



宝钢学术年会
Baosteel Annual Academic Conference

首届宝钢学术年会论文集

第三分册：节能技术、环保和可持续发展

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Energy Saving, Environment
and Sustainable Development

上海宝钢集团公司
Shanghai Baosteel Group Corporation

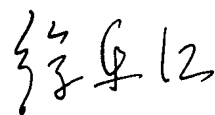
前 言

首届宝钢学术年会(Baosteel AAC'04)于2004年5月27~28日在上海宝钢召开。这是宝钢第一次举办这样的开放式、大型国际学术交流会。中国钢铁市场及钢产量的快速增长已成为举世瞩目的焦点,宝钢作为中国最大的钢铁制造企业,在中国和世界钢铁工业的舞台上扮演着重要的角色。我们希望通过积极认真地举办宝钢学术年会,搭建起世界钢铁科技进步的交流平台,为推动世界钢铁业的技术进步和可持续发展作出更积极、更有价值的努力和贡献。

全球钢铁工业的快速发展引发了一系列“能源”、“资源”和“环境”等方面的问题。如何正确理解和实施科学发展观,是宝钢长期以来十分重视和致力去完成的任务,我们也有着较多的认识和实践,我们将本届年会的主题定为:“可持续的钢铁,可持续的未来”。宝钢十分愿意面向世界,博采众长,加强技术交流与协作,坚持可持续发展观念,共同推动冶金科技进步。

非常感谢国内外广大专家学者对本届学术年会的大力支持和热情参与,也非常感谢宝钢内外的广大科技工作者在较短时间内为大会提供大量高水平、有价值、有影响力的学术论文。对于来自国内外的430篇论文,我们组织专家认真筛选,确定170余篇结集出版。本《论文集》共五册,包括主题报告分册、碳钢生产工艺技术及其产品研发(第一册)、冶金设备及自动控制(第二册)、节能技术、环保和可持续发展(第三分册)、不锈钢和特殊钢生产工艺及其产品研发(第四分册)。希望我们的工作能得到广大科技工作者的理解和肯定。特别感谢本届年会学术委员会成员和顾问专家们为大会成功召开所做的努力和贡献,衷心感谢本届年会的筹备人员和本《论文集》编辑人员所做出的努力。

由于时间和水平有限,《论文集》中疏漏与错误难免,恳请读者批评指正。



2004年5月

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Sustainable Development: Baosteel's Practice and Pondering

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The notion of "Sustainable Development" originates from the natural environment protection campaign in the mid and late 20th century. Its generally accepted definition was given in the report "Our Common Future" by the United Nations' WECD (World Commission for Environment and Development). Sustainable development will "meet the needs of the present without compromising the ability of future generations to meet their own needs". It is a new development view gradually formed. In 1992, the United Nations Conference on Environment and Development, "Earth Summit", passed "Agenda 21", in which sustainable development has become a common choice for human beings facing the 21st century. In 1994, sustainable development was determined to be one of China's basic policies. As China insists on taking a new road of industrialization and building a well-off society in an all-round way, the sustainable development view has been further implemented in China.

The sustainable development view has profound connotations. It is an important embodiment of the scientific development concept to realize sustainable development. Sustainable development means continuous, stable, coordinated and sound development of the economy, society and environment so as to better the quality of life for human beings.

The ultimate goal of carrying out sustainable development is to seek society's harmonious development and all-round progress, with the purpose of satisfying the needs of the present and future generations. Taking the road of sustainable development means that we must shift from the traditional mode of pursuing pure economic growth, ignoring the rational utilization of resources and neglecting the protection of the ecological environment, to the mode of pursuing the utilization of renewable resources, the natural cycles of the environment and the continuous development of economy.

Figure 1 shows the basic relationship of harmonious development between humans, society, resources and the environment with humans at the center.

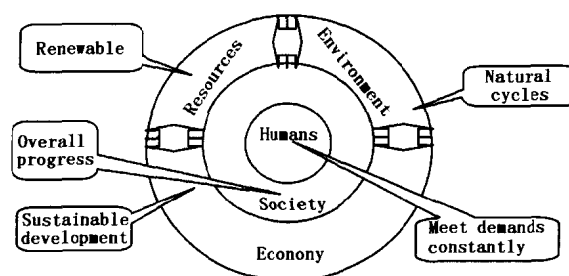


Fig.1 A basic relationship mode for sustainable development

In combination with the status quo of the Chinese iron and steel industry, especially Baosteel's reality, our understanding and ideas on the sustainable development view and Baosteel's practice and future will be discussed.

1 Sustainable development and the iron and steel industry in China

China is now in the historical period of striving for its industrialization. Iron and steel is such an important basic industry that it sustains economic and social development and helps realize industrialization in China. Since the reform and opening up to the world, China's steel consumption has grown faster than China's GDP. China has become the biggest steel consumer in the world (see Figure 2).

Pushed forward by strong market demand, our steel sector has made great progress attracting worldwide attention. China's steel output has gone up faster than ever. With entrance into the 21st century, steel output has increased by over 20% yearly, and China has taken first place in world steel production for eight years running. Technological progress in China's steel sector has been achieved by building a number of new plants with

advanced technical facilities and by completing technological revamping projects in many old plants. This progress obviously enhances the competitiveness of our

steel enterprises, but it also makes an important contribution to the continuous and sound development of our national economy as well (see Figure 3).

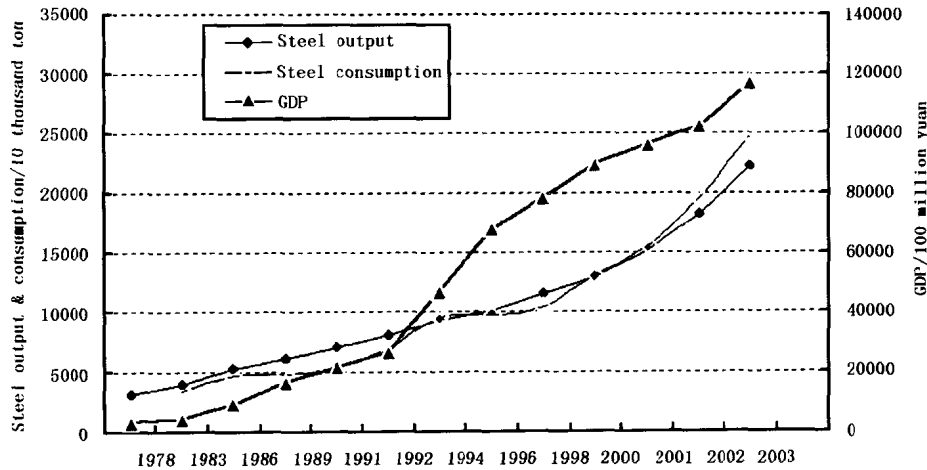


Fig.2 Growth of steel output, consumption and GDP in China

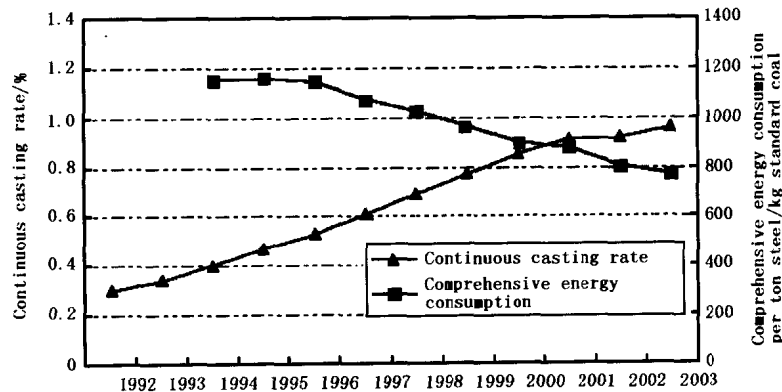


Fig.3 Growth of technical and economic indices of China's steel industry

Steel is a kind of material which has a long product life, can be entirely retrieved and will never be completely replaced by any other materials in the foreseeable future. Meanwhile, the iron and steel industry consumes great amount of resources and seriously affects the environment. Currently, the energy consumed by this industry and the environment load brought about by pollutants from this industry account for about 10% of the total amount by various industries in China. The steel sector's sustainable development has a significant meaning towards China's sustainable development in economy and society.

1.1 Glaring problems in China's steel sector at present

(a) Low degree of industrial concentration

In China, there are huge numbers of iron and steel enterprises, among which 53 have an annual capacity of

over 1 million tons. Their combined output accounts for 82.47% of the nation's whole. Another 13 steel enterprises, each with a capacity of over 5 million tons, account for 44.03% of the total national output. Baosteel, the largest steel maker in China, only produces less than 10% of the nation's total steel products.

(b) Bottlenecked resources

As we do not have rich iron ore resources, we have to import great amounts. In 2003, imported ore reached 148 million tons, causing a rise in the price of ore and transportation rates worldwide. Resources and their rational exploitation and utilization have become the key to unblocking of the bottleneck, which is restraining the development of the Chinese steel industry.

(c) Higher energy consumption

In 2003, the average comprehensive energy consumption per ton of steel for large and middle sized

steel enterprises in China reached 767 kilograms of standard coal, 14.5% higher than that of advanced steel enterprises.

(d) Water resource in short supply

China is relatively poor in its water resources. Its per capita consumption of water is only one fourth of the world average, ranked No. 82 globally. The steel sector is a huge water consumer. The average fresh water consumption per ton of steel is three times that of advanced countries.

(e) Serious environmental pollution

Dust emission by the steel sector alone amounts to 25% of the total volume by all industries in China. The emission of pollutants, such as smoke dust, sulfur dioxide, sewage, waste residue, etc. ranks the top place among all industries. Compared with the advanced countries, there is a wide gap between our environment indices and theirs.

(f) Too fast capacity expansion

In 2003, the steel capacity in mainland exceeded 222 million tons. It will be 330 million tons in 2005, far beyond the predicted demand quantity: 270 million tons. Difficulties caused by over-expanded capacity, irrational layout and low level duplicated construction have become more serious, further aggravating the pressure on resources and environmental protection.

(g) Unbalanced product mix

Currently, the product mix provided by the mainland steel producers cannot meet all the demands of the downstream sectors. On the whole, products manufactured by most of the domestic steel producers are of low grade. Of those imported products, sheet and strip account for over 80 per cent. Most sophisticated products still depend on import.

1.2 Effective countermeasures

Taking the overall situation of the national development strategy as a starting point, we should consider and analyze all the problems met in development in-depth and find solutions to all these problems effectively and systematically in the view of sustainable development. We believe the establishment of the view of sustainable development, enhancement of the sector's degree of concentration and improvement of the technical levels will be three key factors to solving all the diffi-

culties that restrict the sustainable development of the Chinese steel industry.

(a) Establish the view of sustainable development

Sustainable development is the only way of developing our country's steel industry. Actually, any development will be restricted. There will be no such development without restrictions. Expanding steel capacity must be combined with adjustment to the product mix, improvement of the product quality and improvement of the ecological environment. It should be combined with the elimination of the backward technologies and facilities. We have to change our original production and consumption modes featuring "high investment, high consumption and heavy pollution", and carry out clean production and reasonable consumption.

(b) Enhance the sector's degree of concentration

Enhancing the sector's degree of concentration will be beneficial to the rational configuration of resources, reasonable layout of capacity and optimization of product mix. Besides, it will make for enterprises focusing their strength to deal with the bottleneck of resources and environmental pressure. The central government must work out effective policies and adopt powerful measures to guide and support those enterprises with considerable strength and development potential to implement reorganization, combination or merger. Only in this way can resources be concentrated around those leading enterprises so as to form several internationally competitive super iron and steel groups. It will surely lay a solid foundation for the Chinese steel industry's sustainable development.

(c) Raise the entire sector's technological levels

Whether the Chinese steel industry's sustainable development can be realized or not depends on scientific progress. At present, there is a great technological gap between the Chinese steel industry and the world advanced steel industry. Our R&D ability is still weak, our R&D forces are rather decentralized and we do not have a technical innovation mechanism featuring rational division of labor, shared complementary advantages and active coordination throughout the sector. We must vigorously explore new ways of strengthening technical exchanges and cooperation throughout the steel sector. We must establish an all-round and effective technical

innovation mechanism throughout the steel sector in order to raise the technical levels of our steel industry.

It is not only a serious challenge but also a new opportunity to solve technical problems in the course of the Chinese steel industry's sustainable development. We are willing to work side by side with our friends in the same trade at home and abroad to seize opportunities and face challenges in contributing to sustainable development.

2 Sustainable development and Baosteel's practice

Baosteel began its construction in the late 1970s. It has undergone the construction of phases one, two and three projects and experienced the establishment of Shanghai Baosteel Group Corporation. Baosteel is now speeding up the project construction of the Tenth Five-

Year Plan. Sticking to the goal of "Running a world class enterprise, creating world class levels", Baosteel has carried out its leap-frogging development strategy of introducing high level technology and innovating from a high starting point. Taking "scale and technology" as its cornerstone of sustainable development, Baosteel vigorously advanced its construction of new production lines, firmly grasped the revamping of its old plants, quickly expanding its production scale, constantly improving its technology, continuously upgrading its products, substantially increasing its economic benefits and remarkably elevating its comprehensive competitiveness. By the end of 2003, the assets of Shanghai Baosteel Group Corporation reached 168.1 billion yuan, the sales income (merged) that year hit 115.1 billion yuan and its total profit (merged) amounted to 13.6 billion yuan (see Figure 4).

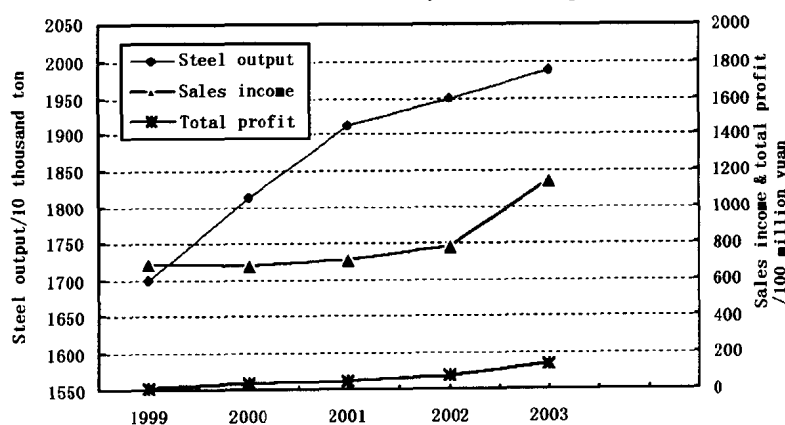


Fig.4 Baosteel's main economic indices

In the course of its construction and growth, Baosteel made great efforts to explore and take a road of sustainable development, suited to our national conditions and with Baosteel characteristics. Baosteel attached great importance to making overall plans, taking all factors into consideration, and bringing everything into line. Baosteel also highly valued the rational utilization of resources and effective the protection of environment. Baosteel's construction and development played an important role in enhancing our national steel industry's degree of concentration and technological level, which greatly promoted the industry's sustainable development.

2.1 Aiming at world class environment protection and laying a solid foundation for Baosteel's

sustainable development

As Baosteel is located in Shanghai, the largest city of our country, much attention from all circles has been focused on Baosteel's potential for environmental pollution. When Baosteel's construction began, China was undertaking all the projects that had previously been delayed and funds were stretched thin; but the policy-makers persisted in planning Baosteel construction in the strategic view of sustainable development.

Since the beginning of the construction, Baosteel people have aimed at the goal of world class environment protection, trying to build Baosteel into a clean factory with world advanced level. Baosteel completely cast away some outdated views of "polluting the environment, then harnessing it" and "production before

environment protection". Adhering to the principle that the projects of its main body and its environmental protection facilities should be designed, constructed and put into operation simultaneously, Baosteel took the realization of world class environmental protection as an important step toward becoming a world class enterprise.

First, we increased our investment in environmental protection. Baosteel has introduced 316 advanced environmental protection technologies and facilities from advanced countries. The investment for environment protection in Phases One, Two and Three was 650 million yuan, 390 million yuan and 1638 million yuan respectively, accounting for 5.3%, 3.3% and 5.3% of the total investment of each phase. This huge investment created favorable conditions for us to build a high-level clean factory.

Second, we paid special attention to use of sophisticated energy efficient equipment. Baosteel controls emission of pollutants at their source.

Third, we brought afforestation in the plant area into line with the overall project plan. With a 43% forest coverage rate, it is possible for Baosteel to combine comprehensive ecological improvement with beautifying

the environment. As a park-like steel enterprise, Baosteel has shown its good image of a clean factory to society.

2.2 Constantly push technological progress forward: making Baosteel's sustainable development leap onto a new stage

After going into operation, Baosteel seriously implemented the policy of "introduction, digestion, tracking and innovation". It keeps following advanced technologies in the world, increasing its investment in R&D and technical transformation and pushing its technological progress forward. New achievements have been made in resource utilization, energy conservation, clean production and pollution control.

(a) Through research and technical transformation, Baosteel's PCI has reached 200 kg per ton of steel. Its sophisticated techniques, such as steel making (converter) with residual energy, residual heat recovery, hot charging and delivery, slag-splashing process for converter protection and systematic energy saving, have reached advanced levels globally. Baosteel has dropped its comprehensive energy consumption per ton of steel from the design value of 940 kilograms to 675 kilograms of standard coal (see Figure 5).

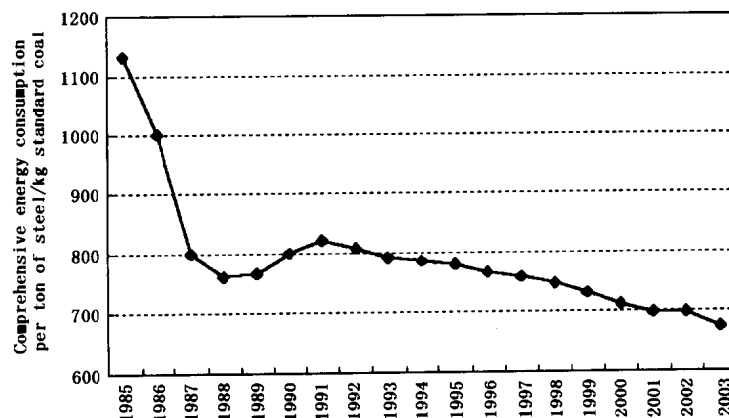


Fig.5 Baosteel energy consumption per ton of steel

(b) Through R&D in technologies of waste water treatment and reclamation, Baosteel's fresh water consumption per ton of steel has been reduced from the design value of 9.0 m³ to 4.57 m³. The recycling rate of water for industrial use has risen to 97.35%, among the world advanced levels (see Figure 6).

(c) Through R&D in technologies of ore matching and coal blending, Baosteel's burden ratio with cheap

brown ironstone and feebly caking coal has been raised, which not only lowers the production cost but promotes the rational utilization of resources as well.

(d) Baosteel has also strengthened its research on multipurpose use of industrial scrap. It developed technologies for drum-type slag treatment and grain slag refinement treatment, which makes its comprehensive utilization rate of scrap equal or close to the world

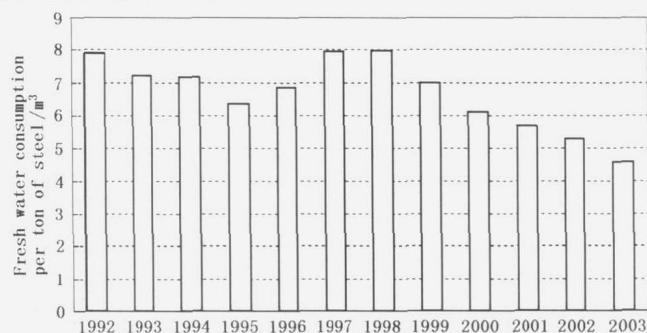


Fig.6 Baosteel's fresh water consumption per ton of steel

advanced levels (see Figure 7).

Due to the fact that we vigorously advanced clean production, controlled pollutant emission throughout the process and pursued technical innovation on environment realignment, the control standard of pollutant emission has been steadily raised, the environment quality in Baosteel's plant area has been continually improved, and production has been constantly increasing. (see Figure 8). Baosteel has established and perfected its environment management system, and at the same time it developed an advanced automatic monitoring system. Because it implemented the environment management system in an all-round way, Baosteel Company

was the first in China's metallurgical circle to obtain the ISO 14001 environmental quality certificate in 1998. In 2003, it passed the TS 16949 certification smoothly.

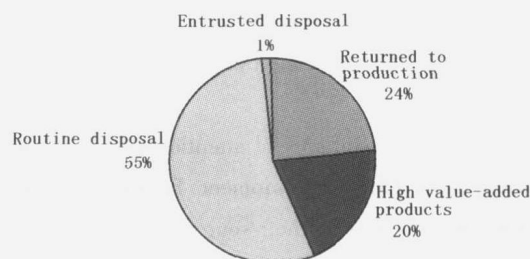


Fig.7 Disposal scale map of 6 million tons of solid rejected materials yearly

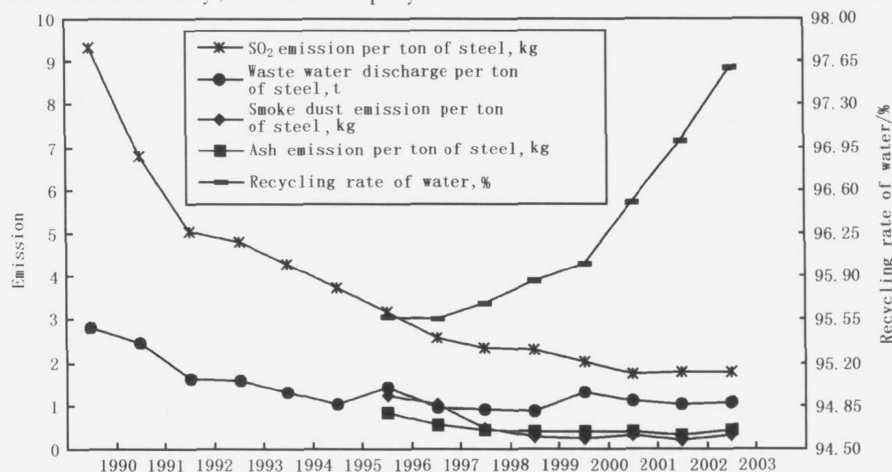


Fig.8 Main pollutant emission indices

2.3 Develop "green products", implement "green operation" and take a green road for Baosteel's sustainable development

Taking the market as its guide and putting customers' satisfaction at the center during the whole production and construction process, Baosteel has made great efforts to develop "green products", implement

"green operation", build a "green enterprise", optimize its product mix and improve its product quality for a long time. Baosteel will firmly take a road of green development.

Technical innovation is a central link for Baosteel to achieve the highest world level and to hoist its core competitiveness. With over 10 years' efforts, we suc-

ceeded in developing the following products: cold rolled TRIP steel with tensile strength of 600 Mpa; X70 and X80 high strength and high toughness pipeline steel; HIC resistant pipeline steel; B40 series plastic die steel; container steel with 700 MPa tensile strength; refractory and weathering steel with low yield strength ratio; T91 high pressure boiler tube; wire rod for tire cord and magnetic levitation railway steel.

In recent years, Baosteel's automobile steel, home appliance steel, pipeline steel, stainless steel, electrical steel, oil field steel and other competitive steel products have won more market share than ever, which not only ensures development of the downstream sectors, but also contributes to the good reputation of numerous users.

2.4 Establishment of Shanghai Baosteel Group Corporation: new opportunities and challenges for Baosteel's sustainable development

Baosteel and some old iron and steel enterprises in the Shanghai area merged to form Shanghai Baosteel Group Corporation in November 1998. Since then, Baosteel has taken the revamping of outdated factories and the elimination of backward processes and facilities with high resource consumption, heavy pollution, poor product quality and low labor productivity as its important mission of sustainable development. Through overall planning, restructuring organizations, adjusting product mix and improving product quality, Baosteel will become the largest competitive product base in China.

First of all, backward processes, such as open-hearth steelmaking, cupola melting, small converters, small EAFs, pack mills and Belgian mills, needed to be eliminated. Now we have eliminated 2.3 million tons of outdated annual steelmaking capacity and 2.95 million tons of outdated steel rolling capacity.

Meanwhile technical transformation projects on old plants, such as Shanghai No. 1 Steel Company's stainless and carbon hot rolled coil project and stainless steel melting extension project, Shanghai No. 5 Steel Company's alloy die steel, special silver steel product and stainless long product projects are under way. Baosteel will continue to adopt advanced technological processes, promote clean production and implement system-wide control over pollutant emission.

In addition, responding to the Shanghai 3 year action project against pollution, Baosteel has invested 44.838 million yuan to harness 9 pollution sources. For instance, Shanghai No. 1 Steel Company's top residual pressure turbogeneration project (TRT) of 2500m³ BF gas, its waste water treatment project, and Shanghai No. 5 Steel Company's waste water treatment project have been started.

Compared with what it was like before the revamping, the local environment quality has improved remarkably. Sulfur dioxide in the atmosphere was reduced by 32%, smoke dust reduced by 79%, industrial dust by 64%, COD in waste water by 63% and oil bearing pollutant by 49%.

Baosteel's reorganization has become a successful model. Baosteel, as an enterprise with competitive edges, has played an important role in enhancing the steel sector's degree of concentration, in revamping those old plants in the Shanghai area and developing them into modern ones. In 2003, Shanghai Baosteel Group Corporation's sales income reached 115.1 billion yuan. It will hopefully become the first steel enterprise in China to be ranked among the top 500 companies in the world.

Compared with advanced enterprises at home and abroad, Baosteel has developed fast in the past 25 years, but Baosteel people still have a long way to go. At present, there are some factors restricting the enterprises' sustainable development. For example, we have to solve the contradiction between capacity expansion and lowering the emission of pollutants, popularize and improve clean production, green manufacturing and technologies used to save energy and reduce consumption. We have to develop new technologies to control and deal with harmful substances like dioxin, carbon dioxide and so on. Therefore, it is Baosteel's important task to tackle the problems of sustainable development in an active and reliable way.

3 Sustainable development and Baosteel's future

China has drawn up its development strategic goal: by 2020 China's GDP will quadruple the figure in 2003, and a well-off society will be built up in a comprehensive way. The demand for iron and steel will be

strong in the market for a long time. There will be considerable room for the Chinese iron and steel industry's further development. Of course, the competition will be very fierce. Baosteel must make full use of its accumulated competitive edge, lay a foundation for its sustainable development, and continue to make its business bigger and stronger. Baosteel worked out a new strategic development goal last June. The goal is to build Baosteel into a world class transnational corporation with its own intellectual property right and powerful integrated competitiveness, respected by the whole society, ranked among the top 500 global companies, and with a very strong main business and moderate diversified development.

In the new development strategy concept, we will still take "scale and technology" as the cornerstone for Baosteel's sustainable development. The scale advantage is the foundation on which technical advantage can be cultivated while the latter is the guarantee that the former can be further promoted. We will expand our business scale by means of the operational capital strategy, upgrade our product series by means of the competitive product strategy, improve our operation by means of the internationalization strategy and enhance our core business comprehensive competitiveness by means of sustained innovation. We will make great efforts to build Baosteel into the most competitive iron and steel enterprise in the world as well as an environment-friendly, green enterprise.

In the next development period, Baosteel will build three main product centers through internal restructure and rectification. They are "Carbon Steel Manufacturing Center", "Stainless Steel Manufacturing Center" and "Special Steel Manufacturing Center". By 2010, the scale of our main business (iron and steel) will be further enlarged, the sales income will reach 150 billion yuan, the technical innovation ability will be manifestly improved and the technical equipment will be first rate level in the world. Baosteel will have key technologies with its own intellectual property right, and its comprehensive competitiveness will be in the forefront of the world steel industry. To realize this goal will not only make Baosteel's development mount a higher stage, but facilitate a rise in the Chinese steel sector's

degree of concentration and technical levels.

In order to realize its strategic conceptualization and goal, we should implement the view of sustainable development in depth, systematically and in an all-round way. Sustainable development is a complex system, and the enterprise's sustainable development an important part of this giant system.

Based on Baosteel's reality, we have formed the following basic understanding and ideas of pushing Baosteel's sustainable development forward.

3.1 To pursue the maximum enterprise value, soul of Baosteel's sustainable development

An enterprise's values will guide the enterprise's behavior directly. Practice has proved that if an enterprise pursues maximum profit unilaterally, it will not take a road for sustainable development. Baosteel has established its core values. That is to maximize the enterprise's value in every possible way. To do so, we should maintain a balance between the enterprise's economic efficiency and social benefits, making our biggest contributions to continuous, sound development of the national economy and all-round social progress.

To pursue an enterprise's maximum value, we must correctly deal with the relationship between the enterprise's expansion and market demand, resources and environment bearing capacity, making great efforts to reach a realm where the production scale and product mix can meet the market demands and coordinate with the resources and environment. To pursue an enterprise's maximum value, we must strengthen exchanges and cooperation with persons of the same trade as well as upstream and downstream enterprises. To pursue an enterprise's maximum value, we must establish a strategic partnership with them and achieve the everyone wins goal. To pursue an enterprise's maximum value, we must realize the shared interests and common development of shareholders, employees, users, suppliers and other interested parties in society. To pursue an enterprise's maximum value, we must fully display the concept of putting people at the center, and promoting harmony between humans and nature, and goodwill between enterprises and the environment.

We believe that fostering these values of pursuing maximum enterprise value will certainly enhance our

consciousness and resolution to take the road of sustainable development, and will correctly guide and facilitate Baosteel's sustainable development.

3.2 Implementing the competitive product strategy, an important base for Baosteel's sustainable development

Shanghai Baosteel Group Corporation has taken "Building itself into China's largest competitive steel product base" as its prime objective. The group has also formed its development strategy: to develop six types of competitive products with great efforts. The six types of competitive products include steel for automobiles and home appliances, steel for ships and pipelines, steel tubes for the petrol industry and power plants, electrical steel and special metal materials, stainless steel and steel for new types of buildings. Since starting the new round of development, the group has planned to enhance its capacity, optimize its product mix, increase its proportion of competitive products and speed up building its competitive product base.

Currently, the production lines for competitive products, which are under construction or in design, cover Baosteel Company's 1800mm cold rolling production line and 5 meter heavy plate rolling mill with corresponding continuous casting lines; Meishan Company's hot rolling revamping project; Shanghai No. 1 Steel Company's stainless steel, carbon steel hot rolled coil and stainless steel smelting extension projects; Shanghai No. 5 Steel Company's alloy rod production line revamping project and Ningbo Baoxin's Phase 4 project.

Competitive steel products are both high-tech, high value-added super products as well as high performing green products, which create high value for users. Baosteel established its strategy to develop competitive products because the low-grade steel market has reached the saturation point while high-grade steel needs to be imported substantially. Moreover, Baosteel also considered the trend of the demand for high-grade steel driven by the upgrading of China's manufacturing sector and industrialization progress.

Developing competitive steel products will be beneficial to enhancing the resource utilization ratio and participating in global competition. It will support the

downstream industries' sustainable development more effectively, create higher economic efficiency for Baosteel itself, and lay an important foundation for Baosteel's sustainable development.

3.3 Carrying out "clean production": a basic requirement for Baosteel's sustainable development

Clean production and green manufacturing means controlling the entire production process and the whole life cycle of a product. It also means continually reducing pollutant emission until zero pollutant emission is attained. In fact, clean production and green manufacturing is a kind of planning or management, which emphasizes production with the least material and energy consumption. In this process, waste materials will be greatly reduced in quantity, converted into resources, rendered harmless or completely disappear from the production process.

Baosteel must take "clean production" as its basic requirement for sustainable development, and implement it within the group in an all-round way with the purpose of raising its clean production ability and environment harnessing levels. Baosteel is ready to lessen the local and global environmental loads and make a contribution to the improvement of our living environment. We should not be satisfied with being in accord with the pollutant emission standard stipulated by the government. We should constantly raise the internal control levels to build Baosteel into an environment-friendly enterprise so as to win public praise and make Baosteel more respected by society.

We will continue to take the following measures:

(a) Invest more in R&D and adopt new environmental protection technologies and equipment to control pollutants at their source.

(b) Set up and perfect the automatic environment monitoring system, form environment monitoring networks across the whole group to inform the group's environment management.

(c) Implement the ISO 14001 environment management system within the group. Enterprises with better conditions should take the lead in using the ISO 14031 and ISO 14041 standards to further improve the accuracy and quantification levels in environment con-

trol.

3.4 Energy-saving and consumption reduction: an eternal objective of Baosteel's sustainable development

"Energy-saving and consumption reduction" involves the rational and renewable utilization of resources and recycling. Energy-saving and consumption reduction is not only an important way of lowering operation cost and enhancing products' market competitiveness; it's also an enterprise's responsibility to promote the perpetual use of resources throughout society and the continuous improvement of the environment. Facilitating sustainable development of all enterprises, and even the entire national economy is a perpetual objective.

Although Baosteel has achieved outstanding success in energy-saving and consumption reduction, the development within the group is not balanced. Compared with advanced world levels, we still have something to do. We will increase the momentum of our work so as to reach the world advanced level in an all-round way.

For this goal, we plan to unfold the following jobs:

(a) Popularize and apply Baosteel Company's advanced systematic energy-saving technology throughout the Group Corporation, paying close attention to old enterprises' technical transformation projects in waste water treatment and water conservation, and complete several energy-saving projects to raise the residual heat utilization ratio.

(b) Turn industrial recyclable materials into resources and further raise the comprehensive utilization ratio of recyclable materials. The recovery rate for steel-making lag, iron-bearing sludge, pulverized coke in dust and other recyclable materials should be as high as 100%.

(c) Invest more in R&D and energy-saving-related technologies, and build a non-BF mini-mill production line in due course.

3.5 Persevering in technical innovation: an essential guarantee of Baosteel's sustainable development

The first life for an enterprise is innovation. The first resource for an enterprise is talents. To make Baos-

teel grow more quickly, become stronger and enjoy a prosperous future, we must constantly enhance and elevate Baosteel's core competitiveness for sustainable development.

Implementing a competitive product strategy, carrying out clean production and launching an energy-saving and consumption reduction program depend on the enterprise's technological progress. Persevering in technical innovation is the only way of realizing an enterprise's technological progress, as well as the essential guarantee of an enterprise's sustainable development.

Conforming to the following trends of the current technological development in the global steel industry, Baosteel will strive to unfold the work of innovation.

(a) Develop ultra high performance materials with characteristics of being safe, clean, energy-saving and material-saving, and create higher value for users.

(b) Develop new technologies with higher control accuracy and flexibility to meet users' manifold needs more quickly.

(c) Develop new technologies which can satisfy demands of the clean production and green manufacturing.

(d) Develop new technological processes and equipment to save energy and reduce consumption more effectively, to utilize resources or use substitutes more reasonably.

(e) Make use of the latest IT achievements to revamp the traditional steel sector and advance the transformation of iron and steel technology.

The development of the global iron and steel technology is opening up a way to steel sector's sustainable development. Conforming to general development trends of the global iron and steel technology, Baosteel must concentrate its energy on the focal points and technical difficulties appearing in the course of sustainable development, and arrange its technical innovation activities in an all-round way. Baosteel will put "independent innovation" in a more striking place, try its best to obtain innovative achievements with its own independent intellectual property right in some key fields, and make greater contributions to the strategic goal in the new round of development and to the sustainable development of the Chinese iron and steel industry.

The above are our understanding and pondering over the steel industry's sustainable development in combination with Baosteel's practice. For a long time, Baosteel's construction and development have drawn great concern, support and help from friends of the same trade at home and abroad. I wish to take this opportunity to extend my heartfelt thanks to those friends. We believe that it has become our common pursuit to promote the steel industry's sustainable development. We will further the exchanges and close cooperation with friends in the same trade at home and abroad, and experts in various fields, to make contributions to the steel industry's sustainable development.

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宝钢系统节能技术的开发与创新

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摘要:文章结合国内外钢铁企业节能技术发展过程,着重论述了宝钢的系统节能技术工作所取得的进步和创新,提出了今后工作的管理思路与发展方向。

关键词:钢铁企业;能源管理;系统节能

Innovation and Development of the Systematic Energy-Saving Technology

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Abstract: In present paper, the development of energy consumption strategy of Baosteel is reviewed, and the rules of the development of the energy-saving technology in other iron & steel enterprises are analyzed. The innovative application of the systematic energy - saving technology is emphasized, which was inspired by considering the production mode of Baosteel. Great efforts made by Baosteel to save the energy and the achievement in energy saving are described. Finally, the strategy about energy management of Baosteel in future is put forward.

Key Words: Iron and steel industry; Energy management; Systematic energy-saving technology

1 宝钢能源管理概述

宝钢股份公司经过一、二、三期的工程建设,到2003年达到产钢1 130万t,生铁1 029万t,连铸坯956.6万t,初轧坯153万t,热轧板卷820.4万t,冷轧板卷348.7万t,钢管59.7万t的生产规模。由于在各个工程建设初期注重引进、消化、吸

收国内外先进的设备和节能技术,因此整体能源利用水平较高。各期建设项目达产后的能源消耗迅速达到并低于设计值,在国内处于领先地位。特别是衡量钢铁企业能耗水平的标志性指标——吨钢综合能耗也在逐年降低(图1)。

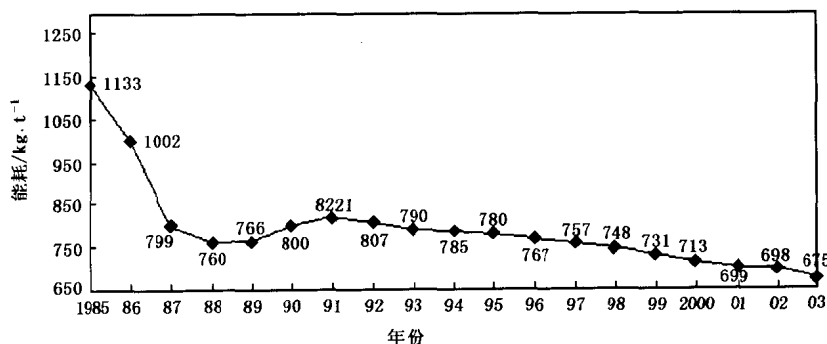


图1 宝钢吨钢综合能耗

然而,先进的能源消耗指标不仅得益于先进设备和节能技术的采用,更得益于优化资源配置、优化能源结构、完善信息通讯系统、运用系统节能的观念和理论合理调度使用能源介质。在消化、吸收国外先进节能技术和装备的基础上,将系统

节能、系统控制、系统优化思想作为挖掘节能潜力、加快节能技术进步、发展能源管理理论的重要方向,通过对节能技术、装备等不断开发、创新,使能源消耗水平在全球千万吨级的全流程钢铁企业处于领先地位。系统节能对宝钢保持能耗的先进

性起着重要的作用,也将继续是宝钢能源管理工作今后的主要课题。

2 国内外钢铁企业节能技术的发展分析

随着社会、经济的发展,以及工业化、城市化进程的逐步加快,人类赖以生存和发展的环境正发生着急剧的变化。环境的日趋恶化使人们深刻认识到,经济发展过程中的生态环境问题不仅直接关系到我们未来的生存,而且也直接制约着经济的发展。钢铁工业是一个资源消耗极大、污染环境严重的行业。从原料进厂到出厂的整个制造过程中所有环节无处不依赖于能源的消耗,而不少重要环节又往往排放余热、废弃物或产生二次能源。不仅造成资源和能源浪费,同时恶化环境。钢铁行业的能源管理不仅要追求能源节约,同时更要重视和强调对环境的保护和可持续发展。为此,近20年来,国内外同行正在不断探索,进行理论研究,通过实践也积累了大量经验。归纳起来,钢铁企业的能源管理工作特点如下。

2.1 系统节能已成为发展的主流

(1)从注重单体设备、工序的节能转向企业整体的节能

在钢铁工业过程中,从矿石到钢铁产品均包括多个生产工序,而每个工序又有多个设备,工序之间、设备之间都在物流、能源等方面彼此联系、彼此制约。因此能源管理已不仅要研究单体设备,还要研究由多个设备组成的生产工序和由多个生产工序组成的整个生产企业。研究设备之间、工序之间的协调与配合,进行权衡得失和整体优化,才能收到最佳的综合效果。

(2)管理方式从经验型管理转向现代化管理

能源管理方式正在逐步发生转变,正由经验管理向现代化管理转变。通过不断完善和强化能源管理领导机构和管理体系,使能源管理工作在先进的管理方式下更具有系统性、合理性、科学性和实用性,更能体现现代化管理的特征,促进能源管理水平的提高。

(3)由纵向管理体系转向综合管理体系

能源是能够产生能量的资源,而非能源物资是花费能源才制造出来的,两者在能源管理者眼中已没有多大区别。因此,能源管理工作已从节约能源发展到节约能源与非能源物资,同时研究设备之间、工序之间的协调与配合以优化用能,从而使能源管理由单一能源部门纵向管理转

向计划、生产、技术、设备、成本和能源等职能部门分工协作的综合管理。

2.2 科学运用能耗分析手段指导能源管理工作

基于完善的钢铁工业能耗指标体系,进一步加强能耗分析工作,采用e-p分析法、“基准物流图”对比分析等方法开展企业的深层次节能。同时,随着企业生产经营活动重心向经济效益转移,企业日益重视节能效果、能源消耗对生产成本、经济效益的影响。

2.3 信息技术与管理技术的应用

钢铁生产是一个工艺复杂的传统产业,消耗能源介质众多而且十分复杂。因此充分利用信息技术推进、改造和提升能源管理水平是钢铁企业一项长期的发展任务。以信息化带动工业化,实现现代化,从而使企业在科学决策、资源配置、产品质量、生产成本、节能降耗等方面不断提高。

2.4 继续不断研究、改进、完善单体设备的节能技术和装备

采用先进的节能技术和装备是企业在节能降耗工作中的重要手段,但一朝拥有并不表示永远先进,时代在发展,技术在发展,管理在发展,不断追求、研究和改进才能使企业永葆青春。因此,世界各先进企业均在不断探索、继续完善节能技术和管理方式。

总之,系统节能与技术节能构成世界节能的发展方向,系统节能与技术节能是点与面的关系,系统节能包括对钢铁厂生产结构、工艺结构、产品结构的调整与优化,使整个生产过程向高效、低消耗、清洁、环保的方向发展,加强能源优化配置、有效利用和整体优化,而技术节能包括新技术、新设备、新产品的应用,在工艺过程中,采用各种高效、节能设备和应用现代高新技术,以达到更好的节能效果和经济效益。

3 宝钢系统节能技术的分析与定位

宝钢一、二期设备基本以引进为主,拥有世界最先进的单体节能技术和节能设备,项目投产后能源消耗指标迅速达到设计值。然而,在拥有世界先进单体节能设备与技术条件下,某些能源指标还落后于世界先进水平,这主要是由于系统没有达到设备(工序)之间的最佳配合、燃料和其它能源介质的调度与分配还不尽合理、设备生产负荷分配不尽完善、企业的能源结构不太合理。

基于对世界能源管理发展方向的认识,以及