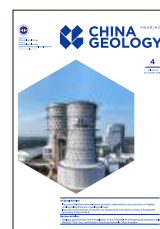




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News and Highlights

World's largest coal-fired carbon capture demonstration project begins operation in Gansu Province, China

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Since the Industrial Revolution, humanity's extensive burning of fossil fuels (coal, oil, and natural gas) has led to a continuous rise in the concentration of greenhouse gases, such as carbon dioxide (CO₂), in the atmosphere. According to data from the World Meteorological Organization (WMO), the global average CO₂ concentration in 2023 exceeded 420×10^{-6} , reaching the highest level in the past 800,000 years. This has led to the increasing frequency of extreme climate events—such as glacier melting, sea-level rise, heatwaves, droughts, floods, and hurricanes—posing a severe threat to ecosystems and human society.

In response to global climate change, the United Nations Framework Convention on Climate Change (UNFCCC) was adopted in 1992, followed by the Kyoto Protocol in 1997. In 2015, nearly 200 countries jointly signed the Paris Agreement, with the objective of holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C. Countries have put forward their Nationally Determined Contributions (NDCs), with targets such as the European Union's plan to achieve carbon neutrality by 2050, the United States' commitment to carbon neutrality by 2050, and similar goals from the United Kingdom, Japan, and others. China has pledged to strive for a peak in carbon dioxide emissions before 2030 and to achieve carbon neutrality before 2060 (Wang H et al., 2023; Jia LQ et al., 2023).

Since then, China has been vigorously promoting this commitment through a multi-pronged approach: Firstly, by facilitating the optimization of its energy mix and accelerating the transition from coal to renewable energy sources (wind, solar, hydro); secondly, by driving industrial transformation

and upgrading, and fostering new green and low-carbon industries and technologies, such as new energy vehicles, energy storage, and the carbon market; and thirdly, by enhancing green technology innovation and stimulating the R&D and application of low-carbon, zero-carbon, and negative-carbon technologies (e.g., CCUS, hydrogen energy, smart grids) (Jia LQ et al., 2024; Wang L et al., 2024a, 2024b).

This report introduces the world's largest coal-fired carbon capture demonstration project, launched at Huaneng Zhengning Power Plant in Gansu Province, China (Fig. 1), which has an annual electricity generation of approximately 100×10^9 kWh.

On September 25, 2025, the world's largest coal-fired carbon capture demonstration project at Huaneng Gansu Zhengning Power Plant successfully completed a 72-hour trial operation and officially commenced operations, with an annual carbon dioxide capture capacity of 1.5×10^6 t. This project marks a historic leap in China's CCUS (Carbon Capture, Utilization, and Storage) technology from “Hundred-thousand-ton Demonstration” to “Million-ton Industrial Application,” offering a “Chinese Solution” for the green and low-carbon transformation of global coal-fired power and contributing to the realization of “dual-carbon” goals.

As a major national sci-tech demonstration project and one of the first green low-carbon demonstration initiatives approved by China's National Development and Reform Commission, the system captures carbon from the desulfurized flue gas of No. 1 at Huaneng Gansu Zhengning Power Plant. Its core equipment is 100% domestically developed, overcoming multiple technical bottlenecks through groundbreaking innovations: These include the world's first “dual-tower integration” composite absorption tower (equivalent to a 27-story structure with over 90% capture efficiency), China's first 8-stage supercritical CO₂ compressor (capable of reducing CO₂ volume by more than 300 times), and the country's largest multi-layer deep saline aquifer

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Fig. 1. Huaneng Gansu Zhengning Power Plant in Gansu Province.

storage system. These multiple “world-first” and “China-first” technologies fill critical industry gaps, elevating China’s CCUS technology to globally leading levels.

The project is capable of capturing over 1.5×10^6 t of CO₂ with a purity of over 99% annually, equivalent to neutralizing the annual carbon emissions from 600000 vehicles or the daily carbon emissions of 18000 people. The captured CO₂, after being compressed into a supercritical state, can be injected 3500 m underground to react with saline water, calcium, and magnesium ferrous ions, forming solid substances for permanent storage. Alternatively, it can be widely utilized in areas such as enhanced oil recovery, green fuel synthesis, and mineralized building materials. This initiative establishes a full industrial chain of “capture-utilization-storage,” supporting coal-fired power plants in achieving large-scale, industrialized deep emission reductions.

Currently, China’s CCUS technology has entered a fast track of development. During the 14th Five-Year Plan period, the country has successively commissioned and put into operation its first million-ton-level CCUS project, its first offshore CCUS project, and the world’s largest coal-fired carbon capture project mentioned above. In September this year, China also released its first international standard in the field of carbon capture, accelerating the industrialization

process of the sector. As a “bottom-line technology” for carbon neutrality, CCUS has been widely applied across multiple fields, achieving a leap from laboratory research to million-ton-level industrial applications and further to international promotion.

Source: https://www.chng.com.cn/detail_jtyw/-/article/cggb60va5Gwc/v/1282776.html.

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