Current Situation Statistics and Macroeconomic Policy Analysis of China's Energy Consumption Structure

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Abstract. With the sustained and rapid development of China's economy, the energy problem is more prominent. China's total energy consumption has increased sharply, and its dependence on coal is relatively high. This has also brought serious environmental problems, which will become one of the main reasons restricting China's economic development. Although the introduction of relevant policies has also achieved certain effects, energy big data is not only the in-depth application of big data technology in the energy field, but also the deep integration of energy production, consumption and related technology revolution and big data concept, which will accelerate the development of the energy industry and Business model innovation. At present, China's energy supply and demand as a whole are stable, the structure continues to be optimized, and comprehensive analysis gives relevant development suggestions.

1. Introduction

In 2018, with the continuous development of China's economic green low-carbon development strategy and energy supply-side structural reforms, energy green development has made positive progress, supply and demand have been stable overall, consumption structure has continued to optimize, and energy conservation and consumption reduction have been steadily advanced. Since the reform and opening up, under the background of China's rapid economic growth, the people's material and cultural living standards have been significantly improved, and the original needs have gradually been met. In the new era, the people's needs for a better life are more extensive, including both the “hard needs” of upgrading and the “soft needs” of new students, especially the people's need for a beautiful ecologically livable environment. The study found that energy consumption is as follows:

First, energy production has grown steadily. In terms of raw coal production, with the continuous progress of relevant policies, the production of raw coal was gradually resumed, with an annual output of 3.55 billion tons, an increase of 5.2% over the previous year, and the growth rate was 2.0 percentage points higher than that of the previous year. Raw coal production continued to be concentrated in advantageous areas and enterprises. The output of raw coal in Inner Mongolia, shanxi and shaanxi accounted for 69.6% of China's total output, 2.7 percentage points higher than the previous year. The output of raw coal was 1.367 million tons, up nearly 140,000 tons. In terms of crude oil production, it has steadily increased since the sharp decline in 2016. The annual output reached 190 million tons, down 1.3% from the previous year, and the decline was 2.7 percentage points lower than the previous year. In terms of natural gas, the exploration and exploitation of natural gas have been continuously increased. The daily production capacity has reached a record high. The annual output is 161 billion cubic meters, an increase of 7.5% over the previous year. The growth rate
has slowed by 1.0 percentage point over the previous year. In addition, in 2018, affected by factors such as “coal to electricity”, general industrial and commercial electricity price reduction policy, and high temperature record in spring and summer, winter cold weather and other factors, power demand is strong, power production is accelerating, and annual power generation is 6.8 trillion kWh. The annual growth rate is 6.8%. With the continuous optimization of the power supply structure, nuclear power, wind power, and solar power generation maintained double-digit growth. The proportion of clean energy power generation such as hydropower, nuclear power, wind power, and solar energy increased by 0.6 percentage points compared with the previous year.

Second, energy imports are growing rapidly. According to the data of the General Administration of Customs, the import of raw coal has grown steadily in 2018, and the import of crude oil and natural gas has reached a record high. Among them, the import of raw coal was 280 million tons, an increase of 3.9% over the previous year; the import of crude oil was 460 million tons, an increase of 10.1%; the import of natural gas was 90.39 million tons, an increase of 31.9%.

Third, the energy consumption structure continues to be optimized. According to preliminary calculations, China's total energy consumption in 2018 increased by 3.3% over the previous year. Among them, the proportion of clean energy consumption such as natural gas, hydropower, nuclear power and wind power accounted for about 1.3 percentage points higher than that of the previous year, and the proportion of coal consumption decreased by about 1.4 percentage points.

Fourth, energy conservation and consumption reduction have been further steadily advanced. According to preliminary calculations, the energy consumption per unit of GDP in 2018 decreased by 3.1% from the previous year, achieving the goal of annual decline.

2. Literature review
Energy is the material basis for human progress and social development, and economic growth requires energy as a support. With the rapid development of China’s economy and the acceleration of urbanization, China's energy issues have received extensive attention from domestic scholars.

Yang yang and Zhang ye (2015) analyzed the data of energy consumption and gross domestic product of Shanxi Province by ADF test and econometric model, and concluded that energy consumption of Shanxi Province has a certain positive effect on economic growth. Qin Huijun, Luo Ji (2015) constructed a variable parameter statistical model based on state space model for the time series data of total energy consumption and GDP in Zhejiang Province, and conducted stationarity test and cointegration test. The Man filter algorithm estimates the parameters of the state space model, and finally concludes that there is a long-term equilibrium cointegration relationship between energy consumption and economic growth. Yu Fengling, Zhou Yang, Chen Jianhong, Zhou Zhiyong (2013) conducted a time series based on per capita GDP and energy consumption indicators and established regression equations, and carried out error correction and Granger causality test. The results show that: energy Consumption and economic development have a long-term stable cointegration relationship, and the Granger causality test proves that energy consumption and per capita GDP are mutually causal.

Liu Qiongfang (2018) quantitatively analyzed the impact of economic scale, industrial structure, energy consumption intensity, and energy consumption structure on carbon emissions from energy consumption in three industries in Fujian Province by using LMDI decomposition method. It is concluded that the economies of scale effect and energy consumption structure have a positive impact on the carbon emission changes in Fujian Province, and the economic scale is the decisive factor that drives the change of carbon emissions; energy consumption intensity and industrial structure have a negative impact on the carbon emission changes in Fujian Province, among which Energy intensity is the dominant factor in curbing carbon emissions growth.

The review shows that there are many references on energy consumption structure in China, and most of them use quantitative methods for statistical analysis. Based on this, this paper combines the latest macro policy research to analyze the energy consumption structure of China.
3. Status of China's energy consumption structure

China has always been a coal-rich, gas-poor, oil-poor energy structure. Coal accounts for more than 90% of the energy structure. Although coal prices have plummeted in the past two years, due to various factors, coal remains for the foreseeable period. It is China's main energy source. As China's environmental protection requirements continue to increase, the coal consumption structure will change, and there will be more coal deep processing projects (coal to oil, coal to olefins, etc.). If there is no major energy change in the short term, coal will remain a major energy source in the future but the proportion will decline and the energy structure will eventually diversify.

Table 1. China's energy consumption from 2000 to 2017 Unit: (10,000 tons of standard coal)

| Year | Total coal consumption | Total oil consumption | Total natural gas consumption | Electricity and other energy |
|------|------------------------|-----------------------|-------------------------------|-----------------------------|
| 2000 | 100670.34              | 32332.08              | 3233.21                       | 10728.37                    |
| 2001 | 105771.96              | 32975.96              | 3733.13                       | 13065.95                    |
| 2002 | 116160.25              | 35611.17              | 3900.27                       | 13905.31                    |
| 2003 | 138352.27              | 39613.68              | 4532.91                       | 14584.14                    |
| 2004 | 161657.26              | 45825.92              | 5296.46                       | 17501.36                    |
| 2005 | 189231.16              | 46523.68              | 6272.86                       | 19341.31                    |
| 2006 | 207402.11              | 50131.73              | 9343.26                       | 21198.56                    |
| 2007 | 225795.45              | 52945.14              | 9343.26                       | 23358.15                    |
| 2008 | 229236.87              | 53542.04              | 10900.77                      | 26931.32                    |
| 2009 | 240666.22              | 55124.66              | 11764.41                      | 28570.71                    |
| 2010 | 249568.42              | 62752.75              | 14425.92                      | 33900.91                    |
| 2011 | 271704.19              | 65023.22              | 17803.98                      | 32511.61                    |
| 2012 | 275464.53              | 68363.46              | 19302.62                      | 39007.39                    |
| 2013 | 280999.36              | 71292.12              | 22096.39                      | 42525.13                    |
| 2014 | 279328.74              | 74090.24              | 24270.94                      | 48116.08                    |
| 2015 | 273849.49              | 78672.62              | 25364.4                       | 52018.51                    |
| 2016 | 270320.00              | 79788.00              | 27904.00                      | 57988.00                    |
| 2017 | 271196.00              | 84412.00              | 31430.00                      | 61962.00                    |

*aSource of data: Chinese calendar yearbook

Table 1 is a trend chart of China's oil consumption, natural gas consumption, coal consumption and total primary energy consumption. From the table, we can see that these four energy consumption have generally shown an upward trend. The increase in coal consumption has increased significantly from 100,670.34 in 2000 to 271,196 million in 2017. Since 2002, the increase in coal consumption has been significant, but at the end of the "Twelfth Five-Year Plan" period, there has been a negative growth for two consecutive years, and the decline has been expanding; followed by oil consumption, primary energy consumption, and natural gas consumption. The total primary energy consumption has grown rapidly, and there is an increasing trend. Especially since 2002, from the consumption of three fossil energy sources, the consumption is from coal to oil and natural gas.

Table 2. China's share of energy consumption in 2000-2016 Unit: (10,000 tons of standard coal)

| Year | Coal | Oil | Natural gas | Power other | Year | Coal | Oil | Natural gas | Power other |
|------|------|-----|-------------|-------------|------|------|-----|-------------|-------------|
| 2000 | 68.50% | 22.00% | 2.20% | 7.30% | 2009 | 71.60% | 16.40% | 3.50% | 8.50% |
| 2001 | 68.00% | 21.20% | 2.40% | 8.40% | 2010 | 69.20% | 17.40% | 4.00% | 9.40% |
| 2002 | 68.50% | 21.00% | 2.30% | 8.20% | 2011 | 70.20% | 16.80% | 4.60% | 8.40% |
| 2003 | 70.20% | 20.10% | 2.30% | 7.40% | 2012 | 68.50% | 17.00% | 4.80% | 9.70% |
| 2004 | 70.20% | 19.90% | 2.30% | 7.60% | 2013 | 67.40% | 17.10% | 5.30% | 10.20% |
China's energy consumption structure includes primary energy such as raw coal, oil and natural gas, and its consumption ratio is basically stable. Although the proportion of coal in the energy consumption structure has been declining since the 12th Five-Year Plan, coal has always occupied a dominant position, and the proportion of coal has remained basically between 65% and 71%. Among them, the proportion of coal in the decline in 2014 was relatively large, and the decline continued until 2016, and then the proportion of oil ranked second, only lower than coal. Since 2000, electricity and other energy sources have also begun to account for a higher proportion of China's energy consumption structure than natural gas. Among them, electricity and other energy sources, although accounting for a small proportion, have been rising. Compared with coal and oil, natural gas is a clean energy source, so the proportion of natural gas is relatively small, which is not conducive to the development of energy conservation and emission reduction. Natural gas ranks fourth among all energy sources. It has been between 2% and 6%. In China's energy consumption structure: the proportion of oil consumption has gradually decreased. It has been from 22% in 2000 to 18.3% in 2010. Although coal is constantly being compressed in the energy consumption structure, the proportion is declining, but coal still accounts for a large proportion of the impact on China's environment and negative impact.

Table 3. China Energy Consumption Intensity from 2000 to 2016 Unit: (10,000 tons of standard coal / 100 million yuan)

| Year | Energy consumption intensity | Year | Energy consumption intensity |
|------|-----------------------------|------|-----------------------------|
| 2000 | 1.47                        | 2009 | 0.96                        |
| 2001 | 1.40                        | 2010 | 0.87                        |
| 2002 | 1.39                        | 2011 | 0.79                        |
| 2003 | 1.43                        | 2012 | 0.74                        |
| 2004 | 1.42                        | 2013 | 0.70                        |
| 2005 | 1.40                        | 2014 | 0.66                        |
| 2006 | 1.31                        | 2015 | 0.62                        |
| 2007 | 1.15                        | 2016 | 0.59                        |
| 2008 | 1.00                        |      |                             |

Energy intensity is a measure of the economic efficiency of energy and reflects the relationship between total energy consumption and GDP. The lower the energy consumption intensity, the less energy consumption is required for unit GDP, and the higher the energy economy efficiency. It can be seen from Table 3 that since 2000, China's energy consumption intensity has shown a declining development trend in general. The continuous decline of China's energy consumption intensity just proves that China's economic structure has undergone great changes. With the continuous implementation of energy conservation and emission reduction in China, the intensity of energy consumption in China will continue to decline.

4. Macro policy analysis and recommendations
First of all, due to China's "rich coal, lack of oil, less gas" energy resource endowment, China's secondary industry dominated, extensive development of the economic structure determines the current energy situation. If we compare the changes in energy structure and economic structure of major industrial countries after World War II, we will find that the energy structure has a natural
connection with the economic structure. China's current economy is dominated by the secondary industries of steel, manufacturing, and construction. At the same time, these industries are highly energy-intensive and highly dependent on coal.

Second, to integrate current national macroeconomic policies, and to develop emerging industries such as artificial intelligence, Internet of Things, virtual reality, network security, big data, and cloud computing. The current concept of energy big data is related technologies and ideas for comprehensively collecting, processing, analyzing and applying data in the fields of energy, petroleum, gas and other energy fields and other fields such as population, geography and meteorology. Energy big data is not only the in-depth application of big data technology in the energy field, but also the deep integration of energy production, consumption and related technology revolution and big data concept, which will accelerate the development of energy industry and business model innovation.

Therefore, it shows that the sustainable development of China's economy has strong dependence on energy consumption and has great room for development. Since China's economic growth must be maintained, it must use the expanding energy supply as a guarantee to change traditional energy and resource utilization. Development methods, improve energy utilization technologies, improve energy efficiency, establish energy-saving emission reduction operation mechanisms, and promote low-carbon economic reform. Hereby make the following recommendations:

4.1 Optimize the energy structure and vigorously develop new energy sources.

Vigorously promote the use of clean energy such as electricity and natural gas. The incomplete energy development and resource and environmental constraints remain the biggest problems in China. The air pollution situation in China is severe, and the energy consumption structure based on fossil energy such as petroleum has not been completely changed. Therefore, China needs to accelerate the promotion of clean energy, especially to promote high-energy-consuming industries such as coal to gas, coal to electricity, which is essential for energy conservation and environmental protection. China should vigorously promote the use of clean energy such as electricity and natural gas, increase the proportion of non-fossil energy consumption, and promote the further optimization of energy consumption structure. On the one hand, we must increase efforts to develop new energy sources. On the other hand, we must reduce the proportion of disposable energy in energy consumption, and actively develop new energy sources and clean energy sources such as nuclear energy, solar energy, and geothermal energy.

4.2 Accelerate the construction of green low-carbon energy.

China must pay close attention to energy conservation and consumption reduction and energy consumption structure improvement, implement incentives to use natural gas, comprehensively use relevant policies such as finance, finance, and management, and accelerate the promotion of oil-to-slag trucks, urban distribution vehicles, and scenic fuel vehicles. Power action, increase the use of electric vehicles, accelerate the planning and construction of charging station facilities, and encourage the use of electric energy in hotels. Administrative agencies in various regions of China should take the lead in promoting green office and green low-carbon travel.

4.3 Adjust the consumption structure of China's energy and reduce the consumption of non-renewable resources.

Once the non-renewable resources are exhausted, it will affect the smooth operation of China's economy. In addition, compared with coal, China's oil resources are relatively insufficient. If it has been relying on imports, it may bring a series of energy security issues. Therefore, we need to adjust its energy consumption and increase the use of other renewable resources. Accelerate the development and use of new energy and renewable resources.
4.4 Pay attention to environmental protection and create a sound economic development environment. Create a benign development model. The massive use of energy such as coal will cause environmental pollution and damage. The Chinese government must strive to deal with pollutants in economic development on time so that non-qualified and non-standard exhaust gas and waste will not be discharged. The relevant government departments should supervise, make full use of existing resources, and encourage enterprises to develop circular economy. The government should start from various aspects, formulate a reasonable and perfect system, increase financial subsidies, accelerate investment, and relax market access rules, thereby promoting the steady growth of China's economy and maintaining the stability of the overall macroeconomic environment.

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