

## Study on Condition and Path of Energy Development Under Low Carbon Economics in China

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**Abstract:** Energy is the base and impulse of human being and social or economic development. The strong, long term exploit and use of energy not only increase human wealth greatly, improve living condition, but also pollute the environment, destroy the ecology and cause the atmosphere change. Aiming to realize both develop and decline emission, the low-carbon economics has been the main trendy and tide of world economy. The paper analyzed the world and Chinese development situation of energy, and put forward the thoughts of energy development under the low-carbon economics.

**Keywords:** low-carbon economics; energy structure; energy consumption; energy production

### 1 Introduction

Energy is an important material foundation of social development and human existence, the main pattern of fossil energy is pushing the world into the industrial age, playing the most important role to the sustained, rapid development of economy and continuous improvement of living standards. With the growth of global population and economies scale, energy area used doubling. The high-intensity development and use of fossil energy in the greatly increased human wealth and improved people's lives, but also brought the serious damage to the natural ecology and environment, and endangered the global climate change, thus thread to human survival. From the 1997 Kyoto Protocol, the World Economic Forum in Davos in 2007, to the APEC meeting, etc, which will be climate change as theme. Under the condition of oil, coal and other fossil fuels are depleting, how to deal with climate change increasingly becomes the topic in the international community context, low-carbon economy came into being, it will achieve a win to develop and the reduce the pollution, and it has become the trend of world economic development.

The concept of low-carbon economy originated in Britain, based on the market mechanism, its main meaning is to promote the technologies of energy conservation, renewable energy development and use, and to promote the transformation of social and economy mode in the high energy efficiency, low energy consumption and low carbon emissions through the development and innovation of institutional framework and policy. Former World Bank senior vice president of Stein published "Stern Report" in 2006, it became the EU's theoretical basis for low-carbon economy. Foreign research literature about low-carbon economy concentrated mainly on the relationship between CO<sub>2</sub> emissions and the economic growth or per capita income. Schmalesee [1], Galeotti [2] confirmed that there was inverted "U" shaped curve between the amount of CO<sub>2</sub> emissions and per capita income. Treffers and other scholars discussed the Netherlands and other countries to reduce GHG emissions [3 - 4]. Many domestic scholars made some researches about the problem of energy development under the low-carbon economy. Wu Weixing, Zhang Kang etc analysis the impact, trends and ideas of energy industry development about the low-carbon economy [5 - 6].

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## 2 Analysis of energy consumption and production status

### 2.1 World energy consumption and production status

Nearly half a century, the world energy demand is growing at the unbearable rapid rate. In the past two years because of the spread of financial crisis in the global, oil, as a representative of energy, their prices going through the highest point in history and then fall across the board. This not only exacerbated the global economic downturn, but also affected the global energy supply and demand [7]. During 1995~2009, the world's energy production and consumption patterns as shown in Figure 1~2: First, the world's energy consumption structure based mainly on fossil fuels. Initially, it is mainly by coal. After the 20th century, oil and gas production and consumption continued to rise. 1995~2009, fossil fuels in primary energy ratio has stabilized at 87%. Second, the world's energy consumption and production both showed an upward trend year by year, during 1995~2008, the average annual growth rates of world energy consumption and production are 2.3% and 2.24%; in 2009, the global GDP growth rate was -1.1%, the world's fossil energy consumption, production, have also appeared the first decline of the past 16 years.

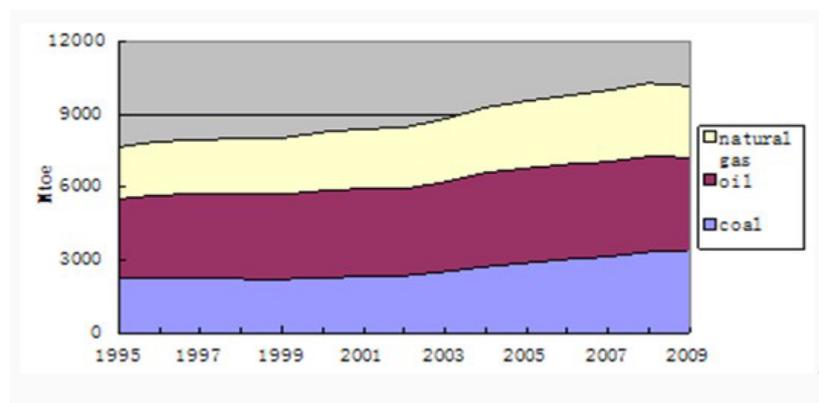


Figure 1: the situation of world energy production from 1995 to 2009

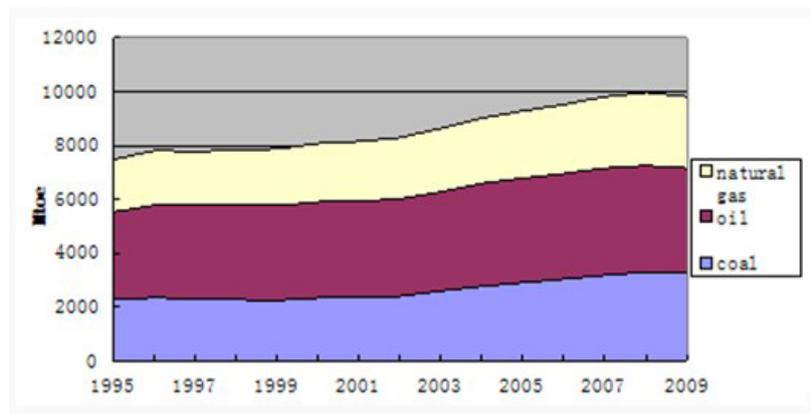


Figure 2: the situation of world energy Consumption from 1995 to 2009

### 2.2 China's energy consumption and production status

#### 2.2.1 Analysis of total amount

During 1978~2009, China's energy production and consumption changes as shown in Figure 3~4. On one hand, with the rapid development of our economy, the total amount of energy production and consumption are increasing. China's total

primary energy production ranked first in the world in 2010, which are 29.9 million tons of coal equivalent, compared with the previous year up by 6.56 %, and it is 4.76 times in 1978; Total energy consumption reached 3.25 billion tons of coal equivalent, which is up 5.9% over the previous year and is 5.68 times in 1978. From the changes of growth rate, our country's energy production and consumption can be divided into three stages: 1978~1996, China's energy production and consumption growth were relatively slow, the average growth rate were 4.3% and 5.09%; 1997~1998, both of energy production and consumption reduced, and declined respectively -3.16%, -2.80%; 1999~2010, energy production and consumption growth rate were faster, average growth rate was 7.74%, 7.99%. On the other hand, the energy gap widened. Energy production and consumption can be divided into two stages: 1978~1991 years ago, China's energy is still self-sustaining, the dependent of the international energy market was very low; after 1992, in the driven of the heavy and chemical industrialization, urbanization and consumer upgrade, the proportion and the total amount of our country's energy gap gradually expanded, and the dependence on international energy gradually increased, the proportion of energy dependence in 1992 was 1.78%, 7.42% in 2000, up to 8.93% in 2009, the highest in 2007, reaching 12.8%.

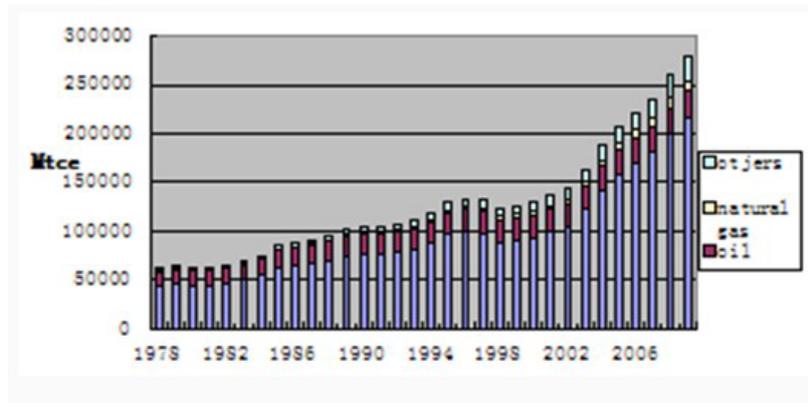


Figure 3: the status of energy production from 1978 to 2009 in China

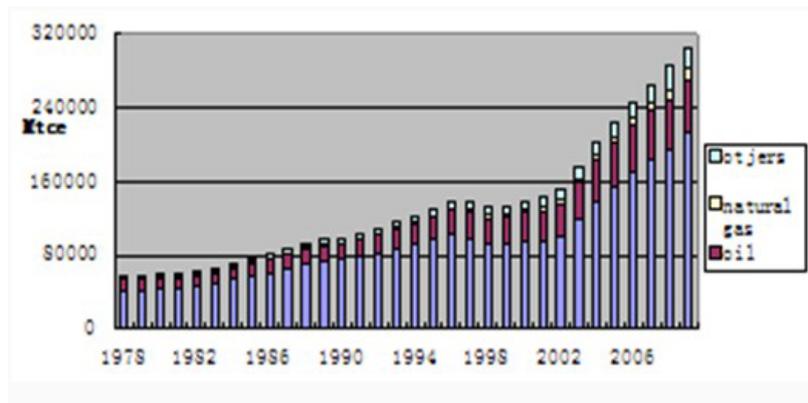


Figure 4: the status of energy Consumption from 1978 to 2009 in China

On various energy terms, during 1978~2009, China's coal supply and demand was in the long-term equilibrium state, both showed the same with the growth of energy production and consumption, with an average annual growth rate of 5.4%, 5.64%. Oil has been presented for the short supply, and supply and demand gap gradually widened; Oil production present a slow growth trend, oil consumption present a year by year growing trend (except from 1978 to 1982, negative growth); Natural gas supply and demand were roughly balanced, production and consumption both showed increasing trend with an average annual increase of 6.1%, 6.52% in addition to individual years. Other fossil energy (mainly nuclear power, hydropower and wind power) production and consumption increased rapidly, with an annual growth of 9.56%, 8.53%.

### 2.2.2 Structure Analysis

In our country's energy resources of proved reserves, coal accounted for 94%, oil accounted for 5.4%, natural gas accounted for 0.6%, with the "oil-poor coal-rich gas-little" of the structural characteristics of energy resources. 1978~2009, China's energy production structure, consumption structure shown in Figure 5~6. In energy production, the overall proportion of coal showed a steady upward trend, it was 75% or higher. In energy consumption, the proportion of coal showed increased and then down, after that showed the upward trend again, in 2009 the proportion was 70.1%, with the proportion in 1978 was essentially flat. In contrast with coal production and consumption, except for a few years, the proportion of oil production showed a declining trend, from 23.7% in 1978 declined to 9.4% in 2009; The proportion of oil consumption showed decreased and then increased later decline of the "inverted S" trend, the proportion of oil consumption in 2009 was lower than the proportion in 1978. The proportion of natural gas production and consumption was still very small, both showed an upward trend after the first down. The proportion of electricity and other fossil energy production and consumption showed a wave-like rise, the proportion of production from 3.1% in 1978 rose to 9.26% in 2009, and the proportion of consumption rose from 3.4% in 1978 to 8.89% in 2008.

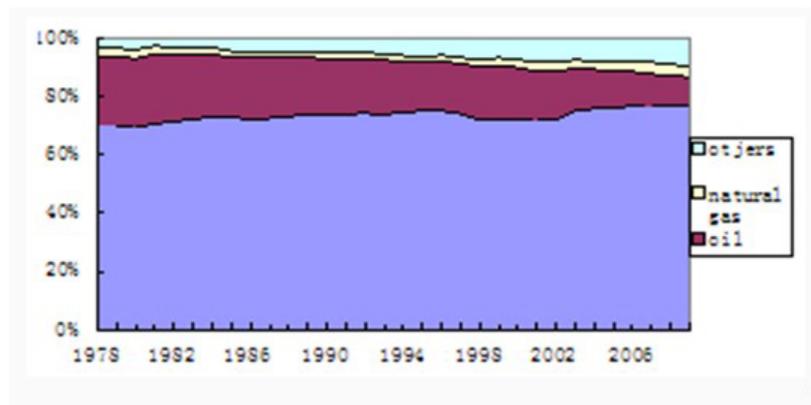


Figure 5: energy production structure from 1978 to 2009 in China

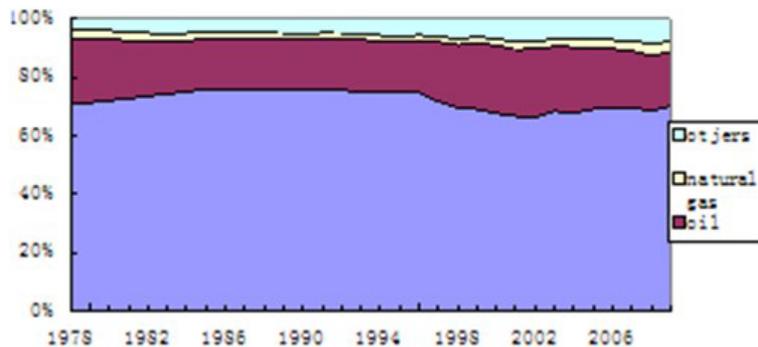


Figure 6: energy consumption structure from 1978 to 2009 in China

## 3 Problems of energy development in China

### 3.1 The dominant position of high-carbon energy is difficult to change in short-term

Energy Information Administration (EIA) released the "International Energy Outlook 2008": during 2005 to 2030, the amount of world energy consumption is expected to increase by 50%, every energy consumption will keep growing. While

oil, coal and other fossil energies are one of the reasons that cause global warming, renewable energy will continue to develop, but it is still not competitive than fossil energies before 2030, the dependence on fossil fuels will remain in long term worldwide.

Energy industry has made remarkable achievements through reform and opening up 30 years in China. China's total primary energy production ranks first in the world in 2010. However, unlike other countries who mainly depend on oil, natural gas and nuclear energy, our energy resources are high-carbon, the coal-dominated energy structure is a long-term constraints to changing to a low carbon development model. China is standing in the industrialization, urbanization, modernization process, and requires a lot of energy security. But the technology of our energy production and utilization, industrial production lags behind, there is a wide gap with the developed countries. If we promote and use the low-carbon technologies, it can not be completed in the short term.

### **3.2 The task of converting the energy structure is arduous**

The converting the energy structure is the key to low-carbon energy economy. There are hundreds of millions of people use traditional biomass (straw, wood) for cooking and heating in rural areas, coal instead of firewood is not completed. The proportion of coal production and consumption is respectively high 44 and 41 percent than the world average in 2009 in China. The proportion of oil production and consumption is lower 28 and 16 percent than the world average. The proportion of natural gas is lower 25 and 20 percent. China has not yet completed the first conversion of energy structure, did not complete the second energy conversion structure, but also the third energy structure conversion will to be. In the context of low-carbon economy, China is not only to solve the greenhouse effect problem caused by CO<sub>2</sub>, but also we have to solve other pollution problems caused by large number of coal-fired emissions of sulfur dioxide, nitrogen oxides, particulate matter, this task is rather arduous.

### **3.3 The resource endowments is constrained, the comparative advantage is disappeared**

Coal is relatively abundant natural resources, both its production and consumption are through a saddle-shaped. Nuclear power is from scratch, but the proportion is still small. Relatively poor resource endowment of oil, its production peaked in the late 20th century, the lack of momentum in the growth, but consumption continues to rise. Limited by natural resources, coal-based energy patterns of production and consumption will be long. In the traditional economic patterns, dominated by coal may have cost advantages as a trade in comparative advantage, but in low-carbon economy, it may become a comparative disadvantage, which in turn directly restricts the development process of low-carbon economy.

## **4 The development path of Chinese energy in the context of low-carbon economy**

### **4.1 To implemente the energy development strategy in the context of low-carbon economy based on the actual situation**

The energy efficiency is 33 percent in China overall, which is lower 10 percentage points than developed countries. We must proceed from reality, actively learn and absorb the advanced concept of low-carbon economy, closely connect with the transform of development mode and the upgrading of structural restructuring, insiste in the principle of step by step, rely the scientific and technological progress, improve the energy efficiency, and rationally draw up the national development plans of low-carbon industries, energy development and special plans, gradually reduce the proportion of coal consumption, increase the ratio of oil and natural gas in primary energy consumption, and actively develop and promote new energy, optimize energy consumption structure, implement the target that the proportion of non-fossil energy consumption increase to 15% in 2020.

### **4.2 To focus on the mechanisms innovation of technology and policy ,and walk on two legs**

Technological innovation is the development basic for low-carbon economy, and the policy mechanisms innovation is the key to develop low carbon economy. The biggest constraint is technological backwardness overall in inverting the "carbon" into "low carbon" in China. To develop the low-carbon economy, we must pay attention to the technological innovation

and the research, development, use and promotion of advanced technology of low-carbon, and actively carry out international technological cooperation through joint research, reasonable transfer and other ways to enhance the technological level and innovation capability. Meanwhile, the policy system must also keep up with the market reform process. To Absorb the experience of low-carbon economy from other countries, to promote the systems and mechanisms innovation of low-carbon economy step by step, such as the system and mechanism innovation in energy-saving and environmental protection industry, or in carbon emissions trading system, or in green technology and institutional mechanisms, and to form a legal mechanisms of low-carbon, clean and green development.

### 4.3 To strengthen the construction of low-carbon society through the public participation

In essence, the development of low-carbon economy is not only the profound change of a mode of social production and economic development, but the profound changes in human social life and consumption patterns. So, we should establish a new concept of low-carbon economy and its development. Government must play a leading role in leading the low-carbon lifestyle and consumption patterns, encourage "low-carbon technologies" to the mass popularization of scientific knowledge through the publicity campaign, foster national awareness of low-carbon economy, make the the necessity, importance and urgency of low-carbon life deeply rooted in popular, create a "low carbon" social atmosphere, and advocating to build a "low-carbon society". Enterprise must strengthen the social responsibility of emission reduction, implement the concept of low carbon business, establish the Clean Development Mechanism. Citizens must consciously improve the lifestyle and consumption habits, actively promote a civilized, scientific, health, ecological consumption, take the low-carbon into a culture. Government, enterprises, and citizens work together, and ultimately form a "resource-saving" and "environment-friendly" low-carbon society.

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