

Service Business

In 2017, by leveraging our advantages in integrated operation and specialized services, our service business continued to expand in terms of market share and operation performance. Competitiveness and profitability were brought to the next level as we actively explored market opportunities in oilfield services, engineering construction, equipment manufacturing, and financial services.

Oilfield Services

In 2017, we saw a remarkable increase in the workload completed, market expansion at home and abroad and a growing market share, driven by streamlined business processes, new business models, buoyant EPC activities, innovative technologies and enhanced productivity and quality. By the end of 2017, we had 5,007 crews providing services in geophysical prospecting, drilling, well logging, mud logging, downhole operation and offshore engineering in 51 countries around the world.

Geophysical Prospecting

In 2017, we deployed 150 seismic crews (71 2D and 79 3D) in 289 projects, acquiring data on 154,904 kilometers of 2D lines and 57,182 square kilometers of 3D profiles. With 100% acceptance for both on-site data acquisition profiles and final data processing profiles, the recorded shots per day of domestic onshore 3D surveys increased by 4.3%.

In view of the technology trends and the requirements in both domestic and international exploration markets, we stepped up R&D of core software and equipment and promoted the extensive use of our proprietary devices and packaged technologies, including the GeoEast and KLSeis II geophysical data processing solutions, EV56 high-precision vibroseis, LFV3 low-frequency vibroseis, G3i wired seismograph and eSeis node system, as well as "wide azimuth, broadband and high density" technology and high-productivity blended shooting acquisition techniques. As a result, we saw rapid productivity and competitiveness gains and steady progress in our geophysical prospecting service projects at home and abroad. In particular, the high-productivity blended shooting acquisition techniques proved successful at the PDO project in Oman, enabling more than 20,000 shots per day.

We refocused on overseas high-end markets and won a number of bids such as the integrated onshore 3D survey project in west Kuwait, a deepwater 3D survey project for BP, and a seismic survey project in the Sahara desert. In addition, we were awarded the contract to conduct the first-ever Z100 node system-enabled acquisition survey in Tomori, Indonesia. In data processing and interpretation, we won a five-year open contract from Kuwait National Petroleum Company and a contract for the Saudi Aramco's S78 Phase III (Farshah) project. Our deepwater fleet became the world's largest towed streamer 2D seismic service provider, claiming a 51% worldwide market share. After expanding into six new markets, i.e., Kyrgyzstan, Somaliland, Canada, Egypt, Cuba and Morocco, we made new progress in the United Arab Emirates, Ghana, Egypt, Indonesia and Morocco.

Geophysical prospecting operations

	2015	2016	2017
Seismic crews in operation	166	165	163
Domestic	96	96	94
Overseas	70	69	69
2D seismic data acquired (kilometers)	132,714	162,684	154,904
Domestic	22,521	35,919	30,644
Overseas	110,193	126,765	124,260
3D seismic data acquired (square kilometers)	47,219	58,120	57,182
Domestic	10,722	10,844	10,313
Overseas	36,497	47,276	46,869

Drilling

In 2017, our 1,183 drilling crews spudded 11,916 wells and completed 11,687 wells, registering a total footage of 25.79 million meters.

We boosted drilling efficiency through wide adoption of EPC services and pad drilling. R&D efforts were ramped up and new techniques were deployed to enhance operating performance and bolster market share and service capabilities. ROP speed-up for deep wells was fruitful, seeing 648 wells deeper than 4,000m drilled, an increase of 121 wells from one year earlier; average depth of 4,922m, up 0.65%; average well construction cycle and drilling cycle reduced by 8.38% and 7.34% respectively; and average penetration rate up to 1,449m per month for each rig, up 9.94%. Pad drilling for tight gas and share gas helped improve efficiency and reduce costs under a "3+3" factory management model. New techniques were developed and promoted, such as hydraulic rotary percussion drilling tools. Particularly, hydros oscillator, rotating hammers and other tools helped enhance average ROP by 60% at applied intervals. Geo-steering drilling was widely used in Tarim and Xinjiang Oilfields and achieved good results.

Overseas, we were awarded EPC contracts in Iraq, Kazakhstan and Uzbekistan, date rate-based drilling service contracts in Venezuela, Ecuador and Saudi Arabia, and an offshore drilling service contract from National Iranian Oil Company for the first time.

Well Logging and Mud Logging

In 2017, CNPC deployed 813 well logging crews and completed 101,531 well-times of logging in 18 countries; and 1,436 mud logging crews on 13,187 wells.

In view of the service condition and logging needs in oilfield production, imaging logging was used to evaluate complex reservoirs and maximize production per well. A range of innovative techniques and processes were widely adopted to boost efficiency and reduce costs. EILog express and image logging solutions enabled a significant increase in logging workload; LEAP800 logging system saw wider application; memory express logging techniques were improved, increasing operating efficiency by more than 30%; coiled tubing and tractor conveyance techniques were effectively deployed to save the operation time by 16.7 hours per well; advancements in perforation methods, tools and equipment contributed to integrated solutions for well completion and EOR.

Progress was made in exploring the international markets, as evidenced by a number of important well logging contracts in Iraq, Iran and Sudan and debut in Kuwait.

Drilling operations

	2015	2016	2017
Drilling crews in operation	1,230	1,205	1,183
Domestic	979	943	921
Overseas	251	262	262
Wells completed	9,387	9,328	11,687
Domestic	8,389	8,686	10,807
Overseas	998	642	880
Footage (million meters)	20.89	19.50	25.79
Domestic	18.38	17.96	23.55
Overseas	2.51	1.54	2.24

Well logging operations

	2015	2016	2017
Logging crews in operation	803	797	813
Domestic	662	663	677
Overseas	141	134	136
Well logging operations (well-time)	88,926	79,231	101,531
Domestic	83,933	75,591	96,588
Overseas	4,993	3,640	4,943

Downhole Operation

In 2017, our 1,845 crews completed 110,844 well-times of downhole operations and 9,237 layers of formation testing.

Our downhole operation performance was further improved through intensified R&D and wider application of innovative technologies. Multi-stage fracturing solutions featuring bridge plug, open-hole packer, hydraulic jet and slickwater fracturing proved successful in volume reconstruction. Pad drilling facilitated large-scale development of shale gas and tight oil and gas. Operation efficiency and reservoir stimulation effect were greatly enhanced, thanks to improved factory-like cross operation, zipper operation, continuous blending and continuous sand feed. Coiled tubing operations were used widely and the scale of snubbing operation was expanded. CO₂ dry fracturing techniques were polished through field tests for more than 10 well-times. Cluster-based subdivision fracturing with coiled tubing and bottom packer resulted in significant efficiency gains. Breakthroughs were made for wireless transmission of downhole formation test parameters, enabling a working depth up to 5,000 meters.

Downhole operations

	2015	2016	2017
Downhole operation crews	2,153	1,914	1,845
Domestic	1,929	1,676	1,592
Overseas	224	238	253
Downhole operations (well-time)	128,879	112,643	110,844
Domestic	126,062	110,818	109,006
Overseas	2,817	1,825	1,838
Formation test (layers)	7,782	8,515	9,237
Domestic	5,051	5,555	6,227
Overseas	2,731	2,960	3,010

Offshore Engineering

In 2017, we provided services in offshore drilling, well completion, well cementing, formation test & production test, downhole operation, offshore engineering design and construction in various sea areas including the South China Sea, Bohai Sea and the Persian Gulf. Throughout the year, our six offshore drilling and operating platforms completed a total drilling footage of 18,500 meters, and our 20 vessels travelled 122,756 nautical miles in total.

In particular, as the general contractor of the natural gas hydrate pilot production project in the South China Sea, we addressed world-class difficulties in extracting shallow free gas and sand control for silty-sand reservoirs, ensuring the success of the project. In addition, we won a shallow water drilling project from Iranian Offshore Oil Company.

Engineering and Construction

In 2017, China Petroleum Engineering Co., Ltd. (CPEC), a specialized subsidiary in charge of CNPC's engineering and construction business was publicly listed after restructuring. Leveraging its advantages in specialized services and integrated management, CPEC adopts a work flow featuring standardized design, factory prefabrication, modular engineering, mechanized operation and IT-enabled management. While continuing to build competence in offering intelligent engineering and construction solutions, CPEC is speeding up the shift from an EPC contractor to an integrated service provider.

Tapping into domestic and overseas markets, CPEC was awarded the contracts for the non-proprietary facilities at the Amur Gas Processing Plant in Russia, AKK Gas Pipeline in Nigeria, a single point mooring system and pipeline installation at the Eastern Refinery in Bangladesh, Haradh Gas Pipeline in Saudi Arabia and EPC for integrated facilities at the Bab oilfield in Abu Dhabi. In 2017, CPEC executed 43 projects in surface engineering, storage and transportation, refining and chemicals and environmental engineering.

Surface Engineering of Oil and Gas Fields

In 2017, our surface engineering projects progressed well in key oil and gas fields at home and abroad. A light hydrocarbon recovery unit for condensate gas production was put into operation at the Tarim Oilfield. Modules for the Phase II and Phase III Yamal LNG project were completed, A de-bottleneck project was delivered at Block 3/7 in South Sudan. The Phase I pressure boosting project at the Saman-Depe Gas Field in Turkmenistan and the Phase I Karakul project in Uzbekistan became operational. The renovation project at the Basra Natural Gas Plant in Iraq and the oil field surface engineering project at the Phase 2.2 development in Chad advanced steadily. The Amur Gas Processing Plant in Russia and the Central Processing Facility of Phase III Halfaya Project (CPF3) were kicked off.



Successful pilot production of gas hydrates in the South China Sea

On May 18, 2017, China announced the success of its first attempt to tap gas hydrates in the Shenhu area of South China Sea, a historic breakthrough in extracting gas hydrates.

CNPC has played an important role in the project as CNPC Offshore Engineering Company Ltd. (CPOE) worked as the general contractor of the gas hydrate pilot production project. Leveraging advantages in integrated technical solutions and based on CNPC's expertise in oilfield development, CPOE has tackled challenges such as silty-sand reservoirs, shallow burial depth, low temperature under deepwater, sand producing and secondary hydrate generating, etc., greatly facilitating the smooth construction of the project. Eventually, the project maintained a steady gas output for 60 days straight and produced a total of 309,000 cubic meters, world's records in terms of producing period and yield amount. During project execution, excellent HSE performance was achieved and the marine ecological

environment well protected, with 100% wastes regulatory compliant discharged and without any safety, occupational hazard or environmental accident. The successful pilot production marks a solid step forward of CNPC in deepwater operation and demonstrates our technical capabilities in deepwater drilling, well completion and pilot production.

On August 24, 2017, CNPC signed a strategic cooperation agreement with the Ministry of Land and Resources and the government of Guangdong Province on promoting the building of a pilot site for exploring and exploiting gas hydrates in the Shenhu area of the South China Sea. Under this agreement, we will carry out field tests for extracting gas hydrates in a bid to increase output per well, reduce costs, protect the environment and facilitate the commercial production of gas hydrates.

Construction of Pipeline and Storage

In 2017, we made important progress in storage and transportation projects. A number of pipelines became operational, including the Zhongwei-Jingbian connecting line of the Third West-East Gas Pipeline, Fourth Shaanxi-Beijing Gas Pipeline, Yunnan Refined Products Pipeline, Myanmar-China Crude Pipeline, Second Russia-China Crude Pipeline and Majnoon Pipeline in Iraq. The north section of the Russia-China Gas Pipeline (Eastern Route) was under construction. A refined products pipeline was kicked off in northern Thailand. The Haradh Gas Pipeline in Saudi Arabia moved forward as planned. The AKK Gas Pipeline project in Nigeria was implemented. As to storage tank engineering, the refined oil tank farm expansion project at the Fishing Port Terminal in Angola became operational.

Construction of Refining and Chemical Facilities

In 2017, we pushed ahead with refining and chemicals projects steadily. The 13 Mt/a refining plant was successfully put into operation at Yunnan Petrochemical. A number of projects made steady headway, including the 10 Mt/a upgrading project at Huabei Petrochemical, Russian crude processing productivity project at Liaoyang Petrochemical and alkylation project for gasoline upgrading under the National VI standards. Phase I of

the Shymkent Refinery upgrading project in Kazakhstan was successfully completed and the Phase II project was under construction. The phosphate project in Saudi Arabia went on stream and the refinery expansion project in Algeria was fully launched.

Environmental Engineering

In 2017, a number of environmental engineering projects were ready for commissioning, including wastewater treatment at Ningxia Petrochemical, emission-reduction at Liaoyang Petrochemical, and flue gas purification at Guangxi Petrochemical. The off-gas treatment at Daqing Petrochemical and VOCs project at Sichuan Petrochemical advanced steadily.



Petroleum Equipment Manufacturing

In 2017, our equipment manufacturing business saw an accelerated shift to the “Manufacturing + Services” model. We continued to promote capacity transfer and international cooperation on capacity building, propel product innovation and industrial upgrading, and improve marketing network. As at the end of the year, CNPC-manufactured equipment and materials were sold to more than 80 countries and regions worldwide.

CNPC’s equipment manufacturing business segment is transforming from an equipment manufacturer to an integrated service provider. So far, we have launched the Version 2.0 for ten standardized service packages, i.e. “Electric pump leasing + Integrated services,” “Steel pipe sales + Service guarantee,” “Drilling rig sales + Integrated services” etc. We achieved a significant increase in the value of service contracts signed throughout the year, which included the contracts on maintenance of power generating units and compressor units in Peru, inspection and overhaul services for refining facilities in Niger, and “Electric pump leasing + Integrated services” in Sudan, South Sudan, Chad, Kazakhstan and Ecuador, etc.

We continued to promote product innovation and technology upgrading to push our products to middle-high end of the value chain. We stepped up R&D and application of new drilling equipment, such as the offshore jack-up drilling system, 4,000m low-temperature rig, 9,000m onshore four single-rod rig, and BHDH high-torque drill rods. Milestones were achieved in the development of X90/X100 high-grade, large-caliber, large-wall-thickness steel pipes. The development of low-temperature pipe materials progressed well. X80 Φ1,422mm SSAW and LSAW steel pipes were used in the Eastern Route of the Russia-China Gas Pipeline. In addition, we continued to promote the use of a range of proprietary equipment, including the 2300-type fracturing vehicles, GX/S dual-track vibrating screens, SEW collapse-resistance casings, and BJC-1 special casings, etc.

International cooperation on capacity building and technology made headway. As one of CNPC’s overseas investments, the first large-diameter steel pipe manufacturing facility in Kazakhstan – Asia Steel Pipe Co., Ltd. – was under construction in Almaty and expected to be operational in 2018 with a designed capacity of 100,000 tons per year. We also signed JV cooperation agreements with Schlumberger, Caterpillar and Parker Hannifin on equipment manufacturing, including drilling bits, fracturing pumps, and hydraulic line, etc.

Financial Services

In 2017, our financial service arm CNPC Capital was publicly listed after restructuring. The restructured company holds the most extensive set of financial licenses in the A-share market among central enterprises under SASAC, with business covering in-house banking, banking, financial leasing, trust, insurance, insurance brokerage and securities.

Leveraging an integrated platform, CNPC Capital continued to expand its product offering and customer base, deepen channel and service innovations and mitigate financial risks effectively to bring operating excellence to the next level.

Based on its expertise and strengths, CNPC Capital maintained a healthy level of profitability by aligning financial services with oil and gas business, promoting collaboration between financial institutions, creating an information sharing platform for products, customers and channels, and improving service quality, in order to boost the development of CNPC’s core businesses.

