Promote Carbon Peaking and Carbon Neutrality with The Concept of Global Warming and Carbon Emission Reduction

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Abstract. To achieve peak carbon neutrality, the authors propose an approach based on the concept of global warming carbon reduction. Based on the concepts of "existing carbon economy" and "low-carbon city", the author summarizes the research on low-carbon evaluation indicators at home and abroad and selects the Hierarchical Process (AHP) as an example. This has been proven by many studies. From 2013 to 2020, calculate and evaluate the low-carbon development level of Province A, and analyze the low-carbon development level of 11 provincial-level cities. Display: From 2013 to 2020, the low-carbon development index of cities in province A showed an upward trend. In 2020, the province's urbanization carbon development index reached 0.899, an increase of 41.2% over 2019 and five times that of 2020. Among them, the ecological environment index and low-carbon development index increased by 49 and 15 times respectively in the past six years, while the economic development index and social development index only increased by 5 times and 2 times respectively, it proves that while maintaining the steady growth of the social economy, province A is actively promoting the process of urban low-carbon development and has achieved table-top results. Blockchain technology can empower the digital transformation of traditional industries, optimize business processes, reduce operating costs, improve collaborative efficiency, provide a regulatory environment for carbon peaking and carbon neutrality, build a credible and efficient carbon trading platform and market, and help carbon It is of great significance to achieve the goals of neutralization and carbon peaking and the green and high-quality development of my country's economy and society.

Keywords: Global warming; carbon neutrality; blockchain.

1. Introduction

China is the world's largest developing country and one of the world's largest emitters of carbon dioxide and other greenhouse gases. It plays a pivotal role in the global response to climate change. my country proposes to strive to reach the carbon peak by 2030 and strive to achieve carbon neutrality by 2060. This is not only a solemn commitment to the world to actively address global climate change, but also a major decision concerning the well-being of the 1.4 billion Chinese people and the sustainable development of the Chinese nation. In this regard, from the strategic perspective of coordinating the international and domestic overall situation and taking into account both short-term and medium-term and long-term interests, we should deeply understand the inevitability and importance of achieving carbon peaking and carbon neutrality step by step in the process of accelerating the process of building a modern socialist country. and urgency, with a firmer belief, a more conscious attitude, a more scientific spirit, and a more active measure, perseverance and long-term efforts, and write a good job of promoting green development, realizing the "dual carbon" goal, and addressing climate change. article [2].

In October 2021, the State Council issued the Action Plan for Carbon Peaking by 2030, which proposed principles, goals, tasks and action guidelines for achieving the carbon peaking goal by 2030. However, my country still faces a large number of problems and severe challenges to achieve carbon peaking and carbon neutrality [3]. As a new generation of information technology, blockchain has the characteristics of decentralization, non-tampering, openness and transparency, transaction traceability, cost saving, etc., and is widely used in finance, industrial Internet of things, government and other industries. In this context, this paper analyzes the problems and challenges faced by my country in achieving carbon neutrality and carbon neutrality, and explores the application of blockchain technology in the field of carbon neutrality and carbon peaking. It is of great significance to realize and assist the green, low-carbon and high-quality development of my country's economy and society [4].

Digital technology is a science and technology that is accompanied by computers. Its essence is to improve the efficiency of resource allocation in the whole society, so it can be used in many industries. For example, the energy industry, although climate change threatens human survival and development, and the energy industry is also a highly polluting industry, in fact, human demand for energy is increasing. How to use energy efficiently has become an extremely important key, and digital technology is the core of solving the contradiction between the utilization of energy and mineral resources and the needs of production and life. With the rapid development of data communication technology, digital technology can promote the digital monitoring of the energy industry, accurate measurement and forecasting of emissions, and improve the efficiency of planning and implementation, thereby greatly improving the efficiency of energy use and reducing carbon emissions directly or indirectly in the energy industry. In addition, in the face of carbon peaking in 2030 and carbon neutrality in 2060, the proportion of new energy and fossil energy in total energy consumption will change from the current 15% to 85% to 85% to 15%), which will lead to Subversive changes in the energy industry, new business forms and new model changes led by digital technology will help to transform the concept of energy consumption, reconstruct the energy business model, and help my country achieve the goal of "dual carbon".

Based on the above, it is obvious that the industrial revolution based on the "dual carbon" goal and relying on high-tech digital technology is rapidly unfolding in China and even around the world. More and more industries are beginning to use 5G, big data, cloud computing, Internet of Things, artificial intelligence and other digital technologies to increase investment and use of clean and renewable energy, promote technological transformation of environmental protection and energy conservation, reduce carbon emissions to meet the challenges of climate change and ultimately achieve the goal of carbon neutrality. The medium and long-term historical opportunities contained in this are self-evident.

2. Carefully organize, implement comprehensive policies, and take multi-pronged measures to continuously promote the realization of the goal of carbon peaking and carbon neutrality

Carbon neutrality is an extensive, profound, and long-term economic and social system change that development must face and experience. In order to achieve carbon emission peaking in 2030 and carbon neutrality in 2060, it is necessary to mobilize the forces of the whole society, scientifically plan implementation measures, do a good job in high-level design, and organize scientific and technological innovation. Build a clean, low-carbon, safe and efficient energy system, and accelerate the construction of a resource-saving energy system, industrial structure, production methods, lifestyles, and space construction, which will protect the environment and move towards a new green and trough [5].

2.1 Adhere to systematic thinking to promote the implementation of various policies

These two major strategies and two historical processes are interrelated and complementary and have the inherent unity to realize the great cause of national rejuvenation. To achieve carbon neutrality, we must firmly adhere to systematic thinking, coordinate high-quality economic development, promote energy conservation and emission reduction, actively transform development methods, resolutely control the substantial increase in energy consumption and carbon emissions, and meet the requirements of the people. The need to improve the ecological environment. Effectively guarantee the national energy security and ensure that energy is used in the interests of economic development and people's livelihood improvement [6]. Seek truth from facts, adhere to scientific, orderly, and graded guidelines and step-by-step implementation, and avoid simple “movement-style” carbon reduction such as “one size fits all” [7].

2.2 Vigorously promote major green technology innovation

To achieve peak carbon neutrality, the key is to replace traditional technologies with green and low-carbon technologies. Technological innovation is the main driver for accelerating the green revolution. In recent years, the world's major economies have deployed green technology innovation and development strategies, promote green technology as a new growth pole, compete for the competitive advantage of the new round of industrial revolution [8]. China should take the promotion of "dual carbon" as an important opportunity, give full play to the dual advantages of the national system and the market mechanism, mobilize various resources, and mobilize the enthusiasm of all parties such as industry, academia, research and application, etc., comprehensive layout, accelerate the promotion of renewable energy, smart grid, hydrogen energy, energy storage, new materials, electric and hydrogen fuel vehicles, carbon capture, utilization and utilization, resource recycling links, etc. have low costs, high benefits, obvious emission reduction effects, and are safe and reliable, a series of major breakthroughs have been made in low-carbon, zero-carbon and negative-carbon technologies with promotion prospects, and they will be transformed into real productive forces as soon as possible to achieve industrialization [9].

2.3 Vigorously promote the green transformation of industrial structure

The industry, construction, and transportation sectors account for 70%, 20%, and 10% of terminal carbon emissions, respectively, accelerating the green transformation and upgrading in these fields is the top priority to achieve the "dual carbon" goal [10]. Optimize the transportation structure, increase the proportion of low-carbon transportation modes such as railways, water transportation, sea transportation, and aviation, and give priority to the development of green travel modes such as public transportation [11]. Develop clean and zero-emission vehicles such as electric and hydrogen fuel cells, and build hydrogen refueling stations, swap stations, and charging stations. Promote the transformation of China's industrial system from a "follower" to a "leader" in global industrial development, and form more Chinese-made and Chinese-created brands [12-15].

2.4 The implementation path of blockchain-enabled carbon peaking and carbon neutrality

Blockchain technology has the characteristics of non-tampering, openness and transparency, and transaction traceability. The application in supply chain management, trusted traceability and other scenarios can help carbon peaking and carbon neutrality to play a positive role.

Develop an action plan to guide the application of blockchain technology: The new generation of information technology such as blockchain has advantages in helping carbon peaking and carbon neutrality goals. Potential advantageous application scenarios in the realization of the goal, and carry out the special action of blockchain-enabled carbon peaking and carbon neutrality. Propose specific task requirements for the application of new-generation information technologies such as blockchain in carbon market supervision and management, including establishing an energy management system for energy-using enterprises based on blockchain, and using blockchain for energy measurement, energy consumption statistics and energy utilization Summary of the situation, etc.

Promote blockchain technology to empower the digital transformation of traditional industries: blockchain technology features high reliability, transaction traceability, cost savings, etc. It can effectively solve industry pain points in the fields of payment asset management, securities, settlement, user identification, etc. industry efficiency. Carry out "blockchain+" industrial low-carbon action and green manufacturing projects, promote the application of blockchain technology in traditional high-energy-consuming industries such as coal, chemical industry, and steel, accelerate the digitalization process of traditional industries, and promote industrial structure adjustment, transformation and upgrading, Improve the level of digitalization, networking, and intelligentization of enterprises[16].

3. Evaluation models and methods

3.1 Determination of indicator weights

According to the above index system framework, a hierarchical structure model is constructed, including a comb layer (A), 4 criterion layers (B1-B4) and 16 index layers (C1-C16), on this basis, a judgment matrix is constructed. The judgment matrix is used to express the relative importance between any two elements in the previous layer. The author adopts the method of pairwise comparison to judge the importance of the criteria layer and index layer indicators, and the scale is divided into 1-9. The number of final judgment matrices depends on the number of indicators in the target layer and the criterion layer, and there are 5 judgment matrices [17]. The weight data is obtained through the internal logical relationship method of the four criterion-level indicators. When determining the relative importance of indicators, the following rules are used; The economic level is the foundation of the development of the society, the protection of the ecological environment for the degree of social development, and the improvement of the ecological environment determines the level of low-carbon development. For the other four judgment matrices, the relative weight ranking of each index is determined with reference to the weight distribution method of existing research. The per capita disposable income and per capita GDP of urban residents in the B1 matrix are both indicators reflecting the income status of residents, but from different angles, so they are of equal importance to economic development [18].

On the basis of constructing the judgment matrix, the eigenvectors of the indicators (C1-C16) under the criterion layer B are obtained by normalization, denote the vector $W = (w1, w2, ..., wn)T$, and each component wi is the weight value of each criterion or index. In addition, a consistency check must be carried out to judge the logical rationality of the weights. Through the characteristic equation $\lambda_{\max W}$, the maximum eigenvalue $\lambda_{\max}$ of each judgment matrix is solved, and the consistency index is calculated as follows:

$$CI = \frac{\lambda_{\max} - n}{n-1} \quad (1)$$

Determine the average random consistency index RI by looking up Table 1 and calculate the consistency ratio:

$$CR = \frac{CI}{RI} \quad (2)$$

Table 1. Average random consistency index Table

Order	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

If CR<0.1, it indicates that the judgment matrix is acceptable and consistent, at this time, the weight vector of the matrix is the normalized eigenvector corresponding to the largest eigenvalue $\lambda_{\max}$; If CR>0.1, the matrix A needs to be adjusted until the consistent results are obtained. All weight index values, and consistency tests were calculated using the Analytic Hierarchy Process (AHP) software YaaHP 6.0 [19].

According to the index system designed in this study, the judgment matrix of each level is as follows:

Judgment Matrix A:

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ \frac{1}{2} & 1 & 2 & 3 \\ \frac{1}{3} & \frac{1}{2} & 1 & 2 \\ \frac{1}{4} & \frac{1}{3} & \frac{1}{2} & 1 \end{pmatrix} \tag{3}$$

Judgment matrix B1-B4:

$$\begin{pmatrix} 1 & 1 & 2 & 3 \\ 1 & 1 & 2 & 3 \\ \frac{1}{2} & \frac{1}{2} & 1 & 2 \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{2} & 1 \end{pmatrix} \begin{pmatrix} 1 & \frac{1}{2} & 2 & 3 \\ 2 & 1 & 3 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{3} & 1 & \frac{1}{1} \\ 3 & 2 & 4 & 1 \end{pmatrix} \begin{pmatrix} 1 & 3 & 4 & 2 \\ \frac{1}{3} & 1 & 2 & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{2} & 1 & \frac{1}{3} \\ \frac{1}{2} & 2 & 3 & 1 \end{pmatrix} \begin{pmatrix} 1 & 3 & 4 & 2 \\ \frac{1}{3} & 1 & 2 & \frac{1}{2} \\ \frac{1}{4} & \frac{1}{2} & 1 & \frac{1}{3} \\ \frac{1}{2} & 2 & 3 & 1 \end{pmatrix} \tag{4}$$

3.2 Standardization of evaluation indicators

Since different evaluation index values have different dimensions, and the index values vary greatly, it is necessary to standardize each index, and the author adopts the normalization method. Among the 16 indicators in the indicator layer, the larger the value, the higher the level of low-carbon development of the city, which is a positive indicator, and vice versa. The calculation method of the normalization of the positive index (Z positive) is:

$$Z_{\text{front}} = \frac{C_i - C_{\min}}{C_{\max} - C_{\min}} \tag{5}$$

Among them, C is the actual value of each indicator (i is the 16 indicators C1-C16), $C_{\max}$ is the maximum value of this indicator in the evaluated objects (such as different years or different cities in province A).

For the inverse indicator (Z inverse), the calculation method is:

$$Z_{\text{reverse}} = 1 - Z_{\text{front}} \tag{6}$$

3.3 Comprehensive value of urban low-carbon development index

Based on the standardized values of the evaluation indicators at each layer and the corresponding extreme weight of the indicators, the simple linear weighting method is used to evaluate the low-carbon development level of the city, that is, each index of the indicator layer is calculated separately, then, the criterion layer index is calculated by weighting the index layer index, and finally the comprehensive index (Low Carbon index, LDI) of the target layer is calculated by weighting[20]. Compare and evaluate the urban low-carbon development levels of province A from 2013 to 2020 and 11 prefectures and cities in province A in 2020. The specific calculation formula is as follows:

$$LDI = \sum_{i=1}^{n} W_i \left(\sum_{j=1}^{m} W_{ij} Z_{ij} \right) \tag{7}$$

Among them, n is the number of criterion layer indices (n=1, 2, 3, 4), and m is the number of index layer indices (m=1, 2, ..., 16). Wij is the weight of the i-th index of the criterion layer in the composite index, and $\sum_{i=1}^{n} W_i = 1$; Zij is the normalized value of the jth indicator in the indicator layer. Wij is the weight of the jth indicator in the indicator layer, and $\sum_{j=1}^{n} W_j = 1$.

3.4 How digital technologies can contribute to the twin carbon goals

As for how to make good use of digital technology? The system summarizes 3 paths for digital technology to change business models, namely automation and digital enhancement, digital expansion and digital transformation. Among them, automation and digital enhancement refers to the use of digital technology to enhance the existing operation mode; digital expansion refers to the use of digital technology to support new business processes and then change the original operation mode. These new business processes supplement existing activities and processes; digital transformation Refers to the use of digital technology to develop new operating modes of enterprises. Specifically, it is mainly reflected in the following levels and approaches:

There are currently two mainstream carbon emission quantification methods: the nuclear method and the CEMS method. However, no matter which method is used, it is inseparable from the application of digital technology. The nuclear method uses data such as emission factors, raw materials and fuel usage, and uses data such as carbon balance theory to calculate the direct and indirect emission data of carbon dioxide through cloud computing on a big data platform: CEMS method is called online monitoring system (Continuous Emission Moni toring System).), through the installation of digital capture systems on production and sewage equipment, etc., to build carbon emission measurement models and report data in real time. Compared with the two, the CEMS method has less human interference and a higher degree of digitization. At present, my country's carbon monitoring is also changing to the CEMS method, and in the future, with the improvement of digital technology, the quantification of carbon emissions will be more accurate.

4. Empirical Analysis

From 2013 to 2020, the low-carbon development index of cities in Province A showed an upward trend. In 2020, the province's urban low-carbon development index was 0.899, an increase of 41.2% over 2019 and five times that of 2013 (Figure 1). Although the economic development index and social development index only increased by 5 times and 2 times, respectively, the ecological environment index and low-carbon development index increased by 49 and 15 times respectively during the Wei years, indicating that while maintaining stable social and economic growth in province A, actively promote the low-carbon development of cities and achieve remarkable results [21]. Due to the higher weights, the economic development index and social development index have a greater contribution to the composite index. In 2020, the contribution rates of the economic development index and social development index to the composite index are 49% and 23%, respectively, while the contribution rates of the ecological environment index and low-carbon development index are only 19% and 9% (Figure 1). However, between 2013 and 2020, the contribution rates of the economic development index and the Kuanghui development index decreased by 7% and 44%, respectively, while the contribution rates of the ecological environment index and the low-carbon development index increased by 10 times and 3 times, respectively, over the past six years, urban development has shown a trend of low carbonization.

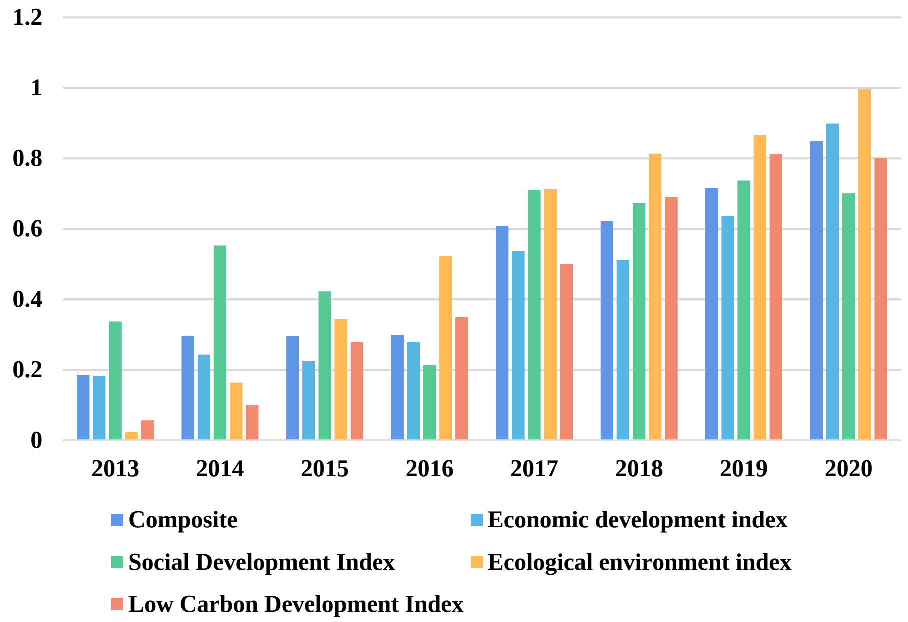

Figure 1. 2013-2020 Cities Low-Carbon Development Index in Province A (self-painted)

The growth rate of per capita GDP in Province A continued to rise from 2013 to 2020, at the same time, it is accompanied by a simultaneous increase in the disposable income of urban residents (Figure 2). The report shows that during the "Eleventh Five-Year Plan" period, the economic situation and the people's material living standards in Province A have been greatly improved [22]. At the same time, the rate of increase in the consumer price index remained relatively stable, and in 2017, it decreased by 1.5% compared with 2016, this shows that in general, rising prices have less negative impact on the actual living expenses of urban residents. However, the proportion of urban fixed asset investment in GDP decreased slightly, and there was a certain gap with the larger increase in per capita GDP.

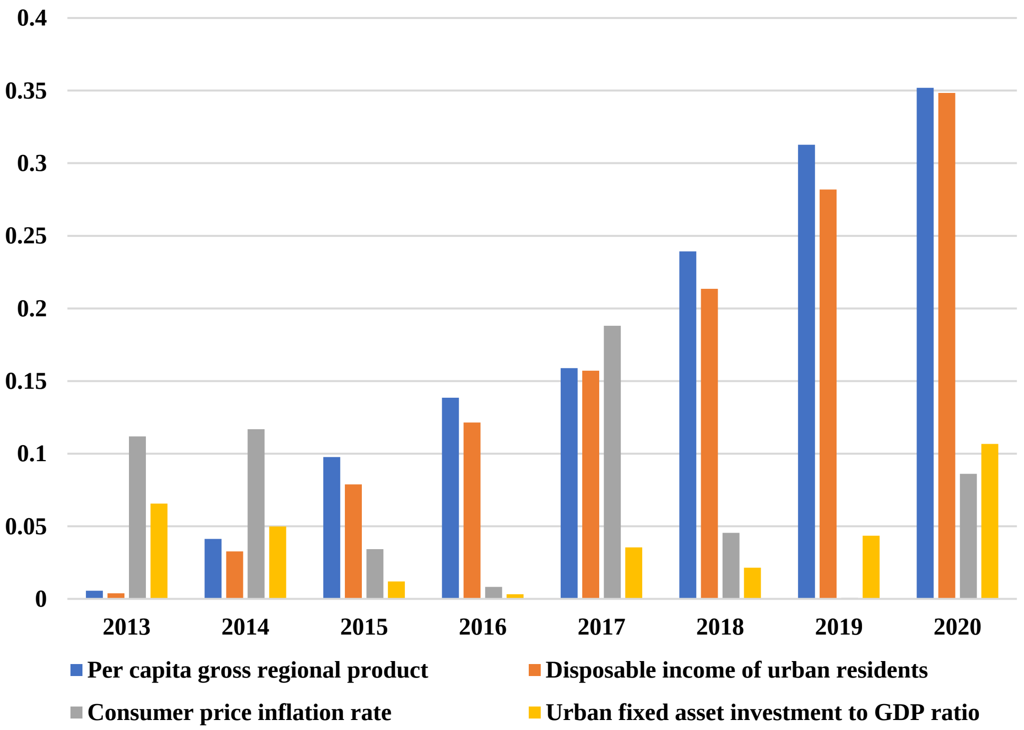

Figure 2. Economic Development Index of Province A from 2013 to 2020 (self-painted)

During the "Eleventh Five-Year Plan" period in Province A, the basic pension coverage rate increased by a large margin, indicating that the government began to pay attention to people's livelihood while developing the economy. Unemployment has still partially improved despite an increase in the non-agricultural population, falling from 3.7% in 2013 to 3.01% in 2020. The Engel coefficient of urban residents rose from 33.8% in 2013 to 36.4% in 2016, and then fell back to 35.1% in 2020, as a result, there are large fluctuations in the social development index (Figure 3). This is since this indicator has a large weight in the social development index (0.467), and on the other hand, it also shows the impact of price fluctuations in the process of rapid economic development on food consumption expenditures [23, 24].

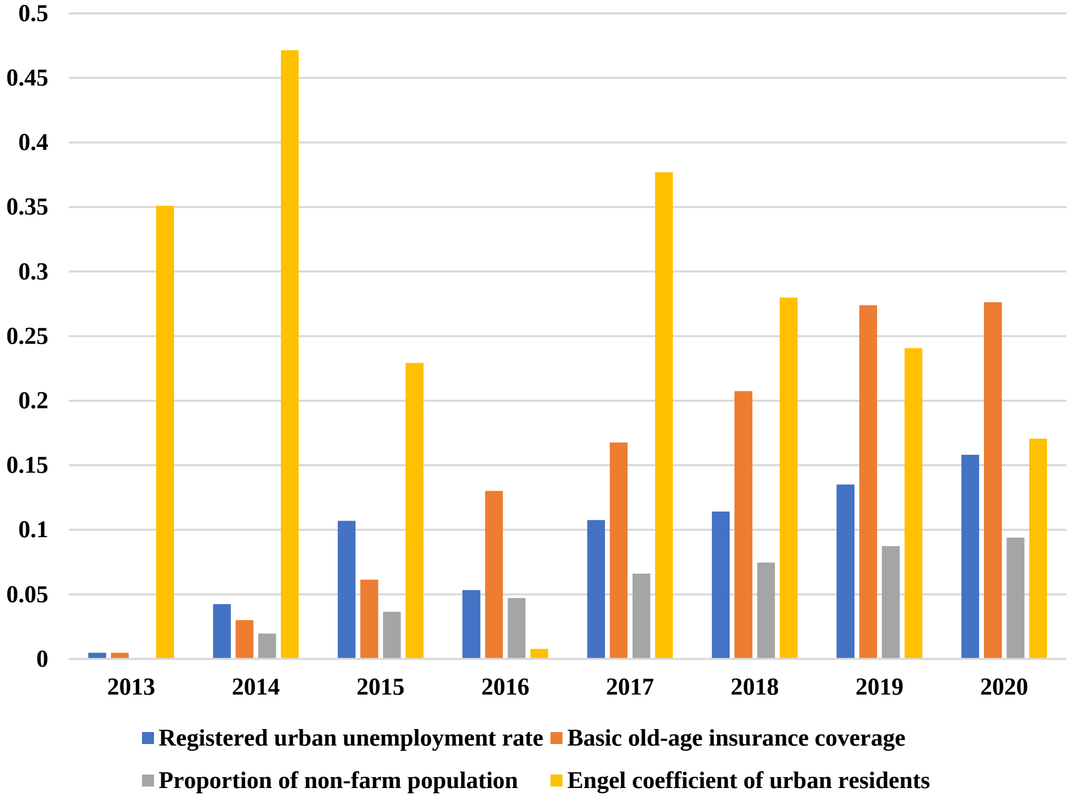

Figure 3. Social Development Index of Province A from 2013 to 2020 (self-painted)

5. Conclusion

Form and improve a financial investment system for green and low-carbon development, increase public capital support, leverage, allow social capital to participate in green investment, and set up investment funds for related industries. Establish and improve the green financial system, create monetary policy tools to reduce carbon emissions, supplement and improve the catalogue of green bond projects and green industry guidelines, support financial institutions to issue green bonds, and update green financial products and services. Analytical Hierarchy Process (AHP) measures and evaluates the low-carbon development level of Province A from 2013 to 2020, which has been proven by many studies. The first-tier cities were analyzed. The test results show that from 2013 to 2020, the low-carbon development index of cities in province A has increased, and there are significant differences in the level of low-carbon development among cities. The characteristics of blockchain technology that cannot be tampered with, such as open, transparent transactions and traceability, make it play an active role in enabling carbon peaking and carbon neutrality, and can provide visual, credible and reliable supervision for carbon peaking and carbon neutrality. Environment, build a credible and efficient carbon trading platform and market, and help achieve the goal of carbon peaking and carbon neutrality. Future policies should pay more attention to formulating mid- and long-term plans for urban low-carbon development, adjust industrial structure and energy structure, improve people's living standards and environmental quality, and take a low-carbon and low-carbon pace. Local and other development tools and approaches for managing low-carbon urban and rural development.

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