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 foundation, 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.

Energy and the Future

Opportunities and Challenges

Continuous growth in energy demand. The world population is projected to reach more than 9 billion by 2050 by the United Nations’ World Population Prospects. Population growth, together with urbanization in developing countries and industrialization, will continue to drive the growth of global energy demand and consumption.

The trend of energy transition. Energy transition is a prominent feature of global energy development. Developing clean and low-carbon energy has become a consensus shared by governments, different industries, and the society. Nevertheless, fossil fuels will remain the main source of energy for decades to come, and will continue to dominate the energy market for a long time in the future.

Inevitable transition to clean and low-carbon development. Climate change has become a major issue affecting the destiny of the whole world and all mankind. The Paris Climate Conference has set the goal of limiting global warming below 2°C by the end of the century, and that the future lies in low-carbon and low-energy intensity development.

The pivotal role of natural gas. Natural gas is the only low-carbon and clean energy in fossil energy. Accessible, affordable and sustainable, it has become the fastest growing fossil energy and is expected to reach 30% in primary energy consumption 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 have equal access to energy is an important part of achieving the Sustainable Development Goals (SDGs) of the United Nations.

The consensus of global cooperation. The energy transition featuring low carbon and carbon-free development calls for all-round international exchanges and cooperation in advanced technology, management concept, and knowledge and experience. A wide range of global energy cooperation will help countries jointly cope with new energy security risks.

We

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

Forecast of global primary energy demand by category by 2050 *

<table>
<thead>
<tr>
<th>Category</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>27%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>27%</td>
</tr>
<tr>
<td>Coal</td>
<td>11%</td>
</tr>
<tr>
<td>Hydroelectric power</td>
<td>8%</td>
</tr>
<tr>
<td>Nuclear power</td>
<td>5%</td>
</tr>
<tr>
<td>Other renewable sources</td>
<td>14%</td>
</tr>
</tbody>
</table>

Forecast of global primary energy consumption mix by 2050 *

<table>
<thead>
<tr>
<th>Category</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>31%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>19%</td>
</tr>
<tr>
<td>Hydroelectric power</td>
<td>8%</td>
</tr>
<tr>
<td>Nuclear power</td>
<td>6%</td>
</tr>
<tr>
<td>Other renewable sources</td>
<td>46%</td>
</tr>
</tbody>
</table>

* Data source: Energy Outlook 2050 by CNPC Economics & Technology Research Institute
Strategic Response

The world is undergoing a profound and rapid energy transition towards a cleaner, more efficient and diversified energy structure. The 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.

Oil and gas will remain the world’s primary energy source for a long time to come. In the short to medium term, the Company will still focus on oil and gas business, while strengthening restructuring of oil and gas operations. First, we will increase the share of domestic natural gas production, and expect to see the ratio of our domestic oil and gas production equal reach 1:1 by 2020, enabling more low-carbon energy supply. Second, we will increase the share of overseas oil and gas production. By 2030, the share of our overseas oil and gas equity production will rise to over one third of the company’s total. Third, we will strengthen the development of unconventional resources, especially shale oil and gas and tight oil and gas.

While intensifying our efforts in restructuring oil and gas operations, we will actively deploy new business. First, we will steadily promote fuel ethanol business; second, promote the use of associated resources such as geothermal energy; third, make greater efforts in the research of new energy business, so as to lay a solid foundation for future planning and development.

Technology and Innovation

Advanced and applicable energy technology enables us to provide more and cleaner energy, and address global issues such as climate change and enhancement of energy utilization efficiency. Thanks to theoretical innovation and technological breakthroughs, CNPC increases efficiency in the development and utilization of existing resources, explores new areas of energy development, and develops green production technology to provide energy for society in a more responsible way.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Measures</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase both reserves and production under complex geological conditions</td>
<td>• Continue to deepen the theories on ancient carbonate rock reservoir formation and deep zone exploration&lt;br&gt;• Continue to improve technologies such as development of unconventional, deep and ultra-deep and complex-structure reservoirs</td>
<td>• Discovered a 1 billion-ton-grade uncompartimented conglomerate oilfield in Muha, Xinjiang&lt;br&gt;• Discovered 100 bcm-grade condensate gas reservoirs in Tarim (Well Zhuguang No. 1)&lt;br&gt;• Drilled a high-yield volcanic rock industrial gas well in the Lushui Basin&lt;br&gt;• Obtained high-yield commercial oil flow in the southern margin of the Junggar Basin, showing probability to discover large-scale blocks for reserves and production growth</td>
</tr>
<tr>
<td>Improve energy efficiency, reduce costs and ensure energy security</td>
<td>• Integrate information technology into the oil and gas industry&lt;br&gt;• Integrate technologies such as ‘cloud computing, big data, and internet of things’ into the whole process of the company’s production and operation</td>
<td>• Digital Oilfield: Changing Oilfield realized unmanned operation in gas gathering stations and used drones to patrol wells&lt;br&gt;• Intelligent Refinery:gradual transformed production control mode from automatic control to intelligent control&lt;br&gt;• Intelligent Pipeline: took the Eastern Route of Russia-China Gas Pipeline as a pilot project to construct intelligent pipelines featuring comprehensive and unified data, interaction and visualization for perception, system integration and interconnection, accurately matched supply, intelligent and efficient operation, and controllable forecast and warning&lt;br&gt;• Intelligent Service Station introduced new mode of Service Station + Internet + IV</td>
</tr>
</tbody>
</table>
In the face of global energy transition and climate change, we work with energy companies at home and abroad for solutions to the crisis. In 2018, we explored ways to improve energy efficiency, worked on the mode for the most efficient utilization of natural gas, and studied commercialization of carbon capture, utilization and storage (CCUS) technology, so as to jointly promote the energy industry to make contributions to addressing climate change.

Promoting CCUS projects. We conducted research on important carbon emissions reduction technologies, such as carbon dioxide flooding and sequestration, assessment of carbon sequestration potential in saline aquifers and reservoirs, and capture of carbon dioxide from flue gas in self-provided power plants. In Jilin Oilfield, we completed China’s first full-scale CCUS project covering carbon dioxide separation, capture and oil displacement. We entered into a memorandum of understanding on technology and R&D cooperation with GE, further enhancing our cooperation in such fields as carbon dioxide capture, storage and utilization, and low-carbon and environmental protection technologies.

Advancing the operation of CTSA-CCUS. Under the guidance of the Ministry of Science and Technology and in partnership with enterprises, universities and research institutes with strong R&D capabilities in CCUS, we established the China Technology Strategic Alliance for CO2 Capture, Utilization and Storage T echnology Innovation (CTSA-CCUS) to lead the progress of CCUS technology in China.

We have built a scientific and technological research system centering on major special projects, and deployed one national oil and gas special project, one national technology innovation platform, and research institutes with strong R&D capabilities in CCUS, we established the China Technology Strategic Alliance for CO2 Capture, Utilization and Storage (CTSA-CCUS) to lead the progress of CCUS technology in China.

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 networks, 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.

“Green Power” Optimizing Energy Structure
(Data source: Energy Statistic Data by CNPC Economics & Technology Research Institute)

In 2018, the Company produced 138.02 billion cubic meters of natural gas, including domestic production of 109.37 billion cubic meters, up by 5.9% year-on-year and accounting for 70.2% of the national total. CNPC increased the import of natural gas from overseas pipelines and LNG while working to increase its production capacity. We supplied 172.42 billion cubic meters of natural gas to the society, an increase of 13.6% over the previous year, providing a strong support for the optimization of China’s energy structure and the construction of a beautiful China.

Composition of natural gas production in 2018
- Conventional gas: 67.3%
- Tight gas: 27.0%
- CBM: 1.77%
- Shale gas: 4.9%

Composition of domestic natural gas production in 2018
- Conventional gas: 64.5%
- Tight gas: 70.2%
- CBM: 46.3%
Sustainable Energy Supply

By the end of 2018, the Company’s natural gas production capacity was 110.6 billion cubic meters.

Unconventional natural gas

Shale gas

- Prepared CNPC’s Special Plan for Shale Gas Development 2017-2020
- An annual gas production capacity of 6.6 billion cubic meters in southern Sichuan, including 4.264 billion cubic meters of gas production from state-level shale gas demonstration zones at Changning-Weiyuan and Zhaotong, and daily production of 20 million cubic meters to ensure supply in winter
- Made significant progress in deep shale gas evaluation in western Chongqing

Coalbed methane

- Completed two coalbed methane industrial bases in Qinian and Edong, with annual production capacity of 2.2 billion cubic meters
- Added 32.4 billion cubic meters of proven CMB reserves, and produced 1.934 billion cubic meters of coalbed methane

CNPC actively cooperates with the governments of Beijing, Tianjin and Hebei and companies in the industry to increase natural gas supply, and promote natural gas pipeline network construction and “coal-to-gas” projects, so as to fully meet the need for clean energy in the Beijing-Tianjin-Hebei region and improve the regional atmospheric quality.

Clean energy supply

- As of late 2018, the first, second and third Shaanxi-Beijing Gas Pipelines had delivered a total of 205.6 billion cubic meters of natural gas to the Beijing-Tianjin-Hebei region. The combustion value of which equaled to CO₂ emission reduction of 292 million tons, SO₂ emission reduction of 4,523,100 tons, smoke dust reduction of 186 million tons

Pollution control

- All subsidiaries achieved “zero coal consumption” in “2+26” cities in the Beijing-Tianjin-Hebei region and surrounding areas in advance

Pipeline Construction

By the end of 2018, CNPC operated 54,270 kilometers of natural gas pipelines, forming a gas network covering 30 provinces (municipalities and autonomous regions) and Hong Kong SAR in China, benefiting more than 500 million people.

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 2018, the Company vigorously promoted coal-to-gas projects, and achieved full coverage of “coal to gas” in Baizhou, Zhaotou, Baoding, Qianhuangdao, Tianzhan and Hengshui of Hebei province.

CNPC’s Measures to Secure Market Supply during Special Periods in 2018

Agricultural production

During spring plowing, summer planting, summer harvesting and summer field management

- Surveyed oil demand, developed plans to secure supply and optimal green channels
- Scheduled resources availability, and coordinated distribution of fuels in advance

Natural disasters

In response to heavy snowfalls in the three provinces in Northeast China, torrential rains in Minxian County, Dingxi, Gansu province, earthquakes in Jiuquan of Gansu province and Tonghai in Yuxi of Yunnan province, and landslide resulting in barrier lake in Jinsha River, Tibet

- Started an emergency plan to secure oil supply
- Opened green channels to secure oil supply for disaster relief
- Ensured adequate oil supply for disaster relief

Major national events

During the Forum on China-Africa Cooperation (FOCAC) in Beijing and Shanghai Cooperation Organization (SCO) Summit in Qingdao

- Planned in advance and carefully organized supply
- Guaranteed stable supply of resources
Sustainable Energy Supply

Upgrading of Refined Products

We promote the optimization of the energy consumption mix through upgrading quality of energy products. In 2018, we invested more than RMB 3.4 billion in building a batch of refined oil quality upgrading projects, and all of our refining and chemical enterprises completed oil product quality upgrading to National VI standard. In 2018, we supplied 117.538 million tons of refined oil (gasoline and diesel) to the domestic market, accounting for 36.1% of the domestic market share.

Energy including geothermal energy and biofuels. In 2018, CNPC continued to expand its new energy business, such as geothermal energy, solar energy, biofuels, and charging and battery swap stations.

With an eye on the future, we continued to promote the development and utilization of renewable energy, such as geothermal energy, solar energy, biofuels, and charging and battery swap stations.

New Energy

We actively respond to

Three-Year Action Plan to Win Battle for Blue Skies

Work Plan for the Acceleration of the Quality Upgrading of Refined Oil

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 demand 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 number of cooperation agreements with companies in Central Asia, Middle East and some other regions, and carried out all-round cooperation in such areas as upstream, downstream, trade and marketing, and technical support. Therefore, we have achieved cooperation throughout our industry chain and value chain. In 2018, CNPC produced 172.39 million tons of oil and gas equivalent overseas, with CNPC equity production of 98.18 million tons, up 10.2% 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. The South Suihe Project was in steady progress, with an annual gas output of more than 2.24 billion cubic meters. The Chuanzhong Project in Sichuan Province increased its daily gas collection and transportation from 800,000 cubic meters to 1.2 million cubic meters, further ensuring gas supply in winter. Our domestic oil and gas production of China Resources in Sichuan Province increased its daily gas collection and transportation from 800,000 cubic meters to 1.2 million cubic meters, further ensuring gas supply in winter. Our domestic oil and gas production equivalent in cooperation with international partners amounted to 10.118 million tons in 2018.

International Trade

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 2018, we reported 480 million tons of international trading volume, and witnessed further improvements in both scale and operational quality.

CNPC operates 92 oil and gas projects globally.

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Creating and sharing value through services

Positioning and development of overseas operation hubs