

Powering into the future

THE WORLD'S LARGEST OIL REFINER is leading the transition to sustainable energy through innovation and diversification.

There are few challenges as daunting as those faced by Sinopec in its decarbonization efforts. The world's largest oil refiner by volume, Sinopec has recently rolled out a major green hydrogen project to align with China's commitment to achieving net-zero carbon emissions by 2060.

Yongsheng Ma, Sinopec's new chairman and its former chief geologist, says there is an urgent need to strike a balance between improved fossil fuel technology and renewables, as the country strives for energy transition.

Under Ma's leadership, Sinopec is now spearheading China's climate action efforts with a focus on advancing green hydrogen production and carbon capture, utilization and storage (CCUS) technology.

ELIMINATING CARBON EMISSIONS FROM EXISTING PROJECTS

The large-scale deployment of CCUS technology is critical to meeting emission goals. Globally, there are now 135 commercial CCUS facilities in the project pipeline, accounting for 11 million tonnes per annum (Mtpa) in carbon dioxide capture capacity.

In line with a national target to achieve peak emissions before 2030, Sinopec's recently completed project in Shandong province, in east China, is

currently the largest of its kind in the country. It is estimated that the project can cut emissions by as much as 1 million tonnes per year, which is equivalent to planting nearly 9 million trees or taking 600,000 passenger vehicles off the road.

Construction of this landmark project began in July 2021. It involves capturing liquefied carbon dioxide at the Qilu refinery, and injecting it into 73 wells in the nearby Shengli oil reservoirs via a closed pipeline system, which helps improve the sequestration rate. With a purity higher than 99%, the extracted carbon can be mixed with crude oil — a process known as 'carbon dioxide flooding'. To date, Sinopec has completed 36 carbon dioxide flooding projects.

This project demonstrates major technological breakthroughs for the decarbonizing of the country's most energy-intensive industries. With the technology poised to become an integral aspect of China's climate strategy, the project has paved the way for a nationwide utilization of CCUS.

The engineering team at Sinopec has built on the success of another CCUS pilot project at the Shenhua Guohua Jinjie coal-fired power plant in west China's Shaanxi Province. The project, with a capture capacity of 150,000 tonnes per



Sinopec's Qilu Petrochemical-Shengli Oilfield CCUS project opened in January 2022 is the first million-tonne-level CCUS project in China.

annum, integrates state-of-the-art components including a high-efficiency capture reactor, as well as innovative energy-saving processes such as interstage cooling, split flow analysis, and mechanical vapour recompression (MVR) evaporation, thereby reducing energy use by 40%.

Sinopec has also helped shape the nascent technology's industry standards through research and drafting of a potential CCUS evaluation method and establishment of the Sinopec source and sink database.

To accelerate the industrialized development of CCUS by 2025, as stipulated in the 14th National five-year plan, Sinopec is also planning to establish a dedicated

R&D centre that will focus on spurring the technology's deployment across different power generation plants.

UNLOCKING THE POTENTIAL OF GREEN HYDROGEN

The race to transition to a net-zero economy has also opened up prospects for green hydrogen as a clean energy source for heating, energy storage, alternative fuel, or fuel-cell vehicles. As the United Nations plans to scale up its goal for green electrolyzers to 45 GW by 2027, Sinopec is leading the effort in harnessing hydrogen's considerable potential in tandem with its investments in other sources of renewable energy generation.

Currently, Sinopec is the largest producer of hydrogen in

China, with its annual hydrogen production reaching 3.9 million tonnes, and accounting for 11% of the country's total production volume. Sinopec is planning to expand the critical infrastructure for hydrogen by building and operating 1,000 hydrogen refuelling stations by 2025, 5,000 charging and battery swap stations, and 7,000 distributed photovoltaic power generation sites. The company has already built at least 21 hydrogen refuelling stations in 14 provinces and cities, including Guangdong, Shanghai and Hainan.

Sinopec is also set to invest 30 billion yuan in its hydrogen-related business and ramp up its R&D for hydrogen production technologies to achieve an emission cut of more than 10 million tonnes.

In 2021, the company set up its first proton exchange membrane (PEM) hydrogen production demonstration station with Beijing-based subsidiary, Yanshan Petrochemical. The PEM electrolyzer, the station's core technological component, has a hydrogen production efficiency of more than 85%.

Sinopec has also recently started construction of China's first 10,000-tonne photovoltaic green hydrogen pilot project in Kuqa, Xinjiang. With a total investment of 3 billion yuan, the project includes a photovoltaic power station with an installed capacity of 300 MW and annual generation of 618 MWh, an electrolyzed water hydrogen plant with an annual capacity of 20,000 tonnes, as well as

hydrogen storage tanks and transmission pipelines.

Upon its scheduled completion in June 2023, the project will have an annual green hydrogen output of 20,000 tonnes, making it one of the largest of its kind in the world.

EFFICIENCY OF SOLAR POWER IN OILFIELDS

To further tap into solar potential, Sinopec has developed mobile photovoltaic power station to support its expanding operations.

In May 2021, the company successfully completed the power station's trial run in its Northwest Oilfield, located in the Taklamakan Desert. With an annual power generation capacity of up to 116,800 kWh, the mobile PV station can run on- and off-grid. It is cost

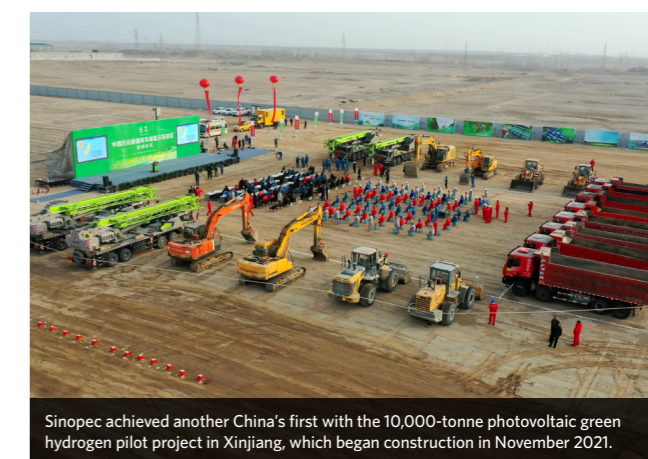
efficient and features adaptive autonomy.

In September 2021, Sinopec commenced operations of its first photovoltaic power station in Shanghai. The grid-connected plant can produce 400,000 kWh of power annually.

By 2025, up to 7,000 PV stations will be under construction or completed, with a total installed capacity of 400 MW. Sinopec also plans to develop offshore wind and hydrogen demonstration projects in Shanghai, with the goal of becoming a major green hydrogen provider in the region. ■



China's first integrated energy service station in Jiangxi opened in December 2021 with hydrogenation, charging and other support by Sinopec.



Sinopec achieved another China's first with the 10,000-tonne photovoltaic green hydrogen pilot project in Xinjiang, which began construction in November 2021.



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