A Study on the History of Metallurgical Science and Technology with Benxi Iron and Steel Group as an Example

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Abstract: Iron and steel industry is an important basic industry of national economy, and also a resource-consuming industry. With the rapid expansion of China's iron and steel industry in recent years, it also shows that China's steel metallurgical technology is becoming increasingly hard. In order to study the development of Metallurgical Science and technology in our country, we can gain experience and improve technical level. Therefore, this paper will take Benxi Iron and Steel Group as an example to study the history of Metallurgical Science and technology. In the face of the financial crisis and the severe challenges of rising fuel prices and fierce competition in the mining market, Benxi Iron and Steel Group adhered to the low-cost strategy and carried out the “three-standard” activities in depth, achieving a year-on-year decline in costs and a substantial increase in benefits. In addition, it continues to develop new metallurgical technologies and accelerates the optimization, integration and efficient use of mining system technology resources.

1. Introduction

Benxi Iron and Steel (Group) Co., Ltd. was founded in 1958 and has now formed a large-scale steel conglomerate based on steel products [1]. On April 7, 2006, the National Development and Reform Commission, the National Energy Office, the National Bureau of Statistics, the General Administration of Quality Supervision, Inspection and Quarantine, and the State-owned Assets Supervision and Administration Commission of the State Council issued a notice [2]. And decided to start from April 2006, in the steel, nonferrous metals, coal, electricity, petroleum and petrochemical, chemical, building materials, textiles, paper and other nine key energy-consuming industries to organize 1,000 energy-saving initiatives [3]. Forged devices are used only when fine accessories or large high-strength devices (such as knives, swords, and large anchors) are required [4]. The mining company was thus built into a modern mining base with a capacity of 35 million tons. Based on the existing conditions of the enterprise, the existing problems in energy utilization and the energy-saving potential of the enterprise are analyzed, and the energy-saving direction is defined. The metallurgical industry has also formed 34 enterprise groups with a certain scale, but the trend of metallurgical enterprise groups has attracted people's attention [5]. Our ancestors made such outstanding contributions to human culture in ancient times. However, due to the feudal rule in China for more than 2,000 years and the extremely slow or stagnant development of production, ancient scientific and technical rice in China did not get the due development [6]. In the past ten years, the output of carved steel has increased from 158,000 tons in 1949 to 12 million tons this year, while the non-ferrous metal industry has almost been established from scratch [7]. Founders in ancient China developed a series of outstanding technologies. In recent years, Benxi Iron and Steel (Group) Company has formed an enterprise group with the deepening of China's economic system reform and the objective needs of socialist planned commodity economy and socialized mass production [8]. After bronze ware, cast iron was widely used in ancient China. China, like other countries, started casting with stone models and later used copper models. A large number of Shang and Zhou bronzes used pottery models [9]. After more than three years of practice, Benxi Iron and Steel Group has walked out of a successful road of integration and development across regions, minerals and ownership without any precedent for reference. Benxi Iron and Steel Group has realized the strategic transformation from single mineral to comprehensive development of multiple minerals and from scattered and simple reproduction to unified and centralized control [10]. Benxi

Iron and Steel Group's metallurgical science and technology work on steel is mainly carried out around the need for production and long-term development of industrial construction. The ability to occupy Bengang's vast construction market provides good opportunities and severe challenges. Benxi Iron and Steel Group has realized the standardization and mass production of this advanced technology of iron and steel metallurgy. In the past 100 years, due to the oppression of imperialism, this has further deepened our backwardness. That is to say, in the industrial layout, the iron ore mining and processing is the main body, and the colored and vanadium and titanium resources are selected and processed into two wings, supplemented by pyrotechnics manufacturing, mining machines, mining construction and modern logistics.

2. China's Energy Situation

2.1. A new starting point for energy development

During the “Tenth Five-Year Plan” period, China's energy development achievements were remarkable, basically meeting the needs of national economic and social development, and laid a solid foundation for the development of the “Eleventh Five-Year Plan” and the longer period. Facing the future, China's energy industry stands at a new historical starting point. In the Warring States Period, coins were minted in this way, and later developed into a multi-layered film stacking method, which was a multi-piece casting method. Due to factors such as resource reserves, mining years and mining conditions, many mines face open-air wells, and individual mine resources are depleted, and transformation is urgently needed. The so-called goal is the same, in order to accelerate the development of the steel industry, to achieve complementary advantages and common development. Whether Benxi Iron and Steel Group can realize the contract period on schedule, the installation of converter equipment is the key. We found that fluorine has no significant effect on the balance distribution of sulfur between slag and iron. Under the condition of properly increasing the basicity of slag, pig iron with extremely low sulfur content can be obtained and smooth operation of blast furnace can be ensured. China is rich in total energy resources, but its per capita share is relatively low, especially the per capita resources of oil and natural gas are only 7.7% and 7.1% of the world average. This is a major development to further improve work efficiency following standardization and batch production of casting. Benxi Iron and Steel Group's leading products include: refined iron powder, refined molybdenum powder, dolomite powder, initiating explosive device, ferroalloy, etc. The so-called difference in direction means that the scope and direction of development are different.

From 2012 to 2018, with the expansion of the enterprise scale, the improvement of technology and the renewal of equipment, the scale of Benxi Iron and Steel Co. Ltd. has continuously expanded, and the steel output has increased by leaps and bounds, as shown in Table 1.

Table 1 Comparison of main production indexes and energy saving of benxi steel this year

Time	Steel output	Total energy consumption	Comprehensive Energy Consumption per Ton of Steel	Energy saving
	(Ten thousand tons)	(Ten thousand tons)	(kg/ton steel)	(Ten Thousand Tons of Standard Coal)
2012	423.12	430.14	1365	45.65
2013	456.51	463.21	941.36	61.55
2014	542.36	549.36	914.21	35.68
2015	645.31	675.62	824.22	54.14
2016	736.52	736.35	785.25	46.68
2017	826.54	712.21	641.57	38.47
2018	912.45	845.26	641.23	54.69

Table 2 gives examples of the changes in the operating rate of various processes in the whole industry. It can be seen that the metallurgical industry in China is gradually improving the operating

rate of processes while highlighting the Chinese characteristics of intensified smelting.

Table 2 Changes in operating rates of main processes

Working procedure	2014	2015	2016	2017	2018
Sintering industrial rate	80.42	87.69	89.54	91.69	90.41
Industrial rate of blast furnace	4.63	4.56	2.69	5.69	1.69
Converter industrial rate	54.69	71.69	84.62	71.69	87.62
Industrial rate of electric furnace	41.36	66.84	46.69	58.69	78.69
Industrial rate of continuous casting	54.63	64.36	65.69	69.64	71.69
Industrial rate of steel rolling	50.26	57.69	60.69	75.69	68.69

2.2. Energy policy

The 11th Five-Year Plan Outline of the National Economic and Social Development of the People's Republic of China proposes that the energy consumption per unit of GDP should be reduced by about 10% during the 11th Five-Year Plan period. The use of iron and the high level of casting technology are binding indicators for reducing the total amount of major pollutants discharged. It has been cast into a two-tone chime with accurate tone, a large copper drum with a very thin thickness, and a ring pattern of 0.1mm fine at the bottom of the head of Yue bronze sword. Most of these mines are small and medium-sized mines with an annual output of over 100,000 tons to hundreds of thousands of tons of concentrate. The equipment level is mostly in the 1960s and 1970s. Some even use the equipment of the Japanese puppet regime. Benxi Iron and Steel Group is going to choose two kinds of ideas. It can't be studied in isolation. It must be based on various links between resources, capital, products, technology, production and management, and from the complementary advantages and mutually beneficial relations. Because the converter construction scheme is advanced, practical, economical and reliable in design, the implementation effect is to complete the construction task with high speed, high quality and safety. Benxi Iron and Steel Group has a 25-day advance period and is highly praised by the leaders of all levels of this steel. Adhering to the basic national policy of conserving resources and protecting the environment, it is related to the vital interests of the people and the survival and development of the Chinese nation. It can be seen that in the future, Benxi Iron and Steel Group's energy-saving strategy will become the country's long-term development strategy, and will take tough measures to ensure energy conservation and promote efficiency.

3. Implementation of Integration and Development Strategies

3.1. Comprehensive and in-depth analysis of the characteristics of the industry's operation, its own advantages and disadvantages

First, resources control the advantages. The mining company's iron ore resources control has reached 5 billion tons. By the end of the “Twelfth Five-Year Plan”, the domestic resource control will reach 7.2 billion tons, and the foreign resources will be 800 million tons. The current production system of Benxi Iron and Steel Group mainly includes the main production systems of iron making, steel making and steel rolling, coking, power generation, oxygen processing conversion production system and auxiliary production systems such as power, railway transportation, public transportation, slag and machine repair. According to preliminary statistics, the metallurgical industry has formed 34 enterprise groups and consortiums of a certain scale. The electronic control equipment in Benxi Iron and Steel Group is composed of a large number of components, and its failure mode appears to be random and diversified, so its fault compliance index will change with time. When the ore or fluorine-containing charge falls to the area where the start-up is started, the fluoride first melts into the melt, and as the temperature rises further, the fluoride volatilizes along with the other compounds, and the furnace gas rises. This test method is applicable to electronic control and automation equipment under the conditions of complex circuits, high reliability requirements and few units. The advancement of China's casting technology was

also manifested in the use of metal molds to make iron moulds, which were then used for mass production.

At present, the global demand for high-strength steel is continuously increasing. as shown in fig. 1, the domestic and foreign demand trends for stainless steel, conventional steel and high-strength steel.

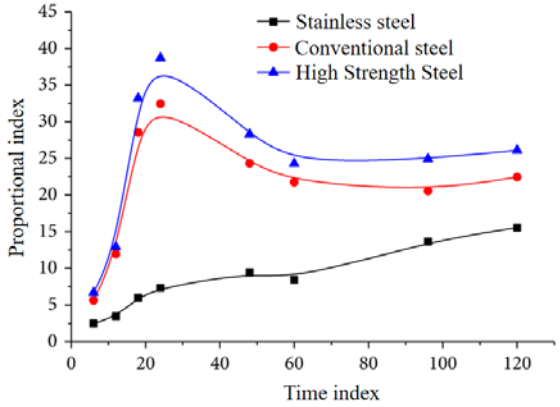

Fig.1. Demand trend of high strength steel at home and abroad

3.2. Formulate a suitable development strategy

Under the guidance of opportunity (SO) strategy, Benxi Iron and Steel Group, guided by the concept of “serving the country through mining and developing steel through mining”, put forward the goal of building a “largest domestic and first-class international” modern mining base, and formulated a “two-in-one, two-wings” development strategy, which is divided into three levels: strategic level, implementation level and specific operation level. The internal production process of Benxi Iron and Steel Group is also unbalanced. Quasi-reliability test is relatively easy to control test methods and conditions, and the obtained data are also of high quality. The test results can be reproduced and analyzed. However, under the limitation of test conditions, the data are difficult to correspond to the relatively real situation, and the test cost is huge. It can be seen that the intrusion of fluoride in different parts of the blast furnace is different. To this end, we use the principle of mass balance to verify the relevant information of the entire input-output process based on the supply of raw materials, production and processing, waste generation and product warehousing provided by Benxi Iron and other secondary mines. . It can be copied by the master model for mass production. The molds and vanes are calcined and relatively strong, creating superior conditions for the casting of bronzes. Some new mines are inevitably faced with difficulties in relocating villages and occupying a large area of land. These require patience and meticulous work. If the shape is not at the core of the group, the function of the investment center will not be realized.

4. Conclusion

The iron and steel industry is an important basic industry of the national economy. During the 10th Five-Year Plan period, the annual growth rate of steel output is 17.1%, and the average annual growth rate of energy consumption is 17.1. The “Technical Reform Project” of Benxi Iron and Steel Group started with pollution control, introduced advanced copper smelting process and equipment to replace the traditional smelting furnace process and equipment, and increased the concentration of flue gas. The flue gas was acidified by two-rotation and two-suction process. There are some problems in the development of China's current steel industry. However, it has successfully carried out the tasks set forth by the State Construction and Investment Commission. And made creative contributions, the main reason is due to the correct leadership of the party and the superiority of the socialist system. At the same time, this is also inseparable from the true selfless help from the fraternal countries of the socialist camp, especially the Soviet Union. Benxi Iron and Steel Group needs the competent departments of the industry to actively promote the combination of enterprises, set up enterprise groups with large and medium-sized enterprises as the main body, and join small

and medium-sized enterprises to optimize production factors, give full play to the overall advantages and benefits, and make contributions to accelerate the development of China's iron and steel industry.

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