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“CLEANER PRODUCTION TOWARDS A SUSTAINABLE TRANSITION”

Analysis on the Status for Cleaner Production in China

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Abstract

Cleaner production (CP), especially in the field of industry, is a key factor in achieving sustainable development in China. Chinese government made great efforts on implementing the strategy of sustainable development. Cleaner production has made remarkable achievements, and gained recognition world widely. Cleaner production has become a core policy of pollution prevention in China, while its meaning and connotation are continuously developing. After being implemented for more than 20 years in China, great progresses have been made in CP policies, capacity building and technical support system. In this study, unique set of practices of CP in China, including were analyzed, to summarize the main experience of CP implementing for other developing countries.

Keywords: *Cleaner production; Pollution prevention; Cleaner production policy*

Instructions

Since 20th century, the global extension economy development has brought serious questions, such as ecological environment pollution and resources energy crisis. People took some terminal pollution control measures in the reconsidering foundation, but only depending on the traditional terminal pollution control measures could not solve the problem fundamentally. For this reason, an innovative idea--cleaner production (CP), which made the overall preventive environmental strategy apply continually in the production process, the product and the service, to increase the ecology efficiency and reduces human and the environment risk, emerged as times required. At the beginning of 1990s, the concept of cleaner production was introduced into China. After nearly 10 years of consumption and exploration, "the People's Republic of China Cleaner Production Promotion Law" had been promulgated by National People's Congress(NPC) Standing Committee for the first time in June 29, 2002, making the work of cleaner production in China enter the stage with legal support. Subsequently, the relevant departments of China had promulgated related policies and regulations that greatly promoted cleaner production work in China. In recent years, cleaner production as an important point of pollution prevention, plays a vital role in saving resources, reducing energy consumption, and decreasing pollution generation and discharge, etc. aspects, and its connotation has been gradually penetrated into the field of environmental protection, industry, agriculture and service industry, etc. various domains in China.

Presently, China is facing the stern situation of severe resource constraints, serious environmental pollutions and ecosystem degenerations. 18th Communist Party of China National Congress proposed that "put the ecological civilization construction in a prominent status" and "promote green development, the cyclic development and the low-carbon development". This mentality offers

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opportunities for the cleaner production work, meanwhile sets a higher request. This paper will deal with the status quo of China's cleaner production from laws and regulations, management system, audit specification, technical support and capacity-building comprehensively, analyze existing problems and put forward suggestions, to advance the work of realizing cleaner production and promote energy conservation and ecological civilization construction in China.

1. The status quo of cleaner production in China

1.1 Gradual improvement of cleaner production policies and regulations system

Cleaner production policies and regulations system are the premise of carrying out cleaner production in China. Ever since the introduction of cleaner production concept in the 90's, China's relevant departments and agencies have begun to research on cleaner production mechanisms. It continuously keeps the policies and regulations deep, which was driven by international demonstration project. During 1992-2002, China promulgated legal documents, such as "China 21st Century Agenda" "Atmospheric Pollution Prevention Law of PRC" and "Solid Waste Pollution Prevention Law of PRC", etc., which all increased the cleaner production aspects (see Tab. 1). On January 1, 2003, the "Cleaner Production Promotion Law" was promulgated, marking the legalization of China's cleaner production. Since then, the relevant departments of China had formulated a series of supporting policies and systems: On August 16, 2004, "Interim Measures for Cleaner Production Audit" promulgated jointly by National Development and Reform Commission (NDRC) and Ministry of Environmental Protection (MEP) (named State Environmental Protection Administration (SEPA)), which established the system of cleaner production audit; In 2005, MEP issued "the Regulations on the Procedures of Cleaner Production Audit for Key Enterprises" clear the cleaner production audit procedures and requirements to make cleaner production audit rules. In order to further ensure cleaner production work effective, MEP released "Notice on further strengthening the CPA in key enterprises" on July 1, 2008, which articulate key enterprise cleaner production audit evaluation and inspection work carried out, innovate in and improve the compulsory cleaner production audit systems, and was supervision and guidance of strengthen Department of Environment Management to the enterprise cleaner production audit. MEP also released "Notice on further promoting clean production of key enterprises" on April 22, 2010, which combined key enterprise cleaner production audit with environmental management systems and provided a guarantee to key enterprise cleaner production audit. In addition, the cleaner production was also taken into account as important elements in various sectors and important documents of the country, like "National 12th five-year plan of Environmental Protection", "Notice on issuing Atmospheric Pollution Prevention Action Plan", "12th Five-Year plan on strengthening pollution prevention and control of heavy metal" and "12th Five-Year plan on implementation of the cleaner production in industry". Under the national policy support and guidance, the provinces (regions and cities) have been developed and published the corresponding supporting policies, escort for implementation of cleaner production in different regions. By the end of 2012, there were 4 provinces (cities) to promulgate "Cleaner Production Promotion Regulations", 20 provinces (regions and cities) to introduce "Measures on the implementation of cleaner production", 30 provinces (regions and cities) to issue "Rules on the implementation of cleaner production audit" and 22 provinces (regions and cities) to formulate "Cleaner production enterprises approval way". In general, the development of cleaner production in China has experienced more than 20 years, and cleaner production system has been basically established and formed a relatively complete, top-down policies and regulations, which provide policy supports and legal protections for the comprehensive development of cleaner production in China.

Tab.1. The construction of cleaner production policies and regulations system in China

year	Government Departments	Laws and Regulations, Management System
1992	-	"Participation in the UN Conference on environment and development about sustainable development strategy" and "China 21st Century Agenda"
1994	State Council	"China 21st Century Agenda"

1995	The Standing Committee of the NPC	"Atmospheric Pollution Prevention Law of PRC"
1995	The Standing Committee of the NPC	"Solid Waste Pollution Prevention Law of PRC"
		"Water Pollution Prevention Law of PRC"
1996	State Council	"Decisions on several problems relating to environmental protection"
1997	SEPA	"Opinions on the implementation of cleaner production"
1998	State Council	"Environmental Protection Management Measures on Construction Projects "
1999	State Economic And Trade Commission (SETC)	"Notice on the implementation of cleaner production demonstration pilots"
2001	The Standing Committee of the NPC	10th five-year plan of the national economic and social development
2002	The Standing Committee of the NPC	"Cleaner Production Promotion Law"
2003	SEPA	"Opinions on the Implementation 'Cleaner Production Promotion Law"
2004	NDRC, SEPA	"Interim Measures for Cleaner Production Audit"
2004	Ministry of Finance (MF)	"Management interim measures of Central government specific funds for clean production "
2005	SEPA	"Provision on cleaner production audit procedures of key enterprises"
2006	NPC	11th five-year plan of the national economic and social development
2008	MEP	"Notice on further strengthening the CPA in key enterprises"
2008	MEP	"Guideline on implementation of CPA assessment and acceptance in key enterprises"
2009	MF, Ministry of Industry and Information Technology (MIIT)	Notice on strengthening and promoting CP in MIIT
2009	MF, MIIT	"Interim Measures for the central finance special funds for clean production management"

2009	State Council	Notice on a number of opinions about the curb overcapacity and redundant construction in some industries, and guide the healthy development of industries
2009	State Council	"Opinions on strengthening pollution prevention and control of heavy metal"
2009	State Council	"Notice on the implementation of curb overcapacity in some industries and redundant construction of key projects division"
2010	MEP	"Notice on further promoting clean production of key enterprises
2010	NPC	12th five-year plan of the national economic and social development
2011	MEP	"National 12th five-year plan of Environmental Protection "
2011	MEP	List of sector classification management of CP in key enterprises
2010	MIIT, NPC	"12th Five-Year plan on implementation of the cleaner production in industry",
2012		12th five-year plan of the national economic and social development
2012	The Standing Committee of the NPC	"Cleaner Production Promotion Law" amendment (Draft)
2013	State Council	Notice on issuing Atmospheric Pollution Prevention Action Plan

1.2 The establishment of cleaner production technology supporting institutions

For enhancing cleaner production technologies support in policy development and management, the establishment of China National Cleaner Production Centre was approved by State Environmental Protection Administration in December 1994, and it was one of the earliest research institutions carrying out clean production and promoting clean production, as well as support mechanism of the United Nations Industrial Development Organization and the United Nations Environment Programme cleaner production in China. Then, in order to promote regional and sectoral cleaner production, a number of Regional Cleaner Production Centers and Enterprise Cleaner Production Centers have been established successively. Judging from regional level cleaner production centers development, with incomplete statistics, China had established at least 22 provincial-level cleaner production centers by the end of 2012(as shown in Fig. 1,), including Tianjin, Hebei, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Shandong, Henan, Hunan, Guangxi, Guangdong, Yunnan, Shaanxi, Qinghai, Gansu, Xinjiang, Hainan, in which some provinces did great efforts to the implementation cleaner production and carried out work progress faster. Furthermore, it had also established 18 municipal cleaner production centers. These cleaner production centers have played an important role in the local construction of cleaner production policies, dissemination of cleaner production concept, as well as cleaner production consulting and technology promotion. It can be seen from the progress, some of these provinces (cities) level cleaner production centers continued

to shoulder the task of promoting clean production in different provinces, and some of them went-to-market, offering consulting services to businesses. In terms of the development of sector-based cleaner production centers, China set up centers including coal industry cleaner production centers, metallurgical technology cleaner production centers, light industry cleaner production centers, chemical engineering cleaner production centers and Sinopec cleaner production centers, which played an important role in sectoral cleaner production technology promotion and upgrading with their respective advantages and practical experience. Meanwhile, the establishment and operation of these regional and sectoral cleaner production centers provided strong support for the cleaner production work to carry out.

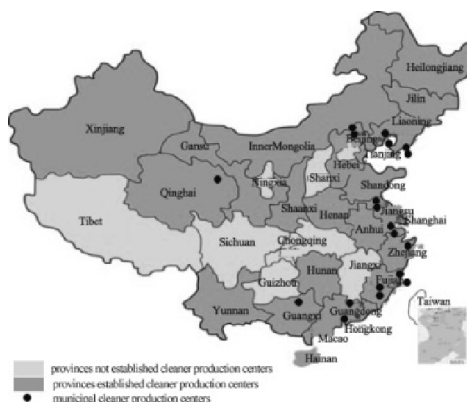


Fig. 1. The map of CP centers in 2012

1.3 Vigorous development of cleaner production consulting body

Cleaner production consulting bodies are important force to promote the development of cleaner production in China. With the advancement of cleaner production in China, China's cleaner production consulting bodies are flourishing. Cleaner production consulting bodies in China have grown rapidly in recent years. According to incomplete statistics, in 2002, there were only 40 cleaner production consulting bodies in China, however by the end of 2012, the number of those has grown to 806 (Fig. 2). The growing of cleaner production consulting bodies had a close relationship with the advancement of cleaner production in China.

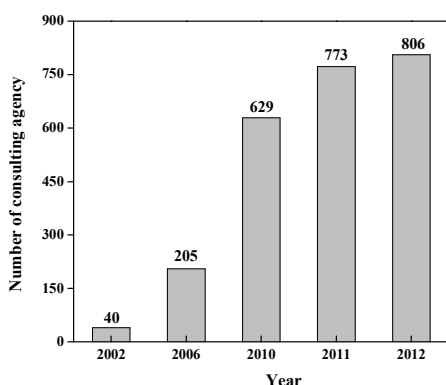


Fig. 2. The number of cleaner production consulting bodies from 2002 to 2012

From the regional development, distribution of the cleaner production consulting bodies mainly concentrated in east and middle China, and the number of those in Guangdong (130), Hebei (64), Zhejiang (60), Liaoning (43) and Anhui (38), 5 provinces accounted for 41.6% in the country (Fig. 3), which had a close relationship to regional economic development, implementation efforts and other

relevant factors.



Fig. 3. The regional distribution of CP consulting bodies in 2012

From the linked form, cleaner production consulting bodies in China are affiliated in various forms, according to the incomplete statistics in 2006, Environmental Protection Bureau approved up to 96.6% in 205 CP consulting bodies, 41.9% for which affiliated research institutes, 10.7% for colleges, 8.3% for trade associations and 37.1% for independent legal personality (Fig. 4). In recent years, with cleaner production audit marketization, the proportion of independent legal personality consulting agencies is increasing.

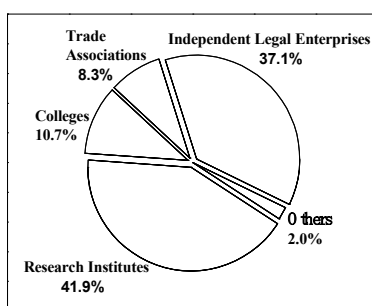


Fig. 4. The affiliated agency distribution of cleaner production consulting bodies (2006)

The main task of these cleaner production consulting bodies is clean production audit. It play an important role through analyzing and finding the potential cleaner production in enterprises or sectors then put forward the technological scheme to achieve technology progress of enterprises or sectors, and to promote national clean production work.

1.4 Cleaner production capacity building in progress

Cleaner Production is an interdisciplinary and comprehensive work that requires top-quality professionals. Cleaner production capacity building is an important measure to promote China's cleaner production work and it has been highly regarded by the government since it is promoted in China. Knowledge about the connotation of cleaner production, the procedure and method of cleaner production audit and the key technology of cleaner production in typical industry are provided in national cleaner production training.

As can be seen from Fig. 5, the total amount of the national cleaner production training participants is increasing year by year and more than 25 thousand people participated in national cleaner production training by the end of 2012. The growth was most significant in 2005 and 2010 because of the release of "Provision on cleaner production audit procedures of key enterprises" (2005) and "Notice on further promoting clean production of key enterprises" (2010). With the stimulation of government policies, cleaner production audit was carried out comprehensively in key enterprises, greatly increasing the

demands of professionals in cleaner production area.

In terms of the regional distribution, the national cleaner production audit training has covered all the six regions of China and more than 30 provinces. Fig. 6 illustrates the amounts of the national CPA training participants in six regions. Fig. 7 shows the amounts of the national cleaner production audit training participants in 30 provinces. Center South, Northeast and Northwest had better performance in capacity building, which accounted for about 75% of the total amounts. In these regions, Guangdong, Hebei and Jiangsu provinces had the greatest training amounts. The local economy and the promotion measures of government were related directly to the distribution. Through the national cleaner production training, a large amount of participants have been cultivated and become the backbone in the field of cleaner production in China.

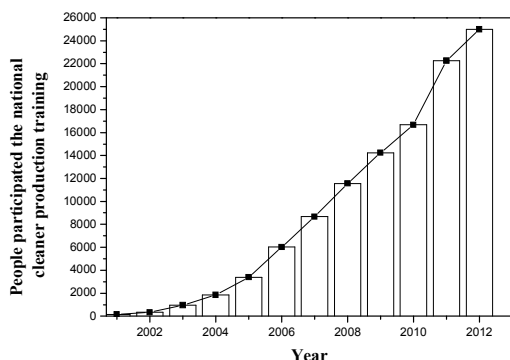


Fig. 5. the number of people participated the national cleaner production audit training from 2001 to 2012

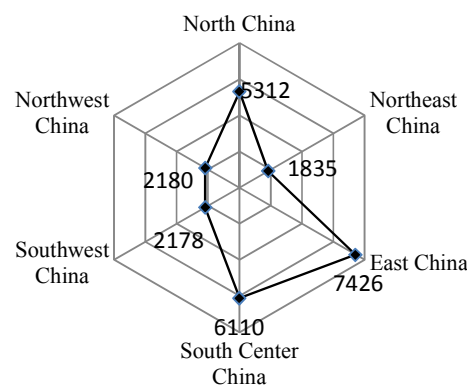


Fig. 6. The regional distribution of the national cleaner production training participants in 2012

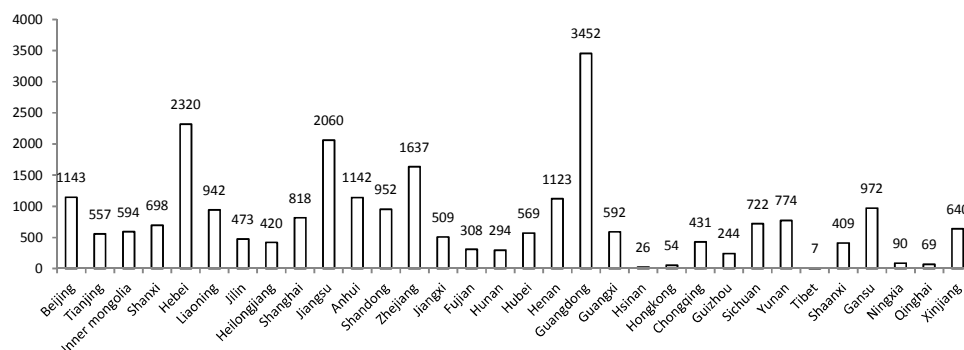


Fig. 7. The provincial distribution of the national cleaner production audit training participants in 2012

Besides, local governments took a variety of measures to build local cleaner production capacity, such as provincial training, cleaner production knowledge spreading lectures and enterprise internal training. According to incomplete statistics, over 200 thousand people were trained only in one year in 2012. Local cleaner production capacity building in China is fully under way that provide a large number of cleaner production professionals. With the development of cleaner production, professionals with advanced management and technology abilities of cleaner production are required. The future of cleaner production capacity building is faced with new opportunities and challenges.

1.5 Cleaner production technical supporting system developing in succession

The implementation and promotion of cleaner production depends on the cleaner production technical supporting system. In order to promote clean production, a number of clean production technical

supporting tools have been formulated and issued successively in China.

(1) Standards and Evaluation Indexes

Cleaner production standards and evaluation index system is the most important basis for enterprises to carry out cleaner production work and implement cleaner production audit. It also plays an important role in measuring the cleaner production level of enterprises and evaluating the performance of cleaner production audit. Since 2002, MEP has released 58 industry cleaner production standards. And it is regarded as a review content in EIA of the new construction, construction renovation and expansion project that whether the project is in line with the national industrial policy and clean production standard. Meanwhile NDRC has released 45 cleaner production evaluation index systems in 7 batches, including steel, plating, printing and dyeing and other key industries. In 2010, MIIT announced entry criteria for some key industries like soda ash industry that proposing cleaner production index system to become the barriers to entry and the conditions of government procurement and requesting new project, reconstruct project and expansion projects in key industries to achieve the advanced level of clean production standards in corresponding industry.

However, now the request of the cleaner production standards and evaluation index systems in the same industry issued by different ministries is roughly similar but little different emphasis. It both increases costs and raises the difficulty of cleaner production execution in enterprise. The new "Cleaner Production Promotion Law" provided "to establish a unified and canonical system of cleaner production standards" so that NDRC jointly with MEP, MIIT and some other departments released 2 new cleaner production evaluation index systems in April 2014. "The cleaner production evaluation index system of iron and steel industry" "The cleaner production evaluation index system of cement industry" have been implemented so far, And a number of new evaluation index system planning to be released have also been completed.

(2) Audit Conduction

For further carrying out cleaner production audit, MEP released 2 batches of "List of toxic and harmful substances that are emphasized to be audited" respectively in 2005 and 2008 and "List of industry classification management for key enterprise of cleaner production" in 2010 to provide a reference for releasing list the compulsory audit enterprise of cleaner production and urge the enterprises using or discharging toxic and hazardous materials in production or exceeding the national or local discharging standards or exceed the total volume control targets for major pollutants to carry forward cleaner production audit actively. Meanwhile more than 10 cleaner production audit guidelines for specific industries including iron and steel industry, chemical industry and cement industry were announced by MEP which detailed realize the technologic procedures and strengthen the manipulations and instructions on cleaner production audit.

(3) Technology Catalogue

In order to promote the industrialization and application of cleaner production technology and reduce the intensity of industry pollutant emissions, former SETC and MEP jointly issued 3 batches of "catalog of the elimination of backward production capacity, technology and product" requesting enterprises to eliminate the production technologies, processes, equipment and products that waste resources and discharge serious environmental pollution during 1999 to 2002. Then NDRC and EMP jointly issued 3 "clean production technology oriented Catalog of national key industries" including 141 cleaner production technologies to guide enterprises to adopt advanced technologies, processes and equipment. Moreover, since 2009 MIIT has issued 34 implementation programs of cleaner production technologies in key industries in 5 batches and supported over 300 cleaner production technology demonstration projects using the central government special funds for cleaner production and even released 43 cleaner production demonstration enterprises to set benchmarks for the key industries.

Overall, the technical support system of cleaner production provides a broad range of services, from evaluation index system construction and the audit process conducting to technology demonstration promotion, and offers strong support in advancing cleaner production comprehensively.

1.6 Cleaner production expert database gradually establishing

Scientific decision-makings, which are inseparable from expert advice, are needed to make CP play its due role. On January 22nd, 2007, the List of National Cleaner Production Expert Database (the First Batch) including 183 experts was promulgated by NDRC. As the brain of CP management trust and the government's assistants in making policy, these experts are playing important roles in forming CP implementation policy and annual plan, studying out CP guidelines and standards, assessing CP projects and CP audit. With further implementation of CP, the amount of these experts is still far from being able to meet the current demand and needed to add. Therefore, positive actions have been carried out, and 16 local cleaner production expert databases have been built in Beijing, Tianjin, Shanxi, Inner Mongolia, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Fujian, Hebei, Henan, Hainan, Chongqing, Yunnan, Shaanxi and Gansu provinces/municipalities including 1529 industry and cleaner production experts by the end of 2012, according to incomplete statistics. These cleaner production expert databases effectively promoted local development of cleaner production.

1.7 Key enterprises cleaner production audit in Full Swing

The key enterprise of cleaner production audit system which proposed according to the producing characteristics and environment management level after cleaner production theory introduced into China in early 1990s, is an innovation and improvement to the international cleaner production practice and now became one significant policy for industrial pollution prevention in China. With the implementation of the system, key enterprise cleaner production audit started with demonstration pilot project and is gradually in full swing.

Firstly, China's environmental protection authorities deployed nearly 30,000 key enterprises to carry out cleaner production audit according to the incomplete statistics from 2003 to 2012, and the number of the publicized enterprises and implemented enterprises were increasing each year, especially significantly since 2009, as shown in Fig. 8. For industry distribution, cleaner production audit were deployed covering 21 industrial sectors in 2012. Moreover, five major industries such as 'Metal Surface Treatment and Heat Treatment Processing' (MSTHTP), 'Chemical Materials and Products' (CMPs), 'Light Industries' (LIs), 'Textile' and 'Electrical Machinery and Equipment Manufacturing' (EMEM), accounted for 55% of the total amount of key enterprises (Fig. 9), which related closely with the promulgation of the Notice on further promoting clean production of key enterprises (2012) (MEP No.54) and 12th five-year plan on pollution prevention and control of heavy metal.

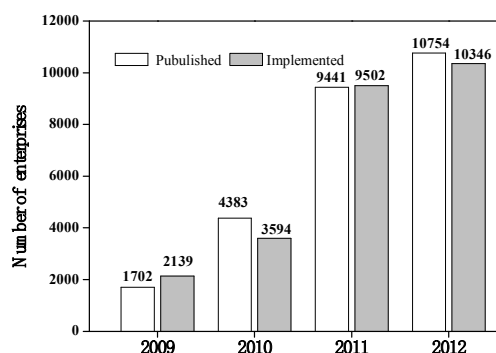


Fig. 8. The number of key enterprises been published and implemented CPA (Year 2009-2012)

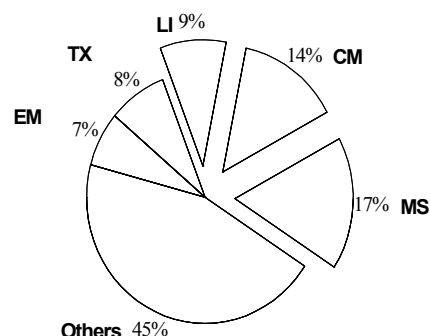


Fig. 9. The industry distribution of key enterprises implemented CPA in China

For regions, CPA was firstly implemented in Yunnan province, and then spread out widely in China, increasing from West to East China. By the end of 2012, the number of key enterprises which implemented cleaner production audit in Shandong, Jiangsu and Zhejiang provinces of Eastern China and Guangdong province of South China accounts for 72.7 percent of the national total amount (Fig. 10). The data indicate that cleaner production audit for key enterprises have been promoted rapidly

and effectively, which is closely related to the CP policy, regulation and the perfecting CP technology supporting system by the relevant departments between 2009 and 2011.

Significant environmental and economic benefits have been reaped through the implementation of key enterprises CPA. According to incomplete statistics in 2012, there are 197,000 cleaner production options have been proposed, and 186,000 options of which have already been implemented. With the implementation of these options, 17.2 billion tons of wastewater, 120,000 tons of COD, 190,000 tons of SO₂ and 180,000 tons of NO_x have been decreased, and also greatly reduced 0.6 billion tons of water, 1.1 billion tons of coal and 5.8 billion kW•h electrical energy including economic income of 28.461 billion China Yuan.

The data using above were collected by the MEP, not including the compulsory CPA statistics implemented by local departments, or the voluntary CPA statistics implemented by the NDRC and CRIT (Commission of Economy and Information Technology).

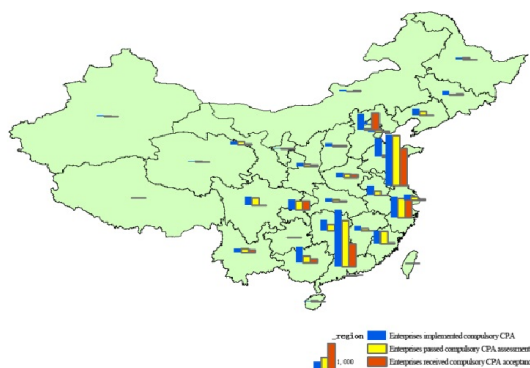


Fig. 10. The regional distribution of key enterprises CPA

2. Conclusion

It's been more than 20 years since CP was firstly introduced into China in early 1990s. After two decades of exploring and learning, practice and implementation, there are many remarkable accomplishments. Such as perfecting laws, regulations and standards of cleaner production, increasing professional consulting bodies and experts, decreasing pollutants and energy consumption and growing economy benefits. And all these successful experiences could provide reference for developing countries in the world.

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