

Development Strategy for China's Energy Conservation and Environmental Protection Industry

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Abstract: Developing the energy conservation and environmental protection industry—a new economic growth engine—is an important guarantee for the promotion of ecological civilization construction and the realization of green development in China. This paper proceeds from the development status of this industry to analyze the deep-seated problems affecting China's energy conservation and environmental protection industry development, study and determine the new industrial development trends in the 13th Five-Year Plan period, and define the development objectives and key projects of this industry, thereby offering strategic suggestions for promoting the energy conservation and environmental protection industry development in China.

Keywords: energy conservation; environmental protection; industry; development strategy

1. Development status and problems of the energy conservation and environmental protection industry

1.1. Industry scale is obviously expanded, but market competitiveness is weak

Since the 12th Five-Year Plan period, China has cultivated and developed the energy conservation and environmental protection industry as a pillar industry of the national economy and has issued a series of supportive policies such as the *Air Pollution Prevention and Control Action Plan*, *Water Pollution Prevention and Control Action Plan*, *Soil Pollution Prevention and Control Action Plan*, and the *Opinions on Accelerating the Construction of Ecological Civilization*. These approaches have significantly stimulated market demand for this industry. As a result, industry scale was expanded, and the output value increased from 2 trillion yuan in 2010 to about 4 trillion yuan in 2014 (Fig. 1) [1], indicating that a certain industry scale has been formed. During the economic downturn, the energy conservation and environmental protection industry maintained continuous

and stable growth at an annual average growth rate of above 15%, higher than the growth rate of the national economy, and became a new economic growth engine under the new normal of China's economy.

The energy conservation and environmental protection industry shows great developmental momentum, but its share in the national economy is low, and it still falls short of certain requirements of pillar industries in national economy. Moreover, this industry is dominated by small and micro businesses—large enterprises take up a small portion, and its scale efficiency is not obvious. Enterprises lack core technologies, mainly produce low- and medium-end products and equipment, and are weak in market competitiveness.

1.2. Industrial clustering is accelerated, but industrial layout needs to be optimized

In its spatial layout, this industry shows a trend of cluster development. Some cluster areas have been formed, such as Beijing–Tianjin–Hebei, Yangtze River Delta, Pearl River Delta, and Changsha–Zhuzhou–Xiangtan [2]. However, on the whole,

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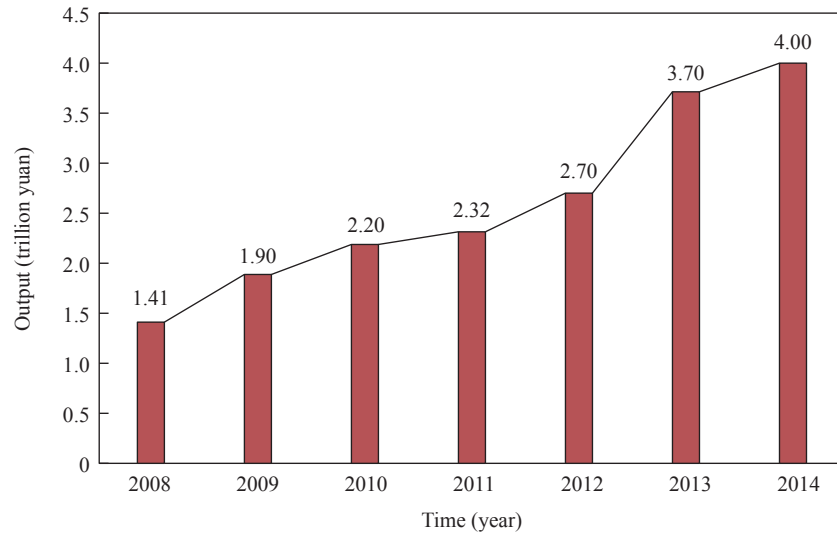


Fig. 1. Output value of China's energy conservation and environmental protection industry from 2008–2014.

the development level of this industry is consistent with the development level of the regional economy from east to west, but its regional development is unbalanced. In the eastern region, this industry has advanced steadily and is outstanding in the fields of R&D of energy conservation and environmental protection technology, environmental finance, facility maintenance, and operation service; while in the central and western regions, such progress is yet to occur. Regarding the development level of industrial clusters, Bohai Rim has an obvious advantage in technology development, achievement transformation, and talent reserve. The Yangtze River Delta region has the most concentrated environmental protection industry in China. It assumes a leading position in water treatment and air pollution control equipment. The environmental protection industry in Pearl River Delta is mainly distributed in Guangzhou, Dongguan, Shenzhen, and Foshan. Guangdong ranks first nationally in environmental protection services [3].

1.3. Some technologies are at international leading levels, but the overall strength in technology innovation is weak

In recent years, the technical level of China in energy conservation and environmental protection has risen continuously, and the dominant technologies and products can meet basic market needs. Conventional sewage treatment technologies, electric precipitation technology, and bag-type dust removal technology have reached international leading levels. Membrane separation technology and products have made some breakthroughs and are being extensively applied in small-scale sewage treatment. In addition, desulfurization equipment has realized localization, and positive progress has been made in the denitration technology and catalysts; promoting power plant flue gas ultra low emission integrated technology has been affirmed, and the appli-

cation of this technology is being expanded; and energy-saving, advanced, and appropriate technologies and equipment are being promoted on a large scale.

However, the overall technical level of China's industry is low, as seen in two aspects. First, original technology innovation is inadequate. The organizational characteristic of the energy conservation and environmental protection industry, dominated by small and micro businesses, results in weak internal motivation in the industry for technology innovation and a lack of original innovation in particular. At present, some efficient core technologies for energy conservation and emission reduction, as well as critical equipment, are yet to be fully mastered. For example, technical bottlenecks exist in many fields, including recycling of waste batteries and membrane technology for advanced sewage treatment. The performance and efficiency of some independently researched and developed energy conservation and environmental protection equipment remain too low. Second, technology integration is lagging, and the integration, serialization, and standardization levels of such equipment are low. Meanwhile, the transformation and application of technology achievements are difficult, the transformation rate achieved for key technologies is low, and a market mechanism for technology transaction, transfer, and diffusion is yet to be formed, hindering mass industrialization of products and equipment [4,5].

1.4. Government investment continues to increase, but capital shortage is still a significant bottleneck

The government continues to increase investment in the energy conservation and environmental protection industry, as it considers that it is important to cultivate this pillar industry of national economy. In the first four years of the 12th Five-Year Plan, the total investment in environmental control increased

from 761.22 billion yuan in 2010 to 957.55 billion yuan in 2014, accounting for 1.5% of the GDP [6]. In the 13th Five-Year Plan period, with the implementation of the *Water Pollution Prevention and Control Action Plan*, *Air Pollution Prevention and Control Action Plan*, and the *Soil Pollution Prevention and Control Action Plan*, the investment in environmental protection is expected to increase with a large margin as well. The investment in energy conservation and environmental protection in the 13th Five-Year Plan period is expected to be more than twice that in the 12th Five-Year Plan period. The trend of investment in environmental pollution control and its ratio to GDP from 2001–2014 are shown in Fig. 2.

However, on one hand, as the payback period of the energy conservation and environmental protection industry is long, and large amounts of funds need to be invested in fields such as infrastructure construction, technology R&D, and talent cultivation in the initial stage of development, whereas most of China's enterprises in this industry lack financing capacity and capital. On the other hand, regarding technical progress, in 2011, only 11% of the enterprises had R&D capacity, and the average R&D level was similar to that of other industries. However, R&D input was still inadequate concerning the environmental protection industry's high dependence on technology [7].

1.5. Service industry business types are diversified, yet its overall service capacity is weak

In recent years, the energy conservation and environmental protection service industry is growing actively and has provided consultation, technologies, engineering construction, operation and maintenance, and financial services to the overall industry. It has the highest potential in the energy conservation and environmental protection industry. In 2015, the output value of China's energy conservation and environmental protection service industry exceeded 800 billion yuan. The service forms are dominated by contract energy management and contract environment man-

agement. The actual business models vary with local conditions and requirements and include entrustment, contracting, build-operate-transfer (BOT), build-own-operate (BOO), and transfer-operate-transfer (TOT).

Nevertheless, this service industry is still in its initial stages and accounts for only a small portion of the energy conservation and environmental protection industry. Few large, comprehensive environmental service enterprises are able to provide integrated package solutions. Marketization of the environmental protection service industry is low and only shows an increase in the fields of municipal sewage treatment and garbage disposal.

1.6. Marketization has been accelerated, but the market order needs improvement

In the middle and late stages of the 12th Five-Year Plan period, China launched the marketization of the energy conservation and environmental protection industry. The Third Plenary Session of the 18th Central Committee of the Communist Party of China explicitly called for the "establishment of a market mechanism for attracting social capital to invest in ecological and environmental protection, and practice of third-party environmental pollution control" in the development of an ecological civilization system. After that, the *Guiding Opinions on Innovating the Investment and Financing Mechanism for the Key Fields and Encouraging Social Investment*, *Guiding Opinions on Further Promoting the Pilot Project for Paid Use and Trading of Emission Rights*, *Environmental Protection Tax Law of the People's Republic of China* (exposure draft), *Several Opinions on Promoting the Price Mechanism Reform*, and other marketization measures were introduced.

Following the gradual liberalization of the energy conservation and environmental protection markets, the market entry threshold lowers, and numerous enterprises enter the market. However, these enterprises' scale is universally small, and the competition is also scattered. Except for production equipment

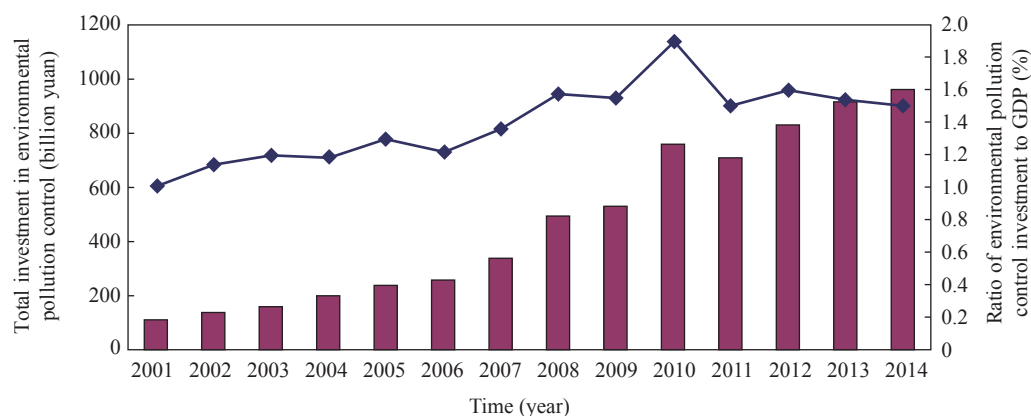


Fig. 2. Investment in environmental pollution control and its ratio to GDP from 2001–2014. Data source: China Statistical Yearbook on Environment (2015) [6]

industries of the solid waste disposal product, noise and vibration control product, and resource recycling product, which have high concentration ratios and an oligopolistic market, the overall concentration ratio (CR) 4 and CR8 are only 19.02% and 26.39%, respectively, for the environmental protection industry in a state of excessive competition [7]. Meanwhile, because supporting systems are imperfect, market supervision is inefficient, and market competition is irregular, the phenomenon of vicious competition and “bad money drives out good” often occurs [3]. Public-private partnership (PPP), third-party governance, and other market-based models are restricted in practice due to unclear responsibility demarcation between the government and market and between the third parties and polluters, as well as a lack of stable legal protection.

2. Development trend of the energy conservation and environmental protection industry

2.1. The industry continues to maintain fast growth

By the end of the 13th Five-Year Plan period, the energy conservation and environmental protection industry is expected to become a pillar industry of the national economy. In addition, the orientation of the national macroscopic strategy and increasing effort in environmental protection is expected to create huge market demand, along with broad development space and tremendous market increment. In China, the industry is projected to maintain an annual average growth rate of about 15% in this period, with an output value exceeding 8 trillion yuan by 2020 [3]. The development trend of this industry scale is shown in Fig. 3.

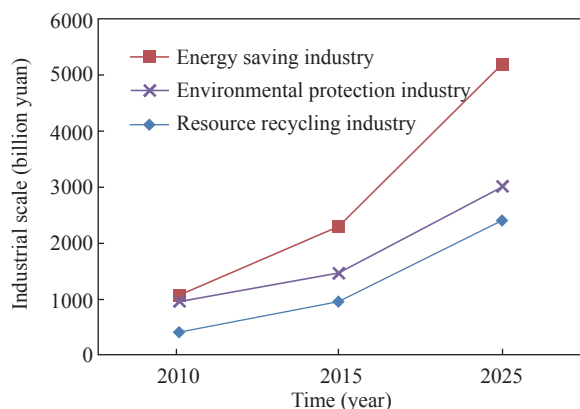


Fig. 3. Development trend of the energy conservation and environmental protection industry.

2.2. The industrial structure is being reformed to lay equal stress on equipment manufacturing and service

At present, the market shares of advanced technologies and equipment with high efficiency and low consumption is only 10% in the energy conservation and environmental protection

industry, and they are concentrated in the traditional equipment manufacturing industry [8]. In 2014, China's environmental protection equipment manufacturing industry realized about 500 billion yuan. Under the support of the *Made in China 2025, Project Implementation Plan for Industrialization of Major Environmental Protection Technologies, Equipment, and Products*, and other national strategies and policies, and with the deepened works and more and more strict standards toward energy conservation and emission reduction, the energy conservation and environmental protection equipment manufacturing industry is expected to maintain a prominent position following further expansion of the overall industry. Meanwhile, the energy conservation and environmental protection service industry will continue expanding. Plans include the transition of the overall industry from traditional equipment manufacturing to provision of products and energy-saving environmental service, as well as reforms meant to lay equal stress on the high-end equipment manufacturing and service industry. Influenced by evolving market demand, products are to be developed for standardization, integration, and intelligence. The energy conservation and environmental protection service industry is expected to gradually transform itself into an integrated and comprehensive industry by providing products and services in single links, such as environmental protection equipment and product or engineering construction, as well as operation and maintenance, thus raising its concentration ratio [9].

2.3. The environmental monitoring and garbage collection industry is expected to leverage the power of the Internet for environmental protection

In July 2015, the State Council issued the *Guiding Opinions on Actively Promoting “Internet Plus” Action*, pointing out a clear direction for future integration between the energy conservation and environmental protection industry and the internet.

Applying big data, cloud computing, and other information technologies to manage the environment will become an inevitable trend. Environmental management departments at all levels establish environmental information centers for monitoring, transmitting, collecting, and analyzing data in real time by carrying out online monitoring of the atmosphere, water, and soil, as well as promoting regional air environment evaluation and early-warning systems. They also conduct or implement risk pre-assessments of sources of drinking water, network-based full-process supervision of law enforcement, and other environmental management measures. Meanwhile, resource recovery and utilization enterprises with innovative business models continue to emerge and have begun to apply mobile Internet technology to provide renewable resource recovery services for communities, for example, the Shanghai “Green Fortune”, Hangzhou “Scrap Collection”, Beijing “A new Lives”, and Tianjin “Recovery Brother” models. In the future, the environmental monitoring

and garbage sorting and recycling industry are expected to leverage the power of the internet for environmental protection.

The combination of the energy conservation and environmental protection industry and the Internet should bring a new mode and driving power to the development of the industry. Fundamental changes are expected in the business models, operation mechanisms, and competition patterns of the industry.

2.4. Mergers and acquisitions in the industry, as well as cross-border integration are significant

Under the macro-background of environmental quality objectives, a series of policies promoting the development of the energy conservation and environmental protection industry were issued successively, making this industry become a new favorite in the period of structural economic transformation. Industry companies are expected to realize continuously increasing profits, and attract a large amount of social capital.

From 2012, there is an apparent trend of mergers and acquisitions in the environmental protection industry, mergers and acquisitions are concentrated in the relatively mature water and solid waste industries. Additionally, the capital scale has increased from 1.2 billion yuan in 2012 to about 60 billion yuan in 2015 [10].

Cross-border mergers and acquisitions of non-energy conservation and environmental protection enterprises have risen enormously, reaching 25% of the total capital. Sinopec Group, CTCE Group, XCMG Group, Beijing Guodianfutong Technology Development Co., Ltd., and Shandong Huading Co., Ltd. have entered the environmental protection industry. As the energy conservation and environmental protection industry gains popularity, the scale of mergers and acquisitions in the industry is further enlarged, capital is expanded, and fields are occupied. In addition, the concentration ratio of the industry increases, and the comprehensive giant enterprises integrating the entire industrial chain become leaders of the industry.

2.5. The industry accelerates “going out”

In the face of globalization of the energy conservation and environmental protection market and the tendency to saturate the domestic environmental protection infrastructure construction market, more and more enterprises in this industry are adjusting their development strategies and shifting their attention to the international market. In 2011, the Ministry of Commerce and Ministry of Environmental Protection of the People’s Republic of China, and other relevant departments put forth the “going out” strategy for enterprises in strategic emerging industries. In 2014, a government work report made at the National People’s Congress (NPC) and China People’s Political Consultative Conference (CPPCC) stated that “We will usher in a new phase of China’s opening to the outside world and ensure its high stan-

dard performance, engage in bilateral, multilateral and regional opening up and cooperation in a coordinated way, strive to make progress in negotiations on agreements concerning trade in services, government procurement and information technology, and speed up negotiations on new areas such as environmental protection and e-commerce.” Such national strategic positioning provides policy support for “going out” in China’s energy conservation and environmental protection industry. Meanwhile, Sinoma Energy Conservation Ltd., Beijing Sound Environmental Group Ltd., Beijing Enterprise Water Group Limited, Fujian Longking Co., Ltd., and other backbone enterprises have obtained many overseas project orders, tapped the markets of many countries, and accumulated rich construction and operation experience.

3. Development objectives and key projects of the energy conservation and environmental protection industry

3.1. Development objectives

In the 13th Five-Year Plan period, the development objectives are as follows: 1) to cultivate and establish large energy conservation and environmental protection companies with potential international competitiveness and comprehensive environmental service capacity; 2) to further increase the agglomeration degree of the industry, and build energy-saving equipment-manufacturing industry bases, environmental protection industry bases, “urban mineral” bases, and remanufacturing industry bases that can effectively raise resource and energy-use efficiency; 3) to make major breakthroughs in low-temperature surplus heat and pressure technology, technology to extract valuable elements from denitration catalysts and electronic wastes, and other key technologies for energy conservation and environmental protection, as well as to develop energy conservation and environmental protection technologies, equipment, and products with full proprietary intellectual property rights and international leading levels; 4) incorporating environmental monitoring technology, environmental pollution control technology, and an energy consumption monitoring system with remote sensing, geographic information, satellite positioning, and Internet technologies to realize the instant collection of accurate monitoring data and, thereby circumventing the geographic and time limitations of energy conservation and environmental protection; and 5) to increase more than 15% of annual output value of the energy conservation and environmental protection industry on average and realize more than 8 trillion yuan of output value in 2020 [7].

3.2. Key projects

3.2.1. Project for the popularization and application of energy system optimization technologies

In the 13th Five-Year Plan period, China will focus on popu-

larizing and applying energy system optimization technologies and equipment in iron and steel, chemical, electric power, cement, papermaking, and other industries with high energy consumption. It will produce key technologies and products with high energy-use efficiency, small discharge amount of pollutants, and high economic benefit on a large scale and will promote and apply integrated solutions of efficient and energy-saving technologies.

3.2.2. Project for the cultivation and industrialization of key technologies and equipment for the energy conservation of buildings

China will support new and high-tech small- and medium-sized enterprises (SMEs) to research and develop composite thermal insulation materials for walls, compact-type air heat pump devices, building energy storage technologies, and other building materials and products. It will accelerate popularization of passive buildings with low energy consumption, smart buildings, green buildings, and other new energy-saving buildings and will continuously implement energy-saving building reconstruction projects.

3.2.3. Project for the cultivation and transformation of key technologies for comprehensive control of atmospheric dust-haze

China will conduct R&D and production of complete sets of online dust-haze monitoring equipment and particulate matter (PM) control, motor vehicle exhaust purification, desulfurization and denitration, and multi-pollutant collaborative control technologies and equipment.

3.2.4. Project for the transformation, popularization, and application of key technological achievements for water pollution prevention and control

In order to be in line with the implementation requirements of the *Action Plan for Water Pollution Prevention and Control*, regarding industrial pollution, China will focus on accelerating the transformation and application of key technological achievements in metallurgy, pharmaceutical, chemical, food processing and other industries according to the key areas and targets of water pollution prevention and control; for urban pollution, It will focus on accelerating urban sewage treatment plants to upgrade and reconstruct, on enlarging membrane bioreactor (MBR) technology markets continually, and on expanding the application scope of membrane technology; and for non-point source governance, it will accelerate the centralized processing of livestock and poultry breeding and expand social needs for the decentralized community sewage treatment.

3.2.5. Project for the popularization and application of "urban mineral" exploitation and utilization technologies

China will establish a system for recycling scrap metals and scrap, rare and noble metals, and other urban minerals; popu-

larize and apply key and generic technologies for exploitation and utilization of "urban minerals"; promote industrialization of renewable resources recycling technologies; and develop high-quality and resource-based products.

3.2.6. Pilot project for the construction of energy conservation and environmental protection industry cluster areas

China is expected to build up about 30 energy conservation and environmental protection industry cluster areas with advanced technology, up-to-standard environmental protection, standard management, and strong radiation effects all over the country; to condense and promote paradigms of cluster development of the energy conservation and environmental protection industry suitable to the national condition of China during the construction of such cluster areas; and to raise the capacity of technology R&D and independent innovation of the industry in cluster areas and promote large-scale cluster development of the industry.

4. Strategic suggestions for promoting the development of China's energy conservation and environmental protection industry

4.1. Implement top-level design and improve industry policies

Owing to the particularity of the energy conservation and environmental protection industry, policy design and formulation should proceed from a full lifecycle. China should comply with the new environmental protection law, the ecological civilization construction scheme, and the general deployment of the 13th Five-Year Plan for national economy to introduce supporting measures as soon as possible and then to strictly implement them, strengthen assessment on them, investigate violations according to the law, and increase the accountability of criminal and administrative responsibilities. In addition, China should also accelerate legislation for soil environmental protection and its relevant industries; modify and improve the *Circular Economy Promotion Law* to implement the producer responsibility extension system in an all-round way and expand the government procurement range of recycled products; and introduce motor vehicle pollution prevention and control regulation and other regulations as soon as possible. In addition, China should revise the administrative measures for the energy conservation of key energy consumers, energy efficiency label, and certification of energy-saving products; and establish industrial standard systems, such as building a quality standard system for energy-saving and environment-friendly products and establishing a statistical accounting system for the energy conservation and environmental protection industry, thereby raising the energy efficiency standards for key energy-consuming products, energy consumption quota standards for key industries, and standards for discharge of pollutant.

4.2. Strengthen market supervision and create a market environment of fair competition while streamlining administration and instituting decentralization

China should proceed from the particularity of the energy conservation and environmental protection industry to clarify the boundary of macro-administration of the government and attach importance to the reinforcement of market supervision while streamlining administration, instituting decentralization, and reducing administrative intervention. To be specific, China should strengthen the quality supervision of energy-saving and environment-friendly products, consolidate management of standard marks, and introduce corresponding methods to test products and supervise organization to form effective product standards and quality inspection systems. In addition, it is necessary to strengthen price supervision of the energy conservation and environmental protection services to prevent vicious competition; strengthen energy conservation evaluation and examination of fixed asset investment projects; strengthen market supervision and highlight industry management after cancelling the pollution control and operation facility permissions from the Ministry of Environmental Protection and environmental protection verification of listed companies; and establish a sound, fair, and transparent market rule system to regulate the energy conservation and environmental protection market order, exercise strict supervision of law enforcement, and formulate a rule-breaking punishment mechanism, thereby forming reverse constraints.

4.3. Increase financial and tax support and place priority on the guiding role of government funds

Considering the current development stage of the Chinese energy conservation and environmental protection industry, more state budgetary investment and financial support should be appropriated. It is critical to focus financial support on cultivating advantageous energy conservation and environmental protection enterprises, supporting industrial projects, and encouraging technology R&D and innovation. In addition, financial support should be provided for the industrial demonstration and development of key energy conservation and emission reduction and high-efficiency energy conservation and environmental protection technologies and products; policy-based lending to the industry should be moderately increased [11]. Furthermore, it is necessary to revise the denitration electricity price subsidy policy to raise the subsidy ratio; further study whether to exempt land and house property taxes from the construction of sewage treatment and refuse processing plants, or to reduce or exempt the value added tax (VAT) of sewage, garbage, and sludge disposal labor and reclaimed water; and give tax preference to the links of production and consumption of recycled products. Finally, the government should increase

preferential treatment according to the type and composition of environmental protection projects to encourage taxpayers to purchase and use environmental protection equipment and carry out qualifying environmental protection projects; and extend preferential scope of the *Catalogue of Preference to Environmental Protection Equipment*.

4.4. Improve PPP, the third party control, emission trading, and other market mechanisms to attract social capital

China should further improve the market mechanisms of the energy conservation and environmental protection industry and prioritize the decisive role of the market in resource allocation; establish and improve trade market rules of carbon emission permits to lay a foundation for the nationwide launch of carbon emission permits trade in 2017; accelerate the formulation of national codes relevant to energy conservation; and continue to promote pilot projects for paid use and trading of emission rights, to research and formulate regulations for paid use of emission rights and trading price, thereby regulating local pricing methods and bases [12,13].

Additionally, China should establish and improve the PPP operational procedures and other relevant systems. To be specific, it is important to clearly define the rights and obligations of the government and cooperators, establish default punishment mechanisms, regulate interest distribution and risk sharing, and streamline the rights and obligations among the National Reform and Development Commission, Ministry of Finance, and other relevant departments.

Moreover, there is an urgent need for third-party environment pollution control. To be specific, China should clarify the responsibility boundaries between the government and market and between the pollution controllers and third parties; raise third-party enterprise access standards; establish and improve the third-party operation service standards; conduct performance evaluations and improve the supervision and verification methods; and establish third-party pollution control enterprises' credit-rating systems and corresponding reward and punishment systems.

Finally, China should encourage institutional and private capital to establish and develop funds inclined to energy conservation and environmental protection enterprises, including guidance, private equity, and venture capital funds; explore hypothecated loans for sewage treatment, garbage refuse, and other prospective earnings; accelerate development of green finance, optimize supporting policies relevant to green finance, and establish a multilayered green finance system; encourage financial institutions to provide financial support to energy conservation and environmental protection enterprises and projects, lower loan conditions and lending rates, and set limitations on the country; and encourage mature energy conservation and environmental protection enterprises to raise funds.

4.5. Strengthen the drive of technology innovation and improve the environmental technology evaluation and transformation policy

The energy conservation and environmental protection industry needs to conduct independent technology R&D and innovation and drive the advancement of technology. Therefore, it is necessary to increase financial support for the energy conservation and environmental protection enterprises that carry out technology R&D and improve incentives for technology innovation and achievement transformation; built up a technology innovation platform to support R&D of generic and critical technologies of the industry; and raise the transformation rate of technology achievements and promote a technology innovation system dominated by enterprises and integrated with the industry, universities, and research institutes, thus accelerating technology R&D and achievement transformation and application. In addition, China should improve the market mechanism for the promotion of technical service and a socialized technology achievement transfer mechanism; establish and improve an environmental technology evaluation system to accelerate the determination of optimum feasible technologies for pollution prevention and control of more China's industries; and encourage the establishment of industry alliances to support vertical business combination of the industry chain, thereby providing total solutions that meet the requirements of energy conservation and environmental protection.

4.6. Expand and strengthen enterprises and industrial cluster areas to promote intensive and clustered development of the industry

It is imperative to encourage and support the development of SMEs and actively guide them in the energy conservation and environmental protection industry to accurately orientate within the industry chain and realize professional and refined operations. In addition, it is necessary to implement a driving strategy by leading enterprises such as the Beijing OriginWater Technology Co., Ltd., Sound Environmental Resources Co., Ltd., Beijing Capital Co., Ltd., and other leading enterprises. Furthermore, large environmental protection groups with outstanding industrial characteristics, technology, capital, and operation experience and comprehensive environmental service enterprises with strong capital strength, investment, and financing ability to provide total solutions should be established.

Finally, it is necessary to guide the standard and intensive development of energy conservation and environmental protection industry clusters and play their clustering and driving role. Regarding formed key industrial clusters, in order to develop an environmental protection industry at high level, the Yangtze River Delta region should not only enlarge the scale but also assure

industrial quality, increase economic benefit, increase the industrial technical level, and optimize the industrial structure. In the Bohai Rim region, the environmental protection industry is balanced in overall development, and it is expected to maintain its development strength and vigorously develop the environmental protection equipment manufacturing and resource recycling industries. To maintain the advantage of environmental protection equipment manufacturing, the along-river development axis in the central part of the region aims to vigorously develop an environmental protection service industry and promote structural upgrades of the regional environmental protection industry. The Pearl River Delta region plans to moderately expand its industrial scale while maintaining its existing development potential and advantage of economic benefit.

4.7. Pay attention to the synergistic effect between energy conservation and environmental protection, and promote integration with the information industry

It is beneficial to focus on the synergetic effect between energy conservation and environmental protection; conduct integrated haze control in cooperation with the *Air Pollution Prevention and Control Action Plan* and implement feasible energy conservation measures; introduce a regional control plan for total coal consumption regarding the total pollutant quantity control targets and relevant policies; work toward energy consumption reduction in sewage treatment, fume control, and pollution prevention and control; and prioritize the combined effect of energy conservation and emission reduction.

It is also important to promote the integration of the energy conservation and environmental protection and information industry; make full use of the mobile internet, cloud computing, big data, and other online technologies; and apply wireless communication technology, Internet of Things (IoT), and other computing technologies to establish digital environmental protection platforms and online monitoring networks. In addition, it is valuable to acquire and monitor data in a real time, all-direction, and full-coverage manner, accurately transfer and analyze data, and evaluate environmental conditions in a scientific and reasonable way, thereby forming integrated solutions to solve environmental problems according to local conditions; and integrate remote sensing, geographic information, and global positioning systems to break through the management practice and geographic limitations of energy conservation and environmental protection. Finally, there should be goals to develop the energy conservation and environmental protection equipment manufacturing industry and the construction industry, with combining 3D-printing technology; and establish specialized information platforms to improve the information acquisition, feedback, and release systems and efficiently update information about the energy conservation and environmental protection industry.

4.8. Accelerate the introduction of supporting measures for the “going out” strategy to promote globalization of the industry

China should improve the policies and regulations for the “Going out” strategy of China’s energy conservation and environmental protection industry, including rules, standards, and trading modes for overseas investment of the industry, as well as reserve talent. Additionally, it is necessary to grant preferential policies for the export of the industry’s products, equipment, and technologies; extensively implement international exchanges and cooperation in the industry and vigorously publicize the industry at all types of meetings and exhibitions; and create demonstration bases and projects for international development of the environmental protection industry to exhibit Chinese environmental protection enterprises. Last, it is also important to develop government public service platforms to introduce the development tendency and demand of the international energy conservation and environmental protection industry, as well as the relevant systems, environmental protection systems, and specifications of the industry [14–16].

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