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Research on Low Carbon Development Path of Petroleum and Gas Resource Enterprises

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Abstract: With the development of social economy, emission of greenhouse gases and environmental pollution has caused greenhouse effect problems that need to be urgently solved. Combining with the definition and connotation of the low carbon economy and low carbon development, on the basis of analyzing the production of petroleum and gas resources and current consumption at home and abroad, this paper discusses the low-carbon development path of petroleum and gas resources enterprises.

1. Introduction

The world economy has been growing quickly since the Industrial Revolution. With the huge consumption of fossil energy, emission of carbon dioxide has increased sharply. Carbon dioxide is gradually becoming the most important greenhouse gas, accounting for about 3/4 of the total emission of greenhouse gases^[1]. The global climate changes caused by emission of greenhouse gases has already raised common concern worldwide^[2]. Emission of carbon dioxide in China is estimated to reach its peak approximately in 2030^[3]. And China plans to increase the proportion of non-fossil energy in primary energy consumption to around 20% by 2030. Under such background, petroleum and gas resources enterprises should continue to carry out the development concept of innovation, coordination, green, openness and sharing, radically change the development model of high input, high consumption, high pollution and low efficiency under the traditional development mode in the past.^[4] For many countries, petroleum and gas resources are not only the lifeblood of energy but also the main source of high carbon emissions. The research on the low-carbon development of petroleum and natural gas resources is of great significance for countries to achieve emission reduction goals^[5].

The Low-carbon Economy concept was first proposed in the 2003 UK Energy White Paper, *The Future of Our Energy: Creating a Low-Carbon Economy*^[6]. Proposal of this concept is from the discussion on climate changes and the greenhouse effect. Low-carbon economy is the way to promote economic development. Its purpose is to maximize greenhouse gas emissions^[7]. The essence of a low-carbon economy is energy efficient use and clean energy development, core of which is innovation in energy technology and emission reduction technology, innovation in the industrial structure, system and radical changes in the concept human survival and development^[8]. Low carbon development is a sustainable development model characterized by low consumption, low pollution and low emission, and it is the organic combination of "low carbon" and "development". Low-carbon development is a development model in which the basic feature is the reduction of carbon dioxide-based greenhouse gas emission, specifically represented in the low carbon concept, low carbon technology, low carbon



system, etc.^[9]. Low carbon development is the essential feature of the Scientific Outlook on Development, an important part in the Ecological Civilization, and an inevitable choice to promote the all-round development of economic and social development and modernization.

2. Current status of production and consumption of petroleum and gas resources at home and abroad

2.1. Current status of production and consumption of petroleum and gas resources in the world

With the continuous and strong growth of the renewable energy, the global energy structure is moving towards clean and low carbon direction. Since 2001, global petroleum and gas production has generally kept growing. In 2017, the global oil production has averagely increased by 600,000 barrels each day; while the global natural gas production has increased by 0.131 trillion cubic meters throughout the year, 4% higher than that in 2016, which almost doubles the average value in the past decade. In 2017, natural gas plays a role leading the growth of the global energy consumption, followed by the renewable energy and oil, global oil consumption increased by 1.8%, which exceeds the average growth rate of 10 years (1.2%) for the third consecutive year; the natural gas consumption increased by 0.096 trillion cubic meters throughout the year, 3% higher than that in 2016, making 2017 the year that has the fastest growth since 2010^[14].

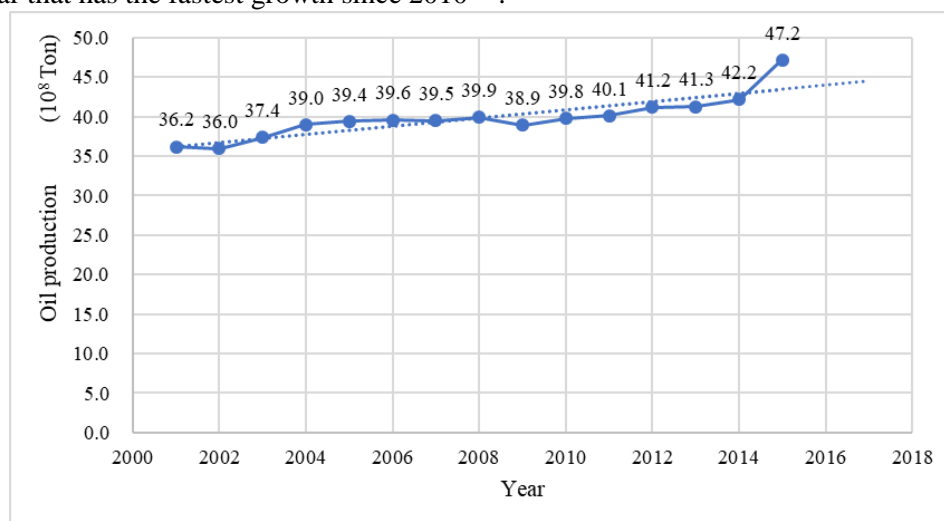


Figure 2-1 Global Oil Production Map From 2001 to 2015

Data Source: Strategic Center Of Oil And Gas, Mlr, Geological Survey Of China^[10]

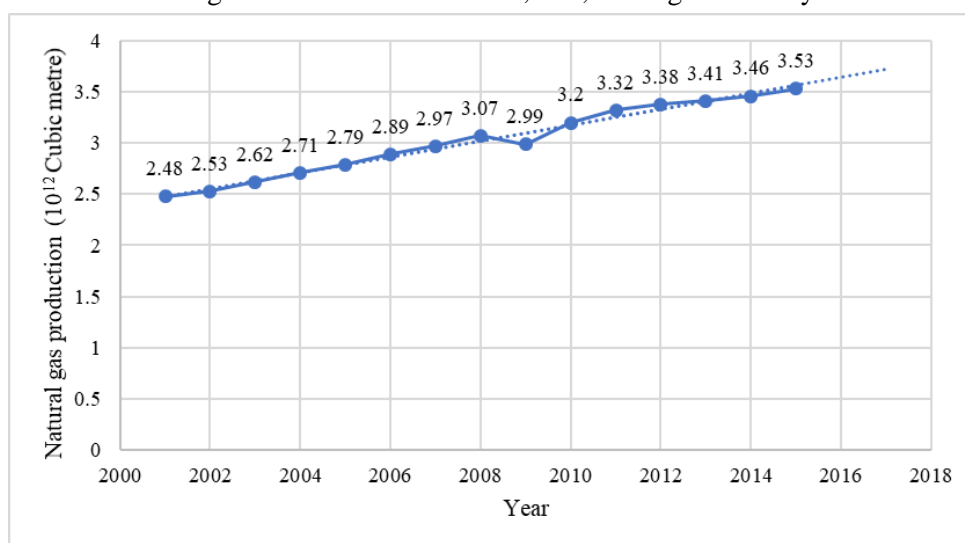


Figure 2-2 Global Natural Gas Production Chart From 2001 to 2015

Data Source: Strategic Center Of Oil And Gas, Mlr, WwW.Chyxx.Com

2.2. Current status of production and consumption of petroleum and gas resources in China

China is a country rich in petroleum and natural gas resources, with considerable potential and broad prospects for development. As of 2016, China has accumulated proven oil reserves of 5.7 billion tons; natural gas reserves grows rapidly, with a cumulative proven geological reserve of 3.92 trillion cubic meters.

2.2.1. Current production of petroleum and gas resources in China

In 2017, crude oil production in China was 191.5 million tons, a YoY reduction of 4.1%, while natural gas production was 133.007 trillion cubic meters, exceeding 100 billion cubic meters for 7 consecutive years, an increase of 8.0% YoY^[11]. By the end of 2017, in China, accumulative crude oil production has reached 6.7835 billion tons, and accumulative crude oil production has reached 1.943 trillion cubic meters^{[12] [13]}.

2.2.2. Current consumption of petroleum and natural gas resources in China

In China, crude oil consumption accounts for 18.6% in the primary energy consumption ratio, which is lower than the world average of 32.9%. Over the past 30 years, annual consumption of crude oil has grown at a speed of 7%. In 2017, consumption of crude oil increased by 3.9%; consumption of natural gas increased by 15%, the largest annual increase since 2012, accounting for 32.6% of the net increase of global natural gas consumption^[14].

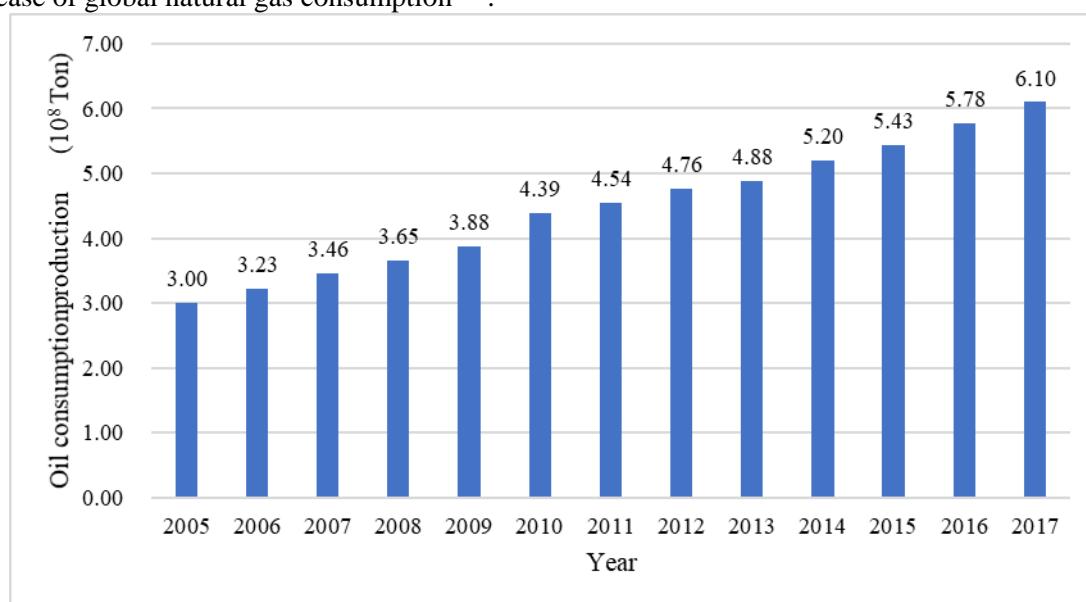


Figure 2-3 Map for Oil Consumption in China From 2005 to 2017

Data source: <http://www.chyxx.com>, <http://www.in-en.com>, <http://www.eastday.com>,
<http://news.sohu.com>

3. Low-carbon development model of petroleum and natural gas resources enterprises based on the whole industry chain

With the continuous rise of oil consumption, petroleum and gas supply and demand are growing, which further increases the difficulty in emission reduction. Under this background, while petroleum and gas resources enterprises are expanding the business of clean energy, they need to implement a low-carbon development model on the basis of the entire industrial chain, further optimize the industrial structure, promote the energy saving, consumption reduction, low carbon emission reduction in the upper, middle and lower reaches of the entire industry chain, as shown in Fig.3-1.

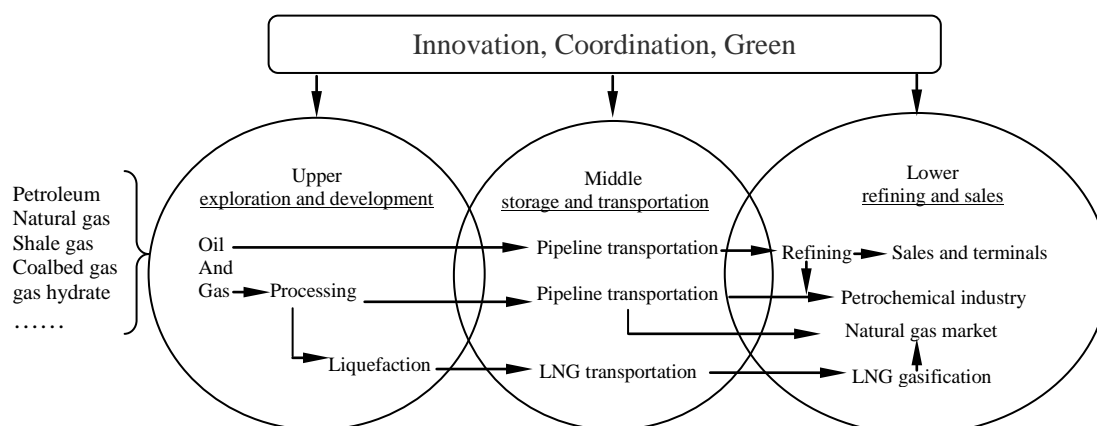


Figure 3-1 Low-Carbon Development Model of Petroleum and Gas Resources Enterprises based on the Whole Industry Chain

3.1. Low carbon emission reduction in the upstream sector

The upstream of the petroleum and gas sector usually refers to the exploration, recovery and production of crude oil and natural gas, also including the search for underground, underwater oil and gas fields, drilling, etc., as well as the subsequent operation of oil and gas wells such as crude oil mining and natural gas recovery.^[15] The low-carbon emission reduction in the upstream sector is mainly to strengthen research on energy-saving technologies and methods, import and master advanced equipment and process techniques, promote the system optimization design, reduce losses, and promote energy saving and carbon reduction.

3.2. Low carbon emission reduction in the middle and lower reaches

Middle and lower reaches of the petroleum and gas sector mainly include storage and transportation of petroleum and gas, petroleum refineries, chemical plants, and distribution and sales of petrochemical products. The lower reaches involve thousands of oils and chemicals, such as refined oil, synthetic rubber, plastics, fertilizers, pesticides, pharmaceuticals, etc.^[16] Low carbon emission reduction in the middle and lower reaches is mainly to strengthen the energy-saving transformation of production process, improve the utilization of residual pressure and waste heat, improve energy efficiency, and provide cleaner products.

3.3. Expanding the field of clean energy business

While paying attention to their carbon emission activities and characteristics, petroleum and gas resources enterprises should expand the proportion of clean energy production and optimize the structure of petroleum and gas supply^[17]. Promoting the development and utilization of unconventional petroleum and gas resources and new energy sources, continuously develop efficient and clean products, gradually expand the business fields that are helpful to reduce the carbon emission, including flammable ice, wind power, solar energy, biofuels, and carbon capture and storage.^[18]

4. Guarantee measures for the low carbon development of petroleum and natural gas enterprises

Petroleum and gas resources enterprises should follow the general requirements of ecological civilization construction in the new period. vigorously carry out the low carbon development strategy for the entire industrial chain, implement various guarantee measures helpful to low carbon development, actively cultivate the new, efficient advantages on low carbon development of enterprises.

4.1. Policy guarantee

In the future, policies of petroleum and gas enterprises should focus on saving first, improving the efficiency, while improving the crude oil production, further deepen the system reform, continuously

strengthen the internal vitality for development of enterprises in the petroleum and gas sector. Adhere to the equal attention on petroleum and gas, diversified development, provide vigorous support to the innovation in the low carbon technology, strengthen investment in low carbon development of in the petroleum and gas sector, for example, to compensate through the assessment on ecologic benefits and carbon transaction, including waste water treatment, innovation in low carbon techniques, updates of emission reduction equipment.

4.2. Management guarantee

With innovative management to reduce greenhouse gas emissions during petroleum and gas production, to develop and utilize clean energy, to rationally utilize resources, to resolutely abandon the development model of polluting the environment. Perform overall planning in the management, through the sustainable development strategy, clean production approaches, to eliminate backward production capacity, produce, develop and utilize products and services with less pollution, lower emissions, lower energy consumption, to improve the capability to obtain competitiveness^[19].

4.3. Technical guarantee

Pay attention to the research of low-carbon technology and vigorously develop safe, clean and efficient modern energy technologies. Make breakthroughs in a number of core technologies for exploration and development, accelerate the progress and popularization of energy-saving and low-carbon technologies in key areas, and gradually form a system supporting technical equipment system of high efficiency and a low cost. Gradually apply advanced technologies of clean production and intelligent control, improve the automation, information and intelligence level of enterprises, achieve continuous quality improvement, cost reduction and efficiency increase^[20]. On the energy saving and efficiency increase, emission reduction and waste recycling, carry out research on key technologies.

4.4. Talent guarantee

We should strengthen construction of the talent team adaptive to the requirements of low carbon development of petroleum and gas enterprises, including team building of scientific and technological R&D teams, strategic and policy experts, carbon trading and carbon finance professionals. Strengthen the professional training of low carbon talents, and build a low-carbon-oriented training system.

4.5. Cultural guarantee

It is necessary to strengthen the understanding of energy saving and emission reduction, green and low carbon development from a strategic perspective, and strengthen top-level design. Regularly carry out low-carbon cultural activities, vigorously promote energy conservation and emission reduction, create a low carbon environment at home and abroad, and gradually form a low carbon corporate culture. Cultivate employee's low carbon development concept, strengthen the low carbon ideology, cultivate the low carbon consciousness, activate the employee's sense of responsibility to the enterprises through various forms of propaganda and education, so that they achieve their personal values in the completion of the low carbon targets.

5. Conclusion

Arrival of the era of low carbon economy, means not only challenges but also opportunities to petroleum and natural gas resources enterprises. Based on domestic resources, petroleum and natural gas resources enterprises should make full use of the favorable international and domestic policy and technology environment, strengthen international cooperation, vigorously promote the innovation in the management and technique of the entire industrial chain, perform political, economic and social responsibilities, achieve the green, low-carbon and sustainable development while providing clean and efficient energy products to the society.

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