

Talk about the Chinese iron and steel industry development and environment protection

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The iron and steel industry (referred as “the industry” afterwards) is one of the most important foundation industries props up our country’s national economic development. In 2005, the crude steel yield of our country exceeded 350 million tons for the first time, and the total industrial production value attained 2,116.9 billion dollars, occupying 11.61% of the whole nation’s GDP. The structure adjustment, energy saving and environment protection of the industry all obtained great progress. However, our country’s industry development still faces many problems that need to be resolved immediately: the iron mine stone’s dependence degree on the outside markets is increasing; the bottleneck of the coal, electricity, water resources and conveyance ability and so on is increasingly serious. Low concentration degree, advanced productivity and undeveloped productivity exist simultaneously; the average energy consumption still has a big gap compared with the developed nations. Facing the development targets that the energy consumption per GDP unit must descend 20%, and the quantity of pollutant per GDP unit must descend 10% during the “fifteen fives” periods, developing circulation economy is the necessary road to develop the industry of our country.

1. The present development condition analysis of the industry

1.1 Production capability relatively superfluous, the product structure still needs adjustment

Along with the fixed assets investment of the industry growing fast, the production ability of iron-making, steel-making and steel rolling of the whole country accelerates quickly (for details please refer to figure 1). Including the iron and steel productivity which has not been put into use and the projects in construction, the iron-making comprehensive ability will attain 475 million tons, steel-making comprehensive ability 538 million tons, and the steel rolling comprehensive ability 534 million tons. But the national steel material requirement is anticipated to be 337 million tons in 2006, 10.12% increase compared with last year. The contradiction of the productivity excess begins to appear, but now this kind of excess is relatively structural excess.

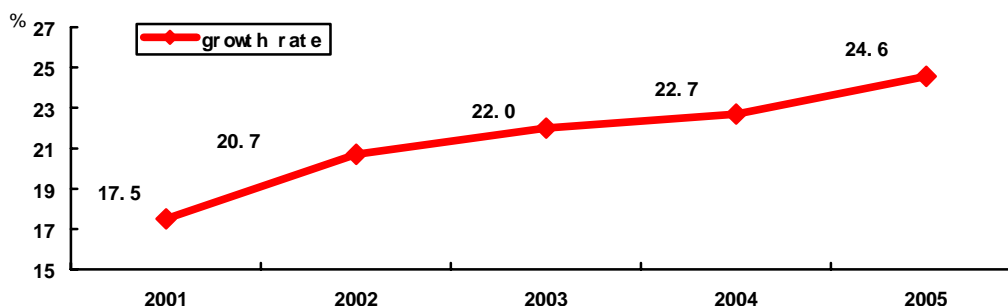


Diagram 1: In 2001 – 2005 the industry’s crude steel yield growth rate
Data source: Chinese iron and steel association

In 2005, the crude steel yield of our country attained 349 million tons, increasing 69 million tons, about 24.56%, compared to last year, the biggest increase than ever before. However, along with the productivity excess of general steel, the productivity of our country’s top grade, high quality steel products are in shortage. It can't satisfy the requirement of the local market, and has to depend on import in great quantities. In 2005, our country imported 25.8 million tons steel products, among which 22.4 million tons are plate material, accounting for 86.88%. Although the ratio of plate in our country has already rose to 38.56% in 2005 from 36.34% of 2004, it still lagged behind the developed countries’ level. Therefore, our country’s iron and steel product structure still needs further improvement.

1.2 Low profession concentration degree, and high average energy consumption

According to statistic of the iron and steel association, in 2005 the steel profession 4 factory's concentration degree and 8 factory's concentration degree of our country is 14.1% and 25.3%. Low profession concentration degree; advanced productivity and undeveloped productivity exist simultaneously; high average energy consumption.

According to the iron and steel association’s statistic data, comprehensive energy consumption of the big and medium-sized steel enterprise of our country is 741.05kg standard coal per ton in 2005, decreasing 188.95kg standard coal compared with 2000. It decreased 20.32% energy consumption in five years. The fresh water consumption is 8.03m³/t, reducing 17.21m³/t, lowering 68.19% in five years. The electricity consumption declined from 459.31kwh in 2004 to 452.24kwh, saving 1.51%. Though the average energy consumption of our country’s steel enterprise has lowered, it still needs further improvement compared with international advanced level (see figure 2). The energy saving potential of the industry is still very high.

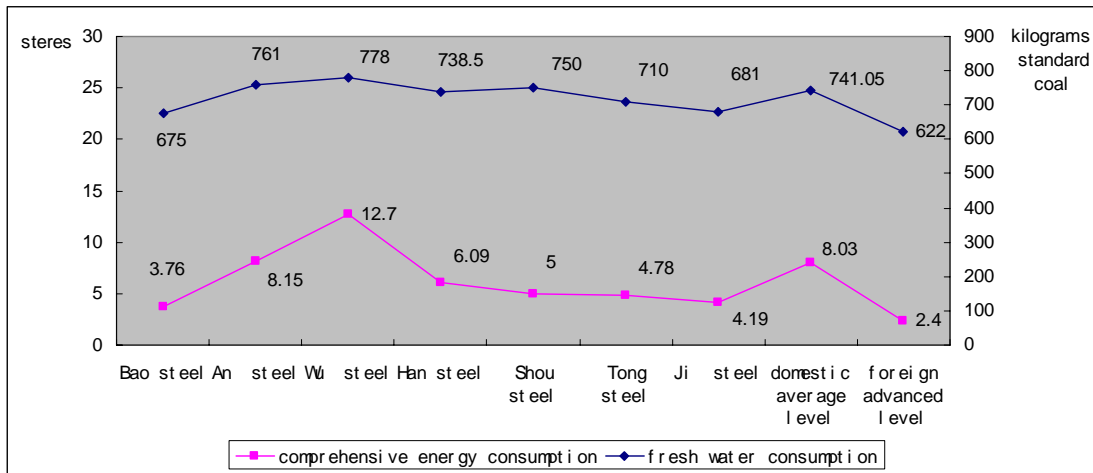


Diagram 2: the comparison of our country's steel enterprise energy consumption level and international advanced level

1.3 The increasing resource restriction

1.3.1 Lack of iron mine resources, and higher dependence on mineral import

Along with the increase of our country's steel yield, the requirement of iron mine resources is becoming bigger and bigger. Although the iron mine stone yield of our country is big, the grade status is low. Currently it can just satisfy the requirement of 100 million ton pig iron production and hard to satisfy the growth of mineral stone requirement. The mineral dependence degree on import rises year by year, while the resources guarantee degree lowers. Concrete data have been showed in figure 3:

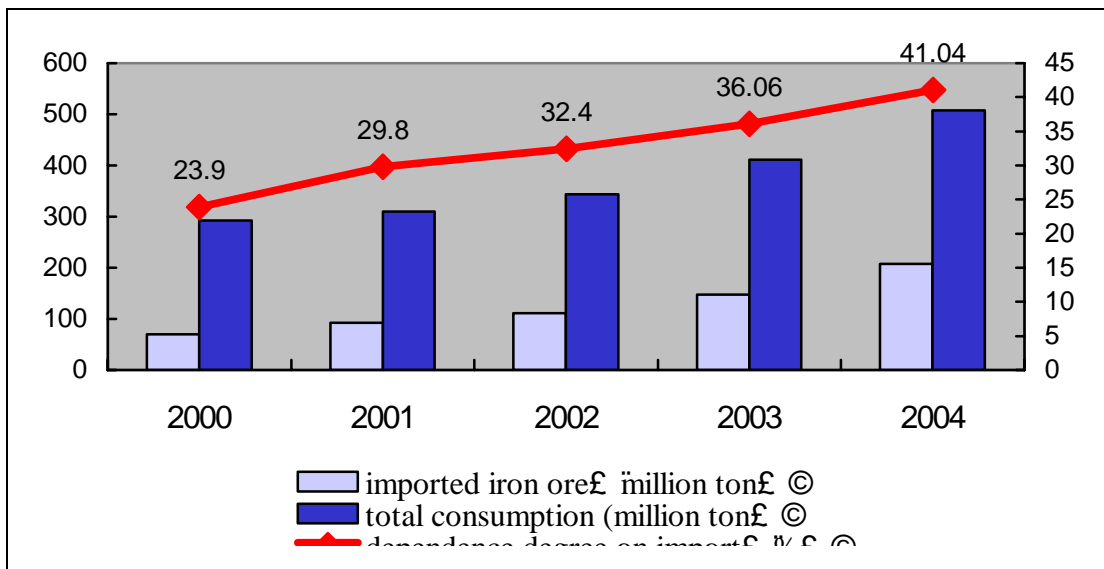


Diagram 3: China's total iron mine stone consumption and the growing trend of dependence degree on import in 2000~2004

Data source: Chinese iron and steel industrial almanac (2005)

1.3.2 The shortage of Coal, electricity, and water resources

At the coal and the coke aspect, though along with the puddling technique has improved, the coke ratio of our country's iron and steel profession descends further.

Owing to the total steel product's acceleration, the requirement of the coke keeps on exceeding local coke yield growth, especially fatty coal and main coal, which still have to depend on import.

As for electricity consumption, the industry's use of electricity accelerated in recent years. From 2000~2004, the industry's electricity use quantity increases from 112.6 billion kilowatt-hours to 219.8 billion kilowatt-hours, about 95.2%. In east China region which in great lack of electricity, 20%~30% production abilities have to idle.

Our country's total water resource descends year by year. From 2000~2004 it decreased from 2770 billion m³ to 2410 billion m³; form 2193m³ to 1856m³ per person. Industry using water occupies 20% of the whole country's consumption, while the steel industry takes a great part, only next to thermal power, spinning prints. Polluted water discourse increases year by year. Water pollution not only worsens the headstream water ecosystem system seriously, but also results reduction of the amount of water that can be used, deteriorating water shortage problem.

1.4 Low railroad conveyance and port load and unload ability

Being an intense resources consuming industry, the industry requires great transportation ability. Generally speaking, 5 tons' transportation ability is needed for 1 ton steel production. Now the industry conveyance mainly depends on the railroad and ports. Take iron mine stone as an example. Local iron mine stone conveyance mainly relies on ports and railroads to convey products to steel business enterprises. Railroads deliver 80% iron mine stone, while highway and aquatic conveyance only 20%. But in recent years our country's railroad capability increases less 10% per year, and the railroad truck about 2%, but the industry's growth exceeds more than 20% continuously for many years. Contradiction between the railroad conveyance and high-speed development of the industry is more and more outstanding.

Unsatisfying railroad capability has made the imported iron mine stone piling in the ports. According to the statistic, in 2004 main harbors such as Qingdao harbor, Beilun harbor, Zhanjiang harbor, Qinghuangdao harbor, Yantai harbor had about 2 million mine stones respectively piled in the harbor for 10~ 20 days.

2 The development trend of China' steel industry

Though the Chinese steel consumption increase speed decelerates, we still can predict China's steel material consumption will keep growing, and there still has the space for the industry to develop according to the following reasons:

(1) China industrialization has not yet finished, and the industry still has development space. Entering the 21st century, especially before 2010, China will still be in the industrialization progress. Currently the average GDP has already exceeded USD 1000, and is predicted to be USD 2000 in 2010, still belonging to low-to-middle income nations. According to the strategic target of the government, our country economy growth the speed is in 7-8%, and the need for fundamental raw materials is increasing continuously.

- (2) The Chinese town turns still has not finished, providing further space for the industry's development.
- (3) The improvement of residents' consumption structure, bringing new steel market.
- (4) The manufacturing industry transfers toward China, bringing the new need of the steel.
- (5) Steel material and its products should extend export in addition to satisfy the local need. It also should include export of manufacturing of machines that are closely related to steel materials manufacturing, shipbuilding, automobile, container, and electric appliance etc.
- (6) Supplement eliminated productivity.

Figure 4 is the estimation of growth rate of each profession's use of steel in 2006.

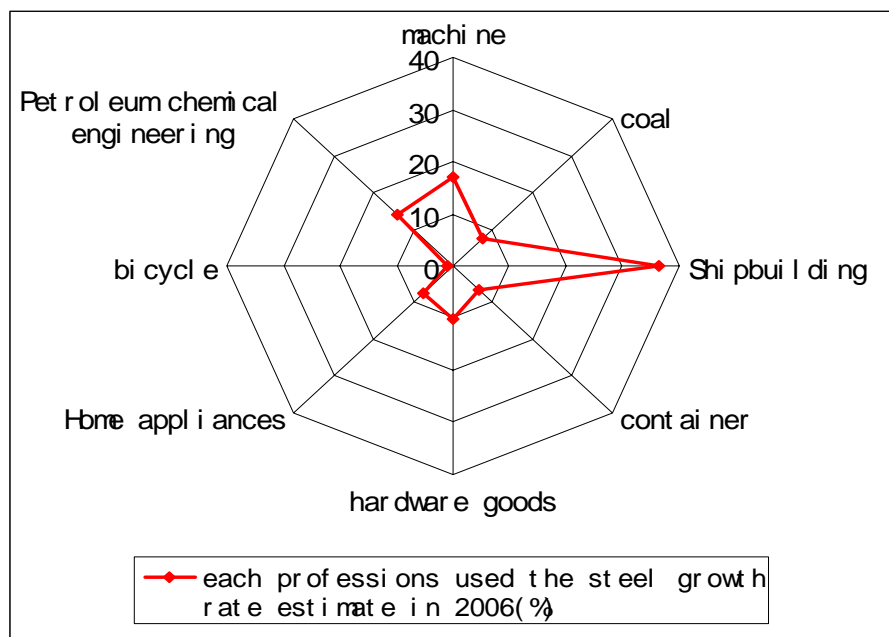


Diagram 4: Each profession used the steel growth rate estimate in 2006
Data source: Chinese iron and steel association

3 The contradict between development and environment protection

With economic development, human survival increasingly strict environmental requirements, the state will adopt various measures to limit the emission of pollutants, particularly industrial pollutant discharge limits. China's iron and steel industry to further expand the existing scale, the energy consumption and pollutant emissions will be constraints and limitations, particularly emission and control of sulphur dioxide, sewage, waste residue, CO₂ and other pollutants. We can have a preliminary understanding about impact of the steel industry on the environmental from the data as follow:

As one of the biggest pollution causers, the industry is facing bigger and bigger environment pressure. Currently, steel business enterprise discards 191 tons aquatic hydroxybenzene, 127 tons cyanide (press the cyanotype root to account), 82600 tons chemistry in the waste water, 6600 tons nitrogen oxygen per year. Discard the residue

exhausts the quantity as 57 million tons (Do not contain the mineral mountain).The sulphur dioxide in the waste gas exhausts the quantity as 600,000 tons, the smoke and dust is 140,000 tons, industrial dust 420,000 tons among them, the industrial dust exhausts 13% of the whole country's total amount. Though along with the effective management, steel pollutant lowers year by year, the total amount of pollutant still increases because of extension of steel production. Environment problem has become an important problem that the steel profession has to resolve.

Iron and steel industry is highly material and energy-intensive enterprises, the every ton of production needs input about 2 tons and 700kg standard coal energy materials. According to our current level of energy consumption every ton of steel production emits about two tons of CO₂ (in 1994, about 2.5 tons of carbon dioxide tons). 2005 China's steel output was 350 million tons; there is a huge space on CO₂ emission reduction in China's iron and steel industry compared not only in terms of total energy consumption but also the unit production energy consumption.

4. Strengthen international cooperation to improve environment

4.1 Energy use and carbon dioxide emissions of the Chinese steel sector in an international context

During the past decade, interest in comparing energy use and greenhouse gas emissions trends between countries has grown in response to the many issues raised as a result of the United National Framework Convention on Climate Change (UNFCCC). The UNFCCC was signed in 1992 by over 150 countries that committed to the goal of stabilizing greenhouse gas concentrations 'at a level that would prevent dangerous anthropogenic interference with the climate system. In 1997, at the third Conference of the Parties (COP-3) to the UNFCCC in Kyoto, Japan, the signatories agreed to the Kyoto Protocol that outlined emissions reduction targets for the Annex I countries, but not for developing countries. Even so, it is generally acknowledged that developing countries have a role to play in abating global climate change since greenhouse gas emissions are growing rapidly in many of these countries. Thus, in order to fairly compare and assess greenhouse gas emissions trends and reduction opportunities, it is important to develop a consistent methodology for making international comparisons.

The international comparisons can follow the methodological recommendations from two workshops and a handbook on international comparisons of industrial energy efficiency. These comparisons can be used to analyze differences in trends between countries as well as to identify opportunities for energy efficiency improvement and greenhouse gas emissions reductions.

When compared to other major developing and developed countries, China is clearly the largest producer of steel and thus consumes a significantly larger amount of primary energy and has equally large related carbon dioxide emissions Primary energy consumption does not correlate exactly with steel production levels, however, due to changes in production technology structure and in the energy efficiency of steelmaking equipment.

4.2 Estimating potential energy savings and carbon dioxide emissions reductions in the steel industry in China

Differences in physical energy intensities between countries are due to differences in energy efficiency as well as structural differences. In order to account for the structural differences, a best practice benchmark energy intensity using best practice energy intensities for the actual product mix and feedstocks used in each country can be calculated. The best practice benchmark energy intensity is calculated to reflect the sector structure for each year for each country, based on that country's product mix and feedstock. This methodology accounts for the share of both primary and secondary steel produced in the country each year. In the iron and steel industry product mix is defined as the share of iron, slabs, hot rolled steel, cold rolled steel and wire. Feedstocks (e.g. scrap, iron ore) are important because the product quality can be influenced by the scrap input due to contaminations from other metals (i.e. product mix is influenced). Also, the quality of the ore (i.e. the iron content) can slightly affect energy use in the blast furnace. These best practice benchmark energy intensities are then compared to actual energy intensities. To make this comparison, we can use an energy efficiency index (EEI) which is the ratio of the actual energy intensity to the best practice energy intensity, where the best practice equals 100.

As with energy intensity, the structural differences between countries can be taken into account by calculating a carbon intensity index, which compares the actual level of emissions per ton of product to a best practice benchmark level of emissions. The best practice benchmark carbon intensity for each of the processes and products is calculated by multiplying the actual carbon intensities with the best practice carbon intensities and the carbon emission factor for each process.

The sectoral best practice benchmark carbon intensity is calculated as a weighted average based on the shares of the processes and products in each country. The carbon intensity index is the ratio of the actual carbon intensity to the best practice benchmark carbon intensity, where a carbon intensity of 100 represents best practice and the higher the carbon intensity index the higher the emission reduction potential for a given sector structure.

Compared to the EEI there is one complicating factor in calculating the carbon intensity index. In addition to sector structure and energy efficiency, fuel mix also influences CO₂ emissions per ton of product. Using the fuel mix associated with the best practice technology in the carbon intensity index calculation implies a fuel switch from actual fuel mix to this best practice fuel mix. Because of constraints on the availability of indigenous resources this is not always economically feasible. Therefore, we can exclude the influence of fuel mix in our calculations of the carbon intensity index. This is done by using a national average fuel mix, instead of the best practice fuel mix; to calculate the benchmark carbon intensity. This means that the index is an indication of the emission reduction potential by efficiency improvements only. Additional emissions reductions can be accomplished through fuel switching.

Identification of the technical potential primary energy savings and carbon dioxide emissions reductions provides a rough estimate of the savings potential available in various countries. While the technical potential is based on actual energy

use and carbon dioxide emissions from plants in commercial operation, country and plant-specific conditions will determine what portion of the technical potential can be realized in any given country.

5 Summary and conclusions

Steelmaking is a very energy-intensive manufacturing process and accounts for over 10% of China's primary energy use and related carbon dioxide emissions. To understand the potential for saving energy and reducing emissions in this industry, it is important to clearly understand how the energy is used and to correctly account for the energy consumed for actual steelmaking. We must make a number of adjustments to the official Chinese energy consumption statistics for the steel industry in order to remove energy use for activities not directly associated with the production of steel, to correct for double-counting of some coal-based energy consumption, and to add energy use for a small portion of the steelmaking industry that is not included in official statistics. Using these adjusted values, we will find that Chinese energy use and associated carbon dioxide emissions are still very high when compared to other countries and to best practice energy consumption values. If best practice technology had been used to produce the same amount and types of steel in China, energy savings and carbon dioxide emissions reductions of 45% could have been achieved.

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