

# *Influencing Factors of my Country's Energy Efficiency Trend Based on Data Analysis and Calculation*

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**Abstract:** Computational thinking occupies the core position in the core literacy of information technology. As the core element of core literacy, computational thinking requires the ability to analyze and solve problems independently and generate innovative thinking. In the information age, it is important for the improvement of human beings and society. The heaviest. The purpose of this paper is to analyze the influencing factors of my country's energy efficiency trends based on data analysis and calculation, and to clarify and analyze the overview of energy efficiency and its influencing factors. Using data analysis and calculation, the data of my country's energy price index from 2000 to 2020, the total energy consumption of the country, and the energy structure of some provinces that meet the standards are investigated and analyzed. Therefore, the research in this paper not only has strong theoretical significance, but also has strong practical significance.

## **1. Introduction**

Without energy, human beings will be unsustainable and the country's economic improvement will stagnate. According to the latest news released by the International Energy Agency, the total amount of energy used by my country in 2018 has surpassed that of the United States, becoming the world's largest energy consumer. Environmental energy efficiency is a more comprehensive and objective indicator for evaluating economic improvement [1]. The traditional economic growth model of my country's industry is purely pursuing economic growth and ignoring environmental effects, which has caused serious damage to our country's resources and environment. Under the increasing pressure of resource constraints, energy saving and consumption reduction are gradually put on the agenda. All regions of our country must unite and work together to achieve the lower stage goal.

Social economy and energy efficiency affect each other and restrict each other. In order to improve and grow a country, the key is to ensure the improvement of energy efficiency. One of the

most important and urgent solutions Jans L needs to tackle global climate change is the transition to a safer, more sustainable and more sustainable energy system. This change is often seen as a technical challenge, as it involves the integration of renewable energy, trends in renewable energy, and increased demand sharing. However, customer engagement conversion is critical to your success. For example, switching to sustainable energy may require consumers to adopt sustainable energy, technology and energy efficiency measures and change their direct and indirect energy use behaviors to terminate and alter (renew) energy supplies. However, these behaviors may not always be easily accepted by clients, as they can lead to personal sacrifice and anxiety, or require a change in attitude or infrastructure, which is understandable and costly. To ensure a sustainable future for all, it is important to understand what drives consumer behavior [2]. Duong MQ believes that solar energy is the primary guide for the improvement of renewable energy to solve the problems of energy shortage and environmental pollution. Advances in power electronics and semiconductor technology have helped reduce the cost of installing solar projects and the construction speed of many solar power plants around the world, especially in China and the United States. At the same time, with the emergence of large-scale solar power stations, solar power generation systems have also received great attention from small customers. The above system is seen as a cost-effective solution for loads that require access to the network and increase the power consumption of the user load. Installation of dog systems should always consider design power, cost, efficiency and return on capital. Roof systems improved in Vietnam for domestic commodities have a high potential for solar improvement. The acquired capabilities are quantified through simulation and testing methods, and systematic factors are proposed [3]. Energy issues have always been the concern of the world.

This paper studies the definition concept of energy efficiency, clarifies the single factor, the influencing factors of it, and puts forward relevant policies and suggestions. Through data analysis and calculation, the calculation of energy efficiency is used to investigate and analyze the data of my country's energy price index and total national energy consumption, the energy structure of some provinces that meet the standards, and the energy efficiency values and average rankings of some provinces that meet the standards.

## **2. Research on Energy Efficiency and Its Influencing Factors Analysis in China**

### **2.1. The Concept of Nouns**

#### **(1) Definition of Energy Efficiency**

The research of energy efficiency is a hot spot in the field of energy consumption and economic improvement. There is no unified definition of the concept of energy efficiency, but some scholars have pointed out that efficiency is the most effective way to reduce input resources under a certain technical level and output level. [4]. The World Energy Council's reduction in energy efficiency is defined as: reducing the energy input of the same energy service. From the point of view of physics, energy efficiency refers to the ratio between the role of energy in use and the actual energy consumption; from the point of view of economics, energy efficiency refers to the energy consumption of the service provided and the total energy consumption. The World Energy Council generally defines energy efficiency as providing more service output with less energy consumption input [5]. Research Status of Energy Efficiency Scholars' research on energy efficiency mainly focuses on the measurement analysis and influencing factor analysis of it [6].

Defining energy efficiency as the amount of energy contribution, especially in promoting the sustainable improvement of economy, society and environment, the meaning of it should be more comprehensive and systematic. environment and other goals [7]. The evaluation indicators of it

mainly include four categories: thermodynamic indicators, economic indicators, physical thermodynamic indicators, and economic thermodynamic indicators. Energy efficiency is divided into seven specific efficiency indicators, including macro efficiency, factor allocation efficiency, economic efficiency, value efficiency, physical efficiency, physical efficiency, and factor utilization efficiency, and introduces the measurement principles, calculation methods and application scope of each efficiency index. [8]. The calculation of energy efficiency must use the comparable price of GDP, so as to make the energy efficiency of different years comparable.

#### (2) Single Factor of Energy Efficiency

Single Factor Energy Efficiency (Energy Consumption Intensity) uses energy consumption intensity to represent energy efficiency, and through data analysis, it is found that since the first oil crisis, the increase in per capita income and energy prices and appropriate government intervention have continued in the United States energy consumption intensity played an important role in the descending process [9]. Using Diesel and Pull decomposition methods to decompose the energy consumption intensity of my country's manufacturing industry, it is found that the changes in economic structure lead to the reduction of energy efficiency, and the improvement of production efficiency has a very large contribution to the reduction of energy consumption intensity. By analyzing the energy consumption data of major industries in the United States, it is found that changes in the economic structure can significantly reduce the energy consumption intensity of the entire society, especially in the fields of commerce and industry [10]. The U.S. energy consumption intensity is decomposed from five perspectives: technological progress, labor-to-energy ratio, capital-to-energy ratio, technological catch-up, and output structure. The study finds that technological progress, output structure, and changes in capital accumulation are the major sources of energy consumption in the United States in the past three decades. The main reasons for the decline in consumption intensity, and the differences in time and space are more obvious in these five parts. Energy consumption intensity is decomposed into several aspects, such as changes in economic structure, changes in production levels, changes in efficiency, and changes in fuel sources. Changes in factors such as economic structure, efficiency, technology and environment will cause changes in energy consumption intensity, so energy consumption intensity is not suitable as an evaluation index of it [11]. Despite this, energy consumption intensity is still widely used in academia because it is simple to calculate, facilitates the comparison of different periods in the same economy, and more intuitively reflects the relationship between economic output and energy consumption.

## 2.2. Influencing Factors of It

Technological progress affects it through direct or indirect ways, and technological progress as an exogenous variable of energy efficiency is ultimately beneficial to the improvement of it [12]. When analyzing the data of China's industrial sector, it is found that energy prices and technological progress play a very important role in the improvement of it. In addition, industrial structure and ownership structure play an important role in the improvement of it. Through data analysis, it is found that rising energy prices, scientific and technological progress, and the reform of the property rights system and the transformation of industrial institutions are the main reasons for the improvement of China's energy efficiency and the reduction of energy consumption intensity [13]. The proportion of government fiscal expenditure in GDP has a significant negative effect on it, and the increase in the proportion of the tertiary industry contributes to the improvement of it and its influence is increasing year by year. It is found that energy technology innovation and energy price

elasticity play a key role in reducing the carbon intensity of the economy. At present, the academic community mainly analyzes the influencing factors of it from three levels: country or region, industry and enterprise, and building, and proves that industrial structure and technological progress are the key factors to improve it through empirical evidence. In addition, through the super-efficiency DEA method The proportion of my country's tertiary industry is analyzed. Taking China's data as a sample, the analysis shows that there is a close relationship between the upgrading of industrial structure and the improvement of it. In addition, compared with the provinces whose industrial structure adjustment is in the early stage and the economy starts later, the change of industrial structure can be more effective. Significantly improve it of provinces with better economic foundations [15].

### 2.3. Policies and Recommendations

On the whole, my country's energy is on the rise as a whole, and we can promote the improvement of efficiency through a series of measures. In cooperation to improve energy, the spatial correlation between provinces should be fully considered. my country should properly adjust macroeconomic policies and reduce investment in fixed assets [15]. A lot of investment in knowledge-intensive industries that save energy, such as electronic computers, electronic appliances, software, systems engineering, communication equipment, CNC machine tools, atomic energy, industrial robots, etc. The Chinese government should formulate a sound energy legal system and strictly implement it [16]. Environmental protection must be driven by the government, as it is an area where market mechanisms fail.

(1) The government sets standards and laws and regulations.

The first thing the government should do is to formulate environmental protection standards and laws and regulations, and at the same time formulate incentive measures such as taxation and finance, and improve market-oriented means [17]. At present, the legal cost in most areas of our country is seriously lower than the cost of pollution control, which causes some enterprises to pay fines rather than control pollution and improve efficiency from the perspective of cost. Therefore, not only should there be sound laws, but also the legal cost is higher than the cost of pollution control. Only in this way can enterprises consciously improve efficiency, strengthen environmental protection, and achieve the pollution control model of "improvement and control at the same time". my country should actively expand energy imports and actively improve renewable energy and new energy. Therefore, my country should actively expand the import of energy, especially the import of oil and clean energy. Electricity imports can not only meet people's daily electricity needs, but also reduce my country's over-investment in the power industry and energy industry, thereby easing the trend of "heavy-duty" economy in my country. Compared with traditional one-time energy, renewable energy, such as wind energy, solar energy, is renewable. In addition, there is to strengthen the improvement of new energy such as nuclear energy.

(2) Raise the threshold for foreign investment to avoid the "environmental pollution hypothesis".

At present, many cities will actively attract investment and actively introduce foreign capital, hoping to digest the surplus labor in the city through foreign capital and realize local economic growth. However, some local governments even introduced foreign capital at all costs, but did not conduct high-standard examination and approval for the introduction of funds. These foreign capitals often have low technical content, high consumption and serious pollution. Such an approach seriously hinders the improvement of China's energy [18]. Therefore, China should firstly raise the threshold for foreign investment, improve the level of foreign investment, and strictly

control the entry of foreign capital into industries with high energy consumption and high pollution. Optimize the structure of foreign investment through relevant policies, and at the same time do a good job in environmental protection and supervision, and improve the level of energy.

(3) Improve the level of science and technology and promote technological progress.

Technological progress is the main reason for China's improvement. Therefore, to improve efficiency in the future, we must implement an innovation-led improvement strategy. Put the focus of improvement on technological innovation, implement industry-university-research work, form a "combined force" for innovation-driven improvement at the regional, enterprise, and school levels, formulate corresponding talent introduction policies, increase the construction of scientific and technological talent echelons in various regions, and encourage science and technology. Innovation. Establish high-tech improvement zones to improve high-tech industries and new energy industries.

(4) Liberalize regional administrative control to achieve coordinated improvement.

There is a big gap in energy efficiency. Efforts to narrow the difference in energy between cities and promote coordinated regional improvement will be the best choice for green innovation and sustainable improvement. In order to achieve the goal of green and sustainable coordinated improvement faster and better, it is necessary to gradually release the administrative controls of various local governments, promote the transfer of energy industries and the rapid flow of factors between cities and provinces, and improve the price distortion in the factor market. Happening. Finally, in order to prevent the upstream pollution from being transmitted to the downstream, the relevant departments should also issue relevant policies for the coordinated management of river basin pollution, so as to achieve common governance and common improvement.

### 3. Investigation and Research on the Change Trend of Energy Efficiency Based on Data Analysis and Calculation

#### 3.1. Data Analysis and Calculation

Use China's data over the years to analyze and calculate the trend of our energy efficiency. Through the calculation method of energy efficiency, the data of my country's energy price index from 2000 to 2020, the total energy consumption of the country, the energy structure of some provinces that meet the standard, the value of some provinces that meet the standard and their average ranking are analyzed.

#### 3.2. Calculation of Energy Efficiency

Energy efficiency refers to the ratio of energy input to output. It is relatively simple to use single factor, that is, to calculate the ratio of energy input to economy without considering other production factors. The energy input includes coal, oil and natural gas, which are converted into the sum of standard coal. Among them,  $EE_{it}$  represents the efficiency of the i-th province in the t-th year, and represents the energy invested in the i-th province in the t-th year converted to the sum of standard coal.  $TE_{it}$  represents the total input of coal, oil and natural gas, and represents the coefficient when these three energy sources are converted into standard coal. The specific formula is as follows:

$$EE_{it} = \frac{GDP_{it}}{TE_{it}} \quad (1)$$

$$TE_{it} = \sum_{j=1}^3 E_j \delta_j \quad (2)$$

#### 4. Analysis and Research on the Change Trend of the Country's Energy Efficiency Based on Data Analysis and Calculation

We consider the following factors affecting energy efficiency: energy price and energy consumption structure. Theoretical analysis of the specific relationship between various factors and efficiency is as follows: Energy price At present, the Chinese government implements an administrative examination and approval system for price adjustment, and achieves price stability by subsidizing energy enterprises, which has a certain effect on improving the allocation efficiency of energy elements. It also has a very negative impact on the innovation of energy technology. Changes in prices have a certain impact on efficiency. The rise in prices will promote enterprises to reduce the input of factors to reduce costs, and use more advanced production technology to reduce the demand for the same output, thereby improving efficiency. From 2000 to 2002, the price index remained basically unchanged. Since 2002, the price index has increased year by year. The main reason is that since 2002, my country's energy demand has been on the rise year by year. When the demand is greater than the supply, prices are rising steadily. The change trend of my country's price index and total national consumption from 2000 to 2020 is shown in Table 1 and Figure 1:

*Table 1. The change trend table of China's energy price index and the total national energy consumption from 2000 to 2020*

Year	China's total energy consumption	Annual energy price index
2000	1.3	160000
2005	1.4	270000
2010	1.7	380000
2015	1.9	450000
2020	2.0	550000

The ratio of coal consumption to total energy consumption is used as a proxy variable for the consumption structure. There are great differences in the possession of various resources in each province of our country, so there must be differences in the consumption structure of each province in our country. However, in the consumption structure of various provinces, coal has always been the dominant one. The utilization efficiency of coal is far lower than that of oil and natural gas. The consumption structure dominated by coal has caused serious environmental pollution. Studies have shown that the proportion of coal consumption in total consumption has a negative effect on the improvement. Table 2 and Figure 2 show the trend of energy structure changes in some provinces that meet the standards:

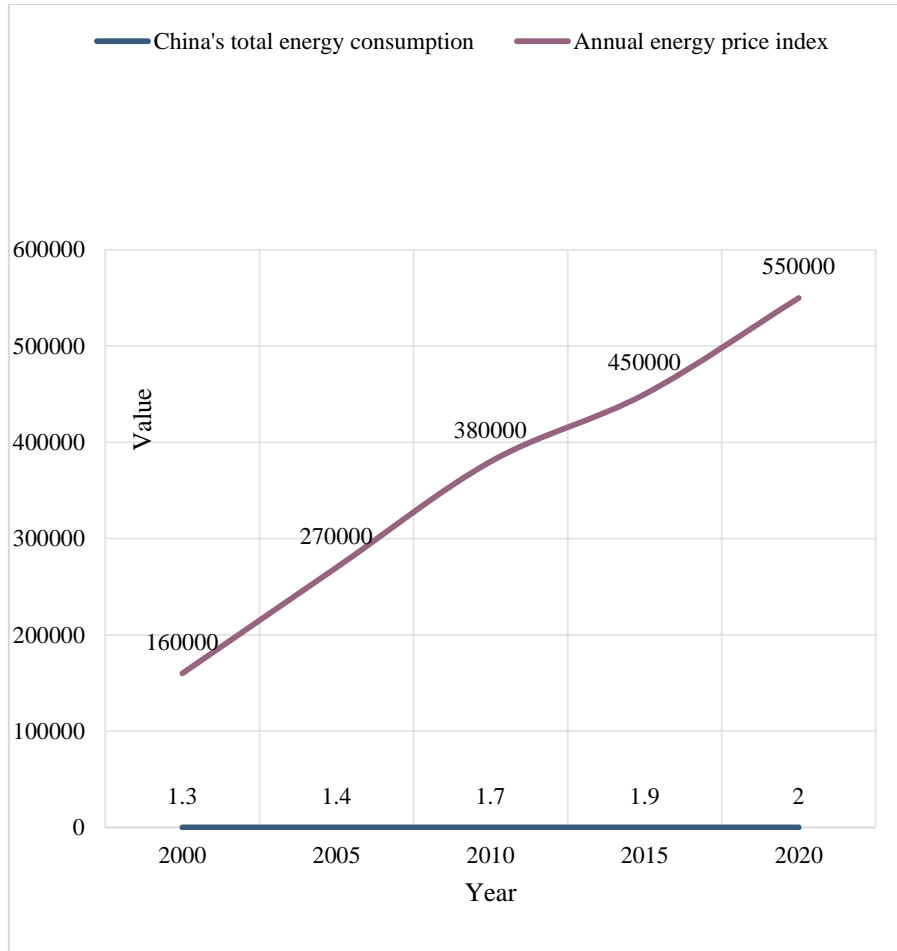


Figure 1. Comparison trend of energy price index and national total energy consumption

Table 2. Trend table of the changes of the energy structure of some qualified provinces

Year	Beijing	Shanghai	Shanxi
2000	0.91	0.71	1.75
2005	0.90	0.54	1.63
2010	0.99	0.43	1.44
2015	0.97	0.40	1.37
2020	0.97	0.38	1.24

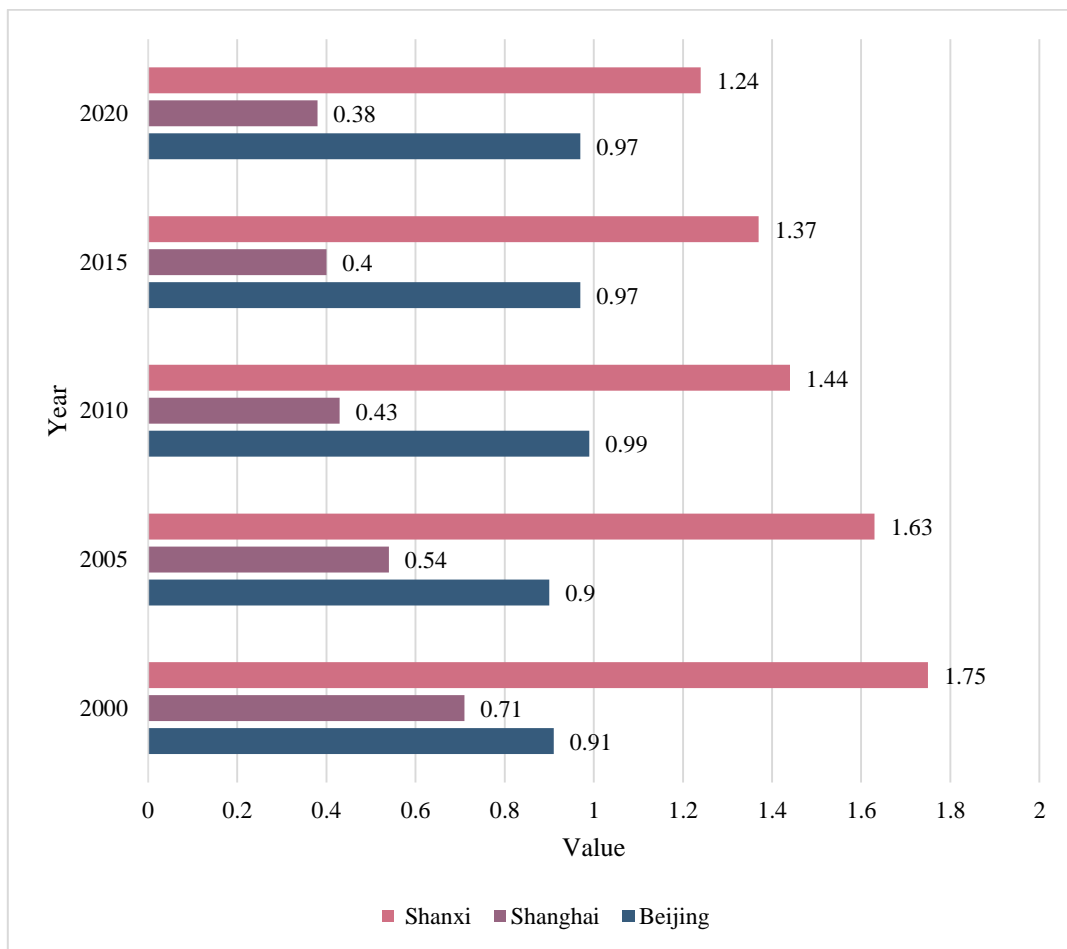


Figure 2. Comparison chart of the energy structure change trends in some qualified provinces

The results show that the proportion of coal in energy consumption represented by Beijing, Shanghai and Shanxi has decreased year by year, while other regions have remained basically unchanged except for a small range of fluctuations.

The energy efficiency values and average rankings of some of the standard provinces in my country in 2000, 2010 and 2020 are shown in Table 3:

Table 3. Energy efficiency and Ranking of some qualified provinces

Year	Beijing	Shanghai	Shanxi
2000	0.56	0.24	0.48
2010	0.99	0.41	0.96
2020	1.67	0.69	1.54
Average rank	5	3	32

Government Intervention my country is a country with public ownership as the main body and multiple ownerships coexisting. The main basis of public ownership makes the state participate excessively in economic activities, and even controls the allocation of most resources. As a result, the allocation of resources does not operate according to the market model, so that the Pareto



optimal state cannot be achieved, which is not conducive to the improvement of my country's energy efficiency. In the analysis of macroeconomics, it is believed that the more market-oriented the economic policy of a country or region is, the higher the market opening degree of the country or region will be, which will also promote the sustainable improvement of it. This conclusion applies especially in improving countries. Appropriate government policy guidance can promote the improvement of energy efficiency in the early stage of energy economic improvement, but excessive intervention will reduce the efficiency. The improvement of energy economy should be integrated into the process of social and economic improvement, and through the "invisible hand" to achieve the optimization of the state of resource allocation. Research shows that the less government intervention and the higher the degree of marketization, the faster it will improve; the higher the degree of fiscal decentralization, the higher the efficiency.

## 5. Conclusion

The energy efficiency of some representative provinces in China studied in this paper generally has a positive correlation between years, and it should be considered when formulating provincial energy policies. The energy consumption structure dominated by coal has a negative impact on the improvement of it. Based on the consideration of simplicity of calculation, it used is single factor, which exaggerates the actual energy, which is a shortcoming of this paper. For further research, it is recommended to use total factor of it. The results are relatively better.

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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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