

# Explore the Motivation and Path of Green Transformation in Cement Industry

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**Abstract.** The cement industry in China plays a very important role in the manufacturing industry, and the transformation and upgrading of the cement industry is an important part of promoting the realization of the "double-carbon" goal. This paper sorts out the development status of the cement industry, summarizes the motivation of its green transformation, and deeply analyzes the possible path of its transformation, providing a possible reference for the transformation and upgrading of the cement industry.

**Keywords:** Green transformation; Cement industry; Transformation motivation.

## 1. Introduction

Green development is the background of high-quality development, and new quality productivity itself is green productivity. Under the background of "double carbon" goal, the previous development model of high pollution and high emission is no longer applicable to the current development environment. Promoting the green transformation of the economic development mode is the trend of the international trend and the general trend, and the green transformation of the industrial development mode is the basis of the green transformation of the economic development mode. Therefore, the cement industry, as an important branch of the traditional manufacturing industry, promotes the transformation and upgrading of the cement industry, discusses the motivation and path of its green transformation, and is an important link to build a green low-carbon circular economic system and promote the comprehensive green transformation of economic and social development.

## 2. Connotation of green transformation of cement industry

### 2.1. The concept of green transformation

Green transformation is an important link in the green transformation of the economic development mode under the goal of "double-carbon". Green transformation depends on advanced technologies to promote the development of the industry towards digitalization, networking, intelligence and environmental protection. Many scholars study the relationship between digitalization and the green transformation of industrial structure from the perspectives of transformation efficiency and structural optimization.

To advocate the green industrial structure, we need to build key measures such as green manufacturing, green products, green factories, green parks and green industrial chain, and strive to develop a modern green industrial system. We will eliminate outdated, energy-intensive and high-pollution production capacity, and actively foster low-carbon and efficient industries, such as integrated circuits, new materials and biomedicine, to significantly reduce the carbon emission intensity.

### 2.2. Green transformation of the cement industry

In January 2024, the Ministry of Ecology and Environment and other relevant departments jointly issued the Opinions on Promoting the Implementation of Ultra-low Emissions in the Cement Industry, which clearly put forward the goal of promoting the realization of ultra-low emissions in the cement

and other industrial sectors. By the end of 2025, the key areas are expected to achieve significant results, with the target of achieving about 50% of the cement clinker capacity to complete related transformation, and ensuring that large state-owned enterprise groups in the region basically complete organized and unorganized ultra-low emission technology innovation. By the end of 2028, the cement clinker production enterprises in key areas are expected to fully complete the transformation, while the whole country will strive to achieve 80% of the cement clinker production capacity to complete the technical transformation of ultra-low emissions. The move marks another green transformation in China's traditional industrial sector to achieve ultra-low emissions, following the coal-fired power plants and the steel industry.

### **3. Development status of the cement industry**

#### **3.1. Operation status of the cement industry**

In 2023, China's real estate industry will be deeply adjusted, dragging down the demand for cement. The total demand for cement throughout the year shows a downward trend, and the development of the cement industry is facing severe challenges. Affected by multiple factors such as intensified market competition, high upstream raw fuel costs, downstream real estate downturn and environmental energy consumption constraints, cement production declines, the price fluctuates at the bottom of the operation, cement enterprises' costs rise, inventory is high, and the industry profit is meager.

According to the National Bureau of Statistics data, the performance is in the following aspects.

1. The demand of cement industry is insufficient, and the national real estate development investment, the construction area of real estate development enterprises have all declined in the past two years. Cement demand for the full year fell 4.5 per cent year on year.

2. Output decreased. In 2023, the national cement output above designated size was 2.02 billion tons, down 0.7% from the previous year, and the cement output was the lowest level since 2011.

3. Cement price is high before and low after. In 2023, the domestic cement market price generally shows high before and low after, and shock adjustment trend. According to the statistics of the Information Research Center of China Cement Association, the average transaction price of the national cement market in 2023 is 394 yuan / ton, down 15% from the previous year, and the price is at the lowest level in nearly six years.

#### **3.2. The cement industry faces difficulties and challenges**

1. The green transformation of the cement industry lacks successful guidance, and the transformation cost is high

Since 2022, energy prices have gradually risen, and the proportion of energy cost in cement production cost has been rising, increasing the cost pressure of cement enterprises. At the same time, the requirements of energy consumption, including "ultra-low emission", safety, environmental protection and carbon emission reduction, etc., promote cement enterprises to continuously increase investment in technological transformation, and cement enterprises face great cost pressure.

Compared with the automobile industry, new energy manufacturing industry and other industries, the green transformation progress of the cement industry is lagging behind. According to the action program of implementing the strategy of manufacturing power mentioned in "Made in China 2025", the green transformation of the cement industry is imminent, and there is an urgent need of a batch of intelligent cement factories with information digital system to lead the reform of China's cement manufacturing mode. These intelligent factories will guide the concentration of innovation resources in digital and intelligent fields, and promote green innovation in industrial technology, products and business forms.

2. The endogenous impetus of green transformation of cement industry is insufficient, and the industry profit is meager

In 2023, the cement industry encountered the most serious challenges. Affected by multiple factors such as intensified market competition, high upstream raw fuel cost, downstream real estate downturn and enhanced environmental protection energy consumption constraints, the profits of enterprises shrank substantially, the industry profit is thin, and the sales profit margin of the cement industry is at a low level. The larger decline in profits is mainly concentrated in the Yangtze River Delta, Pearl River Delta and southwest China and other major cement consumption areas.

The cement industry has been oriented by economic cost for a long time, but the value concept of green development has not been effectively promoted, green technology has not yet been mature application, and the standardization of green production is still in its infancy. First, under the premise that the development prospect of the industry is not clear and the benefits of green transformation are unknown, it is a relatively low-risk choice for cement enterprises to maintain a wait-and-see attitude and strive for their own interests. Second, the green transformation of the cement industry often requires the high cost of green technology research and development and the iteration cost of green production line. Although the green transformation of the industry is the general trend, how to balance the cost and income, to ensure that the enterprise invested in green production, research and development costs can obtain the corresponding economic benefits, to ensure the "win-win" of economic benefits and environmental benefits, is still a problem faced by the green transformation of the cement industry.

## **4. The motivation of the green transformation of the cement industry**

### **4.1. External drivers**

PEST analysis is the basic tool of strategic external environment analysis, which generally grasps the macro environment through the four aspects of politics, economy, society and technology. Therefore, this paper uses the PEST analysis method to analyze the internal motivation of the green transformation of the cement industry.

#### **1. Legitimacy factors**

Environmental regulation promotes the green transformation of the cement industry. In recent years, the state has continuously introduced a number of policies and measures to reduce the carbon consumption in cement production, encourage the research and development of key low-carbon technologies, promote the green transformation of the economy and society, and help the realization of the "double-carbon" goal.

In September 2020, China proposed to achieve a carbon peak by 2030 and achieve carbon neutrality by 2060. On August 1 of the same year, the Ministry of Industry and Information Technology, the National Development and Reform Commission, and the Ministry of Ecology and Environment jointly issued the Implementation Plan for Carbon Peak in the Industrial Field to further improve the dual-carbon "1 + N" policy system and ensure the implementation of the target of carbon peak.

On February 19, 2024, the fourth meeting of the central comprehensively deepen reform committee examined and approved the "about promoting economic and social development of comprehensive green transformation opinion", promote economic and social development comprehensive green transformation, with "double carbon" as the lead, jointly promote carbon reduction, pollution reduction, green, growth, the green development concept throughout the whole process of economic and social development.

With the deepening of industrialization in our country, our country's economic strength has been greatly promotion, but the environmental pollution, the waste of non-renewable resources is more and more serious, the traditional extensive, high consumption, high pollution development model will turn to green low carbon development mode, to seek the balance between economic development and the ecological environment.

#### **2. Economic factors**

Environmental regulation is increasingly strict, makes the cement industry many serious pollution enterprises, the result will make the concentration of the industry, for the active green transformation of enterprise has certain positive influence, at the same time the market competition direction also changed, for the cement industry, will face more new opportunities, new direction, new formats.

In order to stand out in the fierce market competition, the cement industry must constantly strengthen its own strength in green technology innovation, green equipment upgrading, carbon cost reduction, green product innovation, green service quality improvement and information management and other aspects. To achieve this target, the cement industry must undergo a series of green transformations to adapt to the changing market demands and technological challenges.

### 3. Social factors

With the gradual improvement of environmental regulation and the increasing public awareness of environmental protection, the cement industry is facing the double scrutiny from the public supervision and media evaluation. The problem of environmental pollution has become the focus of public attention, and the concept of environmental protection has been widely accepted by the whole society as an indispensable social criterion. In this context, the cement industry, while pursuing economic benefits, must assume the corresponding environmental responsibility to ensure that every link of production and operation implements the concept of environmental protection.

In order to seize the opportunity of development, cement enterprises need to constantly strengthen the internal construction, and actively shape and maintain a good corporate image. Promoting the green transformation of enterprises and establishing a set of efficient environmental management system can not only make the business objectives of enterprises fit with the requirements of environmental protection, but also win social trust for enterprises and promote their sustainable development.

### 4. Technical factors

In the wave of global scientific and technological revolution and industrial transformation, as an important part of traditional manufacturing, the cement industry is actively exploring the transformation in the wave of intelligence, and has embarked on the road of transformation from resource-intensive to green and environmentally friendly development. At the same time, as the equipment manufacturing enterprises supporting the development of China's industrialization, they are also experiencing the comprehensive transformation from traditional industrialization to modern industrialization, digitalization and intelligence.

In this process, the intelligent laboratory equipment system has attracted the attention of cement enterprises, the system is rising rapidly, and is expected to become the key force to promote the product control, quality assurance and management innovation in the cement industry. The intelligent laboratory system runs through every link of cement production. Through accurate, efficient and real-time quality control data feedback, it provides a prerequisite for timely adjustment of equipment operation parameters and ensuring the stability of the production process. This stability will not only help reduce the production power consumption, but also reduce the dependence on fossil raw materials such as coal and petroleum coke, thus reducing the carbon dioxide emissions generated by limestone decomposition and raw material combustion, and promoting the cement industry to a more green and sustainable direction.

## 4.2. Internal motivation

### 1. Reduce costs

Enterprises pay green taxes to compensate for pollution and damage to the external environment and internalize external environmental costs. In general, enterprises include some green taxes such as environmental protection tax into taxes and additional items, and taxes and surcharges are regarded as expenses as the top expenses of corporate income tax, which will increase the cost of enterprises and reduce corporate profits. At the same time, paying taxes can also lead to cash outflows. Therefore, the collection of green tax will improve the tax level of enterprises, reduce profits, increase cash outflow, and increase the development pressure of enterprises. Therefore, actively responding to the

government's call for green development for transformation will not only make a greater contribution to the social green development, but also can effectively reduce the company's costs and improve the company's profits.

## 2. Improve competitiveness

With the continuous promotion of China's supply-side reform, the traditional extensive growth model with high energy consumption and high pollution has gradually withdrawn from the stage of history, and the intensive green and clean production model is increasingly favored by enterprises, becoming an inevitable trend of the future development of enterprises. In view of this, the cement industry to pursue long-term sustainable development, must actively participate in the wave of green transformation.

Although in the early stage of green transformation, enterprises need to invest a lot of resources and capital, and it is difficult to see obvious returns and benefits in the short term, which to some extent suppresses the enthusiasm of enterprises to implement green and low-carbon transformation. However, from a long-term perspective, increasing green technology research and development, producing environmentally friendly products, and building green industrial parks will not only help enterprises to shape new competitive advantages in the rapidly changing market environment, but also bring broader profit space for enterprises and achieve sustainable development.

## 5. The green transformation path of the cement industry

### 5.1. Promotion of green production technology

#### 1. Promote the application of energy-saving technologies

We will promote a large proportion of alternative fuel technologies, use household waste, solid waste and biomass fuels to replace coal, and increase the proportion of cement cooperative production lines.

#### 2. Strengthen the replacement of clean energy and fuels

Cement enterprises are encouraged to use their own facilities and sites to implement waste heat and pressure utilization, alternative fuel, and distributed power generation, so as to reduce their dependence on fossil energy and external power.

#### 3. Reasonably reduce the amount of cement clinker

Ultrafine powder with blast furnace slag, fly ash and other industrial solid wastes as the main raw materials to replace ordinary mixed materials and reduce the proportion of waste produced by pollution.

#### 4. Reasonable reduction of cement factory emissions

We will promote advanced filtration materials and low-nitrogen classification and partition combustion technologies, promote the formation of stable and efficient desulfurization, denitration and dust removal technologies and equipment, and promote ultra-low emissions in the whole process and link of the cement industry.

### 5.2. Form the concept of green management

#### 1. Industry low-carbon management system

Industry standards for green production and regular industry self-inspection and supervision mechanisms should be set up in the industry, establish and improve the environmental protection management system, and strengthen the coordinated transformation and development of green and digital industries.

#### 2. Industry low-carbon performance rating

Cement enterprises should strictly implement the requirements of the Ministry of Ecology and Environment and the local ecological and environmental authorities, continue to promote the improvement of on-site environmental performance, and implement the declaration of environmental performance classification. Promote the formation of a full-dimensional evaluation system covering

the whole industrial chain, including quality evaluation, production safety, green certification, ecological and environmental protection, and green "double-carbon" system.

### 3. Promotion of low-carbon concept in the industry

The cement industry should implement the concept of environmental protection, low carbon and green sustainable development, promote the participation of all staff in the industry, through regular management training and diversified environmental protection activities for the enterprises, and vigorously enhance the awareness and ability of environmental protection and low carbon in the industry. Bi Rabbit, carry out the "Environmental protection and Low-carbon Month" activity in the industry, hold environmental protection management and carbon asset management training, form a joint force of green and low-carbon development, and help the green transformation of the cement industry.

## 5.3. Strengthen the treatment of pollutants

### 1. Treatment of air pollutants

Continue to adopt advanced air pollutant emission reduction technology, for nitrogen oxides, sulfur dioxide, particulate matter and other major air pollutants through source control, real-time monitoring and terminal treatment, the implementation of air pollutants treatment, reduce pollutant emissions.

### 2. Waste water management

Promote and realize the "near zero" discharge of waste water along the river, constantly strengthen resource input and technology improvement, carry out the reuse of waste sewage, quality and classification treatment, and realize the "near zero" discharge of factory wastewater.

### 3. Waste management

Following the principle of "classified collection, zoning / inventory release, safe disposal", industrial garbage and household garbage are stored or transported and treated separately. The hazardous wastes generated in the production and operation activities of the cement industry, such as waste mineral oil, laboratory waste liquid, empty paint bucket, empty oil bucket, etc., shall be disposed of by a qualified third party.

## 6. Summary

In order to promote the green transformation of China's cement industry, we need to explore low-carbon technology and publicize the core concept of low-carbon management. This change is not only the inevitable trend of the development of the industry, but also the key to promote the green and high-quality development of the cement industry. In the process of implementing the innovation-driven development strategy, green transformation should be regarded as an important driving force and solid guarantee for adjusting the industrial structure and promoting the sustainable development of the industry. Through this transformation, we can effectively enhance the comprehensive value of the industry and push the whole industry towards a greener and low-carbon direction.

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