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## Sustainable Energy Supply

It is CNPC's due responsibility and mission to meet energy challenges and satisfy the ever increasing demand for low carbon clean energy. To this end, we have enhanced technological innovation, laid a solid resource basis, continued to increase our efficiency in hydrocarbon development and utilization, and raised the proportion of clean energy such as natural gas in our energy supply, in order to make contributions to the construction of a stable, safe, clean and economical energy supply system and the prosperity of human society.

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▶ SDGs

**7** Affordable and clean energy



Ensure access to affordable, reliable, sustainable and modern energy for all

**8** Decent work and economic growth



Promote inclusive and sustainable economic growth, employment and decent work for all

**9** Industry, innovation and infrastructure



Build resilient infrastructure, promote sustainable industrialization and foster innovation

**17** Partnerships for the goals



Revitalize the global partnership for sustainable development

## Energy and Future

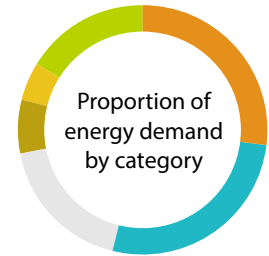
### Energy Challenges

Energy demand continues to increase. Revenue and population growth, and the urbanization and industrialization of developing countries are driving forces of growing energy demand. Although there are still uncertainties in global GDP growth, the world certainly requires more energy to ensure global economic prosperity and development in the future.

Energy structure keeps changing. Despite the accelerated energy structural transition to clean and low-carbon development in a safe and high-efficiency manner, fossil fuels remain the most important energy, whereas non-fossil fuels will grow rapidly. Oil accounts for a fairly stable share of primary energy consumption mix, and natural gas has become and is becoming the fastest growing fossil fuel, and is expected to reach 31% of primary energy consumption mix by 2050.

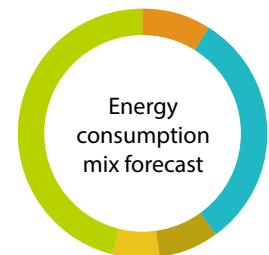
Equal access to energy. Over 1.2 billion people in the world still do not have access to affordable modern energy, losing the opportunity for equal development. Helping this group of people to obtain energy is an important part of the target of realizing the United Nations' goal of sustainable development.

China's economy enters into "new normal". China's economy is moving forward steadily at a reasonable speed with improved quality and efficiency. But there is a serious conflict between overcapacity and upgraded demand structure, with slow growth of domestic oil demand and ample natural gas supply.



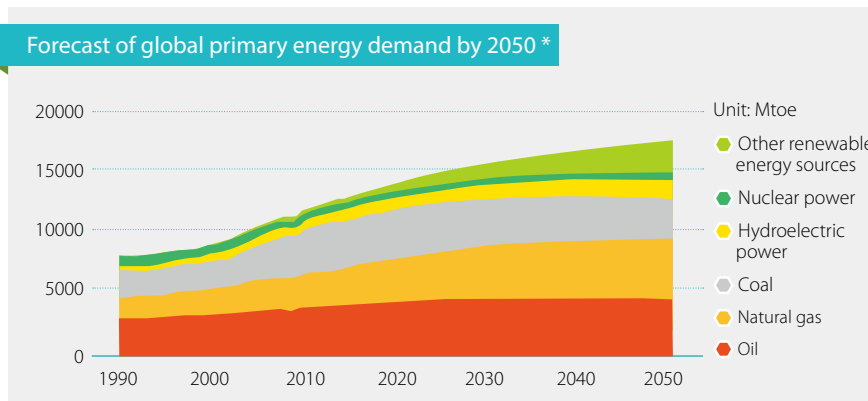
Forecast of global primary energy demand by category by 2050 \*

Oil	27%
Natural gas	27%
Coal	18%
Hydroelectric power	7%
Nuclear power	5%
Other renewable energy sources (including wind power and photovoltaics)	16%



Forecast of global energy consumption mix by 2050 \*

Oil	9%
Natural gas	31%
Hydroelectric power	8%
Nuclear power	6%
Other renewable energy sources (including wind power and photovoltaics)	46%



\* Data source: *Energy Outlook 2050* by CNPC Economics & Technology Research Institute (2017)

## Providing Clean, Low-carbon and Affordable Energy

The world is undergoing a profound and rapid energy transition towards a cleaner, more efficient and diversified energy structure. Oil and gas industry shoulders important responsibility in meeting global energy challenges. As a major player in the industry, CNPC has been actively cooperating with the government and companies in the industry chain, and strives to provide clean, low-carbon and affordable energy while meeting future energy demand, in an effort to jointly build a sustainable energy future.

We implement the development concept of innovation, harmonization, green, openness and sharing, actively improve ways of energy production, strengthen technological and management innovation, and constantly consolidate our resource basis. With the aim of future sustainable energy supply, we accelerate the development of natural gas, explore unconventional energy, deploy new energy development, and supply more clean energy. In addition, we expand international cooperation, optimize global business layout, and strive to become a major supplier to provide energy in a more environmentally responsible way to drive the socio-economic development.

## Technological and Managerial Innovation

Advanced and applicable technology and effective management innovation enable us to provide better energy solutions, address climate change, improve energy utilization efficiency, and mitigate hedge against the economic risk of low oil prices.

### Building the Future of Energy with Science and Technology

Technological innovation is the driving force for us to keep overcoming challenges. The remaining proven recoverable reserves are now mainly low permeability and lithologic reservoirs, whereas new discoveries are deteriorating in grade and difficult to recover. The overall exploration & development environment is getting more complex. Thanks to continuous technological breakthroughs, CNPC increases enhances the recovery of existing resources, explores new areas of energy development through cutting-edge technologies, and develops green production technology to provide energy for society in a more responsible way.

In 2017, CNPC focused on removing technological obstacles to sustainable development and actively promoted R & D of cutting-edge technologies. This provided theoretical and technological support for our major strategic projects, including the steady development of Daqing Oilfield, stable production of Changqing Oilfield, rapid growth of new businesses such as tight oil and gas and shale gas, and increased overseas production and business scope, refinery restructuring and product quality upgrading.



- support the UN' s goal of "Ensuring access to affordable, reliable, sustainable and modern energy for all"
- actively respond to Chinese government' s "13th Five-Year Plan for Energy Development" and intensify our efforts to promote the energy revolution



### Technological innovation platform and talent development

Key laboratories and experiment bases: 47 improved, 5 newly built

**47**

**456**

Research institutes: 84, senior technical experts: 456, researchers: 33,092

144 experiment/test functions improved

**144**

**240**

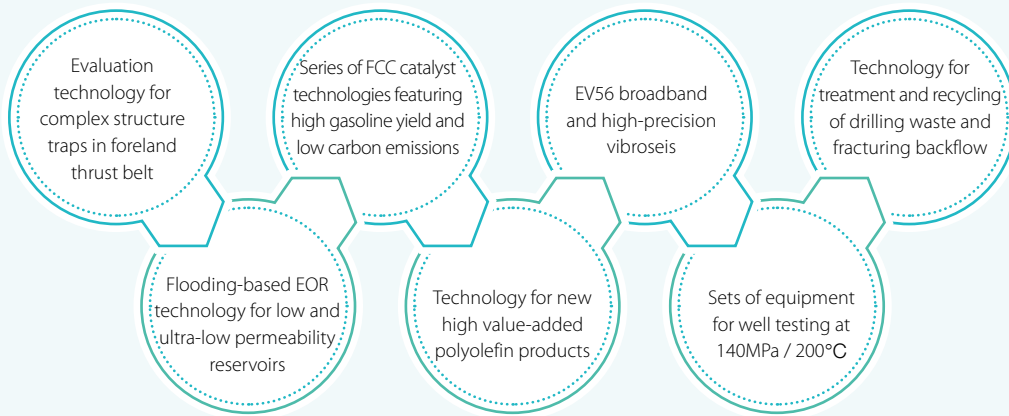
240 new experiment/test techniques and methods developed

Key Laboratories and Experiment Bases

National R & D Platforms

- National Key Laboratory for Enhanced Oil Recovery
- National Carbon Fiber Engineering Technology Research Center
- Chinese National Engineering Research Center for Petroleum and Natural Gas Tubular Goods
- Chinese National Engineering Research Center for Oil & Gas Drilling Equipment
- Chinese National Engineering Research Center for Computer Software for Oil and Gas Exploration
- National Engineering Laboratory for Exploration & Development of Low Permeability Oil & Gas Field
- National Engineering Laboratory for Drilling Engineering
- National Engineering Laboratory for Pipeline Safety
- National Engineering and Research Center for CBM Development and Utilization
- Support Platform for Fire and Explosion Protection Technology of Petroleum and Petrochemical Enterprises
- National Energy Experiment Center for Shale Gas Research and Development
- National Energy Center for Industrial Testing of Technical Equipment for Long Distance Gas Pipeline
- National Energy R & D Center for LNG Technologies
- National Energy R & D Center for High-sulfur Gas Reservoir Development
- National Energy R & D Center for Tight Oil and Gas
- National Energy R & D Center for Heavy Oil Extraction
- National Key Laboratory for Service Behavior and Structural Safety of Petroleum Pipe and Equipment Materials
- National Key Laboratory for Petroleum and Petrochemical Pollutants Control and Treatment
- State Administration of Work Safety Base for Oil and Gas Pipeline Emergency Rescue

Major Technical Achievements



In 2017, CNPC achieved intensive science and technology research

**7**

**5,050**

CNPC scored seven major landmark achievements, applied for 5,050 patents

Won four Second-prize of National Science and Technology Progress Award

**4**

**1**

One Second-Prize of National Technical Invention Award

## CNPC Innovative Technologies Winning National Awards in 2017

Technology	Award
<ul style="list-style-type: none"> <li>• ASP flooding technology for EOR and its industrial application</li> <li>• Industrial application of catalytic cracking catalysts with high gasoline yield and low carbon emissions</li> <li>• Key technology for lightweight design and manufacturing of heavy pressure vessels and its industrial application</li> <li>• Key technology and exploration equipment for geological dynamic assessment of CBM reservoir development</li> </ul>	Second-prize of National Science and Technology Progress Award
Technology for high-diversion, multi-fracture stimulation of temporary targeted plugging of deep reservoirs and application	Second-prize of National Technical Invention Award
Seven technologies including parallel processing technique of prestack Kirchhoff time migration without speedup ratio bottlenecks	Outstanding Medal of China Patent Award



### "ASP flooding technology for EOR and its industrial application" won the Second-prize of National Science and Technology Progress Award

54% of the world's proven oil reserves are stored in sandstone reservoirs. Generally, 33% of the reserves can be ultimately recovered through natural energy development and water flooding, leaving about two thirds irrecoverable. For each one-percent's increase in recovery, there has to be another discovery the size of Daqing Oilfield. Therefore, enhancing oil recovery is a major technological challenge in the industry at home and abroad which needs to be addressed immediately.

In partnership with Research Institute of Petroleum Exploration and Development, Northeast Petroleum University and China University of Petroleum (Beijing), and through more than two decades of technical research, Daqing Oilfield has made innovation on ASP flooding theories, independently developed industrial surfactants, and established a complete engineering and technical system. Thereby China has become the only country with a complete set of such technologies which were put into industrial use.

The application of the ASP flooding technology has enabled an accumulative increase of 20.56 million tons in oil production in Daqing Oilfield, representing a production value of RMB 67.75 billion.

## CCUS

CCS-EOR, generally known as carbon capture and storage-enhanced oil recovery technology, is used to effectively enhance crude oil recovery and permanently sequester most of the carbon dioxide in the reservoir. Some of the carbon dioxide emitted together with crude oil is recycled and injected into the reservoir. The carbon dioxide is fully stored after the reservoir is abandoned, ensuring the zero emission of carbon dioxide.

As of late 2017, 1.1 million tons of carbon dioxide emissions, or over 96% of the total emissions, were stored using the CCS-EOR technology in Jilin Oilfield, enhancing oil recovery by more than 12% on average compared with flooding.



In 2017, CNPC's newly-added proven oil in place exceeded 600 million tons for the 12th consecutive year, and newly-added proven gas in place exceeded 400 billion cubic meters for the 11th consecutive year, with the total of proven oil and gas reserves exceeding 1 billion tons for the 11th consecutive year. CNPC's total oil and gas production reached 184.82 million tons of oil equivalent in 2017. In addition, CNPC is capable of supplying National-VI gasoline and diesel, and its comprehensive energy consumption for oil refining and ethylene combustion dropped continuously. Daqing Oilfield carried out water flooding for fine potential tapping, polymer flooding for efficiency optimization and ASP flooding for large-scale promotion, providing a strong support for the sustainable development of the oilfield. The total oil and gas production reached 37.198 million tons of oil equivalent in 2017. Changqing Oilfield focused on technical innovation to develop core tools for exploration and development, and promoted cost-effective development of tight oil and gas through stimulation technologies such as horizontal well volume fracturing, enabling over 50 million tons of production of oil and gas equivalent for the fifth consecutive year in 2017.



## Case Study Discovery of the World's Largest Conglomerate Oilfield

CNPC has discovered in Mahu Sag, Junggar Basin, Xinjiang a one-billion-ton conglomerate oilfield, the largest conglomerate oilfield ever discovered in the world. In Mahu Oil Province, 1.24 billion tons of possible oil reserves have been discovered, including 500 million tons of proven reserves, which equal the size of the Karamay oilfield.

"Mahu Sag is absolutely a great discovery. It is a giant oilfield, and will expand as more work is done."

—— Academician Zhai Guangming

"The large-scale discovery and capacity building of the One-billion-ton Giant Oilfield is of positive and practical significance to Xinjiang Oilfield. We look forward to make more theoretical innovation and more delicate mechanism innovation, so that the achievements will be fully recognized and well received by the industry."

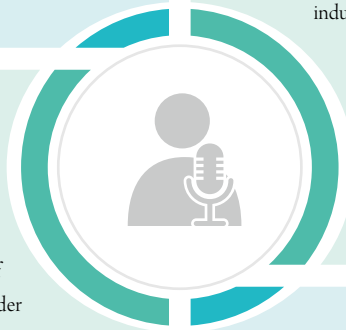
—— Academician Zhao Wenzhi

"Mahu Oilfield is unique in that there is no such conglomerate oilfield with the same formation elsewhere in the world. Therefore, it can guide us in future oil and gas exploration in terms of theories, techniques and the whole process of discovery. More importantly, it was discovered under challenging circumstances. Therefore, it is highly innovative, and its experience should be drawn on. It also plays an important role in guiding the discovery of this type of oilfields at home and abroad."

—— Academician Kang Yuzhu

"The discovery of the giant Mahu Oilfield is one of the most exciting discoveries of crude oil exploration in China, and is a major achievement in our crude oil exploration."

—— Academician Liyang



## Increase Profits through Managerial Innovation

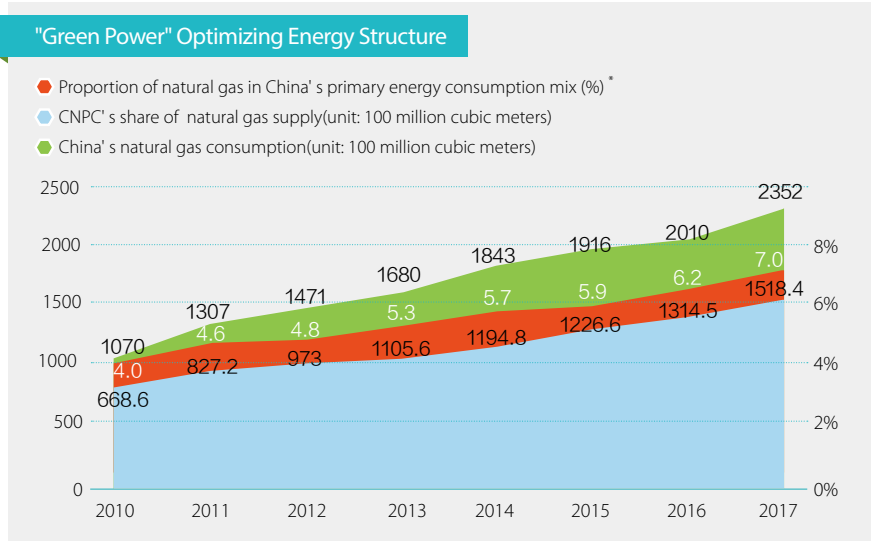
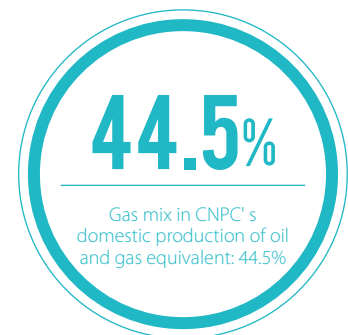
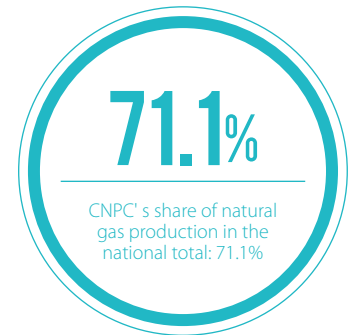
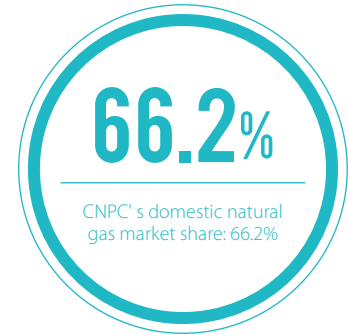
In face of low oil prices and the "new normal" of economic development, CNPC continued to increase profits through managerial innovation. New breakthroughs were made in tackling bottlenecks in reform and pushing forward innovation-driven development. Corporate restructuring at the level of CNPC and its state-owned subsidiaries was completed, and functional optimization and institutional reform of headquarters organs were accomplished. China Petroleum Engineering Company Limited and CNPC Capital Company Limited were successfully listed. The management system reform and professional restructuring and integration of CNPC International division and CNPC Oilfield Service division were in full swing. We optimized the management and control model and management mechanism, exercised differentiated management and control, and promoted mixed ownership reform. We kept increasing efficiency and profit as well as cutting cost and expenditure, strengthened management and technological progress, and controlled costs and enhanced efficiency through adjusting program deployment, innovating production organization models, and making good use of labor force. In 2017, operational costs per unit of oil and gas and marketing cost for per ton oil dropped by 2.2% and 3% respectively.

## Clean Energy

In order to secure sustainable supply of clean energy in the future, we have been vigorously developing natural gas business, continuously enhancing the quality of oil products and exploring new energy development to meet market demand for clean and high-quality energy.

### Natural Gas

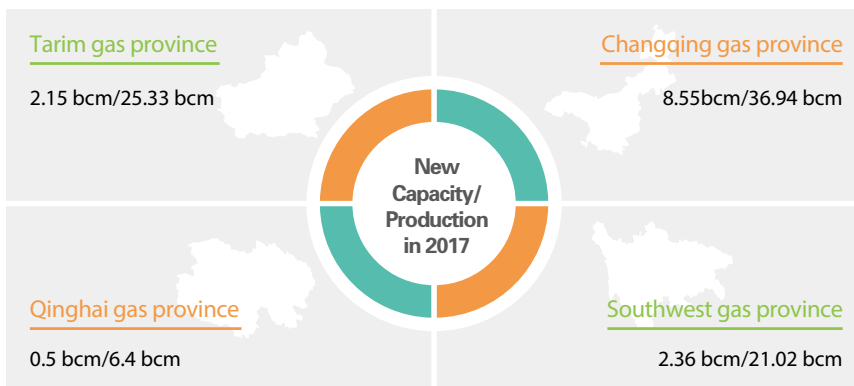
CNPC deems natural gas exploration and development as a strategic and growth-oriented project, keeps accelerating the construction of transnational natural gas pipelines and domestic natural gas pipeline network, promotes the development of conventional natural gas and unconventional gas such as tight gas, shale gas and coalbed methane, and imports overseas natural gas to build a diversified energy supply system.



\*Data source: *Energy Statistic Data* by CNPC Economics & Technology Research Institute

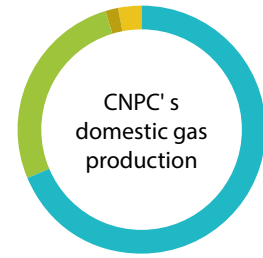
### Production Capacity

With a focus on capacity building projects in mature gas fields including four gas provinces in China (Changqing, Tarim, Southwest and Qinghai), we constantly intensify our efforts in the exploration and development of natural gas fields, further consolidating our resource bases. As of late 2017, our natural gas production capacity reached 104 billion cubic meters.



**In order to secure sustainable energy supply, CNPC steadily promoted the exploration and development of unconventional natural gas resources**

- **CBM:** Steady progress in production capacity building in new blocks such as Mabidong, Daning-Jixian and Jiergalangtu; and comprehensive adjustment in mature blocks in Fanzhuang, Zhengzhuang and Hancheng
- **Shale gas:** Steady progress in the building of shale gas demonstration zones at Changning-Weiyuan and Zhaotong; and 156.5 billion cubic meters of proven geological reserves of shale gas added



CNPC's domestic natural gas production in 2017

Conventional gas	68.8%
Tight gas	26.6%
CBM	1.7%
Shale gas	2.9%

**Pipeline Construction**

In 2017, the Fourth Shaanxi-Beijing Gas Pipeline and the Zhongwei-Jingbian connecting line were completed and put into operation, effectively enhancing resource allocation efficiency and market supply capacity in the Bohai Rim. By the end of 2017, CNPC operated 53,834 kilometers of natural gas pipelines, forming a gas network crisscrossing the country and connecting China with other countries. The pipeline network covers 30 provinces (municipalities and autonomous regions) and Hong Kong SAR in China, benefiting more than 500 million people.

**Progress in Natural Gas Pipeline Construction**

Project	Main Progress
Eastern Route of Russia-China Gas Pipeline	In smooth progress
Central Asia-China Gas Pipeline	Line A / B / C put into operation, Line D put into preliminary work
Fourth Shaanxi-Beijing Gas Pipeline	Put into operation on schedule
Zhongwei-Jingbian Connecting Line	Put into operation on schedule

**Case Study Promoting Connectivity of Domestic Pipeline Networks**

By the end of 2017, CNPC's Shaanxi-Beijing Gas Pipelines were connected with Sinopec's Yulin-Jinan Pipeline and Anping-Jinan Pipeline, and our Second West-East Gas Pipeline was connected with Sinopec's Sichuan-East Gas Pipeline and CNOOC's LNG lines, further enhancing the capacity and flexibility of natural gas allocation.

**Utilization of Natural Gas and Alternative Fuels**

We actively promote the comprehensive utilization of natural gas in city gas, industrial fuels, natural gas power generation, chemical feedstock and vehicle fuels. In 2017, we implemented 10 projects including Changxing Island City Gas and two natural gas power generation projects including Zengcheng Power Plant.

**CNPC's Measures to Secure Market Supply during Special Periods in 2017**

<p><b>Agricultural production</b></p> <p>During spring plowing, summer planting, summer harvesting and summer field management</p> <p><b>we</b></p> <ul style="list-style-type: none"> <li>• Surveyed oil demand, developed plans to secure supply, and opened green channels;</li> <li>• Scheduled resources availability, and coordinated distribution of fuel in advance</li> </ul>	<p><b>Natural disasters</b></p> <p>In response to the mountain collapse in Maoxian County in Sichuan Province, the earthquake in Jiuzhaigou, Aba Prefecture, Sichuan Province, and the landslide in Zhangjiawan Town, Nayong County, Bijie Prefecture, Guizhou Province</p> <p><b>we</b></p> <ul style="list-style-type: none"> <li>• Started an emergency plan to secure oil supply</li> <li>• Opened green channels to secure oil supply for disaster relief</li> <li>• Fully supported earthquake relief efforts</li> </ul>	<p><b>Major national events</b></p> <p>During the major events such as the Belt and Road Forum for International Cooperation, the ninth BRICS Summit, Dialogue of Emerging Market and Developing Countries and the 19th National Congress of the Communist Party of China (CPC)</p> <p><b>we</b></p> <ul style="list-style-type: none"> <li>• Strengthened security of regional resources supply</li> <li>• Optimized secondary distribution management</li> <li>• Guaranteed stable supply of resources during the events</li> </ul>
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**Question** The year 2017 saw robust demand for gas. What measures has CNPC taken to secure gas supply during winter months when gas consumption for heating peaked?

**Answer** In order to minimize the imbalance between gas supply and demand caused by various factors, we responded immediately with emergency plan, took multiple measures to increase production and supply, strictly reduced industrial gas consumption in the petroleum sector, and orderly cut gas supply to direct industrial users. In coordination with users in relevant regions and downstream users, we strived to secure gas supply for people's livelihood and ensure stable market supply.



## Upgrading of Refined Products

We strive to provide cleaner and more efficient refined products and optimize the energy consumption mix by increasing investment, accelerating R & D and application of new technologies, and upgrading gasoline and diesel quality. In 2017, while completing National V gasoline and diesel upgrading on schedule, the Company earmarked on a special-fund R & D program for National VI gasoline and diesel upgrading. As of 2017, we supplied National VI gasoline and diesel to "2+26" cities of Beijing, Tianjin, Hebei, and surrounding areas ahead of schedule.

In 2017, we supplied 114.163 million tons of refined oil (gasoline and diesel) to the domestic market, accounting for 37.2% of the domestic market share. Among them, supply of high-grade gasoline and aviation kerosene both increased over last year.

### Accelerating R & D and Application of New Technologies

We developed a series of catalysts featuring high gasoline yield and low carbon emissions, which have been promoted and applied in Lanzhou Petrochemical, Guangxi Petrochemical, and Dagang Petrochemical. Making a technological breakthrough as it can reduce carbon emissions while enhancing gasoline yield, the technology has won the Second Prize of National Science and Technology Progress Award in 2017.

 We actively respond to



- *Air Pollution Prevention and Control Action Plan*
- *Work Plan for the Acceleration of the Quality Upgrading of Refined Oil*
- *Work Plan for Air Pollution Control in the Beijing Tianjin-Hebei Region and Surrounding Areas in 2017*

## New Energy

With an eye on the future, we continued to promote the development of renewable energy including geothermal energy and biofuels, and made substantial progress in the exploitation and utilization of natural gas hydrates and some other resources.

### Case Study

#### Contributing to the Successful Test Production of Combustible Ice in South China Sea

Natural gas hydrates are also known as "combustible ice". Combustible ice is abundant worldwide, equivalent to twice the amount of other known fossil energy resources in the world. It is mainly distributed in the ocean, and a small amount of it can be found in the tundra on land. Once decomposed, one cubic meter of natural gas hydrates can release 164 to 180 cubic meters of natural gas. It is a high-efficiency clean energy and is hailed as the green energy of the 21st century.

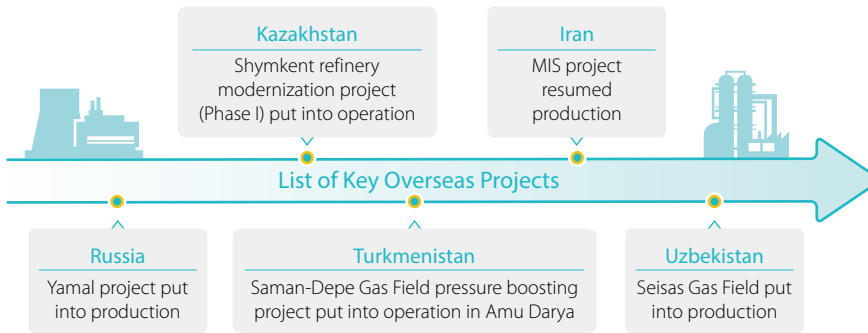
From March to July 2017, CNPC carried out China's first test production program of combustible ice in Shenhu area of South China Sea as the general contractor. It successfully produced gas for 60 consecutive days, with a total production of 309,000 cubic meters of gas, or an average daily production of 5,151 cubic meters. The test production has set two world records: the longest production time and the highest total gas production. Thus, combustible ice was listed as the country's 173<sup>rd</sup> mineral variety. As a result, we received a congratulatory message from the CPC Central Committee and the State Council.

## Energy Cooperation

International energy problems can't be solved without cooperation. Upholding the principle of "mutually beneficial cooperation for common development", we give play to our advantages in integrated businesses, capital, technology and managerial expertise, and cooperate with host governments and partners to address local energy challenges, in order to meet local energy demands and maintain regional energy security.

### International Energy Cooperation

In response to low oil prices and regional turmoil, we worked hand in hand with the government of the host countries and our partners to guarantee the stable operation of cooperation projects. Leveraging China's Belt and Road Initiative, we entered into a great number of cooperation agreements with companies in Russia, Uzbekistan, Azerbaijan and other countries on gas purchase and sales, pipeline transportation, and gas storage construction. In 2017, CNPC produced 162.74 million tons of oil and gas equivalent overseas, with CNPC equity production of 89.08 million tons, up 17.2% year-on-year. The Company made due contributions to meeting energy demand in host countries and supporting local economic development.



### Joint E & P in China

We continue to make steady progress in cooperation with international partners in developing oil and gas resources in China. While deepening cooperation in conventional areas, we reinforced cooperation with IOCs in shale gas and other unconventional resources. In Neijiang-Dazu and Rongchangbei shale gas blocks in partnership with BP, we actively performed 3D seismic data acquisition, processing and interpretation as well as exploration well drilling. In the South Sulige Project, we promoted the large-scale application of velocity strings, leading to an annual gas output of more than 2 billion cubic meters. In the implementation of the Chuazhong Project in Sichuan Province, channel sand was finely characterized and SRV fracturing technology for horizontal wells was adopted, enhancing drilling efficiency and reducing costs and reaching a new high in production and efficiency. Our domestic oil and gas production equivalent in cooperation with international partners amounted to 9.86 million tons.

#### Major Joint E & P Projects in China in 2017

Project	Partner	Progress
Zhaodong crude oil project	New XCL Roc Oil (Bohai) Company	Stable production
Changbei natural gas project	Shell	Stable production
Chuandongbei natural gas project	Chevron	Increased production
South Sulige natural gas project	Total	Increased production



### International Marketing

Supported by our overseas operation hubs and trade networks, we conduct international trading through cooperation and joint ventures in over 80 countries and regions around the world, constantly improving our resource deployment capability. In 2017, we reported 469 million tons of international trading volume, and witnessed improvements in both scale and operational quality.

## Special Report

# CNPC in the Era of Intelligent Energy

CNPC integrates the latest internet information technology into the traditional oil and gas industry, and applies new technologies such as cloud computing, big data and Internet of Things (IoT) to the whole process of production and operation. While reducing costs and enhancing efficiency, it provides consumers with much cleaner, safer energy with lower carbon emission and higher efficiency.

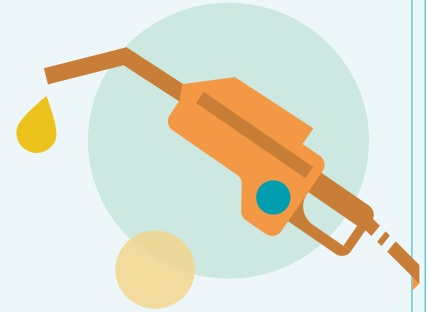


## Digital Oilfield

The widespread use of IoT technology makes it possible to build digital oilfields. CNPC widely has used IoT technology in the building of oilfields such as Daqing, Changqing, Tarim, Xinjiang and Dagang, realizing cross-regional cooperation and information sharing among the oilfields. Specifically, Dagang Oilfield worked hard to build digital oilfields using IoT technology, and integrated the thinking of IoT in all processes including technology, production and management. As a result, it has realized unattended operation at medium and small stations and few-man operation at large stations, significantly reducing costs of manpower and vehicle operation.

## Intelligent Pipeline

Taking the Eastern Route of the Russia-China Gas Pipeline as a pilot project, CNPC is dedicated to the construction of intelligent pipelines featuring comprehensive and unified data, visual and perceptive interaction, system integration and interconnection, accurately matched supply, intelligent and efficient operation, and controllable forecast and warning. Intelligent analysis and decision-making support can be provided through the "mobile client + cloud computing + big data" system by integrating the full life circle data of the pipelines; the quality, work pace, and safety control of engineering projects can be substantially improved through the IoT and intelligent sites and other means; and an intelligent oil and gas pipeline network can be gradually built by such means as intelligent equipment management and overall optimization of the pipeline network.



## Intelligent Gas Station

In the field of sales, based on the traditional gas station sales system and the internet, while using big data, cloud computing, Internet of Vehicles, IoT, mobile payment and other internet technologies, we provide consumers with more convenient and considerate services. Based on mobile payment and refueling card services and focusing on the notion of "People, Car and Life", CNPC e-station APP provides consumers with an efficient, convenient and intelligent automotive service platform. Its core functions include gas station navigation, mobile payment, online refueling card recharge, and refueling card inquiries. In particular, the mobile payment function allows consumers to pay for gasoline or diesel without leaving their vehicles.

## Intelligent Environmental Management

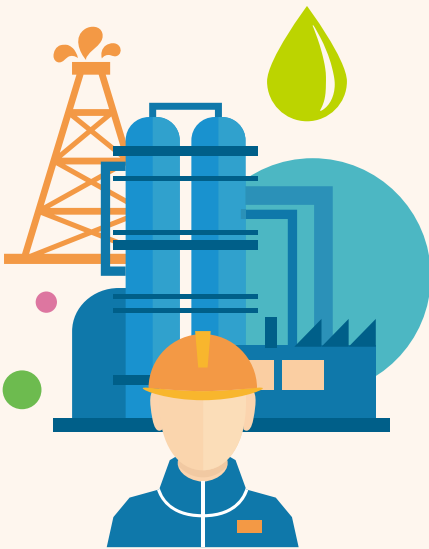
CNPC applied "Internet +" to its environmental management. Our HSE information system (Version 2.0) became operational, forming a globally integrated HSE platform and risk control platform, which fully cover HSE management business both at home and abroad. This can serve as the platform for the Company's HSE decision-making and early warning, management work, real-time monitoring, and problem handling and follow-up measures.

## Special Report

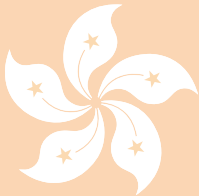
# Contributing CNPC's Solutions to a Low-Carbon Future

The world energy pattern is going through profound adjustment, and transition to efficient, clean and diversified energy is accelerating. As the world's largest emerging economy, China has become the largest energy consumer in the world. Optimizing China's energy mix and promoting China's revolution in energy production and consumption would significantly contribute to addressing global energy challenges.

In order to promote the low-carbon transition of China's energy mix and deliver modern and efficient energy for all, CNPC has taken the accelerated development and utilization of natural gas as a strategic and valuable project. In the ever-bright city of Hong Kong, remote regions in Tibet, smog-hit Beijing-Tianjin-Hebei, and the "Oriental Pearl" city of Shanghai, we accelerated the construction of natural gas pipe networks, and successively implemented natural gas green projects. By the end of 2017, CNPC had completed a trunk pipeline network crisscrossing the country. Covering 30 provinces (municipalities and autonomous regions) and the Hong Kong Special Administrative Region, CNPC's pipeline network is mainly supported by the West-East Gas Pipeline System, Shaanxi-Beijing Gas Pipeline System, Myanmar-China Gas Pipeline System and Northeast Pipeline Network System. In 2017, CNPC supplied 151.84 billion cubic meters of natural gas, which, if calculated by equivalent heat value, is equal to the substitution of 310 million tons of standard coal, and a reduction of 570 million tons of carbon dioxide and 3.89 million tons of sulfur dioxide.



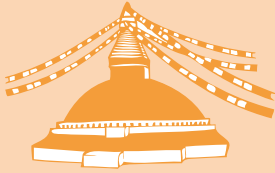
### Hong Kong



**5.17** billion cubic meters

Hong Kong, a prosperous and densely populated city, still uses coal for power generation. In 2012, the Hong Kong Branch of the Second West-East Gas Pipeline was completed and put into operation, and natural gas was delivered to the west coast of the Pacific Ocean from the right bank of Amu Darya River in Central Asia. Castle Peak Power Station, the largest power station in Hong Kong, achieved replacement of coal with gas. It can replace 3.4 million tons of standard coal and reduce 6.3 million tons of carbon dioxide emissions and 40,000 tons of sulfur dioxide emissions on a yearly basis. By the end of 2017, a total of 5.17 billion cubic meters of natural gas had been delivered to Hong Kong through the Second West-East Gas Pipeline. According to the report of Hong Kong's Environmental Protection Department (EPD), the past decade saw a decline in the concentration of PM2.5 in Hong Kong; moreover, the overall air quality continued to improve in 2016, with a decline in the concentration of various air pollutants.

## Tibet



**400** million cubic meters

Tibet is located in the alpine area and ecologically sensitive area. However, gasoline, diesel, coal and liquefied petroleum gas were mainly used for industrial production and residential life, while fuel wood, coal and cow dung were still used by some farmers and herdsmen as fuel, which was not environmentally friendly. Since 2010, CNPC has started to build a gasification station in Lhasa to process the liquefied natural gas delivered from Qinghai Oilfield, meeting the local industrial and domestic gas demand. As of 2017, CNPC had completed one liquefaction plant in Golmud with a daily processing capacity of 350,000 cubic meters and a LNG gasification station in Lhasa with a daily processing capacity of 150,000 cubic meters. In addition, seven LNG filling stations were built in the Haixi region of Qinghai Province and the Lhasa Economic and Technological Development Zone. Since the projects were put into operation, an accumulative total of 400 million cubic meters of LNG has been produced and a total of 80 million cubic meters of natural gas was supplied steadily to Tibet, improving the local energy mix.

## Beijing-Tianjin-Hebei region



**275.1** billion cubic meters

Air pollution has become a major problem hindering the development of the Beijing-Tianjin-Hebei region. In cooperation with the government and companies, CNPC has been making great efforts to promote the construction of natural gas pipeline networks and the development of "coal-to-gas" projects in the region. Since their operation, the first, second and third Shaanxi-Beijing Gas Pipelines have delivered a total of 275.1 billion cubic meters of natural gas to Beijing and the rest of North China. On average, days with good or excellent air quality in November 2017 in 13 cities in the region was up 31.6% year-on-year, while PM 2.5 concentration was down 41.2%, as shown in the air quality report for November released by the Ministry of Environmental Protection of the People's Republic of China.

## Shanghai



**24.7%**

Natural gas has been in use in Shanghai since April 1999, however, the source of gas supply has always been a bottleneck. In January 2004, natural gas from the West-East Gas Pipeline was officially delivered to Shanghai. Since then, the proportion of natural gas has been on the rise in Shanghai's energy consumption mix, directly changing the coal-dominated energy consumption structure. In recent years, the Special Steel Plant, a subsidiary of Baosteel, has removed 149 coal gas furnaces, contributing to an emission reduction of sulfur dioxide and soot by 59.5% and 26.8% respectively, and a decrease of atmospheric dust fall index by 24.7%. The steady stream of green energy will inject new momentum into Shanghai's efforts to develop Chongming Island into a world-class eco-island.

## Special Report

# Yamal LNG Project Completed and Put into Operation

Yamal LNG Project is China's first overseas megaproject since the launch of the Belt and Road Initiative. It is also the country's largest investment project in Russia, widely hailed as a fine example of China-Russia cooperation. CNPC participates in the operation of the project throughout the entire industrial chain and has become a vital player in the international LNG industry.

Located in the Arctic Circle of the Yamal Peninsula in Russia, the Yamal project is an integrated project encompassing oil and gas exploration and development, natural gas processing, liquefaction, marketing and shipping. CNPC, China's Silk Road Fund, Novatek and Total hold 20%, 9.9%, 50.1% and 20% of the equity shares of the project, respectively.



"This project is of great significance, for it can help strengthen our economic cooperation with countries in the Asia Pacific region, particularly the People's Republic of China, one of our most important partners in the region. Meanwhile, it is a model for successful international cooperation with France, Italy, Germany and other European countries."

—Vladimir Putin, President of Russia



### Reserves

60 million tons of condensate, 1.3 trillion cubic meters of natural gas



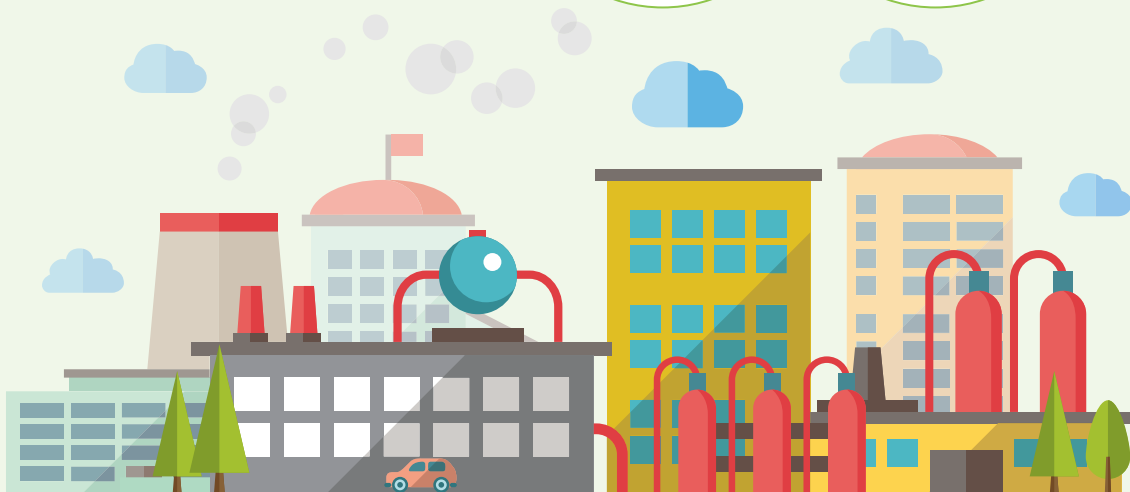
### Annual capacity

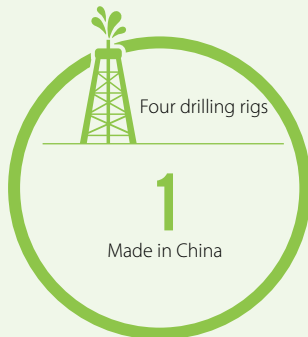
25 billion cubic meters of natural gas, 1 million tons of condensate



### Funds raised

USD 19 billion, 63% of which contributed by China





### Mutual Benefit and Win-win Results

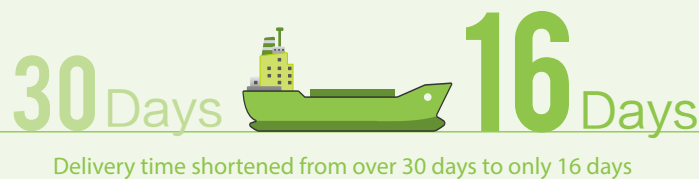
Thanks to concerted efforts of various parties, the first LNG Train of Yamal Project became operational in December 2017. This will not only drive the development of Russia's energy sector and its border areas, but will also diversify China's clean energy supply. Once completed, the project can provide 3 million tons of liquefied natural gas to China every year.

### Promoting Industrial Development

Chinese enterprises have participated in project construction in an all-round way, from financing, design to construction. The construction of the Yamal project has directly promoted the technological innovation and restructuring of Chinese industrial sectors including steel, equipment, materials, construction and shipbuilding. During the construction of the project, Chinese enterprises undertook 85% of the workload for the construction of all modules, and exported products more than USD 10 billion.

### Waterway Expansion

During the construction of the project, more than 60% of the modules were shipped through the Bering Strait and via the North-East Arctic Waterway, which shortened the delivery time from over 30 days via the traditional routes to only 16 days. The opening and development of the North-East Arctic Waterway not only provided convenience for Russia and China, but also facilitated logistics in Asia-Pacific, Europe and even the whole world.



### Environmental Protection

Yamal LNG Project is located on the west bank of the Gulf of Ob in the north of the Arctic Circle. 60% of the surface is covered by marshes and lakes. In order to protect the ecological environment of the arctic region, dedicated equipment and systems were used to treat wastewater, waste gas and solid waste, and rational casing structure was selected to ensure high-quality well-building and protect underground resources. Additionally, engineering recovery and biological recovery were made on the land at the well sites. Since 2013, a total of 761 hectares of land has been restored, which can be used as agricultural land. In June 2017, the project was successfully certified and highly rated by the British Standards Institution HSE management system.



"We are especially grateful for the help from China during our most difficult times, which helped us smoothly advance the Yamal LNG Project. We look forward to further cooperation with CNPC, a trustworthy partner."

— Leonid Mikhelson, Chairman of Management Board of Novatek

