

China's Environmentally Friendly Enterprise Program: A New Approach to Industrial Pollution Prevention and Energy Efficiency in China

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Abstract

China's environment is facing increasing challenges from its rapid economic development, despite achieving a level of compliance with existing laws and regulations. Besides strengthening its current regulatory activities in environmental management, the government has also introduced new approaches of preventing pollution and improving resource efficiency in order to protect China's eco-environment and non-renewable resources. For designing and implementing the new approaches, lessons can be learned from the successful experience of incentive environmental management and series voluntary government-industry partnership programs in USA. Based on the outputs of the cooperative project between the China State Environmental Protection Administration (SEPA) and USEPA, "Sino-US Partnership in Industrial Pollution Prevention and Energy Efficiency", SEPA has issued a new program, "China Environmentally Friendly Enterprise (CEFE) Program", to honor the excellent enterprises that have manifested top environmental performance in China. All kinds of industrial enterprises can apply for the recognition as CEFE voluntarily committing to improve their environmental performance to exceed the current regulations and standards so as to be the environmental leaders in the corresponding sectors. Conferred by the national government, CEFE is the highest award in environmental protection for an enterprise in China. In this article, the background, characteristics, criteria and indicators of CEFE will be explained, and the progress of the program as well as some cases of the new CEFE membership enterprises will be introduced.

Keywords: China Environment Friendly Enterprise (CEFE); environmental management; criteria and indicators; pollution prevention; energy efficiency.

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Introduction

Beginning with the implementation of the Reform and Open Policy in 1978, the rapid expansion of China's economy has attracted global

attention. The annual growth in its gross domestic product (GDP) averaged 9.3% during the past quarter-century, with the industrial growth rate even higher, exceeding 10% (1). The significance of the industrial sector to the national economy increased proportionately.

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Present situation of industrial pollution in China

Rapid advance of industry also brought increasingly serious problems of environmental pollution and resource shortages in China. By 2002, industry accounted for 47% of wastewater discharges, and 81% of SO₂ emissions (2). Most dangerously, industrialization led to the production and release of various kinds of toxic and hazardous pollutants. With its limited natural resource base and carrying capacity of its environment, China has to choose the resource-saving model for its industrial development, a unique option for industrial, sustainable development (3).

Fortunately, by strengthening the environmental management, China's situation of environmental pollution and deterioration did not manifest the same speed with the industrial development in recent years, and industrial pollutant discharges were even reduced (See Figures 1 and 2, (2,4)).

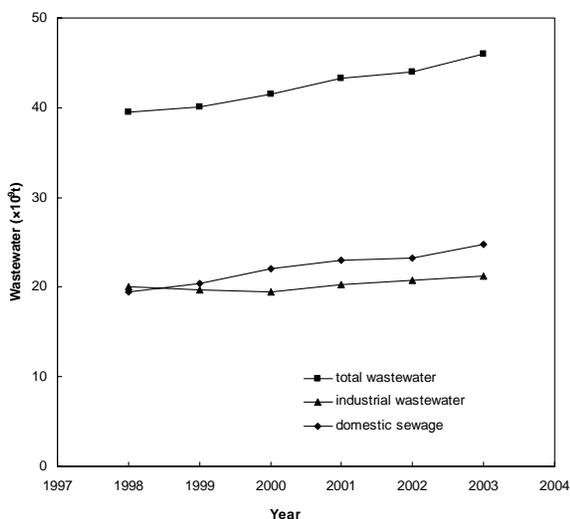


Figure 1. Industrial wastewater quantity increased slower than the rate of the national level.

During the same period, similar progress also occurred in the energy consumption in China. China's reliance on coal as the key energy source has caused huge pressure on its atmospheric environment, especially the industrial sector who used up to 70% first-class energy of the gross consumption and released up to 62% of the energy-related emissions (5). By optimizing the industrial structure and improving energy efficiency, more and more industrial entities abandoned outdated equipment and promoted Cleaner Production, which

has resulted in a decrease of pollutants from emissions and discharges in China (6).

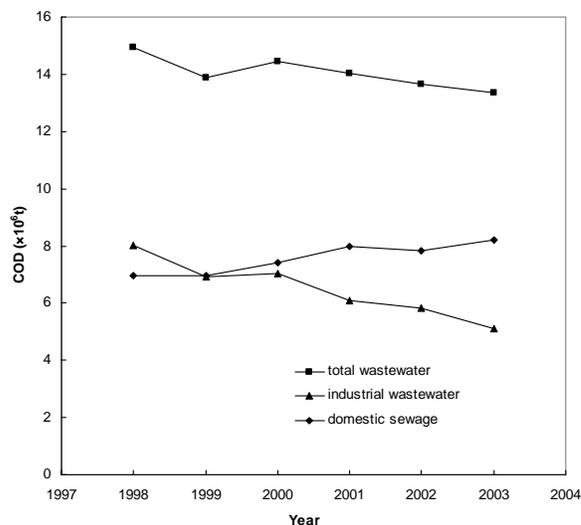


Figure 2. COD discharge amount from industry decreased along with the national economic development.

However, to this day, there is still no fundamental transformation of the traditional coarse mode of economic development and the end-of-pipe mode of industrial pollution control in China (7). Taking industrial energy consumption as an example, China consumes 1,034 kg of standard coal to produce 1 ton of steel, 22 kg of standard coal to refine 1 ton of oil, and 417 kg of standard coal to generate 1 kwh of electricity, compared to 629, 19, and 325 kg of standard coal consumed per output, respectively, by industrialized countries (6). These data also indicate that China has a big potential to improve its energy efficiency and reduce its pollutants.

Current environmental management in China

Over the past 30 years, an integrated legal system for environmental management has been built, and a series of policies, regulations and standards have been issued to guide with their implementation (8). Concerning the current environmental management, administrative management mode of regulation and enforcement, or "command-and-control", is still given priority, such as the Discharge Permit System, Limited Time Treatment and Environmental Impact Assessment; whereas economic management mode with market-oriented tools was under improvement,

such as the Pollutant Discharge Fees and Pollutant Taxes; and voluntary management mode with incentive awards was under development, such as Environmental Management System (EMS) Certification and Environmental Labeling (8).

Through the implementation of environmental laws, regulations and policies, the integrated competencies of industrial pollution control and environmental management have been noticeably improved in China, so that presently the ecological degradation and environmental pollution caused by industry had been retarded substantially despite the increasing pressure of rapid industrial development. Meanwhile, the environmental awareness of both industrial managers and the general public has also increased rapidly.

However, two phenomena should be noticed with regards to industrial management: firstly, an adversarial relationship exists between the environmental protection bureaus (EPBs) and the local enterprises—that is, the “penalty-offices” versus the “polluters” (7). Secondly, considering statistics of the compliance rates with various standards, both the number of excellent enterprises with exemplary achievements in pollution control and the number of illegal enterprises with obnoxious pollution control records are quite small, while the majority of the enterprises have settled for “being-unpunished”, though they may be able to further improve their environmental performance (9). Because necessary incentive mechanisms are lacking in the current environmental management scheme, those enterprises with potential competences have no motivation to reduce emissions beyond the minimum needed to attain compliance.

For eliminating such phenomena, with supports from related ministries and industrial associations, SEPA initiated the communication with industrial enterprises from 2000, trying to establish a new government-industry partnership. In 2001, the cooperative project between SEPA and USEPA, “Sino-US Partnership in Industrial Pollution Prevention and Energy Efficiency”, was launched with the purpose of introducing the United States principles and approaches of the incentive management to promote industrial pollution prevention in China. On the basis of the project outputs, SEPA issued the China Environment Friendly Enterprise (CEFE) Program in 2003, and started the application and assessment of CEFE all over the country since 2004.

Incentive environmental management and voluntary programs in the United States

Since the 1980s, the environmental management mode has gradually transformed from mandatory management into incentive management in the United States. With the aim to motivate industrial corporations to further improve their environmental performance to achieve comprehensive benefits both in the economy and the environment, a series of environmental initiatives and partnership programs were proposed by USEPA, US Department of Energy (DOE), various societies (trade groups) of industrial sectors, and many state governments in the United States (10-13).

USEPA has implemented about 20 voluntary partnership programs, more than 7,000 enterprises and institutions were involved by their own will (11). It was estimated that 8 million tons of solid wastes were reduced, 0.8 billion gallons of water were saved, greenhouse gas emissions (equivalent to 1,700 automobiles) were cut down, and nearly 1 million dollars were saved annually (11,14).

Based on their different targets, the voluntary partnership programs could be defined into 3 levels (10). For the first level, the programs focused primarily on reducing releases of pollutants with high environmental risks. The goal was to eliminate toxic and hazardous chemicals one by one from their headstreams of production through the actions of pollution prevention programs, *e.g.*, “33/50 Toxic Chemical Reduction Program” (11), “Design for Environment” (11), and “Green Chemistry” (11,15,16,17).

For the second level, the programs focused on continuous improvement of energy efficiency of industrial processes and products. Measures to improve the efficiencies of resources and energy, exploit renewable energy, and reduce greenhouse gas emissions were adopted to mitigate the global environmental crisis of resources shortage and climate change in the programs, *e.g.*, “Green Lights” (11,18), “Energy Star” (11,19,20) and “Natural Gas Star Program” (11,21).

For the third level, the programs combined pollution prevention with energy efficiency. Enterprises and institutions voluntarily involved could choose their own environmental targets that were suitable with their conditions and commit to improve their environmental performance not limiting to compliance but beyond the current regulations, *e.g.*, “Environmental Leadership

Program” (22,23), “Responsible Care® Program” (24,25), and “National Environmental Performance Track (NEPT) Program” (26).

The NEPT Program, launched by the USEPA in 2000, was designed to encourage and reward top environmental performance. With the partnership between the government and the facilities, members of NEPT Program receive a range of incentives to motivate further improvements in environmental protection (26). In the Sino-US cooperation project, a feasibility study showed that the NEPT Program could be used as the model for proposing the CEFE Program (27).

Design of the China Environment Friendly Enterprise Program

Objective of the CEFE program

CEFE is the highest national honor awarded to the industrial enterprises in China that demonstrated excellent environmental performance beyond current national environmental regulations and standards (28). The Program establishes model companies to set benchmarks for environmental performance of the corresponding sectors, and promotes the implementation of long term implementation strategies for industrial sustainable development in China.

Characteristics of the CEFE program

Many industrial enterprises now have applied or implemented the Audit of Cleaner Production and the Certification of Environmental Management System, *e.g.*, ISO 14000 and HSE (Health, Safety & Environment) Systems. Compared with those systems, the voluntary CEFE Program also repeats the same requirements to the participants to demonstrate sustained compliance with laws and regulations, highlighting pollution prevention and commitment to continual environmental improvement. Besides those principles, CEFE Program has the following three characteristics:

(I) CEFE Program is an innovative type of governmental action. Presently in China, the government is much more powerful than any kind of non-governmental organization (NGO) to promote a nationwide action. So the SEPA on behalf of the government will carry out the Program, as with the USEPA’s NEPT Program. Participation in the program will be open to all industrial enterprises, corporations, factories, and firms.

In contrast, Cleaner Production is a non-governmental initiative or program restricted to specific industrial sectors, whose corresponding industrial societies issue recommendations about technologies and production practices to eliminate pollution and improve efficiency in their products’ life cycles (29). Similarly, ISO14000 series standards was also a kind of non-governmental program issued by the International Standardization Organization to develop a uniform environmental management system that could be applied to any client, not only to industry, but also to commerce, NGOs, government bodies, *etc* (30,31,32). Therefore, Cleaner Production Audit and ISO14000 Certification have different objectives and targets from the CEFE program.

As the CEFE Program is a governmental initiative, SEPA will organize the assessment and approval to the CEFE candidates who applied voluntarily, and it has the sole right to grant the CEFE certificate to the qualified enterprises. However, Cleaner Production and the ISO14000 System are audited or certified by a third party (*i.e.*, a qualified and independent institution).

(II) The CEFE Program promotes partnerships between the government and enterprises, so the incentive mode of environmental management allows for an enlightened partnership between them. During the implementation of the CEFE Program, the SEPA keeps its independence for assessment and management, while the local EPB on behalf of the local government will encourage more enterprises located in the region to reach the criteria and indicators of the CEFE, support and help the enterprises to apply, and assist the site visit and respond with appropriate incentives. In the audit of Cleaner Production and the certification of EMS, however, it is impossible to build such relationship between the client and the third-party institution, which must maintain total independence in order to ensure credibility of the whole evaluation procedure.

(III) CEFE Program encourages the public to participate. The program has designed some special approaches to attract the public’s involvement, which can increase the outreach of the program and enhance the fairness and credibility of the assessment.

In contrast, the audit of Cleaner Production and the certification of EMS rely on the qualification and reputation of the third-party institution for credibility and objectivity, with no process for public involvement.

Entry criteria and indicators of the CEFE

Available criteria and indicators were designed for the CEFE Program after studying the successful experience of voluntary partnership programs in the United States and investigating 4 large-scale, Chinese corporations that belong to heavily polluting, energy-intensive industrial sectors (*e.g.*, chemical engineering, petrochemical engineering, and steel) but exhibit top environmental performance. Table 1 compares the entry criteria of the CEFE Program and the NEPT Program, in which it can be seen that 3 basic criteria are the same. Every enterprise can apply for the CEFE so long as its environmental performance meets the 4 criteria.

When applying for the CEFE award, the applicant shall check its records of environmental performance, which includes obeying laws and regulations, meeting the waste discharge standards, and avoiding pollution accidents and litigation for the last 3 years. Certification of an EMS along with a framework for a “Plan-Do-Check-Act” will be required for applying the CEFE. Depending on the nature, size and complexity of the enterprise, companies may choose either the EMS recommended by special industrial sectors, or the HSE system adopted by the petrochemical sector, or the well-recognized ISO14000 system.

Differing from the NEPT Program, the implementation of Cleaner Production was set as one basic criteria in the CEFE Program to replace the criteria of community outreach. The Chinese government is now determined to promote pollution prevention and productive efficiency by spreading Cleaner Production in the progress of industrial reform. The CEFE will be required to be the best practitioner of Cleaner Production. Its consumption of resources (energy, water and other materials) and

its pollutants discharge shall be at the domestic advanced level or at the international advanced level in the corresponding sector. On the other hand, generally, environmental awareness of Chinese public was not high enough to devote much passion to an environmental program or activity.

Since one component of the CEFE Program is aimed at community outreach, the CEFE Program designed an indicator to reflect the degree to which the local community and employees are satisfied with the enterprise’s environmental performance. To further encourage people to participate, the enterprise is required to set dialogue channels for communicating with local communities. Further, community members will be allowed to participate in the experts group for on-site inspections, and public opinion will be solicited through several media (SEPA website, China Environmental News and the local newspapers) before the candidates are approved. Finally, on the basis of its past environmental performance, the enterprise shall commit to carry out new approaches to further improvements. The enterprise will demonstrate its commitment to public outreach and report to the local EPB in its annual report.

China has many types of enterprises (*e.g.*, state-owned enterprises, private enterprises, joint-venture enterprises, share-holding corporations, *etc.*). Because of this, a broad sweeping application of the basic criteria may be viewed as a coarse and incomparable method for evaluating different candidates. Historically, the Chinese industry used to set quantified indicators as targets for development based on year to year achievements in the economy. However, the CEFE Program is quite different as it lists detailed indicators with absolute or relative values to assess the candidate’s pollution control. Guided by the indicators, the enterprise can upgrade

Table 1. Entry criteria of the CEFE Program and the NEPT Program

CEFE Program, P. R. China	NEPT program, USA
History of sustained compliance	History of sustained compliance
Environmental Management System	Environmental Management System
Implementation of Cleaner Production audit	Community outreach and performance reporting
Commitment to continuous environmental improvement	Commitment to continuous environmental improvement

its environmental performance step by step, thereby improving its rank in the corresponding sector. Although calculating, collecting and checking the data are not easy, the indicators are good for the Program in maintaining its credibility and objectivity and understandability to the public.

All indicators of the CEFE Program are cataloged as environmental indicators (see Table 2), management indicators (see Table 3), environmentally-friendly product indicators, and self-commitment indicators.

It is almost impossible to give some uniform indicators for environmentally-friendly products, since the configurations, functions and life-cycles of products vary between and within industrial sectors. Moreover, for applicants who have already carried out Cleaner Production, it may be next to impossible to quote indicators for environmentally-friendly products through a labeling scheme by certified institutes or a product with a minimum impact on environment and human health throughout its life-cycle, simply because many kinds of industrial products are out of the scope of the national environmental labeling authentication at this point.

For self-commitment, the enterprise will sign a protocol with the provincial EPB, committing to continuously improve its environmental performance beyond minimal compliance with the national environmental laws and regulations. Main contents in the protocol shall be open to the public so that the targets, measures, and results of the improvement will be under the supervision of the public.

Implementation of the CEFE Program

By the principle of voluntary participation, an enterprise can formally apply for the CEFE after certifying with the entry criteria. The processes of application, assessment, and approval as well as the methods of implementation and management are introduced on a website (33).

Current progress and achievement of the CEFE program

Being the first group, 8 enterprises were recognized as CEFES from 104 applicants in 2004. Table 4 lists the first group of China environment friendly enterprises. CEFE Program has been implemented for only one year; however, great interest has been expressed by many EPBs local enterprises. At present, two additional candidates, including Shanghai Bao Steel Co. Ltd., have been examined by SEPA's designated experts group, and public opinion is being solicited by the media. Further, hundreds of enterprises have initiated their actions for applying.

Owing to the achievement of environmental management and improvement of environmental awareness of Chinese industry in the past years, applicants of the CEFE Program presently are among the outstanding enterprises as measured by their economic progress as well as their environmental performance, with some indicators exceeding the current environmental requirements and standards. Also, the applicants could reach the basic criteria and indicators of CEFE without much economic input.

Table 2. Environmental Indicators of the CEFE (website of SEPA's CEFE)

	Indicator	Requirement
1	pollutants discharge	safely reach the national or local pollutants discharge standards or the indices of gross pollutants discharge amount
2	gross energy consumption per unit of products	keep at the domestic advanced level in the corresponding sector
3	water consumption per unit of product	keep at the domestic advanced level in the corresponding sector
4	main pollutants discharge amount per 10 thousand RMB Production Value	keep at the domestic advanced level in the corresponding sector
5	comprehensive of recovery rate of solid waste	keep at the domestic advanced level in the corresponding sector
6	environmental management system	establish standard EMS

However, those enterprises committed to further improvements will no doubt require larger investment for enhanced technical innovation and pollution control. Figure 3 and 4 show the commitments on environmental protection of two CEFEs.

Benefits for participation

SEPA offers incentives to the CEFEs to recognize their top performance and to motivate continuous improvement. Those incentives include: SEPA awards to every CEFE; priority to CEFE companies by local EPAs for routine inspections, reduced or

Table 3. Management Indicators of the CEFE

	Index	Requirement
1	Cleaner Production	Implement Cleaner Production and equip the advanced process for cleaner production
2	Implementation rate of the Environmental Impact Assessment and the “three synchronization” mechanism* for newly-constructed, reconstructed and expanded projects	100%, checked and accepted by the corresponding environmental office
3	Percentage of time that environmental equipment is operational	95% and above
4	Percentage of wastes that are disposed in a permitted or certified landfill or recycled in a right way	100*
5	Environment within the enterprise	Tidy and beautiful with over 35% area covered by trees and grass
6	Construction of discharging pipes and installation of on-line monitoring instruments	Accord with the standardized requirements for discharging pipes, install and keep in stable operation of on-line monitoring instruments for inspecting key pollutants in the discharging pipes
7	Declaration and registration of pollutants discharge	Declare and register pollutants discharge and obtain the discharge permit
8	Pollution discharge fees	Pay the required pollution discharge fees in time
9	Environmental accident and prosecution	No repeated environmental prosecution and pollution accident in the preceding 3 years
10	Environmental management system	Bring environmental management into daily standardized management, set holistic management branch and mechanism, keep full records of the environmental performance including basic technical data and materials and monitoring data tested by the itself or other qualified institution
11	Percentage of the local community and the enterprise’s employees satisfied with its environmental performance	90% and above

*“three synchronization” mechanism, a policy of environmental protection in China, means that the facilities for environmental pollution prevention and ecological protection shall be designed, constructed and utilized at the same time with the main body of a project (8).

waived grant or loan applications for environmental capital; and free posting on the SEPA website to showcase the CEFE's environmental achievement to the public. Along with the implementation of the CEFE Program, more incentives will be designed in order to attract more enterprises to participate and create certain business opportunities or advantages for the winners.

In the view of an applicant, though it would be costly for a further improvement at a higher environmental level, being a CEFE will serve as a model of industrial sustainable development in China, so as to influence the consumers' choice. Further, the honor will be a "green-passport" that may aid the CEFE to stride into the international market and allow for long term rewards for efforts and inputs.

Table 4. First Group of CEFES

	Enterprise	Facts of Environmental Performance
1	Bayer Wuxi Chemical Co., Ltd. (Jiangsu province)	It owns a top-ranking Leather R&D Center, one of its task is to research environmental-sound substitutes, <i>e.g.</i> chromium free tanning agent, to eliminate the chromic pollution.
2	Qingdao Port (Group) Co., Ltd. (Shandong Province)	Its preeminent management can be seen from the sight of a Garden Port, and all wastewater after treatment are reused in cleaning ore, saving 900,000 RMB of water consumption every year.
3	Shandong Lubei Chemical Corporation (Shandong Province)	It is the pioneer in China and worldwide to see the ideal of a 'recycle economy' become a reality. Located on a saline beach, it developed 3 ecological industrial chains, PSC (ammonium phosphate, sulfur acid and cement) project, multi-use of sea water, and the combination of clean electric power - salt - alkali production.
4	Gold East Paper Co., Ltd. (Jiangsu Province)	It has advanced equipments of paper making (paper made from pulp directly), printing and wrapping, as well as standardized management to pursue the goal of "Green Paper Making".
5	Kunshan Note Paper Plant (Jiangsu Province)	It has advanced production lines and effective practice in Cleaner Production.
6	SinoPec Zhejiang Zhenhai Refinery & Chemical Co. Ltd. (Zhejiang Province)	It is the biggest refining plant in China. All-hydrogenation process is applied to reduce sulfur in its oil products, <i>e.g.</i> 90# gasoline contains sulfur 240ppm, however, the national standard is 800ppm. It opened to the community during the application of CEFE, soliciting the public support and involvement.
7	Nantong Acetic Fiber Co., Ltd. (Jiangsu Province)	It saved raw materials and reduced organic emission by recovering 99.5% acetone and 99.5% acetic acid.
8	PetroChina Xinjiang Dushanzi Petrochemical Corporation (Xinjiang Uygur Autonomous Region)	It is also a model of recycle economy in China. Examples are distilling naphthenic acid from alkali dregs of diesel oil, obtaining sulfur by gas desulfurization, producing ceramic and pavement brick from slag. Located in the desert area, it is marvelous to cover 38% of the factory with trees and grass.

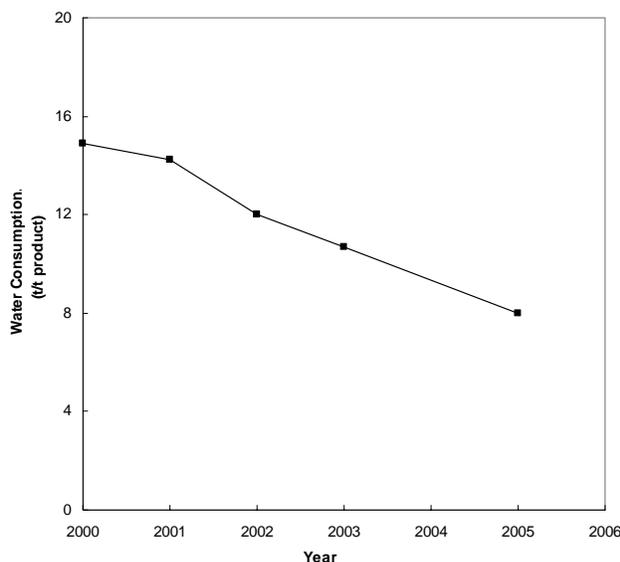


Figure 3. Water consumption per unit of products in 2005 committed by Gold East Paper Co.

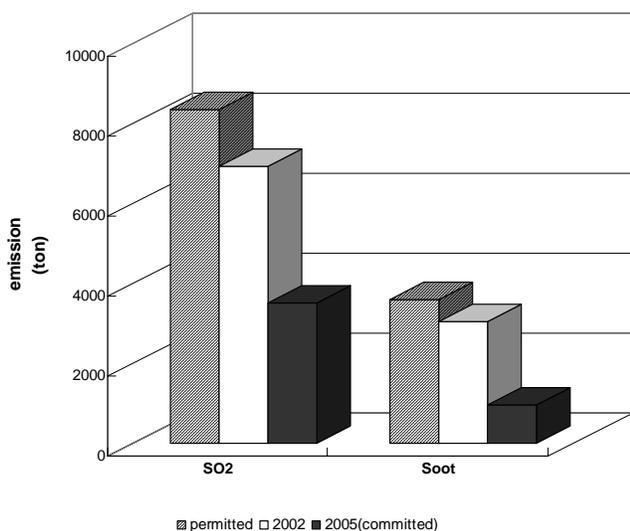


Figure 4. SO₂ and soot emission in 2005 committed by Shandong Lubei Chemical Co.

Conclusion

In order to protect its environment and preserve its resources under the increasing pressure of economic development, the Chinese government makes a great

stride in industrial pollution prevention and energy efficiency by improving its environmental management mode. The new approach of China Environment Friendly Enterprise Program is the first attempt of a voluntary partnership program developed in China.

After certifying conformance with the entry criteria, any kind of industrial entity can apply to participate in the program. During the application, the provincial EPB will be the partner of the local competent enterprises to smooth the procedure. SEPA is responsible for the assessment and inspection. When accepted as a member of CEFE, the applicant will share the program incentives where the most attractive reward is the governmental highest honor as being a CEFE, which will bring them enormous immaterial wealth in the domestic and international market.

We predict that hundreds of enterprises will be recognized as CEFEs in the near future. The program will maintain the partnership between environmental agencies and those China Environment Friendly Enterprises to achieve the win/win situation of the economy and the environment in the industrial development in China.

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