on key low-carbon technologies, including advanced energy storage, CCUS, and flexible coal power, to drive cost reduction and large-scale deployment.

## 03. Standard Co-establishment

Jointly developing unified cross-border standards for green products, low-carbon certifications, and carbon accounting to eliminate trade barriers and facilitate market integration.

## 04. Infrastructure Interconnection

Building interconnected regional power grids and integrating cross-border renewable energy resources to optimize energy allocation and enhance regional energy security.

# Focus on Asia-Pacific, Open to the World



## Joint Pilot Projects

Launching joint pilots for long-duration energy storage and integrated CCUS-coal power systems to demonstrate scalable, clean energy solutions.



## Standard Alignment

Coordinating with industry associations to align international technical standards for energy storage and advanced clean coal utilization.



## Experience Sharing

Sharing best practices on wind-solar-storage-coal hybrid projects to support Southeast Asian nations in their sustainable energy transition.

# Conclusion



## 01. Balanced Pathway

The transition must balance decarbonization with energy security. A mix of renewables, energy storage, flexible coal power, and CCUS creates a practical, stable, and low-carbon energy future.



## 02. Replicable Experience

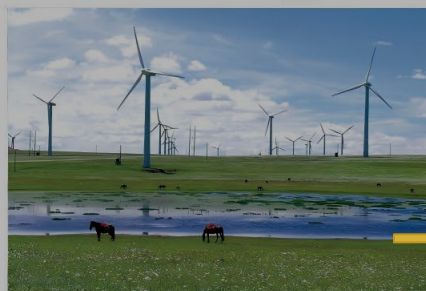
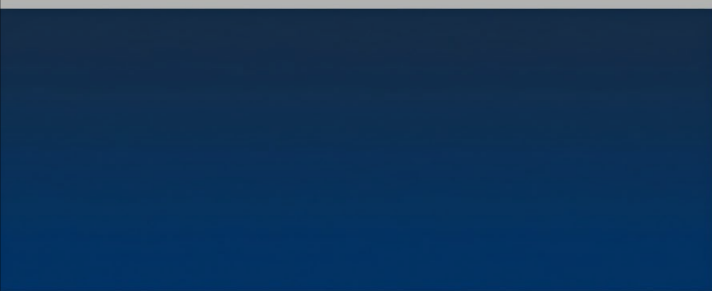
China' s systematic approach—driven by comprehensive policies, large-scale energy storage, and clear quantitative targets—delivers a replicable model for global energy transformation.



## 03. Indispensable Collaboration

Global decarbonization relies on cross-border partnerships. We look forward to deepening cooperation with Japan and all partners on technology, standards, and markets for a sustainable future.

# Thank You



## Questions and discussions