



Chinese cement industry Transition, Status quo, Policy trend and Challenge

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Abstract: Chinese cement industry has been changed tremendously with economic development of China. This article reviews the history of Chinese cement industry and analyzes the current situation of cement industry from the political, environmental, and the other aspects by using the PEST analytic method. The challenges for the evolution of Chinese cement industries are also clarified.

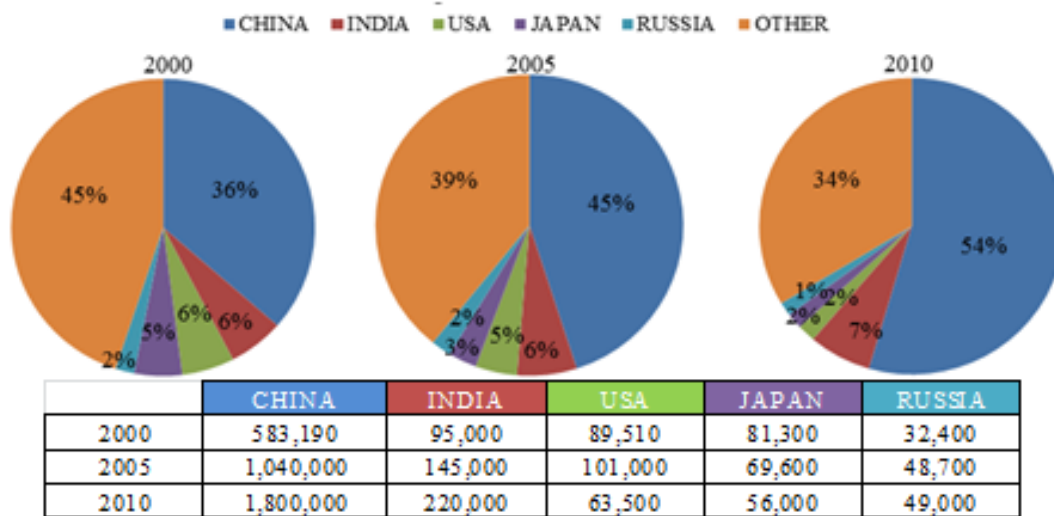
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INTRODUCTION

With the economic growth, China has become the “factory of the world”. Instead of that, however, it is now burdened with serious economic and environmental problems. In Europe, America, the Middle East, and East Asia (China, Taiwan, and South Korea), one company usually builds a large-scale factory, and consistently produces oil and petrochemical goods in the system of one company. Differently from it, two or more companies are concentrated in the coast landfills in Japan, and generally manufacture in the system of groups. The system of production in a petrochemical complex would be a medium-scale level if it sees worldwide. There is the reason by which this system was generated.



Source: Edited by Mineral Commodity Summaries USGS

Figure1 Cement by country share of world

Cement production has expanded greatly. The world production of cement has increased from 1.6 billion tons in 2000 to 3.3 billion tons in 2010 (Figure 1). As the demand for cement in developing countries has increased, China’s share of world production has surged from 36% in 2000 to finally reach 54% in 2010, which accounts for more than half of production.

Reducing CO2 from cement production and improving its energy efficiency are now nationwide propositions 1). In order to improve energy policies in China, a plan to optimize the production system in the cement industry was implemented that has been targeting cement businesses from 2004 onwards to reorganize inefficient companies and weed out those that have kilns with low energy efficiency. According to these policies, the proportion of production using the New Suspension Preheater (NSP) has expanded to roughly 70%.

In 2006, Chinese government declared a policy to reduce the number of cement companies from 5000 to 2000. As the result of it, approximately 1500 production lines were closed by 2008, the volume of production was reduced by 52 million tons, and 1066 plants were removed 2).

These policies, however, have not been sufficient and there are still many natural resource and environmental problems in the industry. Chinese industry greatly affects the world’s resources and the global environment. Thus, it is necessary for China to receive support from developed countries, such as technology transfer regarding to energy and environmental management.

THE STATUS QUO OF CHINESE CEMENT INDUSTRY

Cement classification and production methods

Cement consists of pulverized limestone, clay, silica, and iron raw materials. Cement clinker is made by heating the above mentioned materials at high temperature. Portland cement can be obtained by the addition of plaster and pulverization.

Cement in Japan can broadly be divided into three types, "Portland cement", "blended cement", which is a combination of mixed materials of primarily Portland cement, and also "special cement". The one mainly used in construction is Portland cement (Table 1, 2).

Table 1 Structure of cement	
Portland cement	= Clinker + Plaster
Mixed cement	= Clinker gypsum + Mixed material
Special cement	
Source: The Institute of Cement Association	
Table 2 Type of cement	
Portland cement	Ordinary Portland cement High-early-strength Portland cement Ultra-early-strength Portland cement Moderate heat Portland cement Low-heat Portland cement Sulfuric acid salt Portland cement White Portland cement
Mixed cement	Slag cement Fly ash cement Silica cement
Special cement	Alumina cement Ultrafine particle cement Cement solidifying material
Source: The Institute of Cement Association	

According to the Chinese National Standard (GB), general cement is classified into as shown in Table 3. Special cement is classified according to its use and performance.

Table3 Kind of common cement China

Type	Sign	Component		
		Clinker	Plaster SO ₃	Admixture
Portland cement type I	P. I	95~98%	<3.5%	—
Portland cement type II	P. II	90~97%	<3.5%	<5%
Ordinary Portland cement	P.O	80~92%	<3.5%	6~15%
Slag Portland cement	P.S	25~78%	<4%	20~70%
Pozzolana Portland cement	P.P	45~78%	<3.5%	20~50%
Portland Cement flyash	P.F	55~78%	<3.5%	20~40%
Composite Portland cement	P.C	45~83%	<3.5%	15~50%

Source: The statistics by the number midoro network

Table4 China Cement kiln

- shows the typical cement production methods in China.

China cement kiln	Long kiln	Long hollow drying kiln
		Long wet kiln
		Retour kiln
		Suspension preheater kiln with Suspension Preheater (SP)
		New dry kiln outside cracking furnaces (NSP)
	Vertical kiln	Usually vertical kiln
		Machine vertical kiln

Cement manufacturing processes in China

Cement manufacturing can broadly be divided into five processes, such as (1) mining of raw materials, (2) blending and pulverization of raw materials, (3) firing, (4) finishing, and finally, (5) shipping (Figure2).

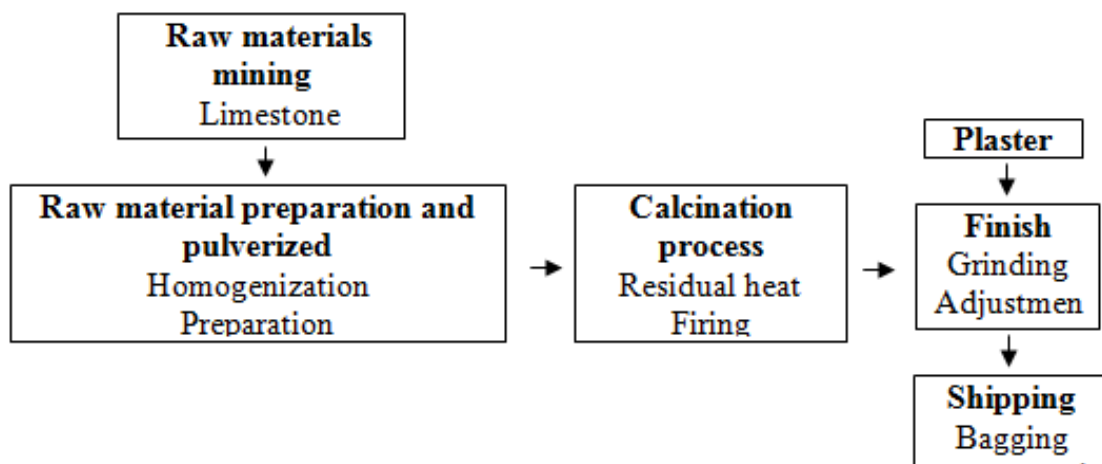


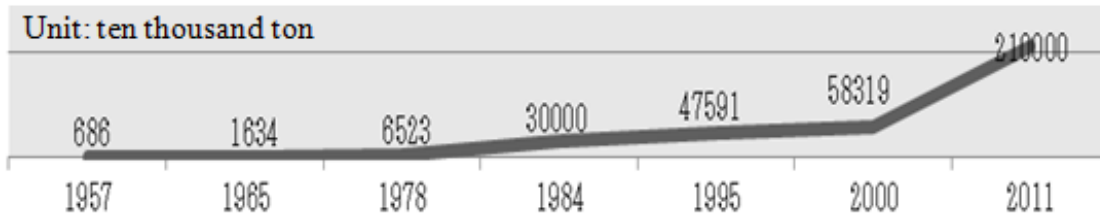
Figure2 Cement manufacturing process diagram

Changes in China's cement industry

The cement industry has supported China's socio-economic development through the supply of foundation materials for construction. Chinese cement industry has developed at very high speed over the approximately 63 years that have passed since the founding of the state of New China in 1949).

1949~ 1957	After the founding of recovery And Initial stage of development
	1949:34 companies, 1952:2.86 million tons, 1957:6.86 million tons, Imported from abroad: production line, 1957: The published standard cement
1958~ 1965	Great Leap Forward policy outcome And Economic adjustment stage
	1958:34% increase from the previous year, 1959: 27% increase from the previous year 1965: 16.34 million tons "Established one company large and medium-sized cement companies in each ministry properly" The spread across the country 3.2 million tons stand kiln domestic
1966~ 1978	"Three line" construction And Stage of promoting "Cultural Revolution"
	1970:Established rotary kiln standard 4.4×180m production line 1978:65.23 million tons Cultural Revolution started, stagnation of economic activity, production of continuous decline Energy consumption and raw materials increase
1979~ 1984	Cement recovery of adjustment
	Announced the "About acceleration of cement industry development" Imports the new dry process production line from Japan and Romania NSP method is standard, I show how the development of the cement industry
1985~ 1995	The cement industry vigorous development stage
	Innovation to the new dry process kiln from the wet Cement companies listed, accelerate the development and expansion 1995:593.99 million tons production capacity
1996~ 2000	Cement industry structure adjustment steps
	1996:Change to modernization building materials industry 1998: To overproduction in the proliferation of small and medium-sized enterprises 2000: Lose the 3108 production line
2001~ 2011	New dry process high-speed development And Stage mergers and restructuring of industry
	2002: Lose the 4894 line small kiln, 2007: Conducted mergers and reorganizations 2011: 2.1 billion tons

Figure3 History of China cement industry



Source: Resized by each data

The current status of Chinese cement

According to the statistics on the cement industry by the National Bureau of Statistics of China, the volume of cement produced in 2012 increased by about 7% on 2011 to reach 2.21 billion tonnes (Figure 4).

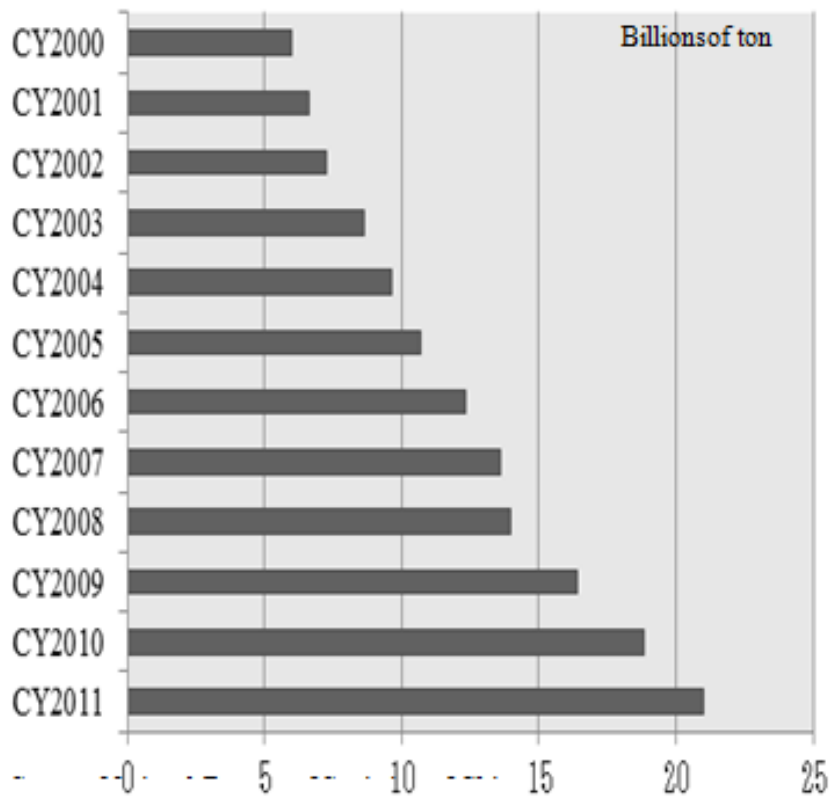


Figure 4 Annual production of cement in China

Due to the effect of the real estate restraint policies, from the latter half of 2011, the growth rate of cement production decreased. Amid a swelling stock due the downturn in demand, plants began to either stop or cut back production. Reflecting the trend in supply and demand, the price of cement then dropped continuously up until the end of 2012 4) (Figure 5).

Chinese government’s policies

The Chinese government has continued to uphold “industrial consolidation” and “environmental protection” as two major themes in the 12th five-year plan of 2011. As to the “industrial consolidation”, the Chinese government promotes the consolidation of the cement companies and increases the market share of the ten largest cement manufacturers up to 35% by 2015. As to the “environmental protection”, the Chinese government facilitates the replacement of small-scale, old-fashioned, and inefficient plants with large-scale, state-of-the-art, and efficient ones, with the consolidation of the cement industries.

The leading Chinese cement companies

The leading private companies in the Chinese cement industry are located by region, because of the logistic problems of the procurement of raw materials and distribution of products. Thus, the leading companies locate in the economically-developed coastal regions. Table 6 shows the five largest cement companies for clinker production volume in 2012.

	Corporate group name	Location (China)	Production volume (Billions of tons)	Growth rate (%)
1	CNBM	Northern, Central Southwest, South	2.95	50.51
2	CONCH	Eastern, Southern	1.50	12.00
3	SINOMA	North, Northwest	0.72	29.17
4	JIDO	Central, Northern	0.67	26.87
5	CRCHL	Southern	0.54	3.70

Source: network number midoro

The energy consumed by the cement industry

The energy-saving methods of the cement production are the Suspension Preheater (SP) method and the NSP method, and their utilization ratios in some countries are shown in Figure

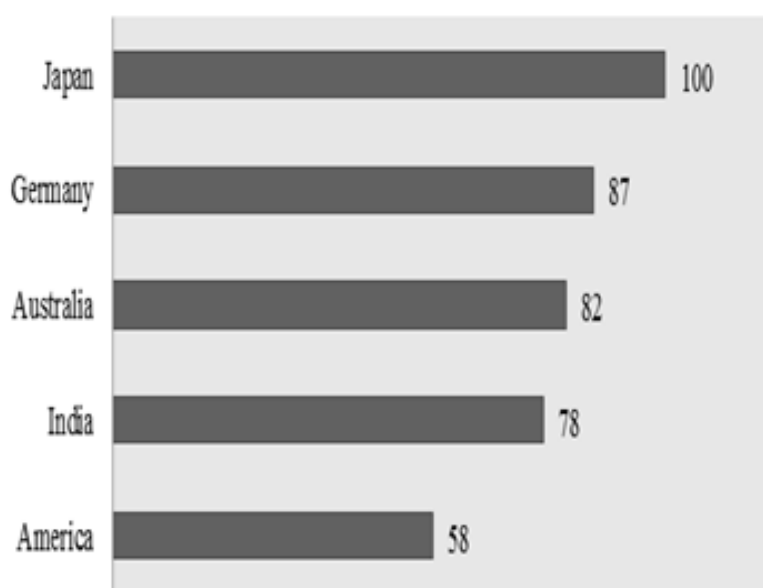


Figure 6 Penetration of SP • NSP (Production volume and capacity based)

Table 7 shows the energy efficiency for cement production in China and the developed country (Japan).

	china	Advanced level international comparison
Cement energy consumption [kgce (coal equivalent) /ton]	126	118(Japan)

Source: China the Energy Statistics

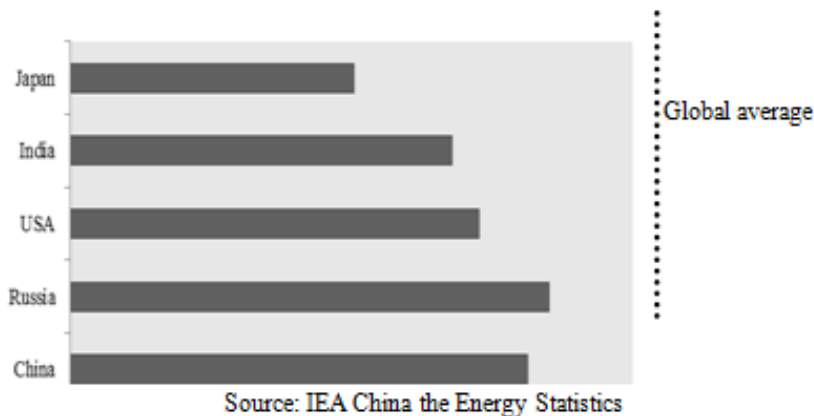


Figure 7 International Comparison of cement energy efficiency

PEST analysis for China’s cement industry

The PEST analysis was applied to the Chinese cement industry. The results are shown in Table 9 and it describes that the opportunities for and barriers to the expansion of Chinese cement industry can coexist.

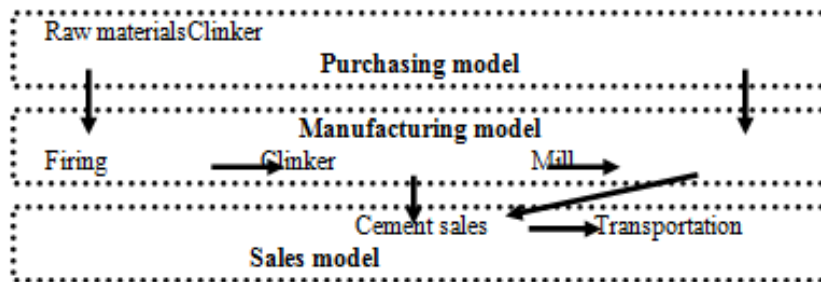
Production methods	Clinker heat consumption (kJ/kg)	Clinker coal Consumption (kgce/t)	Relative value (%)
NSP • SP	3269	111	100
Reporu kiln	4096	140	126
Vertical kiln	4180	143	129
Long hollow drying kiln	5434	186	168
Long wet kiln	5852	200	180

Source: China the Energy Statistics

China's cement supply chain

Figure 8 shows the supply chain of Chinese cement industry. It consists mainly of the 3 parts such as purchasing model, manufacturing model, and sales model.

As manufacturing models, firstly, in the “single plant type”, the processes, purchase → clinker manufacture → milling → finishing → sales, and so on, are all completed at the same plant, the second is the “clinker + finishing plant type”, in which, while the purchase of raw materials and clinker manufacture is completed in a suburban plant, milling → finishing → sales, and so on, is completed in an urban neighbourhood, and thirdly, the “finishing type” consists of just the processes clinker → milling → finishing → sales, and so on.



Figur8 Industrial chain of china cement

Political factors	Due to policy, industry consolidation and reconstruction is accelerated
Economic factors	Expansion continues to infrastructure investment
Social factors	Promotion of energy efficiency
Technology factors	Birth and spread of new technologies

PROBLEMS FACED BY CHINESE CEMENT INDUSTRY

With the structural adjustment of the world's coal industry due to restrictions on natural resources and energy, as well as the environment, the business is feeling pressure from such factors as the continuing high coal price, shortage of electrical power, a shortfall in rail transport capacity, and the high-level cost of fares.

Although the tendency of China's cement industry to show a healthy increase is continuing, manufacturing technology is lagging when compared to developed countries, and a lack of investment in research and development means that the small capacity for innovation now presents a large obstacle (Table 10).

Persistent problems of imbalance exist: firstly, in the distribution of production; secondly, in the amount of fixed assets investments; and thirdly, in the distribution of total assets in cement.

Item	Developed countries	China
Company size	World 60-120million t Europe 70-80million t Japan 260million t	8million t
Rate of production	France 3000t/worker Germany 3000 t/worker Japan 15000 t/worker	District 160 t/worker National 280 t/worker
Kiln system Utilization rate	94%	89%
Clinker Heat consumption	World 2800kJ/kg Japan 2900kJ/kg	3900kJ/kg (Long kiln average)
NSP heat consumption	2888 kJ/kg Clinker	3555 kJ/kg Clinker
Clinker production Coal consumption	100kgSoot /t	175kgSoot/t
Cement manufacturing Power consumption	85kWh/t	115kWh/t
Clinker strength	70	60
Kiln dust emissions	25mg/ Nm ³	57mg/ Nm ³
Kiln exhaust gas NOx	200 mg/ Nm ³	500~ 1200 mg/ Nm ³
Kiln exhaust gas SO ₂	50mg/ Nm ³	200~ 400mg/ Nm ³

Source: China the Energy Statistics etc.

Eastern China, Southern China, Central China, and Northern China have become separate market leaders, respectively.

The top 10 companies in China only occupy 23% of China's market share, whereas the top 10 companies in the world occupy nearly 50% of world's market share, China's poor industry-intensive situation is thus evident.

The government has accelerated the transfer and weeding out of companies which do not conform to environmental policies, and has prohibited any new construction and expansion of cement companies that discharge large amounts of pollutants (Table 11).

Country	Dust (mg/Nm ³)		SO ₂ (mg/Nm ³)	NOx (mg/Nm ³)
	Kiln	Chiller		
Germany	50	50	400	500
France	50	100	500	1200
UK	40	50	200	900
US	70	40	750	900
Japan	50	50	750	500
China-1	100	100	400	800
China-2	150	150	800	1600
China-3	100	100	600	400

Source: China Cement Association
Note: China-1: Grade 2 Long kiln, China-2: Tertiary long kiln, China-3: Class vertical kiln.

The government has laid down goals for the cement industry to help build a recycling-oriented society that is energy and resource-saving. Business expansion is being constrained due to lack of policies and standards. Study on policy and financial support to the technological development and the installation of waste receiving and treatment facilities is underway.

CONCLUSION

The Chinese cement market is the largest one in the world, and is also an open up market. All the world's top cement companies have entered this market. In recent years, along with the strengthening of national policy on environmental protection and the improvement of production technique, the large Chinese cement companies have helped China cement industry to reach the global advanced standards gradually through both self-driven technology innovation and acquisition of international advanced technologies.

That said, when compared with international cement companies in the global cement market, China cement companies should further strengthen capabilities in the following areas including competitive edge, emerging- and resource-saving technologies, energy consumption, labor production, and utilization of resources and wastes. The following points help highlight the directions for further study and observation: (1) To consider the investment made by Japan's cement industry in China, (2) To consider the possibilities of transferring Japan's energy- and resource-saving technologies to China, (3) To consider the effects on the environmental protection if advanced technology were to be introduced to China, (4) To propose the required mechanisms to allow innovation in China's production.

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