



Technology

We made great efforts in tackling technical challenges, and strengthening the integration and application of scientific and technological achievements. Our independent innovation competence was further enhanced, resulting in a series of significant achievements in key and major technologies R&D and equipment manufacturing.

CNPC regards technology as a key support for achieving more efficient development. Our sophisticated and unified open-research system focuses on the independent and comprehensive innovation of major R&D projects, key equipment, and proactive technologies. Our aim is to build a well-positioned and rationally-organized technological platform that facilitates collaboration between our research institutions.

2007 saw an improvement in CNPC's core competitiveness and independent innovation, thanks to its remarkable achievements in major scientific and technological projects and the application of new technologies. Construction of key laboratories and test bases was actively promoted. More supportive policies were also developed to encourage independent innovation. All these provided enhanced technical support to our relatively fast but sustained, effective and coordinated growth.

With regard to exploration, CNPC made significant progress in the integrated evaluation of marine reef flats, and made a breakthrough in carbonate reservoir exploration. The effective hit rate of gas exploration in volcanic rocks reached 89%, and the success ratio of deep exploratory wells rose from 52% to 75%. Successive exploration in the Tarim and Junggar basins was supported by the foreland-basin exploration technology package, which was represented by mountainous seismic data acquisition, 3D prestack depth-migration, complex tectonic modeling of foreland thrust-folded belts and combined drilling technologies to ensure fast and good quality in wildcatting in thrust-folded belts. Progress was also made in oil and gas field development technologies. ASP (Alkali-Surfactant-Polymer) flooding delivered remarkable results in an industrial test at the Daqing Oilfield and is expected to become the major technology in the enhanced recovery of mature oilfields. SAGD (Steam Assisted Gravity Drainage) boosted heavy oil recovery efficiency at the Liaohe Oilfield. Production technologies for low-permeability oil and gas fields were further improved and realized economic and effective development at Changqing and other low-permeability fields. Our significant progress in the refining and chemical sector was reflected by the second-phase industrial test of Heavy Oil Slurry Bed Hydrocracking (HOSBH) technology. Major obstacles to HOSBH industrialization, including fluid level control of loop reactors, prevention of reactor coking and blocking, and leakage-free sealing on high-pressure inlet pumps, were tackled. The Polyolefin Copolymerization Monomer Hexylene-1 production technology package passed its interim test and entered industrial testing. In 2007, we made impressive progress in developing and applying core technologies and equipment based on our independently owned proprietary rights. A 12,000m drilling rig and a high-performance X80 steel pipe with a diameter of 1,219mm were developed.

In 2007, CNPC acquired 1,172 patents out of its 1,418 patent applications, including 155 out of 425 applications for invention patents. This was the first time more than 1,000 patents were acquired in a single year. By the end of 2007, CNPC had acquired 7,010 patents out of its 9,693 patent applications.

In 2007, CNPC received four National Science and Technology Advancement Prizes. These included the first-class prize for "Geological Theory, Prospecting Technology, and Major Discoveries in the Large-area of Lithostratigraphic Reservoirs with Mid-to-low Abundance"; the second-class prizes for the "Efficient Development and Matching Technologies for Complex Subsalt Carbonate Reservoirs in the Kenkiyak Oilfield in Kazakhstan", "Research and Application of New Technologies for Reservoir Protection and Reforming During Exploration and Development", and "Research and Application of Key Technologies for New High-performance Strapdown Inertial Measurement Device". CNPC has won 38 national awards since 2002, including four first-class and 32 second-class National Scientific and Technological Advancement Prizes, and two second-class China National Technical Invention Prizes.

Prospecting of Lithostratigraphic Reservoirs

The theory of formation of lithostratigraphic oil and gas reservoirs in zones goes beyond the traditional prospecting concept in secondary structural belts. Large oil and gas pools have been discovered in the sand bodies of shallow water deltas in continental basins. Thus, the geological theory that large-area lithostratigraphic oil and gas pools with mid-to-low abundance could be formed was created. Enrichment patterns of lithostratigraphic reservoirs in the continental downwarping basins, faulted basins, foreland basins and marine cratonic basins have been revealed.

The geological theory and prospecting technology created in this study have successfully directed massive prospecting in lithostratigraphic oil and gas reservoirs, as well as the industrial application of the technology. Several oil and gas fields, each with reserves of hundreds of million tons, were discovered in the deep zone of the Songliao Basin, the Xifeng area of the Ordos Basin, the Chuanzhong area of the Sichuan Basin, and the Tazhong area of the Tarim Basin. In the past two years, 1.07 billion tons of oil and 563.32 billion cubic meters of natural gas were proved in lithostratigraphic oil and gas pools with mid-to-low abundance.

Integration of Development Technologies in the Sulige Gas Field

Integration generally includes preferential block selection, well location optimization, speed drilling, separate pressure production, downhole choking and surface facility optimization technologies. It effectively drove the full-scale development of the Sulige Gas Field, which had built an annual gas productivity of 3 billion cubic meters in 2007, and delivered 10 million cubic meters daily.

Industrial Application of Prestack Seismic Reservoir Description

While studying prestack reservoir description technology, a series of unique technologies in seismic-based petrophysical analysis, preserved amplitude processing of seismic data, prestack effective reservoir prediction and hydrocarbon detection were developed, and they were applied in a series of oil-and-gas-bearing basins. Prestack processing and composite interpretation was completed on 6,265 kilometers of 2D seismic data and 1,010 square kilometers of 3D seismic data in the Ordos, Sichuan, Tarim, Qaidam, and Bohai Bay basins, helping to prove 210 billion cubic meters of natural gas reserves. Tested by 43 wells actually drilled, the application delivered a 90% hit rate of effective reservoir prediction and an 85% hit rate of hydrocarbon detection.

12,000m Drilling Rig and Matching Top Drive System

The ZJ120/9000DB drilling rig is a new land VFD rig with a maximum drilling depth of 12,000 meters, characterized by digital and intelligent control throughout the drilling process. It is designed with a maximum hook load of 9,000kN and a rated power of drawworks of 6,000HP. The rig is welded with high tensile, low-temperature resistant steel to operate in environments from -40°C to 55°C.

When developing the rig, we tackled technical problems in the high-speed heavy gear drive, and the structural design and machining of the large hoisting drum. In addition, a matching top drive system was developed.

X80 Spiral Welded Steel Pipes

After the successful application of X80 steel pipes on a pilot section along Ji-Ning Branch of the West-East Gas Pipeline, X80 Spiral Welded Steel Pipes with a diameter of 1,219mm and wall thickness of 18.4mm were put into mass production. These technically compliant pipes will be the only pipes installed on the Second West-East Gas Pipeline.



CNPC independently developed a drilling rig for ultra-deep wells, with a rated drilling depth up to 12,000 meters.