

# *Research on Green Development of Coal Industry*

## *——Taking Yongcheng City as an Example*

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**Abstract:** This paper takes Yongcheng as an example to study the green development of the coal industry. Yongcheng is a typical resource-based city and has abundant coal resources. It is one of the six largest anthracite coal bases in China. The paper is divided into six parts. The first part analyzes the importance of the development of the green coal industry in Yongcheng. The second part first defines the coal industry, and then elaborates on the definition and methods of the green development of the coal industry. The third part analyzes the distribution of coal resources in Yongcheng and the status quo of coal industry development. The fourth part analyzes in detail the problems in the development of the Yongcheng coal industry. The fifth part proposes an effective mode for the development of the coal industry in Yongcheng. The sixth part proposes corresponding solutions to the problems. The above analysis results show that there are three main problems in the implementation of green development in the Yongcheng coal industry. There are four proposed feasibility suggestions, namely the establishment of an eco-industrial park, the establishment of a coal university, the establishment of a coal green economy museum and the rational planning of a mining area. The results of this study have provided certain practical guidance for the green development of “coal resource-based cities”.

## **1. Introduction**

In 2015, China proposed to realize the development goals during the “13th Five-Year Plan” period, and it must effectively implement the five development concepts of innovation, coordination, green, openness, and sharing. In order to achieve green development, we must adhere to the basic national policy of resource conservation and environmental protection, adhere to sustainable development, and accelerate the building of a resource-saving, environment-friendly society. At the present, coal enterprises have problems such as low concentration and disorderly competition, which will not only affect the scale and efficiency of coal companies, but also cause waste of resources, thus hindering the sustainable development of the coal industry. At present, the main source of pollutant emissions in China is the exploitation and utilization of coal and related resources. Therefore, it is an inevitable choice for the coal industry to take the road of green development.

Coal is one of China's main energy consumables, which account for about 65% of China's total energy consumption. Therefore, the coal industry occupies an important position in our national economy. However, the coal industry is also one of the major departments of resource waste and environmental pollution in China<sup>[1]</sup>. Taking year of 2016 as an example, its energy consumption is about 4.36 billion tons of standard coal, of which coal consumption accounts for about 62% of total energy consumption. The discharge amount of major pollutants in waste gas was 35.06 million tons. The above data shows that the coal industry in China is still under the development mode of high energy consumption and high pollution, and it is urgent to take the road of green development.

In Yongcheng, the coal industry is a pillar industry. Coal resources have made tremendous contributions to Yongcheng's national economy and social development. However, the unreasonable development mode of the coal industry has also brought some problems that cannot be ignored. First, due to the unreasonable exploitation of coal resources and the lack of mining technology, Yongcheng's coal resources cause excessive waste of resources and land collapse in large areas, which make people relocate collectively. For example, in a village of Chen Da Zhuang, Miaoqiao Township, most houses have cracks and land collapsed, so villagers have to move as a whole. Second, environmental pollution is increasingly serious and seriously threatens people's health. Third, due to the irrational and inaccurate exploitation of the coal resource, large amounts of arable land are occupied, and large areas of food resources and arable land resources are wasted. Fourth, a single product structure leads to lower value-added coal products, which seriously reduces the economic benefits of coal companies. The current unsustainable development mode of the coal industry has made the contradiction between population, resources and the environment intensify. The modern economy seeks green development. Our needs for the economy cannot be sacrificed at the expense of the needs of future generations<sup>[2]</sup>. It is necessary for the coal industry to take the road of green development.

Through the analysis of the problems in the green development of the coal industry in Yongcheng City, we can find some solutions from the perspective of problems. Optimizing the allocation and utilization of coal resources, optimizing industrial layout and industrial structure, slowing down the process of intensifying the contradiction between energy and the environment, and reducing the rate of resource waste. This is not only the requirement for the country to develop a green economy, but also the local market conditions in Yongcheng, in line with the scientific concept of development. Concept.

## **2. Definition of Coal Industry and Related Theories of Green Development**

### **2.1 Definition of Coal Industry**

In a broad sense, industries include all walks of life in the national economy. Coal resources are non-renewable resources, and coal industry is a growth industry. The coal industry includes not only the production of coal resources, but also the organizational relations among departments, economic and technological links, structural evolution, and provision of services for production and operation; according to the definition of industry, the coal industry refers to all kinds of mining, processing, or provision of coal products, the production and management group composed of the departments of circulation means, service labor, etc.<sup>[3]</sup>.

### **2.2 Related Theory of Green Development**

The green economy emphasizes people-centeredness and takes the development of the economy and the overall improvement of people's livelihood and welfare as the core. It is an economic form

that uses the energy and resources as a means to protect the human living environment as a goal <sup>[4]</sup>. Green development, that is, vigorously establishing ecological civilization construction, is essentially similar to the concept of recycling low carbon and scientific development. The so-called “green” refers to energy conservation, environmental protection, recycling, low-carbon, high-efficiency, and sustainability. It is a new concept of values, development, and people's livelihood, which means a new transformation of production and lifestyle <sup>[5]</sup>.

The coal resources are non-renewable, and the mature period is most conducive to the green transformation of the coal industry. Once its development cycle enters a recession period, it will greatly restrict the transformation capability and transformation speed of the coal industry <sup>[6]</sup>. The green development of the coal industry is mainly from the perspective of energy conservation, emission reduction and pollution control. To develop the green industry as the goal, highlight the concept and connotation of green development. Taking the scientific concept of development as the principle, optimizing the coal industry development model as the core of development, taking cleanliness, safety, and efficiency as the production targets, focusing on improving the recovery and utilization of coal resources, vigorously promoting the clean use of coal, reducing environmental pollution, and promoting coal Sustainable industry development <sup>[7]</sup>.

There are three major ways for the coal industry to achieve green development. One of the first methods is to vigorously promote the construction of green mines and support the coal industry in implementing green production safety measures. Increase the utilization rate and recovery rate of coal resources as much as possible so that resources can be saved from the source and pollution can be reduced. The second is to vigorously promote the clean and efficient use of coal resources, continuously optimize the structure of the coal industry, and slow the intensification of the contradictions between the ecological environment and economic development. Finally, it is reasonable to extend the industrial chain, realize the conversion of turning waste into treasure, convert some or all of the waste into available resources, and can be recycled by the economic system to reduce the damage to the natural environment. Finally, the three-win situation of economic benefits, social benefits and environmental benefits is achieved <sup>[8]</sup>.

The integration of circular economy and low-carbon economy forms a green economy <sup>[9]</sup>. The development of the coal industry in Yongcheng City is based on the above theories, with the goal of improving the utilization of coal resources and the utilization of coal as the goal, and realizing the green development model of the coal industry.

### **3. Distribution of Coal Resources in Yongcheng and Status of Coal Industry**

#### **3.1 Distribution of Coal Resources in Yongcheng**

Yongcheng Mining Area is located in the eastern part of Henan Province, which also is the intersection of Jiangsu, Shandong, Henan, and Anhui provinces. It belongs to the county-level provincial direct management city in Henan Province, which is known as “the Pearl of Yudong”. There are 29 townships in Yongcheng City, with a total population of 1.57 million people and a total area of 2020 square kilometers. Yongcheng Mining Area is one of the six major anthracite coal bases in China.

Yongcheng is rich in mineral resources, underground coal storage area of nearly half, mining reserves of 5.045 billion tons, while the Yongcheng mining area also contains iron ore, china clay, iron, kaolin, marble, granite, quartz porphyry, cement ash There are 17 kinds of mineral resources such as rock, dolomite, mineral water and clay minerals. Yongcheng mineral distribution map shown in Fig.1:



Fig. 1 Distribution of Yongcheng Minerals

The coal of Yongcheng Mining Area is dominated by anthracite <sup>[10]</sup>, and the annual output of raw coal is 23 million tons. It is one of the six major anthracite coal bases in the country and is also an important coal chemical base in Henan, Shandong, Jiangsu, and Anhui. At the same time, it is also the National Development and Reform Commission. It is one of the seven largest coal chemical bases in the country. In recent years, the annual production of raw coal in Yongcheng Mining Area is shown in Table 1:

Table 1 Raw Coal Production in Yongcheng City and Henan Province (Unit: 10,000 tons)

Year	2011	2012	2013	2014	2015
Yongcheng city	2112.50	2028.67	1945.49	1813.10	1450.48
Henan Province	23200.00	14724.01	15330.28	13521.31	13544.10

### 3.2 Status Quo of Green Development of Yongcheng Coal Industry

(1) The development trend of the coal-dominated industrial chain is good.

Yongcheng Mining Area is one of the six largest anthracite coal bases in the country. In 2016, the total GDP of Yongcheng City reached 46.76 billion yuan, and the ratio of three industrial structures was 13.8:49.1:37.1, of which the total output value of the coal industry accounted for 52.41% of the total industrial output value. According to the "Statistical Communiqué of the Yongcheng City National Economic and Social Development Statistics 2016", the total coal production of the Yongcheng City in 2016 was 151.45 million tons, an increase of 4.4% year-on-year. Anthracite coal output was 3.45 million tons, a year-on-year decrease of 5.4%. The coal mining and washing industry achieved revenue of 5.994 billion yuan, a year-on-year increase of 9.1%. In 2010, the three industrial structure ratios were 14:63:23. It can be seen that although the proportion of the industrial sector has decreased compared to that in 2010, the industrial contribution to the city's economic growth has exceeded 50%, and it has developed into an industrial type. city. In the first quarter of 2017, the GDP of the Yongcheng region was 10.549 billion yuan, an increase of 9.2% year-on-year, of which the second industry completed an output value of 5.558 billion yuan, accounting for 52.7% of the regional GDP.

Currently, Yongcheng's major industrial sectors include coal mining and washing, and it owns two national top 500 companies, Shenhua Group and Yongmei Group. A group of companies

represented by the coal mining chemical base of Yongmei Group, Henan Shenhua Industrial Park, and Yudong Power Plant have taken root in Yongcheng City and gradually formed a large number of new industries such as power generation, electrolytic aluminum, coal chemical industry, and building materials, gradually replacing traditional industries. Coal industry enterprise. The coal industry has greatly increased the employment rate of Yongcheng people, and the number of people engaged in coal and related industries has exceeded 20,000. The income of the relevant staff and workers in the Yongcheng coal industry is significant, thus stimulating local consumption and promoting the development of the third industry in Yongcheng.

(2) The number of security incidents is controlled in a smaller range.

The number of security incidents is controlled to a smaller extent. Compared with Henan Province, the accident rate in the Yongcheng Mining Area is relatively low, but it still exists. The occurrence of safety accidents has caused nearly 10,000 people to relocate every year due to coal mining collapse in Yongcheng City. Coal mine safety accidents occur almost every year. The number of accidents and deaths in coal mines in Henan Province and Yongcheng City in recent years is shown in Table 2:

Table 2 Number of Accidents in Yongcheng Coal Mine (Unit:frequency; Person)

Year	2012	2013	2014	2015	2016
Henan Province	5/12	8/10	20/47	10/14	3/10
Yongcheng city	0/0	1/0	0/0	1/2	1/1
The reason of Yongcheng coal mine accident	0	Roof falling accident	0	Gas outburst	Roof accident

(3) Effective management of environmental pollution.

Environmental pollution in Yongcheng City has now been effectively managed. PM2.5 is the main pollutant of atmospheric pollution in Yongcheng. In 2015, the annual NOX emission of Yongcheng City was 17855.77 tons, ranking second in 10 provinces with direct management, and sulfur dioxide emissions reaching 12,736.94 tons, in Henan Province. The 10 provinces ranked directly in the middle of the county and ranked third, with a smoke and dust emission of 20,199.80 tons, ranking second, with industrial emissions of 59.423 billion cubic meters, ranking second. In 2015, Yongcheng discharged 4.19922 million tons of wastewater, ranking third in the province's direct management. Yongcheng Environmental Management Project has achieved good results. In 2016, the city's air quality reached 264 days, far exceeding the average number of days in Henan Province. At present, the best example of Yongcheng's management of the coal mining subsidence area is the Sun Moon Lake Park located between the east and west districts of Yongcheng City. Now it has become a good place and an important shooting base for Yongcheng citizens to play.

#### 4. Problems of the Development of Green Coal Industry in Yongcheng

First, economic efficiency is low. Low economic efficiency is manifested in three aspects: 1. The comprehensive utilization rate of coal gangue is low. Yongcheng coal gangue reserves have increased year by year. In Yongcheng, there are nearly 1.5 million tons of coal gangue discharged every year. Coal gangue is piled up arbitrarily, causing the government to collect a large amount of sewage charges and land occupation fees every year. The comprehensive utilization rate of coal gangue is less than 60%. 2. The utilization rate of coal combustion is not high. The type of coal in Yongcheng City is mainly anthracite, and the use of anthracite as fuel is the most common method



of use. However, the backwardness of combustion technology makes the utilization of heat energy low and pollution serious. 3. The added value of the products is relatively low. The mode of development of the coal industry is a single model, and coal is mainly used as fuel for heating.

Second, the safety accidents caused by the operation of coal mining workers are not standardized. The technical operation of coal mining operators is not standardized, and the safety protection measures of workers are not in place, resulting in coal mine accidents. At present, most of China's coal mining methods are underground operations, and the resulting coal mine accidents account for more than 70% of the major accidents in industrial and mining enterprises<sup>[11]</sup>. Safety issues are an important factor in the green development of the coal industry. Gas outburst and roof accidents are the major disasters in coal mine accidents.

Third, coal mining has caused damage to cultivated land and environmental pollution. Coal mining is extremely damaging to land resources, especially if large quantities of coal gangue are piled up on rainy days, which is likely to cause landslides. Heavy metal pollutants, among other things, can seriously pollute the water sources. coal gangue is piled up in large quantities, which not only occupies a large amount of land resources, but also floating dust and other pollutants that rise with the wind can seriously pollute the atmosphere and water resources, affect air quality and drinking water quality, endanger the health of Yongcheng people, and exacerbate the economy. The contradiction between development and the ecological environment does not fully meet the rigid requirements for the green development of the coal industry.

## 5. The Mode of Green Development of Yongcheng Coal Industry

According to the basic characteristics of coal resources in Yongcheng City, the basic model for green development of the coal industry is summarized, as shown in Fig.2:

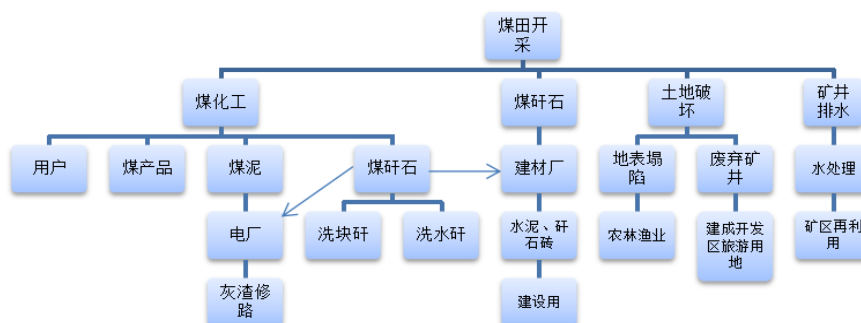


Fig. 2 The general pattern of green development in the coal industry

Green development means sustainable development. The green development of the coal industry is guided by the concept of green development, with environmental protection as the leading factor and green management as the guarantee to achieve sustainable development. The above models are in line with the important indicators of green development. The entire economic activity has become a model of “resources-products-consumption-resources reuse”<sup>[12]</sup>, forming a complete industrial chain among coal-related industries and achieving economic, social, and environmental coordination. Development situation.

The goal of the green development of the coal industry is to strive to establish green ecological mining areas, strive to build resource-saving and environment-friendly mining areas, and promote the harmonious development of people and mining areas<sup>[13]</sup>. Yongcheng's coal industry is developing well, but the added value of products is too low, and it does not have a good connection

with the chemical industry. The future development goals will be coal chemical industry, coal industry, electricity, etc. to take the industrial chain model, and coal and related industries. Become the absolute advantage of Yongcheng City's economy.

## **6. Countermeasures**

### **6.1 Establish an Eco-industrial Park, Encourage Technological Innovation and Rationally Extend the Industrial Chain**

Establish industrial parks in the coal-related industries near the mines and extend the ecological industry chain. To achieve the green development of the coal industry, the establishment of a green coal mining area is the basis for the development of the use of mineral resources, economic and social development and ecological environment protection<sup>[14]</sup>. Eco-industrial parks include mining, washing, coal chemical, power plants, building materials factories, garment factories, and environmental monitoring companies. Just like a small ecosystem, every enterprise in the ecosystem can be effectively developed. This will not only help reduce transportation costs and environmental management costs, but also improve the efficiency of coal resource utilization, form a complete industrial chain, make the best use of it, improve economic efficiency, and form a large circular economy within the industrial park. Taking a coal-fired power plant as an example, coal ash slag and desulphurized gypsum or fly ash produced by a power plant can be backfilled into underground coal mines, which not only improves the comprehensive utilization of solid waste, but also prevents surface subsidence and reduces the cost of environmental protection.<sup>[15]</sup> The development of non-coal industry can rely on related technologies of the coal industry, use of coal by-products or waste, and form a non-coal eco-industrial chain on the basis of mature industrial chain construction<sup>[16]</sup>. The establishment of an eco-industrial park has a good role in promoting the development of urban development.

Based on the establishment of eco-industrial parks, coal companies are encouraged to develop technological innovation mechanisms, increase the added value of coal products, and develop the recycling economy of the coal industry as the key tasks for the development of the current coal industry. Local coal companies need to cultivate a holistic awareness and long-term vision. They must not only care about the current interests and ignore the in-depth study of coal. Innovation is the primary driving force for development. It is necessary to cultivate innovation awareness and form technological innovation mechanisms. Constantly explore the production technology of briquette and calcium carbide, increase the utilization rate of coal resources, expand the scope of use of coal resources, implement the construction of green mines, and ultimately achieve a win-win situation in economy, society, and the environment.

### **6.2 Establish Coal University, Train Professional Talents, Increase Safety Factor**

The University of Coal is established to vigorously cultivate relevant technical and intellectual talents to provide local coal companies with suggestions for the development of circular economy. At present, the educational level of Yongcheng coal companies is relatively low. Most of them are professionals and technical schools with low-level talent and education. Professional personnel account for less than 20% of the total coal workers. According to statistics, nearly 5/6 of the accidents that occurred in coal companies were caused by irregular staff operations. Therefore, according to the local situation in Yongcheng City, the University of Coal was established to establish an accident safety precautions and early warning mechanism, to carry out work safety inspections for coal mining staff, to train employees in the use of advanced electronic equipment, to

detect dangers in a timely manner and to withdraw in a timely manner. Workers are subjected to safety inspections to form a system of safety mechanisms to cultivate employees' awareness of safety hazards. In-service training and skills assessment are conducted for employees to comprehensively improve their labor skills and knowledge literacy, and the probability of occurrence of security accidents is greatly reduced.

In addition, accelerating the development of professional talents, increasing the study of the cyclical coal industry and other industries<sup>[17]</sup>, give full play to the potential of professionals.

### **6.3 Establish the Museum of Coal Green Economy**

Establish a coal green economy museum in the coal mining subsidence area, display the complete industrial chain of coal and related industries, and make waste coal residue into rockery shapes or other handicrafts. This will not only help people fully understand the value of coal and related industries. The operation mode of the chain can also promote the concept of green development of the coal industry and raise people's awareness and importance of the green development of the coal industry. The realization of green development in the coal industry is not a matter of a company or a department, but it requires the participation of all the staff. Only in this way can the green development of the coal industry be carried out from the perspective of the whole society and the resources be fully utilized. Using the museum's economic income can also provide financial support for the research of deep processing of coal resources.

### **6.4 Rationally Plan Mining Areas, Reduce the Area of Coal Mining Collapse**

The proven reserves of coal resources in Yongcheng have been rising year by year, and coal mining technology has been continuously improving. When the government approves mining projects, comprehensive consideration is given to various factors, and the use of Internet + coal resources integration<sup>[18]</sup> restricts bad mining behavior. Giving scientific guidance to coal mining enterprises enables coal companies to scientifically formulate mining plans under the guidance of the government to prevent and reduce the occurrence of coal mining subsidence.

## **7. Conclusion**

Although Yongcheng Coal removed excess capacity of 780,000 tons in 2016, this does not mean that coal resources have become unimportant. On the contrary, in the very long period of time, the coal industry is still a dominant industry in the Yongcheng economy. Therefore, Coal and related resources are used for deep processing, widening the coal industry chain<sup>[19]</sup>, and actively developing briquette. The green development model is in line with the national development policy. The purpose of green development is to make the economy, society and ecology develop harmoniously. Based on this theory, the application of the green development model of the coal industry in Yongcheng City is more reasonable and practical.

Coal resource-based cities are a worldwide problem, and they are also an increasingly difficult problem that restricts China's economic development<sup>[20]</sup>. The "Smoke in London" incident has given us a profound warning that the transformation of the coal industry development model will benefit both the people of the day and the sustainable development of the coal industry. Yongcheng Mining Area, as one of the six major anthracite coal bases in China, studies its development model and has practical significance for the development of the entire coal industry.

The insufficiency of this paper's research is that the measures involved in the coal industry's green development model are not comprehensive. For example, the adoption of green logistics



operations in the coal industry park<sup>[21]</sup> is also a green development, but it is not covered in this paper. The research involves a green development model at the park level, which has certain limitations for the social development model of green development. Limitations for the social development model of green development.

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