

Services Business

Leveraging its integrated capabilities and expertise, the company kept optimizing market layout and improving service quality. Its competences and operating results in oilfield services, engineering and construction, equipment manufacturing and financial services continued to improve in 2018.

Oilfield Services

The company's oilfield services arm proceeded with its reform and restructuring initiatives in 2018 with a focus on the optimization of top-level design, streamlining of business processes and innovation of service offering. Domestically, we managed to achieve continuous improvement in quality, efficiency and earnings amidst a surge of workload by rationally deploying deep-well drilling rigs, fracturing units and coiled tubing units, boosting drilling and fracturing operations in winter months and introducing new techniques. Overseas, market development efforts were fruitful. In particular, the value of service contracts signed in traditional markets such as Algeria, Niger and Pakistan was doubled; and bids were awarded for a number of major geophysical prospecting and drilling projects in UAE, Saudi Arabia and Kuwait. By the end of 2018, the company had 8,176 service crews, offering geophysical prospecting, drilling, well logging, mud logging, downhole operation and offshore engineering services in 53 countries around the world.

Geophysical prospecting: Targeting technical bottlenecks in oil and gas exploration, we have pushed ahead with R&D efforts in velocity modeling and shear-wave data acquisition and facilitated the adoption of broadband wide-azimuth, high-density seismic techniques, GeoEast data processing and interpretation solution, and EV56 high-precision vibroseis. These technological advancements have contributed to major discoveries in Qiulitage (Tarim), Mahu (Xinjiang) and Sulige (Changqing). Project management capabilities have been bolstered by optimized technical solutions, improved project coordination and wider adoption of digital seismic system and drones. The Shehong-Yanting 3D Seismic Acquisition Project in China and the deep-sea OBN Project in Indonesia were completed in a timely and efficient manner. In 2018, we deployed a total of 164 seismic crews, acquiring data of 105,739 kilometers of 2D lines and 76,702 square kilometers of 3D profiles, marking 8.5% and 8.6% of average efficiency increase on a daily basis for 2D and 3D seismic data acquisition respectively.

Drilling: The rate of penetration was increased by 5% as a whole, with impressive growth in the numbers of horizontal wells and deep wells as well as the amount of drilling footage, by optimizing drilling parameters and using aggressive drilling techniques. In particular, Well 202H13-6 in the Weiyuan Block set a drill time record of 27.6 days; Daqing Drilling



Engineering Company used hydraulic rotary percussion tools for the drilling of 21 wells, achieving a 129% increase in the average penetration rate. A number of difficult wells have been drilled successfully. In Tarim Basin, Well Keshen-21 was completed at a depth of 8,098 meters; in Sichuan Basin, Well Wutan-1 created a fresh record of 8,060 meters for risk drilling in the Sichuan-Chongqing region; in Uzbekistan, 23 technical troubles were solved when drilling Well M-15 and resulted in 8 proprietary techniques. In 2018, we deployed 1,183 drilling crews to spud 11,385 wells and completed 11,264 wells, with a total footage of 25.71 million meters. In particular, 816 wells are deeper than 4,000 meters, up 25.9% from a year earlier; 931 horizontal wells were drilled, up 22.2% year-on-year.

Well logging and mud logging: A range of state-of-the-art logging technologies have been developed and deployed. EILog and LEAP800 logging systems have continued to improve. R&D achievements in such as Azimuthal gamma imaging while drilling and array induction imaging logging techniques have been put into use. New techniques and procedures for express logging were widely used to boost logging efficiency. In particular, the "Logging Kit" approach increased the logging efficiency for vertical wells by 48% on average; the express logging and through-pipe memorized logging techniques for horizontal wells made the logging process 30% and 60% more efficient respectively. In 2018,

we deployed 817 well logging crews to complete 106,963 well-times of logging in 19 countries and 1,035 mud logging crews to complete mud logging at 14,256 well.

Downhole operation: R&D and deployment of improved downhole techniques and practices such as SRV fracturing for horizontal wells and multi-stage fracturing with dissolvable bridge plug contributed to a 23% increase in conventional fracturing and a 32% rise in factory fracturing. In 2018, our 1,839 crews completed 87,007 well-times of downhole jobs, including 11,969 layers of formation testing.

Offshore engineering: We offer offshore engineering services for well drilling, well completion, well cementing, formation testing and production testing, downhole operation as well as the design and construction of offshore projects in the South China Sea, Bohai Sea and Persian Gulf. In 2018, we had deployed a total of 12 offshore drilling rigs and production platforms, completing a total drilling footage of 72,000 meters for the full year.

Oilfield services operations

	2016	2017	2018
Geophysical prospecting			
2D seismic data acquired (kilometers)	162,684	154,904	105,739
3D seismic data acquired (square kilometers)	58,120	57,182	76,702
Drilling			
Wells completed	9,328	11,687	11,264
Footage (million meters)	19.50	25.79	25.71
Well Logging			
Well logging operations (well-time)	79,231	101,531	106,963
Downhole operations			
Downhole operations (well-time)	112,643	110,844	87,007
Formation test (layers)	8,515	9,237	11,969

Engineering and Construction

In 2018, heightened measures for project lifecycle management contributed to continuous improvement in the construction quality and project execution. R&D efforts on frontier technologies, especially on digital and intelligent applications, have picked up pace. As part of the efforts to create a global network, we entered into strategic partnerships or engineering service agreements with CSIC and Shell, etc. and secured a number of new contracts, e.g. a crude processing project at Garraf Oilfield in Iraq, a pipeline project linking Haradh with Hawiyah in Saudi Arabia and a refinery revamp project in Malaysia.

We executed 97 key projects in oil and gas field surface engineering, refining and chemicals, storage and transportation, and environmental engineering throughout the year, with positive advancements achieved.

Construction of intelligent pipeline

The Russia-China Gas Pipeline (Eastern Route) Project is a pilot program aimed at promoting intelligent pipeline systems. The project integrates real-time data acquisition and transmission, site monitoring, lifecycle project management capabilities, unit communication and project management platforms to enable IT-driven pipeline design, detection, management and hand-over and promote a shift from digital pipeline to intelligent pipeline.



Oil and gas field surface engineering: A range of overseas projects have been delivered or made operational, including the Halfaya Project Phase III (CPF3) in Iraq, the Jose Refinery for the MPE3 project in Venezuela, the Chad Project Phase 2.2, the Karakul Gas Field in Uzbekistan, the EGR Project at the Saman-Depe Gas Field in Turkmenistan, etc. Domestically, a number of projects designed to expand production and stabilize supply were well underway, such as the Changning-Weiyuan Shale Gas Project. The Belt and Road projects including the Amur Gas Processing Plant in Russia and the integrated facilities at the Bab Oilfield in UAE were making steady headway.

Storage and transportation: The construction of key pipelines in China accelerated. A number of refined products pipeline projects were completed, including the Kunming Branch of Yunnan Refined Products Pipeline, Qinzhou-Nanning-Liuzhou Refined Products Pipeline, Fushun-Jinzhou Refined Products Pipeline, Jinzhou-Zhengzhou Trunk and Huabei Petrochemical-to-Beijing New Airport Jet Fuel Pipeline, etc. Key projects aimed at strengthening gas pipeline connectivity were completed. Construction of the Fujian-Guangdong Branch of the Third West-East Gas Pipeline proceeded smoothly. LNG terminal projects (Tangshan, Shenzhen, Jiangsu and Jiangyin) advanced at a faster pace. The Russia-China Gas Pipeline (Eastern Route) gathered pace. The Haradh Gas Pipeline in Saudi Arabia and the single-point mooring (SPM) project in Bangladesh were making steady headway.

Refining and chemical facilities: Domestically, key refining and chemical projects saw new progress. Liaoyang Petrochemical's revamp project for Russian crude processing went on stream. The 10 Mt/a upgrading project was completed at Huabei Petrochemical. Alkylation projects at Qingyang, Jilin and Harbin were delivered and made operational. An integrated project was kicked off at Guangdong Petrochemical. Facility upgrading projects were moving forward as planned at Daqing Petrochemical and Dushanzi Petrochemical. Overseas, the Phase II renovation project became operational at the Shymkent Refinery in Kazakhstan and the refinery expansion project in Algiers, Algeria proceeded steadily.

Environmental engineering and others: Emission reduction, wastewater treatment, VOCs, and off-gas treatment projects were launched at Tarim, Daqing and Liaoyang. Aromatics projects were in full swing at Guangxi Petrochemical, Liaoyang Petrochemical and Urumqi Petrochemical. An Indian polypropylene project was ready for commissioning.

Petroleum Equipment Manufacturing

Undergoing a shift from traditional manufacturing to service-oriented manufacturing, our equipment manufacturing arm is gaining momentum with a substantial boost in profitability. Efforts were made to expand market share both at home and abroad, with an increasingly improved sales network. As of 2018, CNPC made petroleum equipment and materials were



sold in more than 80 countries and regions around the world.

The production and operation management was more lean-oriented. Lean management proved successful two years after the start of its promotion and pilot across the company in 2016. Our equipment manufacturing sites enjoy increased capabilities for visualization and standardization, enabling IT-driven management of production processes and continuous improvement in productivity and product quality.

Centering on a "Manufacturing + Services" model, we continued to push ahead with the integration of R&D, manufacturing, marketing and service competences. We refocused our manufacturing business on the higher end of the value chain through product innovation, technological upgrading and customization. A range of new products have been developed and launched, including X80 steel pipes, 4000m low-temperature composite moving cluster drilling rigs, high-strength variable-thickness coiled tube CT110, etc. Our customer-centered services provide tailored products and solutions, 24h/7d technical support, leasing, maintenance & repair, testing and recycling throughout the entire life cycle of products.

New breakthrough was made in market development, with the number of new contracts increasing significantly year-on-year. Our "Electric pump leasing + Integrated services" entered many markets, taking a 50% market share in Sudan and South Sudan and a 100% market share in Chad and Niger. Low-temperature rigs were sold to Russia; coiled tubing products were exported to

South America, South Asia and Europe. We were awarded major contracts for electric pump services in Iraq and line pipes in Egypt. In addition, marketing efforts broke ground in Nigeria and Djibouti.

Financial Services

In 2018, our financial service sector saw robust growth in key operation indicators and remarkable improvement in business agility, R&D and market development capabilities.

We furthered market research and analysis and accelerated business layout. We participated in the fundraising round of China Tower as a cornerstone investor, invested in US-China Green Fund and entered into strategic partnership with five commercial banks. A regional coordination mechanism was taking shape to align financial services with production needs in innovative forms and at a deeper level. Green financing has remained a priority for the company. Financial resources were directed into the green industry to boost the development of cleaner energy sources.

The control and management of financial risks have achieved new results. We bolstered the risk mitigation framework of "two-tier management and three-line defense", and reinforced total-process management for high-risk items. Our key financial risk indicators remained superior to CBRC's thresholds in 2018, with the non-performing asset ratio standing at a very low level and no significant risk event reported throughout the year.