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Energy Consumption and Carbon Emission Based on Energy Storage Principle and Technology

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Abstract: Energy is a necessity for human activities and social improvement, and it is an indispensable resource for promoting China's improvement. In recent years, China's improvement has brought about a large increase in energy consumption and environmental pollution, which warns us to speed up the pace of energy conservation and emission reduction, and pay more attention to the impact of regional its efficiency. The purpose of this paper is to study energy consumption and carbon emissions based on energy storage principles and technologies. In the experiment, the energy consumption prediction calculation is used to compare the energy consumption and carbon emission trends of A, B and C provinces.

1. Introduction

Literature review of energy consumption carbon emissions carbon emissions are generated in all aspects of daily life, such as animal and plant respiration, fermentation and decay, industrial production, urban operation and transportation, etc. Among them, the largest sources of carbon emissions are coal, oil and Natural gas and other energy consumption, so when studying the change of carbon emission, the focus is on the change of its consumption and carbon emission [1].

In recent years, China's high-speed and high-quality economic improvement and industrialization process has been accelerating. How to realize my country's emission reduction commitments and how to formulate emission reduction policies in line with my country's national conditions has attracted the attention of a large number of scholars.The popularity of Tiano F A electric vehicles is severely limited by charging issues, including electrical impacts on the grid. Compressed air its storage system charging station systems rely on positive displacement compressors and expanders as potential solutions to reduce the impact of charging stations on power system performance. An example of the design and optimization of a compressed air its storage system with a positive displacement compressor and expander is given. The results of an optimization analysis based on a dynamic programming tool are presented and discussed, showing the potential advantages of this solution [2]. Khribish A. has conducted extensive research on the determinants of renewable energy, taking into account many variables related to economic, environmental, institutional, and political conditions. However, little is known about the impact of social improvement on the use of renewable energy. The aim is to overcome this limitation and investigate short- and long-term causal relationships between renewable energy use and social improvement using datasets from high-income countries. The proposed method is based on calculating the Social improvement Index (SDI) by combining several indicators related to social well-being. Trend analysis shows that social improvement contributes significantly to the use of renewable energy in the long run, but not in the short run [3].Nowadays, the irrationality of its consumption structure and the crisis of its resources have become the more prominent environmental problems in our country. Enriching and improving the research in the field of its consumption can lay a solid foundation for the research on carbon emissions.

This paper studies the concepts of energy and carbon emissions, the principles and technologies of energy storage, the definition and classification of energy storage technologies, and the principles and countermeasures of flywheel battery energy storage. In the experiment, the energy consumption and carbon emission prediction calculation formula and the specific carbon dioxide emission calculation formula are used to compare the changes of energy consumption structure in Sichuan, Zhejiang and Henan.

2. Research on Energy Consumption and Carbon Emission Based on Energy Storage Principle and Technology

2.1. The Concept of Energy and Carbon Emissions

(1) Energy

Energy Source is an important material basis of the national economy and plays an important role in the economic system. It is not only an input factor, running through all aspects of social production, but also an important component of consumption demand, and an essential element for residents to achieve a better life. 3]. It refers to the transformation of light, fuel, water, wind, etc. into usable energy by human beings through conversion. Existing research has not yet unified the definition of it, but it can be regarded as a source of it in various forms that can be converted into each other. Therefore, any substance or movement of substances that can provide it for people's production and life can be called energy [4]. Combined with my country's regional economic improvement and actual its utilization, this paper defines it as the material that can provide it for regional economic improvement, including production it and living energy, including coal, oil, natural gas and electricity.

(2) Carbon emissions

Carbon emissions refer to the greenhouse gases produced directly or indirectly by human beings engaged in certain activities [5]. As we all know, carbon dioxide accounts for a high proportion of greenhouse gases, so carbon dioxide is often used as a standard to measure carbon emissions. Humans consume fossil energy in production and consumption, and will inevitably emit greenhouse gases [6]. From this aspect, carbon emissions are closely related to the economic improvement of various countries, and reducing carbon emissions has become an important goal of sustainable economic improvement. According to the National Greenhouse Gas Inventory Guidelines, the following forms are the main causes of carbon dioxide: one is its consumption; the other is industrial production; the third is fugitive fuel; the fourth is the use of agriculture, forestry and land;

the fifth is waste Fermentation [7-8]. Among the above-mentioned types of carbon emissions, its consumption is the most important reason. Among all kinds of its consumption, the consumption of clean energy such as water energy and solar power generation will not cause carbon emission in principle, and the consumption of one-time non-renewable resources such as coal, crude oil and gas is the main source of carbon emission.

2.2. Introduction of Energy Storage Principles and Technologies

(1) Definition and classification of energy storage technology

Energy storage, which is a cyclic process in which a substance, such as chemical or physical methods, is used as an energy storage medium, and a kind of energy is first stored in a certain way, and is released in the form of specific energy when it is needed in the future [9- 10]. According to the definition of its storage, although fuel cells and metal-air batteries do not have the characteristics of "charging" and are not equivalent to its storage in the narrow sense, they are similar to its storage products in terms of their characteristics and application fields. Therefore, in this report , also include them in other its storage categories. In the classification of its storage technologies, physical its storage, chemical its storage and other storage are included [11]. The physical energy storage includes flywheel storage. The typical power of flywheel energy storage is 5KM-1.5MW, and it is 15s-15min. The advantage of flywheel energy storage is large capacity and the disadvantage is low energy density. It is widely used in peak shaving, frequency control, UPS, power quality regulation, performance stability of power transmission and distribution systems, etc.

(2) Principle of energy storage of flywheel battery

A flywheel battery is a device battery that stores it in the form of kinetic energy [14]. As we all know, when the flywheel rotates at a certain speed, it has a specific mechanical force, and the flywheel battery converts its energy into electricity. When the flywheel battery is charged, modern technology is used to generate electrical energy provided by the power frequency grid through an electronic converter, which drives it to rotate at a high speed. The motor maintains a constant speed until it receives an energy release control signal. When it is necessary to supply power to the load, the flywheel acts as a prime mover to drive the motor to generate electricity, generating current and voltage that are critical to the load, thus completing the process of releasing it for the two energy conversions.

2.3. Countermeasures and Suggestions

(1) Efforts should be made to improve the coordination between energy conservation policies and emission reduction policies.

Energy conservation policies and carbon emission reduction policies should be optimized and improved simultaneously, and the realization of its conservation goals can effectively promote the achievement of carbon emission reduction goals [16]. First, there is no absolute boundary between its conservation policies and carbon emission reduction policies. When the government formulates its conservation policies and emission reduction policies, it should fully evaluate the size of the coordination effect between the two, and try to optimize and improve them simultaneously. , The government should take the actual its conservation policy as the priority reference object when formulating emission reduction policies, because compared with the realization of its conservation goals, the role of carbon emission trading in promoting carbon emission reduction may be more tortuous, and achieving its conservation goals will be more tortuous. More effectively promote the realization of carbon emission reduction goals [17].

(2) Increase support for scientific and technological research and improvement and enhance the effect of technological progress.

Science and technology research and improvement is the focus of my country's carbon emission reduction tasks. Science and technology research and improvement has the characteristics of long cycle and great uncertainty. Whether it is a professional technology research and improvement enterprise or an enterprise that wants to transform into energy saving and emission reduction, sufficient funds are required. Support and the support of cutting-edge technologies and talents, truly take the improvement path of a green and low-carbon economy, and promote the improvement of financial inclusion [18]. Innovation is the first driving force for my country's improvement. China has overpaid many dividends in its improvement. Environmental dividends are one of them. Today's extensive improvement has brought many contradictions and problems. Innovation is the primary factor to solve these problems. the soul of economic improvement. Advocating innovation, making it a strong support point for scientific and technological improvement, and enhancing China's international advantages and status. At the same time, under strict supervision, enterprises should be promoted to carry out technological improvement and innovation with low cost and high efficiency, or choose to introduce pollution treatment technology, clean production technology, etc., eliminate backward production capacity, and increase the effect of technological effect on carbon emission reduction.

3. Investigation and Research on Energy Consumption and Carbon Emission

3.1. Research Objects

Because A, B, and C are the top six provinces in terms of economic improvement in the country, and are also the three provinces with a total GDP close to each other, the economic and social improvement in the western, eastern and central regions where they are located. has an important position in it. Using the relevant data of its consumption, carbon emissions and economic growth in A, B and C provinces from 2018 to 2022, this paper analyzes the changes in the total its consumption demand, structure and total carbon emissions of the three provinces, as well as the economic growth trend of the three provinces. Comparative analysis of carbon emissions.

3.2. Calculation of Energy Consumption and Carbon Emissions

The method for calculating carbon emissions mentioned in the calculation of carbon emissions in A, B and C provinces. respectively represent the total carbon emission and the consumption of the ith energy in the t year; respectively represent the coefficient of converting the standard coal of the ith energy and the carbon emission coefficient of the ith energy. The calculation formula of energy consumption and carbon emission forecast is:

$$C_t = \sum_i^3 EC_{i,t} a_i \gamma_i \tag{1}$$

CO_2 represents the explained variable carbon emissions in this paper; i represents 14 energy fuels, namely coal, coke, coke oven gas, blast furnace gas, converter gas, other gas, crude oil, gasoline, kerosene, diesel, fuel oil, Liquefied petroleum gas, natural gas and liquefied natural gas; E_i represents the net consumption of the 14 energy sources excluding the energy used in intermediate processing; NCV_i represents the average low calorific value of the 14 sources used to convert the various consumption into energy units (TJ); CEF_i represents the carbon dioxide emission factor of each energy source. The specific formula for calculating carbon dioxide emissions is:

$$CO = \sum_{i=1}^{14} CO_2 = \sum_{i=1}^{14} E_i \, NCV_i \, CEF_i \qquad (2)$$

4. Analysis and Research on Energy Consumption and Carbon Emissions Based on Energy Storage Principles and Technologies

4.1. Comparison of Energy Consumption Trends in Sichuan, Zhejiang and Henan

(1) Comparison of changes in energy consumption structure

In order to better grasp the difference in the consumption structure of the three provinces of A, B and C, the consumption structure of the three provinces in 2018 and 2022 were analyzed respectively, and on this basis, the changes in the consumption structure of the three provinces were compared and analyzed. my country is a country with coal as the main source. The national conditions of rich coal, little gas and poor oil determine the importance of the improvement of coal industry in the national economy.

It is reported that in 2018, coal accounted for 77.8% of the total national consumption, so the proportion of coal consumption in the total consumption in A, B and C provinces was higher than the national average. However, due to the advantages of coal resource endowment in C, the proportion of coal fuel consumption in A source is 13.7 and 5.2 percentage points higher than that of A and B, respectively. In comparison, due to the endowment advantages of natural gas and hydropower in A, the total proportion of these two clean energy sources in the consumption structure reached 24.2%, which was significantly higher than that of B and C by 13.3 and 19.7 percentage points. The changes in energy consumption structure in 2018 are more specific. The situation is shown in Table 1 and Figure 1:

Table 1. Data acquisition in 2018

Energy	A	B	C
Oil fuel	19.6%	25.6%	15.7%
Coal fuel	30.5%	59.3%	78.4%
Natural gas	17.8%	8.6%	9.7%
Power	35.7%	27.1%	8.7%
Other fuel	3.4%	0.8%	2.7%

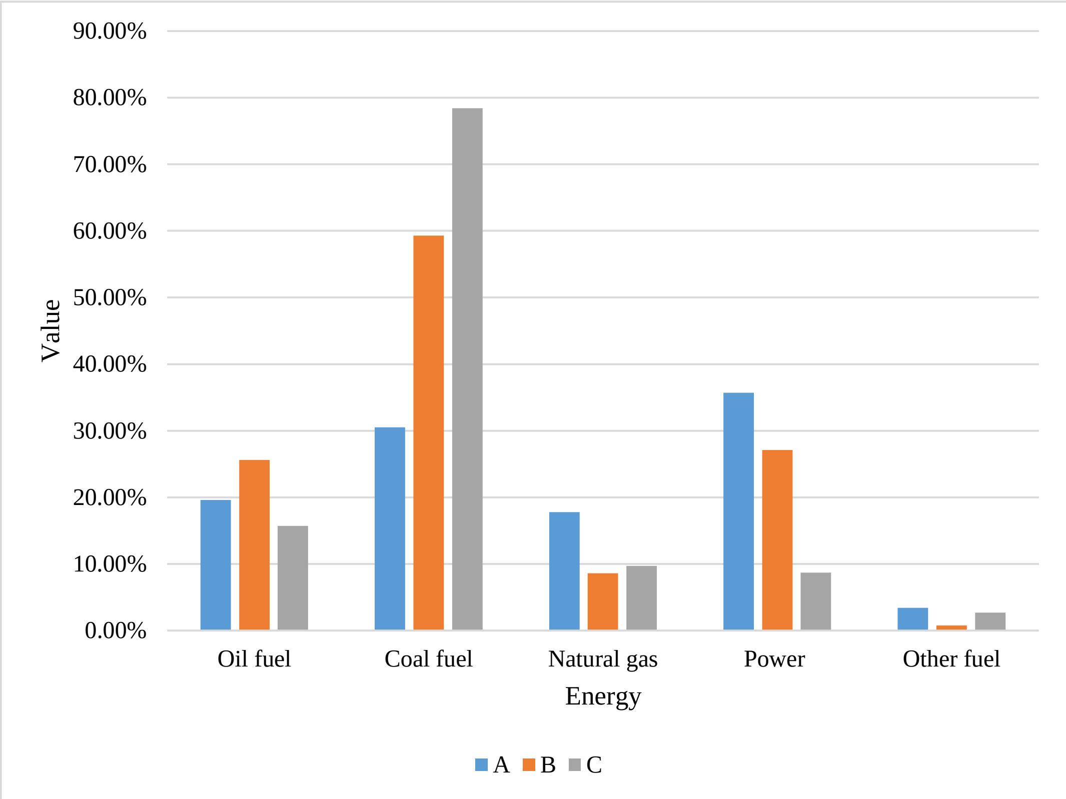

Figure 1. Comparison chart of energy consumption structure changes in 2018

Secondly, from the energy consumption structure of the three provinces in 2022, it can be seen that the energy consumption structure of the three provinces tends to be more reasonable and efficient. Among them, the proportion of coal fuel in the energy consumption structure of provinces B and C is still higher than that of other energy types, and its proportion in the total energy consumption is still as high as 89.3%. Much higher than B and A; compared with coal-based fuels, the proportion of oil-based fuels in the energy consumption structure is not much different among the three provinces, while the proportion of oil-based fuels in B is slightly higher than that of A and C; natural gas, electricity The proportion of clean energy in A’s energy consumption structure totaled 53.1%, which was significantly higher than that of B and C, which was similar to the situation in 2018, indicating that A continued to maintain its leading edge in the use of clean energy. The comparison of the changes in energy consumption structure in 2022 is shown in Table 2 and Figure 2:

Table 2. Data acquisition in 2020

Energy	A	B	C
Oil fuel	25.9%	30.7%	20.4%
Coal fuel	35.4%	64.8%	83.7%
Natural gas	23.4%	13.2%	12.3%
Power	40.1%	23.4%	13.2%
Other fuel	8.3%	5.4%	7.2%

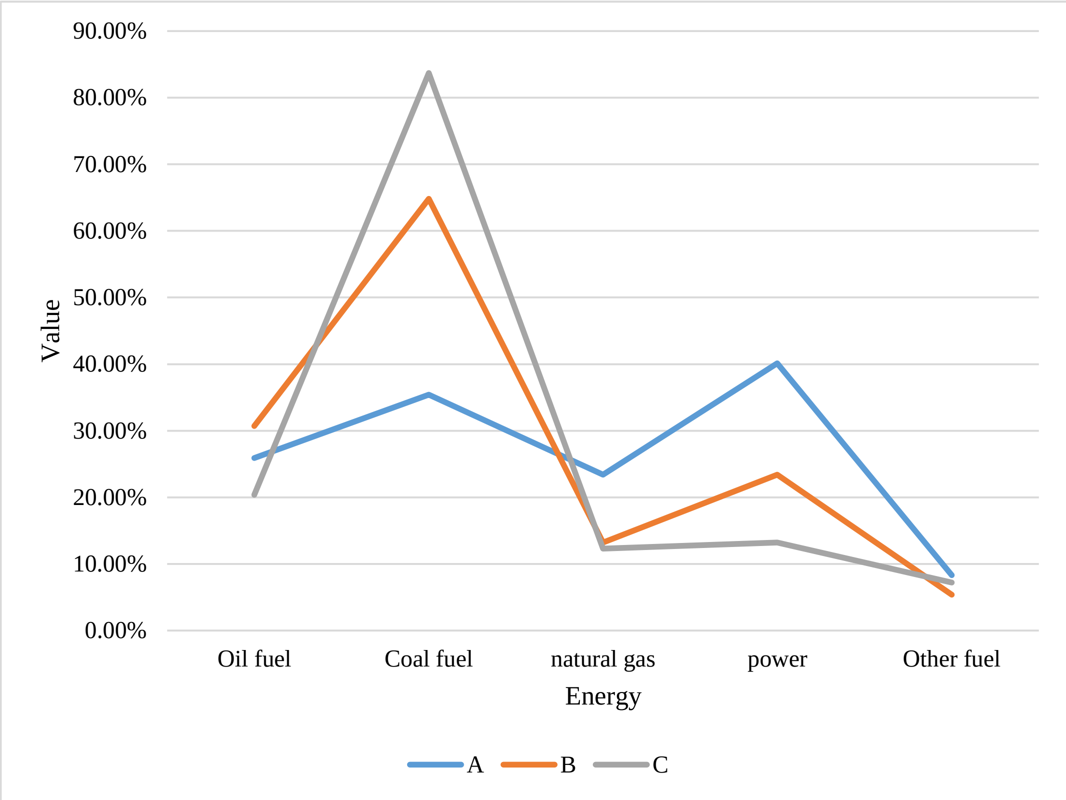

Figure 2. Comparison chart of energy consumption structure changes in 2020

Finally, comparing the changes in the energy consumption structure of the three provinces in 2018 and 2022, it can be seen that the characteristics of coal abandonment in the three provinces are becoming more and more obvious. Among them, the proportion of coal product fuel and the proportion of total energy consumption in the three provinces have all declined to varying degrees in the past three decades, and the characteristics of coal abandonment in A are particularly obvious.

4.2. Total Carbon Emissions Data Acquisition

The specific situation of the proportion of the total energy consumption of the three provinces is shown in Table 3 and Figure 3:

Table 3. Total carbon emissions data from 2018 to 2022

A particular year	A's total carbon emissions	B's total carbon emissions	C's total carbon emissions
2018	24845	35698	44521
2019	25131	36741	45314
2020	25421	36921	46352
2021	26341	37541	46325
2022	27365	38214	48365

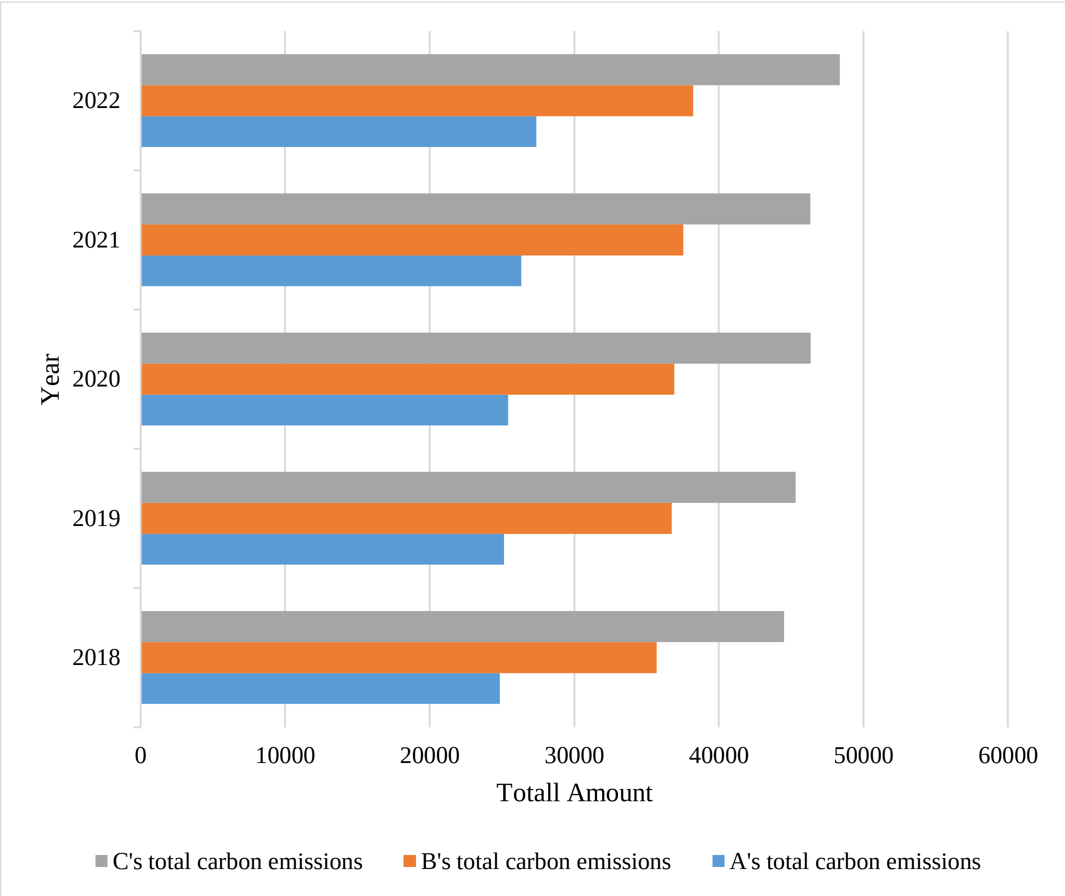

Figure 3. Collation map of total carbon emissions caused by energy consumption from 2018 to 2022 (unit: 10,000 tons)

According to the calculation data, it can be seen that the total carbon emissions of the three provinces are on the rise as a whole, but the difference in the changes of carbon emissions in each province is reflected in the following: In 2018, the carbon emissions of Province A were 248.45 million tons, and by 2022, this value will reach 273.65 million tons; In 2018, the carbon emission of province B was 356.98 million tons, and until 2022, the value reached 382.14 million tons; in 2018, the carbon emission of province C was 445.21 million tons, and until 2022, the value reached 483.65 million tons.

5. Conclusion

At present, how to balance and coordinate the relationship between energy consumption and carbon dioxide emissions has become one of the major problems that our country needs to overcome urgently. Optimize the consumption structure and release the carbon emission potential of the consumption structure. This plays an important role in promoting energy conservation and emission reduction goals and realizing the green transformation and improvement of the economy. The energy consumption structure of most industries is the effect of emission reduction, but the power of emission reduction is insufficient. With the gradual intensification of the resource crisis, breakthroughs have been made to optimize the consumption structure and innovatively change the way of energy utilization.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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