

Highlighting market orientation and operational benefits, the company continued to optimize production organization and resource allocation, promote an integrated and coordinated approach to oil and gas production, refining, chemicals, marketing and trade activities, and improve internationalized business operation and service market competitiveness.



Newly proven oil
in place (Domestic)

659.45

mmt



Newly proven gas
in place (Domestic)

569.8

bcm

Exploration and Production

In 2017, focused on economically producible reserves and effective output, our E&P sector achieved steady growth and better than expected operating results, through promoting technological innovation, scientifically organizing domestic exploration and production activities, furthering unconventional resource exploration and development, and deepening joint E&P in China.

Exploration

With an emphasis on upgradeable and producible reserves, we reinforced preliminary and risk exploration, and rolled out fine exploration in mature areas, resulting in six 100 Mt grade uncompartmented oil zones and six 100bcm grade uncompartmented gas zones in six basins including Tarim, Sichuan and Qaidam. In 2017, we increased 659.45 million tons of proven oil in place and 569.8 billion cubic meters of proven gas in place in China, exceeding 1 billion tons of oil equivalent in total for the 11th consecutive year and sustaining a peak rate of reserve growth.

Reserves and operating data (Domestic)

	2015	2016	2017
Newly proven oil in place (mmt)	728.17	649.29	659.45
Newly proven gas in place (bcm)	570.2	541.9	569.8
2D seismic (kilometers)	15,909	24,885	26,813
3D seismic (square kilometers)	9,095	8,764	7,843
Exploration wells	1,588	1,656	1,773
Preliminary prospecting wells	924	865	986
Appraisal wells	664	791	787

Major Discoveries

Oil exploration won new achievements

- Five oil-rich areas and two prolific blocks were discovered, and two 100 Mt grade oil zones, Huachi-Nanliang and Jiyuan, were identified in the Ordos Basin.
- Commercial oil and gas flows were obtained at multiple wells from upper Wuerhe Formation in the Junggar Basin, adding 200 million tons of probable and possible reserves and marking another strata series for reserve replacement in the Mahu area.
- Two 100 Mt grade oil zones were identified in the Songliao Basin, one of conventional oil reserves in the north and one of tight oil reserves in the south.
- A number of large-scale oil zones were discovered in Tarim, Qaidam and Bohai Bay Basins.

Natural gas exploration achieved significant progress

- In the Tarim Basin, three new gas-bearing structures were discovered and proved at the Kuqa Depression, namely Keshen-24, Dabei-11, Bozi-3; high-yield oil and gas flows were obtained from the Tudong-2 well at the northern Kuqa tectonic belt, unveiling new opportunities to tap these Jurassic reservoirs.
- Three 100bcm grade gas zones were identified at Sulige South Block I, Shenmu and Lower Paleozoic of the eastern ancient uplift in the Ordos Basin.
- In the Sichuan Basin, high-yield gas flows were obtained from Xingtan-1 well of Leikoupo Formation in the southwestern part of the basin; new discoveries in Weiyuan and Zhaotong Blocks added 156.5 billion cubic meters of proved shale gas reserve.
- A new gas-bearing belt was discovered in the Altun Mountains in the Qaidam Basin.
- A number of exploration wells at Dinan uplift yielded commercial gas flows, opening up new areas of high-efficiency gas exploration in the Junggar Basin.



Crude production
(Domestic)

102.54

mmt



Natural gas production
(Domestic)

103.3

bcm

Development and Production

Domestic oil and gas production saw balanced running in 2017. Thanks to heightened management and technological progress, the company was able to reduce costs and boost efficiency through overall planning, innovative production models and pad drilling. Throughout the year, our oil and gas production reached 184.82 million tons of oil equivalent.

Crude Oil

In 2017, we stepped up production management in key oilfields and continued to optimize development program and output structure. We highlighted efficient capacity building, maintained a focus on reservoir fine description, waterflood optimization and redevelopment of mature fields, and major field experiment. In 2017, our newly installed capacity for crude oil was 11.61 million tons and the crude output was 102.54 million tons.

Daqing Oilfield continued to roll out tertiary recovery, achieving improved development efficiency and yielding 34 million tons of crude throughout the year. Changqing Oilfield achieved overall improvement in productivity and development efficiency through strengthening fine waterflood and deploying applicable technologies such as reservoir stimulation, horizontal well drilling and SRV fracturing. The yearly production of crude oil was 23.72 million tons. Liaohe Oilfield put over 1,300 new wells into production to boost production capacity. Daily output of new wells hit a ten-year high, thanks to wider adoption of SAGD technology.



Annual output of Changqing exceeded 50 million tons of oil equivalent for the 5th consecutive year

Changqing Oilfield produced 53.16 million tons of oil equivalent in 2017, including 23.72 million tons of crude oil and 36.9 billion cubic meters of natural gas, marking the 5th consecutive year of achieving an annual output of above 50 million tons since 2013. Over the past five years, Changqing produced a total of 120 million tons of crude oil and 183.7 billion cubic meters of natural gas, i.e. 268 million tons of oil equivalent.

Changqing Oilfield, located in the Ordos Basin, became operational in 1970s, featuring hard-to-tap tight reservoirs with low permeability, low formation pressure and low hydrocarbon abundance. Over the years, we have developed a series of technologies and technical packages for large-scale highly efficient development of the tight reservoirs, making Changqing China's fastest-growing oilfield in recent 10 years in terms of reserves and production. Changqing yielded over 20 million tons of oil equivalent for the first time in 2007, and this figure soared to over 50 million tons in 2013. Now Changqing boasts China's largest oil and gas field.

In recent years, Changqing has been facing challenges caused by continuous decline in reservoir quality and increasing pressure of investment and cost control amidst lower oil prices. The oilfield has managed to address difficulties in stabilizing production by continuously adjusting and improving its exploration and development approaches. Leveraging an elaborate and efficient

approach to exploration, Changqing contributed 49% of CNPC's total newly proven oil in place in 2017. Annual crude output has been maintained at about 24 million tons for several years through deploying injection-extraction control and zonal injection, and improving tertiary recovery. The recovery factor of major gas fields has been enhanced, thanks to refined well management by optimizing intermittent production strategy and extensive use of dewatering gas recovery technology.

Changqing Oilfield's sustained and stable high production is underpinned by technological innovation. SRV fracturing of horizontal wells enabled efficient development of tight reservoirs. Pad drilling of large well group increased the average ROP by 50% and reduced the average drilling cycle by 27 days for horizontal wells. EOR techniques such as bridge-type concentric zonal water injection helped increase the recovery percentage of waterflooded reserves by 2.8%, reduce the rate of natural decline by 0.6% and increase the recovery by 5%. The use of a range of techniques, such as sidetracking of horizontal wells, stratum review and bridge-plug gas lift for dewatering gas recovery, increased the yearly gas output by more than 1.7 billion cubic meters. IT technology and tools are thoroughly utilized, building Changqing into a "digitalized oilfield" featuring unmanned workstations and intelligent production and management.



Pilot Development

In 2017, we achieved positive progress in strategic succeeding technologies such as polymer-surfactant flooding, in situ combustion and CO₂ flooding, etc.

Polymer-surfactant flooding tests made significant headway in surfactants development, formulation optimization and study of emulsification mechanisms, as evidenced by an increase of approx. 19% in oil recovery at the Jin-16 Block of Liaohe Oilfield, marking the next-generation EOR technology after ASP flooding which has been proved successful in Daqing Oilfield. In-situ combustion tests at Du-66 Block of Liaohe Oilfield and Hongqian Block of Xinjiang Oilfield achieved favorable results in heavy oil recovery at mid-late development stage. Gas-assisted gravity drainage was tested at the Donghetang oilfield in the Tarim Basin, resulting in a drop of water cut growth rate from 4.5% to -0.4% and substantial rebound of production. CO₂ flooding, as an integrated process of CCS-EOR, is expected to enhance oil recovery by more than 10%.

Natural Gas

In 2017, our four major gas zones, Changqing, Tarim, Southwest and Qinghai, reported sustained growth in natural gas output, thanks to flexible adjustment of production according to the production-sales dynamics and seasonal change as well as improvement in capacity building and production management pattern, featuring big well clusters, multiple layers, diversified well patterns, pad drilling and three dimensional development.

Throughout the year, CNPC built up new capacity of 13.4 billion cubic meters and produced 103.3 billion cubic meters, an increase of 5.2 billion cubic meters year-on-year.

Changqing Oilfield, China's largest natural gas production base and a reliable source for the Shaanxi-Beijing Gas Pipelines, yielded 36.9 billion cubic meters in 2017, over one-third of CNPC's total domestic production. Tarim Oilfield produced 25.3 billion cubic meters of natural gas in 2017, thanks to accelerated implementation of key projects in Kuqa area, such as high-efficiency development of natural gas, and efficient development of carbonate gas fields, and key capacity building programs in Keshen and Tazhong. Gas production of Southwest Oil and Gas field reached 21 billion cubic meters, standing above 20 billion cubic meters for the first time. Qinghai Oilfield managed to maintain steady production in mature blocks and ramp up production in new areas, as a result of synergy in enhanced gas recovery and capacity building measures. Progress was made in natural gas development in the Songliao Basin. Gas production grew steadily in the Daqing, Jilin and Huabei oilfields.



Gasi Oilfield in Qinghai Province

Exploration and Development of Unconventional Oil and Gas

CNPC has made remarkable progress in the exploration and development of unconventional oil and gas in recent years. As a number of production blocks and pilot development bases put into operation, our unconventional oil and gas output continued to grow. The year 2017 saw new achievements in exploration of coalbed methane, shale oil/shale gas and tight oil/tight gas, accelerated capacity building and wider application of innovative key and supporting technologies.

Shale Gas

Leveraging an integrated approach to exploration and development, we produced 3 billion cubic meters of shale gas in 2017, with production capacity expanding as planned. Our shale gas exploration activities in Edong area of Shaanxi province led to new breakthroughs, showing an attractive outlook in that area. Shale gas E&P in the southern part of the Sichuan Basin continued to roll out, with newly added proven reserve of 156.5 billion cubic meters. The demonstration projects in Changning-Weiyuan and Zhaotong speeded up, with a substantial increase in both premium reservoir discovery rate and output per well. The bottleneck projects of Ning-201 dehydration unit, link line of Ning201-209 blocks and Ning-209 central station became operational. A 110km-long shale gas trunk line became operational, which serves as an export channel to deliver a maximum of 4 billion cubic meters of shale gas annually from Changning Block in Sichuan and Zhaotong Block in Yunnan, playing a significant role in ensuring the supply of clean energy in Sichuan and Chongqing. Neijiang-Dazu and Rongchangbei shale gas projects made positive progress.

CBM

Significant headway was made in CBM exploration and development with focus continuously on the Qinshui Basin in Shanxi and Edong Gas Field in Shaanxi, and expanding new areas. In Xinjiang, exploration of CBM made tangible progress. Tectonic pattern and coalbed distribution characteristics of the Houxia Block were basically clear; geological understanding of the Hoxtolgay Block was cleared upon the completion of two exploration wells; the Wucaiwan region showed a potential reserve of 1 trillion cubic meters, with five CBM-bearing areas being identified. A range of measures for revitalizing mature fields were effective, as evidenced by high production maintained at Baode Block and output decline controlled at Hancheng Block. The yield and efficiency of high-coal-rank wells in the Qinshui Basin were enhanced and the low-coal-rank beds in Changzhi, Linfen and Erlian areas were developed efficiently, thanks to innovations in CBM development theories and drainage and production techniques. Capacity building and pilot production activities were implemented steadily in new blocks, including Mabidong, Daning-Jixian, and Jiernalangtu. Joint projects

went on smoothly in Shilouxi, Sanjiao, Chengzhuang. We produced 1.79 billion cubic meters of coalbed methane in 2017.

Tight Oil/ Gas

Large-scale development of tight oil and gas continued in the Ordos, Sichuan, Songliao, Qaidam and Santanghu basins. At Changqing Oilfield, main technologies for developing I-II+III strata have taken shape, and three horizontal well SRV fracturing test blocks and three pilot development areas for tight oil production have been in place and saw remarkable increase in the per-well output. At Xinjiang Oilfield, profitable development was promoted further in the Mahu Sag and progress was made in production capacity evaluation in the Jimsar Sag. At Daqing Oilfield, 10 of its 14 tight oil test blocks were completed and went on stream, capable of producing 200,000 tons per year. In Shanxi Province, tight gas exploration activities reported major breakthroughs at the Daning-Jixian Block, and high yield gas flows were obtained from a number of test wells in the Hedong and Hexi areas, especially DJ 5-6 Well block had a daily output above 1.7 million cubic meters. Additionally, we strengthened application of CO₂/sand dry fracturing and large-displacement fissure control SRV fracturing, resulting in increased tight oil/gas production and profits.

Joint E&P in China

In 2017, we continued to work with our partners to explore and develop oil and gas resources in China, with a focus on low-permeability reservoirs, heavy oil, shallow-water reservoirs, sour gas, high-temperature high-pressure gas reservoirs, coalbed methane and shale gas.

By the end of 2017, we had 35 joint E&P agreements in execution, producing 2.49 million tons of crude oil and 9.3 billion cubic meters of natural gas, totaling 9.86 million tons of oil equivalent.

Zhaodong Oil Project

The project covers 77 square kilometers at the tidal and shallow water zone in the Bohai Bay Basin. New XCL-China LLC. and Australia's ROC Oil (Bohai) Company are our partners. In 2017, the project continued to maintain stable and safe operation, producing 480,000 tons of crude oil. Three new wells were completed and two yielded more than 300 tons per day during well testing.

Changbei Natural Gas Project

Changbei block covers an area of 1,691 square kilometers in the Ordos Basin and operates under an agreement with Shell Group. In 2017, the project produced 3.7 billion cubic meters of natural gas, sustaining a stable production of over 3.3 billion cubic meters for nine consecutive years, and delivered 3.6 billion cubic meters to market, with its commercial gas sales totaling 40.8 billion cubic meters on a cumulative basis by the end of 2017. The phase II project has made important progress and is expected to deliver natural gas in wintertime in 2018.

South Sulige Natural Gas Project

Located in the Ordos Basin, the South Sulige block covers an area of 2,392 square kilometers and operates under an agreement with French energy company Total S.A. In 2017, the project's natural gas production and commercial gas sales amounted to 2 billion and 1.9 billion cubic meters respectively, with a daily output soaring up to more than 6.4 million cubic meters.

Chuangdongbei Natural Gas Project

Located in the Sichuan Basin, the project covers an area of 876 square kilometers and operates under an agreement with Chevron. In 2017, the project's natural gas production grew steadily, delivering 1.8 billion cubic meters of purified gas.

Chuanzhong Natural Gas Project

Located in the Sichuan Basin, the project covers an area of 528 square kilometers and operates under an agreement with American EOG Resources. In 2017, the project produced 230 million cubic meters of natural gas, with daily output doubled from 0.5 million cubic meters at the beginning of year to 1 million cubic meters at the year end, thanks to continuous technological optimization and improvement. Meanwhile, measures were taken to streamline management and control drilling investment and lifting cost, facilitating the low-cost development of the project.

Neijiang-Dazu and Rongchangbei Shale Gas Projects

The projects cover an area of 1,477 and 990 square kilometers in the Sichuan Basin respectively. BP is our partner and CNPC acts as the operator during the exploration period for the first time. In 2017, the two projects completed a total of 100 square kilometers of 3D seismic data processing and interpretation. Four exploration wells spudded successively and the first horizontal well was completed at the year end, with the reservoir discovery rate of 100% and maximum drilling depth of 3,500 meters.

In addition, the Da'an project in cooperation with MI Energy Corporation and Global Oil Corporation (GOC), Hainan-Yuedong project in cooperation with Tincy Group Energy and Zhoushisan project with Hong Kong-based

Central Asia Petroleum achieved better development efficiency, dropping natural decline rate and water cut growth rate of mature wells and stable formation pressure, thanks to technical solutions such as fracture-network fracturing, waterflooding optimization and huff-and-puff steam stimulation. Joint CBM projects saw steady progress, with Sanjiao project in cooperation with Orion Energy and Chengzhuang project with Greka Energy producing 80 million and 90 million cubic meters of coalbed methane in 2017 respectively.



Crude output from joint E&P projects

2.49

mmt



Natural gas output from joint E&P projects

9.3

bcm

