

Energy consumption and environmental economy: The development and impact of fossil energy and new energy in China

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Abstract. With the rapid development of China's economy and the continuous increase in energy consumption, the usage of fossil energy and new energy resources and their impact on the environment and economy have attracted increasing attention. Through literature review and data analysis, combined with relevant research, this paper systematically collates and analyzes the latest statistics on China's energy consumption. It also explores the effects of this consumption on both the environment and the economy. This study will cover the production, consumption and environmental influence of various energy sources, with the aim of providing a scientific foundation for sustainable energy policy. Through extensive studies on the advancement of various energy resources, they can serve as a scientific foundation for the formation of future energy policy and the promotion of sustainable development. The study reveals that while fossil fuels continue to be the primary source of energy, the consumption of alternative energy sources is experiencing a significant and quick increase.

Keywords: fossil energy, new energy, energy consumption, environmental economy.

1. Introduction

Energy plays an important role in facilitating economic and social development. Given the escalating issue of global climate change, governments are now prioritizing the development of new energy resources. As one of the world's largest energy consumers, China, being one of the top energy consumers globally, significantly influences the global environmental economy through its energy consumption. In recent years, the Chinese government has increased its support for the development of new energy and promoted the transformation towards a more sustainable energy system.

China's economy is witnessing a rapid increase, leading to a growing need for energy. However, the consumption of fossil energy is a major contributor to environmental pollution and climate change. In order to deal with these problems, the Chinese government has proposed a strategy to overhaul the energy infrastructure and enhance backing for the advancement of alternative energy sources. At the same time, the international community has also paid great attention to China's energy consumption and its repercussions on the environment and economy. This study aims to comprehensively analyze the energy consumption patterns in China by examining the trends in the consumption of various energy types, specifically focusing on the growth and utilization of important industries including coal, oil, hydro-power, and nuclear energy.

Using literature review and data analysis methods, combined with relevant research, the author will systematically collate and analyze the most recent data on China's energy consumption. This comprehensive investigation will examine the generation and utilization of diverse energy resources and their ecological consequences, to establish a scientific foundation for sustainable energy policies. Through in-depth research on the development of these energy types, a deep understanding of the current situation of China's energy market can be obtained, and a scientific basis for the formulation of future energy policies and sustainable development will be established.

2. Energy consumption

In recent years, China's fossil fuel consumption has continued to grow. Coal serves as the primary energy source, with some consumption of oil and natural gas. As one of the main sources of energy, oil plays a key role in areas such as transportation, industry, and agriculture. Hydropower and nuclear power are highly regarded as representatives of clean energy, but their development also faces a series of technical, environmental, and social challenges.

By taking a closer look at the consumption of these new energy sources, one can gain a more complete picture of the dynamics of China's energy sector while also being able to assess its impact on environmental sustainability and economic development. First of all, it is important to study the trends in coal consumption. China has long relied on coal as its main source of energy, but in recent years, as environmental pressure has intensified and the government has actively promoted clean energy development, people need to understand the share of coal in energy consumption, the growth trend, and the impact of relevant policies on coal use. Second, oil is the energy source that supports many fields such as transportation, industry and agriculture, and an in-depth study of oil can reveal the direction of China's economic activities and provide an important reference for future energy strategies. Hydropower and nuclear energy, as representatives of clean energy, play an important role in China's energy structure. Understanding the development of such new energy sources, including the growth trend of installed capacity and power generation, will help to assess the contribution and prospects of China's clean energy transition.

According to preliminary statistics, the national energy consumption target for 2022 is 5.41 billion tons of standard coal, an increase of 2.9% over the previous year [1]. In this context, this paper will conduct a detailed study of each major energy source type, such as coal, oil, natural gas, and electricity, and analyze their consumption trends and structures.

2.1. Coal consumption analysis

Coal has been dominant in China's energy mix. This article will delve into the growth trends of coal consumption, including specific data and activities on coal consumption and the impact of relevant policies on it.

From 2018 to 2022, coal consumption continued to grow, from 2.74 billion tons of standard coal to 2.97 billion tons of standard coal, with an average annual growth rate of about 2%. Despite its relatively low growth rate, coal remains China's main source of energy, accounting for about 54.9% of total energy consumption in 2022 [1].

However, it is worth noting that the share of coal in total energy consumption is declining year over year. In 2018, the share of coal was 59.1%, which will drop to 54.9% in 2022. This reflects China's efforts to adjust its energy mix and reduce its dependence on coal. Relevant policies, such as "coal-to-gas" and "coal-to-electricity," are driving this trend.

2.2. Oil & Gas Consumption Trends

Oil and gas are important energy sources that underpin transportation and industry. Therefore, this article will provide a detailed analysis of these two fossil energy sources, including fluctuations in consumption, changes in production, and their impact on the country's economy.

Oil and gas consumption grows at different rates and scales. Oil consumption increased from 890 million tons of standard coal in 2018 to 970 million tons of standard coal in 2022, with an average annual

growth rate of about 2.2%. Oil's share of total energy consumption has remained relatively stable, remaining at around 17-18%. This reflects the continued importance of oil in the transportation and industrial sectors.

Natural gas consumption has grown rapidly, from 320 million tons of standard coal in 2018 to 410 million tons of standard coal in 2022, with an average annual growth rate of 6.4%. The share of natural gas in total energy consumption rose from 6.9% in 2018 to 7.6% in 2022. This growth trend reflects China's aggressive clean energy transition and increased use of natural gas [1].

Overall, these data show that China is gradually adjusting its energy mix, reducing its dependence on coal, and increasing the use of clean energy sources such as natural gas.

Table 1. China's energy consumption data from 2018 to 2022 (unit: 100 million tons)[1]

Year	Coal	Petroleum	Natural gas	Total energy consumption
2018	27.4	8.9	3.2	46.4
2019	27.7	9.2	3.4	48.6
2020	28.3	9.0	3.6	49.8
2021	29.5	9.4	3.9	52.4
2022	29.7	9.7	4.1	54.1

2.3. Electricity consumption and new energy development

As a terminal form of various energy sources, the consumption of electricity is directly related to various industries and residents' lives.

From 2018 to 2022, China's electricity consumption continued to grow, from 6.84 trillion kWh to 8.64 trillion kWh, with an average annual growth rate of about 6%. This growth trend reflects China's continued economic development and the increasing level of electrification. Specifically, the economic recovery and the acceleration of digital transformation may have contributed to the significant increase in electricity consumption in 2021 and 2022 [2].

Hydropower, as a traditional renewable energy source, holds an important position in China's power structure. However, its share showed a slight downward trend, from 17.3% in 2018 to 15.7% in 2022. This may be due to the fact that other new energy sources are developing faster, while hydropower development is approaching its limit.

The share of nuclear power has risen steadily, from 4.2% in 2018 to 5.0% in 2022. This reflects China's continued investment in nuclear power development, as well as the growing importance of nuclear power as a clean baseload power source.

Wind power is one of the fastest-growing new energy sources, with its share rising sharply from 5.2% in 2018 to 8.8% in 2022. This growth trend reflects China's rapid development in wind power technology and industrial chains, as well as strong policy support for wind power.

The share of solar power generation has also shown a rapid growth trend, rising from 2.5% in 2018 to 4.7% in 2022. This shows that the PV industry is growing rapidly in China, with costs continuing to fall and market acceptance increasing [2].

Overall, China's electricity consumption continues to grow, while the proportion of renewable energy generation continues to increase. The rapid growth of wind and solar power is particularly significant, reflecting China's progress in promoting the energy transition and developing renewable energy.

Table 2. China's electricity consumption data and the proportion of renewable energy generation from 2018 to 2022 [2].

Year	Electricity consumption of the whole society (trillion kWh)	Proportion of hydropower (%)	Proportion of nuclear power (%)	Proportion of wind power (%)	Proportion of solar power generation (%)
2018	6.84	17.3	4.2	5.2	2.5
2019	7.23	17.8	4.8	5.5	3.1
2020	7.51	17.8	4.8	6.1	3.4
2021	8.31	16.0	5.0	7.8	3.9
2022	8.64	15.7	5.0	8.8	4.7

3. The impact of energy consumption

Energy consumption is mainly dependent on the combustion of fossil fuels, which leads to the emission of large amounts of greenhouse gases, especially carbon dioxide. These gases accumulate in the atmosphere, exacerbating the greenhouse effect, leading to global climate change, rising sea levels, and an increase in extreme weather events. To reduce greenhouse gas emissions, energy efficiency should be strengthened, renewable energy should be developed, and the clean energy transition should be promoted.

Exhaust gases and particulate matter released during energy production and consumption have a direct impact on air quality. Coal and oil combustion releases harmful substances such as sulfur dioxide, nitrogen oxides, and particulate matter, which are harmful to human health and ecosystems. To reduce air pollution, measures should be taken to reduce pollutant emissions and promote the use of clean energy. The energy production and consumption process requires a large amount of water resources. For example, oil, gas, and coal mining require water cooling systems, leading to water scarcity and damage to ecosystems. There is a need to use water more efficiently, explore alternative cooling technologies, and strengthen water management.

Energy extraction, construction, and transmission require a large amount of land. Surface destruction and ecosystem degradation caused by oil, gas, and coal mining threaten biodiversity and ecological balance. Sustainable land management strategies should be adopted to protect ecosystems and promote the use of renewable energy to reduce dependence on land. The energy production and consumption process generates large amounts of solid waste, wastewater, and toxic chemicals. Improper disposal of these wastes and pollutants poses a potential risk to the environment and human health. Waste management and treatment should be strengthened, and resource recycling and cleaner production should be promoted [3].

4. New energy consumption and its impact on the environment and economy

4.1. Consumption of new energy

With the government's increasing attention and support for the development of new energy, China's consumption of new energy is growing rapidly. Among them, the consumption of renewable energy sources such as solar, wind, and hydropower has increased most significantly. Driven by policy guidance and market demand, China's new energy industry has a strong momentum for development [4].

Table 3. China's major renewable energy generation from 2016 to 2021 [5].

Year	Wind power (100 million kWh).	Solar power generation (100 million kWh).	Hydropower (billion kWh).
2016	2410	666	11807
2017	3057	1182	11954
2018	3660	1775	12329

Table 3. (continued)

2019	4057	2242	13021
2020	4665	2611	13551
2021	6526	3259	13405

Wind power generation increased from 241 billion kWh in 2016 to 652.6 billion kWh in 2021, an increase of 170.8%. In particular, from 2020 to 2021, wind power generation increased by 39.9%, showing strong momentum in the development of wind energy. This growth is largely due to the rapid development of offshore and distributed wind power, as well as the continuous advancement of wind power technology [5].

Solar power generation increased most significantly, from 66.6 billion kWh in 2016 to 325.9 billion kWh in 2021, an increase of 389.3%. During this five-year period, solar power generation grew at an average annual rate of 37.3%. This rapid growth reflects the rapid development of PV technology, the continuous decline in costs, and strong government support for distributed PV [6].

Hydropower generation, as a traditional renewable energy source, also showed an increasing trend, going from 1,180.7 billion kWh in 2016 to 1,340.5 billion kWh in 2021, an increase of 13.5%. Although growing at a relatively slow pace, hydropower remains the largest source of renewable electricity in China [6].

4.2. *The impact of new energy on the environment and economy*

The development of new energy sources can reduce the use of fossil energy, resulting in lower pollutant emissions. According to statistics, the development of renewable energy in China in recent years has reduced a large number of carbon dioxide emissions. At the same time, the development and utilization of new energy can also reduce emissions of other pollutants, such as soot and nitrogen oxides. These emission reduction measures are of great significance to improve air quality and protect the ecological environment [7].

Table 4. Renewable energy generation and CO₂ emissions [8]

Year	Renewable energy generation (100 million kWh)	Reduction of CO ₂ emissions (10,000 tons).
2016	15430	12344
2017	17280	13824
2018	18670	14936
2019	20450	16360
2020	22150	17720

These figures demonstrate China's continuous growth in renewable energy generation and the corresponding annual reduction in CO₂ emissions. Renewable sources generated 2,215 billion kWh of electricity in 2020, resulting in a reduction of 177.2 million tons of CO₂ emissions. This is equivalent to 1.77% of China's total CO₂ emissions (about 10 billion tons) in 2020 [8].

In addition, according to a report by the International Energy Agency (IEA), the growth of renewable energy generation in China in 2020 will offset about 5% of the growth of fossil fuel power generation, effectively controlling the growth of carbon emissions in the power sector [9].

At the same time, the development and utilization of new energy can also reduce emissions of other pollutants, such as soot and nitrogen oxides. According to China's Ministry of Ecology and Environment, in 2020, the average concentration of PM_{2.5} in 339 cities at and above the prefecture level was 33 micrograms per cubic meter, down 28.3% from 2015, thanks in part to the development and application of new energy sources.

The development of the new energy industry can lead to the development of related industries, thereby creating more employment opportunities. According to statistics, the number of jobs in the renewable energy sector in China has been increasing in recent years. These employment opportunities

have positive implications for alleviating China's employment pressure and promoting social and economic development.

Overall, the development of China's new energy industry has not only promoted the transformation of the energy structure, but also played an important role in reducing pollution and creating jobs, which has had a positive impact on environmental protection and economic development. However, the development of new energy still faces challenges such as technological innovation and market mechanisms improvement, which require continuous policy support and industrial chain optimization.

5. Conclusion

This paper analyzes China's consumption of fossil fuels and new energy sources in recent years, as well as their impact on the environment and economy. The study found that the consumption of fossil fuels still dominates, but the consumption of new energy sources is also increasing. At the same time, the development of new energy sources has had a positive impact on the environmental economy, including reducing pollution, and promoting employment and economic development. However, the development of new energy also faces some challenges, such as technical bottlenecks, policy support, and market acceptance. Therefore, the government should continue to increase support for the development of new energy and promote the transformation of the energy structure and green development. At the same time, enterprises should also strengthen technological innovation and R&D capacity building to improve the quality and competitiveness of new energy products.

This study provides a preliminary analysis of China's energy consumption and its environmental and economic impacts, but there are still some shortcomings. Due to the lack of comprehensive and systematic primary research data, this study mainly relies on published secondary data and statistics, which may not fully reflect the latest energy consumption dynamics. Future research can collect more detailed and timely data through field surveys, questionnaires, etc. This paper mainly focuses on the macro-trend of energy consumption, and does not analyze the energy consumption of specific industries and regions in depth. Follow-up research can select typical industries or regions for case analysis, and deeply explore the relationship between energy consumption and the environmental economy. By continuously improving the research methods and expanding the research perspective, it is believed that future research will provide more powerful theoretical support and decision-making references for promoting the transformation of energy structures and sustainable development.

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