

Total Emission Control of Major Pollutants in China

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Chinese policymakers are markedly transforming the country's environmental management and pollution control strategy. Over the past few years, China has been moving away from a regulatory system that emphasizes the control of the *rate* of emission discharge to one that focuses on controlling the *total* amount discharged. In other words, instead of placing fixed limits on emissions from individual sources and requiring them to install specific technologies to control pollution, a total emissions approach sets national emission standards and opens up the possibility for market-based emission trading mechanisms. Conventional command and control regulations often place too heavy a burden on poorer industries and areas while mechanisms such as emissions trading grant greater flexibility to individual polluters to meet emission reduction goals.

The purpose of this article is to provide a framework for understanding existing and future applications of the total emissions control approach in China. The authors hope this article will provide a foundation for further research on how to strengthen the implementation of total emissions control policies in China. We begin by providing an overview of the Chinese political, economic, and legal context for TEC policies that began to be developed in the 1990s. This background is followed by examples of and challenges to the implementation of total emissions control policies in China. This article concludes with an evaluation of emissions trading as a promising implementation tool for China's total emissions control efforts.

THE POLITICAL CONTEXT OF TOTAL EMISSIONS CONTROL POLICIES

Prior to the passage of a 1996 total emissions control policy, most pollution prevention measures in China emphasized concentration control. Concentration control consists of discharge standards, systems and environmental management measures aimed at controlling the concentrations of pollutant discharges. The advantage of this concentration control strategy is that it requires simple monitoring equipment and does not demand a highly trained workforce. While the utilization of the concentration control strategy has made important contributions to pollution control in China, especially in water pollution, it is not enough to help China solve its growing pollution problems. Beginning as early as 1985, some researchers and officials in China began noting the drawbacks of concentration control and conducted pilot studies in some regions to replace concentration control with total emissions control measures.¹ Chinese environmental officials and researchers now widely accept that China should make a shift from concentration control to total emissions control because in many regions, despite all pollution sources meeting the concentration standards, the total amount of pollutant discharge has kept growing and the environmental quality has grown worse.

During the Ninth Five-year plan period (1992-1996) environmental protection bureaus (EPBs) and research centers in China began a wide array of experiments and pilot trials utilizing total emissions control mea-

sures. Based on this experimentation, the Chinese government established clear nationwide goals for the control of major pollutants in the 1996 "Plan for Total Emissions Control of Major Pollutant Discharge" (hereafter referred to as the TEC policy). This plan aimed to control ambient pollution levels at the 1995 rate by controlling *total* emissions, rather than simply target the concentration of emissions. The ultimate goal of this new TEC policy was to achieve total amount reduction of pollutant discharge through adjustments in the distribution of industries, enforcement of cleaner production, and eventually the establishment of emissions trading programs.

Under this 1996 TEC policy, the National Environmental Protection Agency (now the State Environmental Protection Administration) targeted twelve major pollutants for total emissions control. These pollutants fall into three categories:

- 1) Air Pollutants: soot, sulfur dioxide, and industrial dust;
- 2) Water Pollutants: chemical Oxygen demand, cyanide, arsenic, mercury, lead, cadmium, hexavalent chromium, and oil pollutants;
- 3) Solid Waste: industrial solid waste.

These twelve pollutants were chosen according to three criteria. Each pollutant was 1) the target of existing pollution control measures; 2) adequately monitored by statistical measures; and 3) characterized as a grave threat to the environment (National Environmental Protection Agency, hereafter NEPA, 1996a). Table 1 presents the targets that were set for the discharge of these major pollutants. At a recent national conference sponsored by the State Environmental Protection Administration (SEPA) on planning of environmental protec-

TABLE 1. TARGETS FOR TEC OF MAJOR POLLUTANTS DISCHARGE: 1995 AND 2000

POLLUTANT	ACTUAL DISCHARGE AMOUNT IN 1995	TARGETED DISCHARGE AMOUNT IN 2000	COMPARISON OF ACTUAL 1995 AND TARGETED 2000 DISCHARGE
			(%)
Soot	1,743.57	1,750	0.37
Sulfur Dioxide	2,369.53	2,460	3.82
Industrial Dust	1,731.15	1,700	-1.80
Chemical Oxygen Demand	2,233.19	2,200	-1.49
Industrial Solid Waste	6,171.96	5,995	-2.9
Cyanide	3,494.82	3,273	-6.4
Arsenic	1,445.56	1,376	-4.8
Mercury	27.01	26	-3.7
Lead	1,669.81	1,668	-1.9
Cadmium	285.35	270	-5.4
Hexavalent Chromium	669.19	618	-7.7
Oil Polutants	84,368.95	83,092	-1.5

Source: Liu Qifeng 1996b: 115

Notes: Chemical Oxygen Demand is a measure of the amount of organic material in wastewater

tion for 2001, Mr. Xie Zhenhua, administrator of SEPA announced that the total emissions control targets for the twelve pollutants had been achieved by the end of 2000 (Xie 2001).

Since the formulation of the 1996 TEC policy, the concept of controlling total emissions has gradually become the basis for reform of existing environmental policies. The growing acceptance for this concept stems in great part from the overwhelming political support from many influential government officials, including President Jiang Zemin, Prime Minister Li Peng, and Song Jian (former head of the Science and Technology Com-

mittee).² This broad base of political support was reinforced during the "Fourth National Conference on Environmental Protection in 1996," when the State Council named total emissions control as one of China's two principal measures for environmental protection during the Ninth Five-Year Plan period (Ninth FYP) (Chen et al. 1996).³ Consensus on the issue within the central government grew from the expectation that the total emissions control approach is in harmony with China's strategy for sustainable development and can reinforce economic growth while improving the quality of life (NEPA 1996a).

TOTAL EMISSIONS CONTROL POLICY AND ECONOMIC GROWTH IN CHINA

The TEC policy is designed to meet the pace of socioeconomic development and industrialization. Implementation of the TEC policy will impact industrial pollution discharge patterns and affect the broader economic development of industrial enterprises and their surroundings. Conversely, the level and direction of economic development in China will constrain and shape the design, implementation, and effectiveness of the TEC policy. Advocates and designers of the TEC policy in China want to harness this two-way relationship not

only to achieve efficient and effective environmental management, but also to facilitate economic reform and sustainable development goals (NEPA 1996b). In order to understand the applicability of this total emissions control mechanism in China, one must first have an accurate overview of China's economic development and industrial activity.

Over two decades of economic reforms and growth have created a greater level of prosperity in China. However, the pressures created by economic, urban, and population growth have also exacerbated environmental degradation and heightened the need for innovative pollution control measures, such as the total emissions control policy.⁴

Three key factors have influenced the direction and extent of China's economic growth. First, economic development is not evenly distributed across China. Second, for the foreseeable future, heavy industry will remain dominant in the structure of the Chinese economy. Third, industrial technologies in China are less advanced than in developed countries, and this poor industrial technology is associated with higher energy consumption and corresponding pollutant discharge levels. Since environmental policies are so closely linked with the economy, it is critical that policymakers understand and account for each of these three factors when designing environmental policies. In other words, environmental protection measures must be regionally flexible and able to accommodate the structural rigidity and technological limitations of the Chinese economy. The discussion below, focusing on three key characteristics of China's economic system, illustrates how the total emissions control approach could be successfully applied within the

current economic structure.

Key Factor 1: Skewed Economic Development

In designing a national total emissions control policy, China faces the challenge that economic development across the country has been very skewed. Specifically, development of the Chinese economy has historically favored the coastal areas. As one moves from the west across China towards the coastal provinces, the level of development generally becomes higher (See Box 1). These inequalities among these three regions are particularly pronounced when comparing the urban areas (See Tables 2 and 3).⁵ Government policies, geography, and historical forces all have shaped this skewed development pattern.⁶

The Chinese government now would like to narrow the regional gaps in China to promote greater prosperity and equity. A major challenge, however, will be how to promote equitable growth among the regions while also mitigating air pollution problems by approximately the same standards. Because environmental policies are often viewed as hindering

economic growth, understandably some officials in the Central and Western Zones have been more lenient in applying air pollution control policies. The flexibility in the total emissions control policy addresses this challenge. By setting differential pollution control targets, the TEC policy could lower pollution levels without overburdening the poorer regions. Specifically, the TEC policy adheres to the following equity principles in setting pollutant discharge targets for the year 2000: the wealthier and more developed Eastern Zone must reduce total pollutants discharged to *below* the zone's 1995 level, the Central Zone must reduce total pollutants discharged *at least* to their 1995 level, while the relatively underdeveloped Western Zone would reduce some of their pollutants discharged to a level set slightly *above* their 1995 level (NEPA 1996b). Moreover, when nationwide emissions trading programs develop the wealthier Eastern Zone companies would be able to sell emission permits to the older, less efficient industries to the west. These equitable emissions discharge targets would also allow the Central and Western Zone

Box 1. Three Economic Zones in China

Western Zone	Central Zone	Eastern Zone
Sichuan	Shanxi	Beijing
Guizhou	Hubei	Tianjin
Yunnan	Jilin	Hebei
Shannxi	Heilongjiang	Liaoning
Gansu	Anhui	Shanghai
Qinghai	Jiangxi	Jiangsu
Ningxia	Henan	Zhejiang
Xinjiang	Hunan	Fujian
Tibet	Inner Mongolia	Shandong
		Guangdong
		Guangxi
		Hainan

Source: State Statistical Bureau, *China Statistical Yearbook 1996*. Beijing: China Statistical Publishing House, 1996: 344.

industries to gradually upgrade or demolish their higher polluting industries.

Key Factor 2: Rigid Industrial Structure

Understanding industrial growth and structural trends is also critical to sound TEC policy design for such insights will help identify the priority for pollution control in coming years. The Chinese economy can be divided into three categories: First, Second, and Third Industries.⁷ The rapid growth of the Chinese economy over the past twenty years can primarily be attributed to the growth of the Second Industry, which is dominated by light and heavy industry (Li Jingwen 1995).⁸ Unfortunately, these industrial gains came with a high environmental cost.

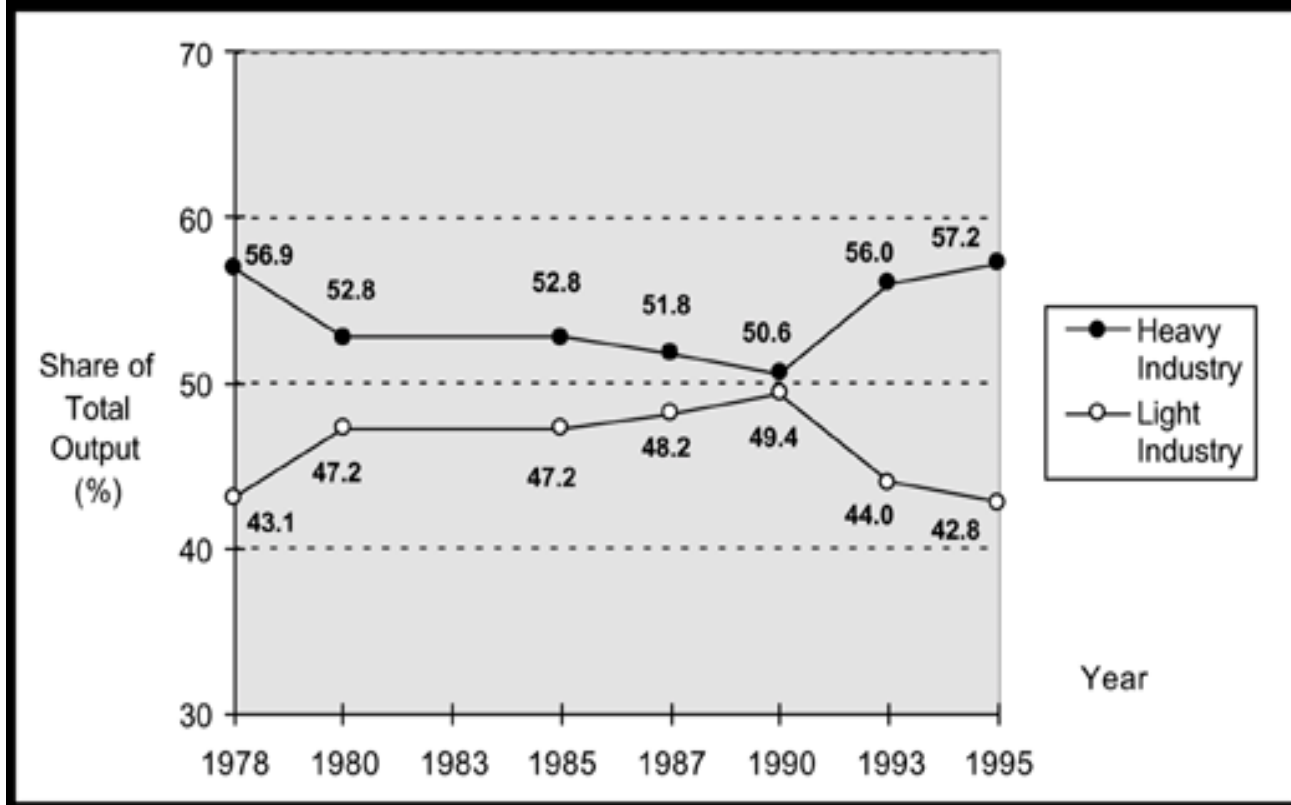
After a short-term prioritization of

light industry beginning in the 1980s, the central government returned heavy industry to its position of top priority. By 1995 heavy industry surpassed its 1978 share of total output value and created the largest gap between light and heavy industry of the entire reform period (See Chart 1).⁹ Li Jingwen's (1995) economic model also predicts that continued growth of the Second and Third Industries, and a simultaneous contraction of the First Industry will characterize industrial structure change over the next decade. Since heavy industry has always been both a dominant economic player and a dominant source of pollutant discharges, it is the main target of China's total emissions control policy.

Key Factor 3: Technology Limitations and Energy Inefficiency

Coal consumption has been the main source of air pollution in China. Therefore mitigation of air pollutants from coal burning industries is the main concern of the policymakers designing implementation of the TEC policy. China's high-energy consumption, mainly in coal, can be causally linked both to backward industrial technology and an unfavorable industrial structure. The "backwardness" of China's industrial technology has cost the country dearly in terms of energy consumption, as well as problems with elevated pollution discharge levels, excess raw material consumption, low enterprise profitability, and higher final product costs. In terms of energy consumption, it requires an average of 112 percent more energy to produce each ton of coal in China than it does in the United States (Wang 1997).

Chart 1. Light and Heavy Industry Share of Total Output Value: 1978-95



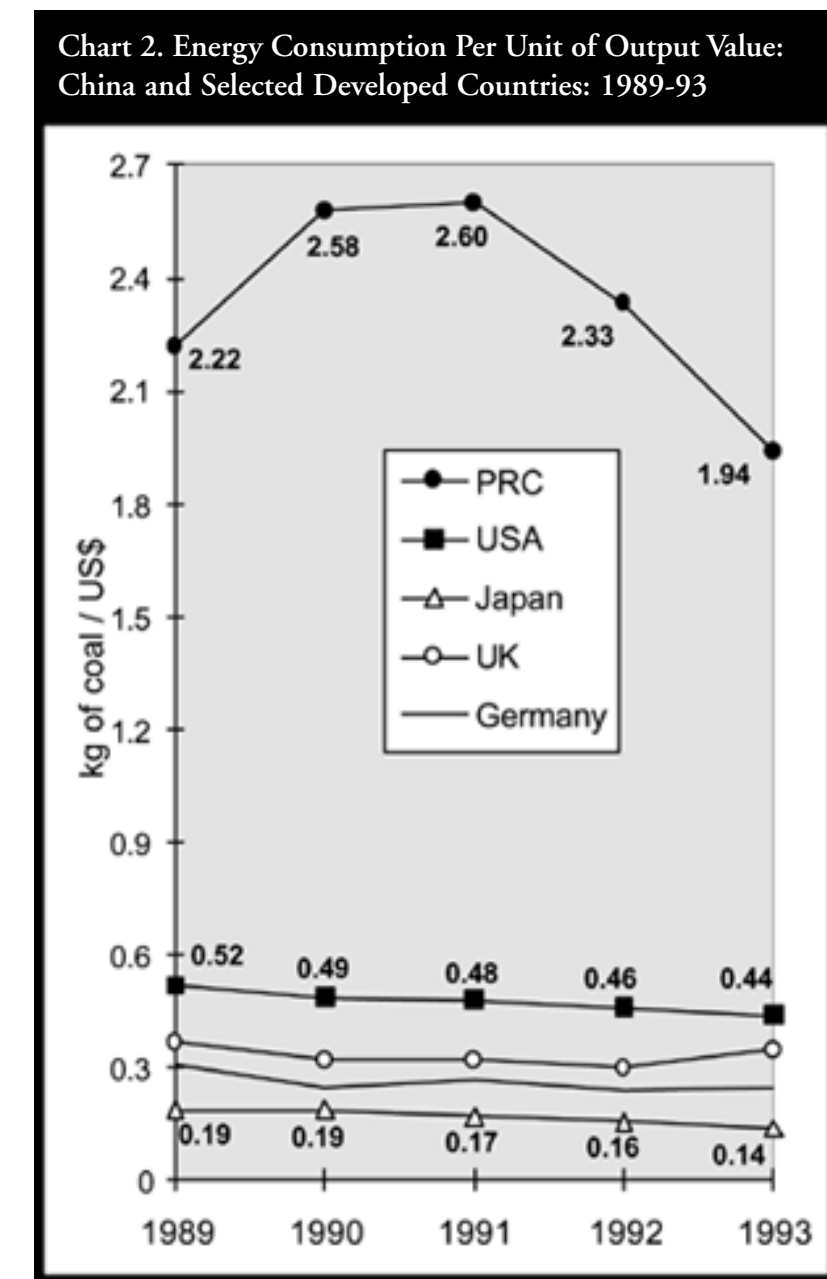
Sources: Li Jingwen 1995: 46-50; SSB 1996: 414; Li Changming 1995: 49

China's tremendous excess energy consumption has significant negative ramifications, including higher pollutant discharges and lower enterprise profits. In 1993, China's energy consumption per unit of production was roughly four times higher than the rate in the United States and nearly fourteen times higher than Japan's rate (See Chart 2). The combined First and Second Industry share of GNP in China was (and is still) significantly higher than the corresponding share in most developed countries. Given that the First and Second Industries are by nature energy-intensive, compounded by the fact that China's rigid industrial structure favors these two industries; China will likely continue to struggle with high energy consumption in production. The design and implementation of total emissions control policies will be challenged by the need to take into account these patterns of development and the current energy consumption patterns.

LEGAL AND REGULATORY DEVELOPMENT OF THE TOTAL EMISSIONS CONTROL POLICY

Since 1979, China's central government has been introducing a broad range of environmental legislation, including six laws dedicated to environmental protection and more than ten laws with environmental protection components. The pollution control and natural resource protection laws were strengthened in March of 1997 when the National People's Congress amended the "Criminal Law" to include a clause that criminalizes certain environmental and resource use offenses (State Council 1997).

Despite the plethora of new environmental laws, pollution levels have continued to increase in China, which has led to experiments with total emissions control approaches. After the passage of the 1996 total emissions control policy, two important



Sources: World Economic Yearbook 1997; China Economic Yearbook 1997; Zhang Sai 1996.

Note: kg of coal/US\$=(energy consumption)/(GDP for each corresponding year and country).

*Germany figures are from the former West Germany.

environmental protection laws that are the pillars of the China's environmental legal framework were amended to include the concept of total emissions control. One is the "Law on Water Pollution Prevention in China" was amended in 1996 to stipulate that total emissions control measures may be implemented for bodies of water

that do not meet environmental quality standards even if concentration standards are not violated.

Another major environmental policy to incorporate the TEC concept is the "Air Pollution Prevention Law" which was amended in April 2000 at the 15th Session of the Standing Committee of the Ninth

NPC. Clause XV of this law now stipulates that TEC be implemented for the acid rain and sulfur dioxide control zones and areas not in compliance with ambient air quality standards. The clause further requires the State Council be responsible for drafting various administrative decrees to facilitate the implementation of the TEC provisions in this law.

Since 1996, the State Environmental Protection Administration (SEPA) has collaborated extensively with the State Planning Commission, the State Economic and Trade Commission, and several other agencies to formulate policies and fine tune implementation programs using a total emissions control strategy. As a result, laws and regulations containing total emission control provisions are now being enforced in many provinces throughout China.¹⁰

Implementation of the Total Emissions Control Policy

After the adoption of the 1996 TEC policy, the central government allocated the total amount of pollutant discharge for each province based on estimates of the provincial-level emission discharges in 1995. Provincial governments in turn began to assign the pollutant quotas to various prefectures and cities within their jurisdictions. The provinces were required to use some of the following criteria in determining the quotas:

- Severely restrict increases in pollution discharge from newly constructed projects or industries
- Reduce pollutant discharge from old pollution sources
- Limit emission quotas within special acid rain control and special sulfur dioxide regions that have been designated by the national government
- Meet the planned targets of environmental protection for "Three Rivers," "Three Lakes," and "Two Regions," of which, the targets of TEC are to be based on a national plan¹¹
- Conform to required environmental quality levels in 47 cities that are national priorities for environmental protection.

In order to balance economic growth needs and local environmental quality in assigning the total emission control levels to prefectures and cities, provinces must also take into consideration the following factors:

- Population
- Local plan for economic and social development
- Industrial and product structure
- Infrastructure in urban areas
- Total amount of pollutant discharge within their jurisdiction
- Current environmental quality and targets for environmental quality

- Types of special environmental protection districts
- Claims by polluting industries that they are meeting the discharge standard.

After receiving the emission quotas, the prefectures and cities have the autonomy to distribute the quotas of pollutants by pollution sources. They can allocate quotas for TEC according to two types of pollution sources: 1) domestic pollution and other low-level polluters and 2) industrial pollution. Prefectures and cities can determine the total amount of pollutant discharge on the basis of standards of pollutant discharge in accordance with TEC targets assigned by provincial governments (target-based TEC). Alternately, they can determine total amount of pollutant discharge on the basis of standards of environmental quality in accordance with environmental targets of regions or basins (capacity-based TEC). If target-based TEC is adopted, prefecture and city governments must identify the major pollution sources affecting environmental quality in their jurisdiction. Then they must design plans on how they will meet the standard discharge from pollution sources.¹²

To utilize capacity-based TEC strategies, environmental managers must first estimate the largest amount of pollution that might be emitted while maintaining regional environmental quality targets. Based on these estimates, they then must derive the largest amount of allowable pollutant discharge. Next, through economic and technological feasibility analysis, they must optimize distribution of the amount of pollutant discharge among pollution sources. Finally environmental managers must formulate a design for implementation of capacity-based TEC to achieve the regional target for environmental quality.

The target-based TEC strategy is determined by the regional target for

Table 2. Percentage of GNP Share in the Three Economic Zones: 1979 and 1991

	1979	1991	Change	Growth
Eastern Zone	52.5	54.39	+2.4	+4.6
Central Zone	31.0	28.8	-2.2	-7.1
Western Zone	16.5	16.3	-0.2	-1.2

Source: Wen Tong 1996: 57

Table 3. Economic Development of Cities in the Three Economic Zones: 1995

	GDP of Cities		Investment in Fixed Assets		Industrial Enterprises	
	Billion RMB	(%)			Number*	(%)
Eastern Zone	3,293.98	(63.1)	663.05	(61.8)	278,609	(55.7)
Central Zone	1,331.66	(25.5)	270.43	(25.2)	149,710	(29.9)
Western Zone	591.14	(11.3)	140.17	(13.1)	72,261	(14.4)

Source: (SSB 1996: 322-24)

Notes: *Number of Industrial Enterprises reported in unites of 10,000 but this report considers the true unit to be one.

the total amount of pollutant discharges or the target for the total amount of pollution discharge reductions. Then, through economic and technological feasibility analysis, the distribution of the amount of pollutant discharges is optimized among pollution sources according to current level of discharge. Finally, a design for implementation of target-based TEC is formulated to meet the regional target of total amount of pollutant discharge and/or that of total amount of reduction of pollutant discharge.

Enforcing capacity-based TEC requires a high level of technical ability and considerable financial resources to determine the environmental carrying capacity. Given the large number of under-trained and under-funded local EPBs throughout China, it is clear that the target-based TEC strategy is relatively more feasible, for it does not require sophisticated technologies or complex research during the initiative stage of implementation. The target-based strategy requires little funds, for Chinese environmental managers can make full use of existing data available on pollutant discharge and environmental conditions. The target-based TEC can also reduce costs in the decision-making process since the target for control is easy to determine. Another advantage is that it can make full use of existing poli-

cies, laws and regulations, so it is not surprising that there is a political consensus on this policy.

Nevertheless, one major shortcoming of target-based TEC is that the "target" set by researchers is not always accurate enough to assess the exact damages pollutant discharges inflict on the environment, harm to human health, and economic losses. Because the causal relationship between the amount of pollutant discharges and environmental quality is very difficult to quantify, theoretically speaking, we believe that target-based TEC criteria should be considered as an interim instrument until technical and financial conditions for capacity-based TEC are better developed (NEPA and the Chinese Research Academy of Environmental Science 1993).

Although the TEC concept has been incorporated into major water and air pollution laws, the actual implementation of TEC measures has not yet been optimal. In practice, total emissions control measures have only been applied to areas that fail to meet the ambient environmental quality standards (or in special areas designated by the State Council). This limited application of the total emissions control concept is inconsistent with the 1996 TEC policy.

Despite differences between the

potential of TEC as a policy tool and the modest applications of total emissions control measures seen to date, there are valuable policy lessons to be learned from each application. Below we will now consider several local level laws and regulations that have incorporated the total emissions control measures for water pollution control of river basins and lakes. In each case, total emission control measures have been adapted to local environmental and governmental conditions. All of these laws and regulations serve to strengthen and broaden the experience with TEC at the provincial and local levels of government.

LOCAL GOVERNMENT INITIATIVES AND EXPERIMENTATION

The first experiments in regulating pollution based on a total emission control strategy for a river basin or lake in China was "The Tentative Regulation on Water Pollution Prevention in the Huai River Basin." The State Council passed this regulation in Decree 183 on 8 August 1995, which endorsed all six TEC clauses. Because of the growing severity of water pollution problems in their jurisdictions, all four provinces within the Huai River Basin have acted together to meet the target of water pollution control stipulated in this watershed-

wide TEC regulation (State Council 1996).

In another river basin, the "Regulations on Water Pollution Prevention in the Xiaoqing River Basin" were passed on 14 June 1995 by the Standing Committee of Shandong Provincial People's Congress, and were made effective immediately. These regulations established a complex framework for TEC implementation in the Xiaoqing River Basin and its tributaries. Targets for total emission control of are determined by the Shandong Provincial government in several stages so as to take specific local conditions and needs into account. The provincial government allocates total allowable level of pollution into quotas, and distributes these quotas to municipal governments within the Xiaoqing River Basin. These municipal governments were given the authority to allocate the quotas to the actual polluters.

The Xiaoqing River Basin TEC regulations were particularly successful for they set up an innovative and binding scheme of fines and criteria for determining fines to accompany the emissions quota system. This was done in an effort to encourage compliance by holding local governments individually responsible for enforcement and achievement of total emissions control goals. Any municipal level government exceeding the targets for pollution control must pay pollution fines to the Shandong provincial environmental bureau, and is subject to fines set at the discretion of their local EPBs (Bie 1996). In this way, these regulations establish clear penalties for municipal governments who fail to enforce TEC, and also introduce incentives for municipal governments to support the enforcement efforts of their local EPBs.

An example of utilizing TEC concept for controlling pollution in a lake was established through the "Regulations on Water Resource Conserva-

tion in Lake Hongfenghu and Baihuahu in Guizhou Province" at the Eighteenth Session of the Standing Committee of the Eighth People's Congress of Guizhou Province represent another informative case. These regulations contained two clauses relevant to total emissions control. Clause XII stipulated that all water polluters modifying their facilities must meet the targets of TEC for major pollutant discharges. Clause XVI stipulated that a water pollutant permit system would be strictly enforced in the two lake conservation areas. All polluters must comply with the limits of pollutant discharge set by permits (Committee of the Guizhou Province People's Congress 1996).

Finally, one example of local government experimentation that encompassed air and water pollution was in 1994 when Shanghai municipal authorities crafted a regulation that established quotas for total emissions, as well as a system for transfer of these quotas between polluters. "The Shanghai Municipal Regulation on Environmental Protection" was passed by the Standing Committee of Shanghai Municipal People's Congress on 8 December 1994 and was implemented on 1 May 1995. Clause XXXI of this regulation stipulates that "[i]n regions within which Total Emissions Control of pollutant discharge is implemented, any polluter who discharges pollutants must meet related [concentration] standards and quotas of total emissions control set by government.... with approval by the Municipal EPB, polluters can transfer a non-gratis part of their quota of pollutant discharge among them[selves]" (Shanghai Municipal Council 1996:410-14).

Such policy experiments with incentive and monitoring structures at the local level helped shape the 1996 national TEC policy and future efforts to improve TEC implementation. Some insights from these experiments

are addressed below.

REFINING THE DESIGN OF THE TOTAL EMISSIONS CONTROL STRATEGY

The experiments with total emissions control policies at both national and local levels in the past decade have led Chinese policymakers to agree that in order to optimally implement TEC measures they must first calculate the largest amount of pollutant discharge that will maintain regional environmental quality targets. Then, with an optimizing calculation, the targets of pollutant discharges at the national level must be divided up and distributed to various polluters (factories and municipal sources). Another lesson learned is that the quota distribution should be based on different locations, technological standards, and economic bearing capabilities of different pollution sources within the region (Zhu et al. 1991).

Another insight from the early pilot projects and trial policies was the realization of the key role of the permit system in implementing the TEC measures.¹³ In 1987, NEPA held "A Symposium on Enforcing Discharge Reporting and Registering and Permit System of Pollutant Discharge." During the symposium discussions focused on two types of total emissions control strategies: capacity-based and targeted-based total emissions control. In 1988, NEPA held "A Work Meeting of Cities Conducting Pilot Practice in Permit of Water Pollutant Discharge." After the meeting, experimental work on permits of water pollutant discharge was carried out in seventeen cities including Shanghai and Beijing and in the Xiaoqing River Basin. By 1991, the first round of experimental work on TEC and permits for pollutant discharge spanning more than three years was completed (Zhu et al. 1991). The second round of experiments, which included 1,021 enterprises in the two provinces

of Jiangsu and Shanxi, began in 1991 and was completed in 1994 (Li et al. 1996). In 1993, NEPA decided "to make a shift from concentration control only to an integration of concentration control with Total Emissions Control" (Yi 1996: 19). The broad range of experimentation with the permit system in China has pushed forward the development of total emissions control policies.

HINDRANCE TO IMPLEMENTATION OF TEC POLICY

Ideally, complete information on the quantity of pollution emissions across all sectors is needed to best implement and enforce total emissions control policies. Over the past decade, Chinese researchers have been improving the compilation and standardization of environmental data and statistics. However, the pollution emission data have not captured the extent of pollution from township village industrial enterprises (TVIEs) and domestic sources. Three nationwide surveys of industrial pollution sources and pollution sources of TVIEs were made in 1985, 1990, and 1996. These surveys have provided more comprehensive data for understanding China's pollution sources, particularly in rural areas. It will still take many years for Chinese environmental researchers to gather complete information on urban and rural pollution sources. In the meantime, Chinese environmental researchers and government officials have decided to determine discharge amount of:

- 1) Industrial pollutants at the county and higher levels on the basis of environmental statistical data of various regions in 1995;
- 2) Domestic pollutants on the basis of results of calculation with such factors as population, domestic energy consumption, and cor-

responding coefficients of pollution discharge; and,

- 3) Pollutants from TVIEs on the basis of product yields and coefficients of pollution discharge. Modifications to these estimates will be made after more surveys of pollution sources of TVIEs are completed.

In addition to planning more surveys of pollution sources in China, many pilot studies and local experiments have been initiated via various channels to identify and test possible policy instruments to facilitate the implementation of the TEC policy. Below, we provide an overview of pilot studies for emissions trading programs.

TEC PILOT STUDIES AND EMISSIONS TRADING

Since the early 1990s, numerous pilot projects have studied and tested the applicability of the total emissions control strategy in China and explored possible policy instruments to assist in its implementation. One particularly promising policy instrument would be emissions trading systems. Emission trading creates economic incentives to encourage enterprises to use less polluting and low-cost technologies. Currently, emission trading in China is still in an embryonic form, in great part because an emission permit system has not yet been fully implemented in the total emission control areas.

In 1991, SEPA began conducting a pilot program for a permit system for air pollutant emission in 16 cities. In six of these cities (Baotou, Kaiyuan, Liuzhou, Taiyuan, Pingdingshan, and Guiyang) SEPA also experimented with an emission trading mechanism. Despite these initial pilot programs, a permit system for air pollutants emission has not yet been implemented fully in China. A strong, enforceable

permit system will be critical to enable the establishment of emissions trading programs.

Throughout China, four kinds of emission trading methods have been utilized in pilot projects:

- 1) Transfers of emissions allowances between old and new enterprises;
- 2) Sale of excessive emission allowance to the industries needing more emission allowances;
- 3) Transfer of part of the emission permits from industries with low economic profits, outdated technologies, high pollution records, and wasteful in energy and raw resources consumption to industries with better economic profits, advanced technologies, and lower pollution emissions; and,
- 4) Transfer of emission allowances between non-point sources to point sources (China Environmental Science Society 1996).

The development of emission trading has attracted the interest of policymakers within China and led to some bilateral agreements. For example, in early 1999, a memorandum of understanding between the Administrators of the U.S. Environmental Protection Agency and SEPA established a bilateral project on emissions trading and acid rain. In this agreement, the Chinese Research Academy of Science was entrusted by SEPA to conduct the feasibility discussions and studies. Environmental Defense, a U.S.-based nonprofit environmental organization, and the Beijing Environment and Development Institute (BEDI) had initiated their own TEC project in 1998 and were therefore selected by SEPA to conduct the case studies for the U.S.-China acid rain emissions trading program.

Environmental Defense is currently undertaking a project, in partnership with BEDI, to develop strategies for implementing China's total emissions

control policy. In addition, Environmental Defense is working closely with the Planning Department of SEPA to examine TEC implementation policy alternatives, with emphasis on the application of market-based solutions. This cooperative effort has focused on the development of pilot projects in two industrial cities, Benxi and Nantong. Environmental Defense and BEDI are also exploring further opportunities for pilot projects.

Overall, Environmental Defense and BEDI have found that the general macro plan for TEC is well developed in China. Nonetheless, there are many interpretations of the total emissions control policy among and within various Chinese government ministries and departments. Moreover there exists a gap between the concept and actual implementation of TEC policies. One problem that has hindered the implementation of TEC is the lack of policy tools. Of key importance would be the development of a functioning emissions permit system. A permit system for air pollutants was legalized in 2000, four years after the TEC was approved by the State Council, but successful implementation of this permit system will require coordination among a large number of interests and government departments ranging from planning and finance to environment. In order to expedite the implementation of a TEC system, a micro test for emissions trading in two Chinese cities was created to identify obstacles and potential investment sources, as well as to develop specific coordination strategies among practitioners.

The two cities in which Environmental Defense and BEDI are conducting the emissions trading pilot projects are Benxi and Nantong. Benxi is located in Liaoning Province, in Northeast China. Its economy is dominated by steel and cement production, produced largely by state-owned enterprises. Similar to most

such cities, coal is the dominant energy source. In light of its large state-owned enterprise sector, Benxi is a city still targeted for economic reform. The second pilot project is in Nantong, a dynamic city located in Jiangsu Province just north of Shanghai at the mouth of the Yangtze River. In contrast to Benxi, Nantong is an example of a fast growing economic zone in China that has benefited from substantial foreign investment with numerous joint ventures. Light manufacturing and textiles dominate Nantong's economy.

Last year, Environmental Defense and BEDI developed cap and emissions trade rules and procedures for the city of Benxi. These rules and procedures were designed to create a legal basis for TEC to provide coordination among existing environmental policies, to establish emissions measurement and reporting protocols, and to promote compliance. Initially, Benxi officials were skeptical about a foreign organization participating directly in the work of the People's Congress at the city level. However, they are committed to the goal of setting up an emissions trade system and have approved the draft rules and regulations. In Nantong, Environmental Defense and BEDI have developed an emissions trade between a power plant and a light manufacturing facility under existing administrative regulations. The trade allows a cellulose manufacturing plant to expand its operations by acquiring offsetting emissions reductions from a nearby power plant.

Environmental Defense and BEDI are also working with the local environmental protection bureaus to adapt the pollution levy system (PLS) to support TEC efforts. One possibility will be to use the PLS as a tool to stimulate polluters to meet the pollutant emission quotas. In short, the PLS would function more like an incentive system than a revenue col-

lecting device. Environmental Defense and BEDI believe that local experiments of this sort will create a basis for successful resolution of potential policy conflicts at the national and local levels. In fact, successful demonstration of TEC under these pilot projects is a necessary precondition to wider adoption of the policy and implementing legislation at the national level. Although the pilot projects only began in 1999, these experiments conducted by Environmental Defense and BEDI already have provided some insights into the potential of developing an emissions trading system nationwide in China.

FINAL REFLECTIONS ON EMISSION TRADING AND TEC POLICY

The emissions trading mechanism is still in its infancy in China. However, there is a widespread understanding that the twin challenges of continued economic development and environmental improvement will require both increased performance from existing environmental management systems as well as increased flexibility to accommodate the dynamic economy. In the past, flexibility was achieved through policies that did not require absolute adherence of industries to environmental regulations. This situation may be changing as China introduces policies like TEC that are designed to halt environmental degradation by limiting and then reducing pollution discharges by industries.

While China has boldly set emission limits for a number of pollutants, it remains uncertain that it is possible to integrate these pollution limits with the current economic development goals. Admittedly, it will take time for China to completely design and implement the TEC policy and the necessary emissions trading programs. To compare with the United States it should be noted that U.S. TEC poli-

cies were first created 21 years ago, but it was not until the Clean Air Act Amendments of 1990 that the first emissions control trading program (for SO₂) was adopted.

In China, total emissions control laws coupled with emissions trading programs will create valuable tools to empower SEPA and enable environmental and industrial managers to manage emissions and environmental quality problems more effectively. It merits mention that as China's economic reforms continue to promote privatization of industry, such emissions trading programs will become easier to implement.

The 1996 total emissions control policy and the incorporation of the TEC concept into other environmental policies will have more profound and far-reaching implications than any environmental policy previously implemented in China. China has already witnessed that the 1996 TEC policy and the Ninth Five-Year Plan were mutually reinforcing and aggressive in control of pollution emissions. The future implementation of TEC policy, especially through the adoption of emissions trading programs, will promote sustainable development and hence, intergenerational benefits, by accelerating the economic use of resources, shifting the mode of economic growth, optimizing the industrial structure, and stimulating innovation in pollution treatment technology.

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Note: Chinese names begin with the surname.

For example, the author Ban Jian's name could be translated Mr. Jian Ban.

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Endnotes

¹ For example, in 1985, the Shanghai municipal government issued "Regulations on Water Source Protection in Upper Reaches of Huangpu River" and determined to integrate TEC and concentration control of pollutant discharges in the water source protection zone in the upper reaches of the Huangpu River. During the Eighth Five-Year Plan period, the Shanghai municipality implemented the TEC for pollutant discharges throughout the area under its jurisdiction, and required that the total amount of pollutant discharged by 2000 be controlled and kept stable at the 1990 levels (Liu Qifeng 1996a).

² See Li Peng (1996, 1997, 1998a, 1998b); Jiang Zemin (1996, 1997); and Song Jian (1996).

³ The Ninth FYP covers 1996-2000. The China Trans-Century Green Project Plan was also named a principal measure for environmental protection in China.

⁴ China's GNP has increased at an unprecedented average growth rate of more than 10 percent per year. GNP rose from 451.8 billion Renminbi (RMB) in 1980 to 5,727.7 billion RMB in 1995 (SSB 1996). The urban population increased from 191.40 million people in 1980 to 351.74 million people in 1995, with an average growth rate of about 3.5 percent per year (SSB 1996). Despite implementation of the One-Child Policy in 1980, the population as a whole expanded at an average rate of 1.3 percent per year, rising from 987.1 million people in 1980 to a staggering 1.211 billion people in 1995.

⁵ For example, the GDP of cities as well as city-level investment of fixed assets in the Eastern Zone are roughly six times higher than the same levels in the Western Zone and

over two times higher than those in the Central Zone.

⁶ Economic reforms that began in the 1980s accentuated preexisting imbalances by continuing to bolster economic development in the Eastern Zone, and to a lesser degree the Central Zone, at the relative expense of the Western Zone. At the beginning of the reforms, the Eastern Zone share of GNP was more than three times greater than that of the Western Zone. Since that time, both the Western and the Central Zones have lost part of their share of GNP to the Eastern Zone.

⁷ First Industry refers to the agricultural sector; Second Industry encompasses mining, heavy and light industry manufacturing, power supply, power generation, water supply, gas, and construction industries; Third Industry refers to a wide range of service sector activities.

⁸ Between 1978 and 1993, Second Industry contributed 52 percent of China's total economic growth, and light and heavy industry contributed 85.4 percent of the Second Industry economic growth. In this way, heavy and light industry alone contributed over 45 percent, equivalent to a contribution of 2,779.2 billion RMB, of China's total economic growth. Total economic growth equals added value.

⁹ Chinese national government reoriented its resource allocation priorities in 1980 (Naughton 1996). For the first time in China's history, light industry received priority access to financial resources and raw materials that traditionally were the domain of heavy industry. As a result of this reorientation, light industry was able to increase its output by 36 percent in the first two years, rapidly narrowing the gap between heavy and light industry shares of total output value (Naughton 1996). However, this policy shift created a bottleneck in production to form. This bottleneck was blamed for delaying the development of fundamental heavy industries and compromising the national economy. In response, the government returned heavy industry to its traditional position of favor.

¹⁰ For details of TEC enforcement in Jiangsu Province see *China Environmental News*. No. 2140. October 21, 1997:1.

¹¹ The total amount of pollutants discharged in selected areas have been regulated and monitored more strictly than the rest of China. These areas are identified as “Three Rivers, Three Lakes, Two Regions” (*San He, San Hu, San Qu*). The Three Rivers refers to the Huai, Hai, and Liao Rivers. The three lakes are the Tai, Chao and Dianchi. The two regions refer to acid rain and sulfur dioxide control regions.

¹² If the environmental target can be achieved without exceeding standards in a region, the index of total amount of permit-

ted pollutant discharge from each source should be determined in accordance with national or local standards of pollutant discharge. These emissions should then be compared with indices of pollution discharge allocated to a prefecture or city by provincial government. Generally, the total amount should be lower than the latter, in other words, the actual total amount of pollutant discharge meeting standards should be less than total amount of pollutant discharge allocated and assigned. If the environmental targets cannot be achieved even though all pollution sources

discharge pollutants without exceeding standards in a region, total amount of pollutant discharge permitted in the region should be recalculated and reduced, so the regional environmental target can be achieved.

¹³ Permit systems consist of four parts: polluter reporting and registering of their pollutant discharge, planning and distribution of the targets of pollutant discharge, application for and issuance of permits, and the supervision and checking of implementation (Zhu et al. 1991).

The Asia Program at the Woodrow Wilson Center

Taiwan Luncheon Features Frank Discussion

At a February 26 luncheon seminar sponsored by the Wilson Center's Asia Program, Mingwei Zhou, vice minister of Beijing's Taiwan Affairs Office, discussed cross-Taiwan Strait relations with senior American nongovernmental China/Taiwan experts and U.S. government officials. According to Minister Zhou, the fact that his was the first ministerial-level Chinese delegation to visit the United States after the Bush administration took office underscored the centrality of the Taiwan issue in U.S.-China relations.

As a rising star among Beijing's Taiwan policymakers, Zhou is likely to be a key Chinese decision-maker in the years ahead. The Wilson Center luncheon seminar gave him an unusual opportunity to engage experienced U.S. China-watchers in frank exchanges on the potentially explosive issue of Taiwan, and to see firsthand the support Taiwan enjoys even among Americans who disposed toward China.



Vice Minister Mingwei Zhou

Who Will be China's Next Leader?

Jiang Zemin, China's top leader, is scheduled to resign from his posts as Chinese President and party boss over the next two years. If the Chinese Communist Party's supreme power can be smoothly transferred from Jiang Zemin to his designated successor Hu Jintao, it will mark the first routine power transition without the impetus of a political crisis or the death of the top leader in the history of the People's Republic of China.

At a 21 February 2001 seminar on “China's Political Succession and Its Political Implications for the United States,” sponsored by Wilson Center's Asia Program, four distinguished experts on Chinese politics explored China's possible power structure and policy directions after President Jiang steps down. The panelists agreed that Hu Jintao will become China's next top leader. They differed, however, as to whether Jiang Zemin will succeed in his apparent desire to remain the country's key behind-the-scenes powerbroker, and what will be the political agenda for the new leadership in Beijing.

*For more information on these or other Asia Program China meetings and publications
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Green NGO and Environmental Journalist Forum

9-10 April 2001

Hong Kong Jockey Club Beas River Country Club Resort



Sponsored by

The Centre for Asian Studies, University of Hong Kong

The Woodrow Wilson Center for International Scholars

The Journalism and Media Studies Centre, University of Hong Kong

The "Green NGO and Environmental Journalist Forum" was held in Hong Kong on 9-10 April 2001. This two-day workshop brought together for first time environmental NGO activists and journalists from Mainland China, Taiwan, and Hong Kong.

The workshop, in which Mandarin Chinese was the primary language, promoted information exchanges and provided opportunities for 65 participants from Mainland China, Taiwan, and Hong Kong to discuss improving NGO capacity and the quality of environmental reporting in the region. The workshop also promoted dialogues to help these activists and professionals better understand each other's work and to investigate joint activities.



On the second day of the conference, NGO participants role-played in groups that they were environmental NGOs trying to pitch a green campaign to journalists. In this picture journalists evaluate the NGO presentations and explain whether they would report the story. Left to Right: Zhu Zhongqi (Guangdong Daily, China), Nailene Chou Wiest (Journalism and Media Studies Centre, Hong Kong), Sun Xuan (Guangdong Sheng Yangsheng Wanbao, China), and Olga Wong (Ming Pao Daily, Hong Kong).

After the opening session, which compared the environmental movements in Mainland China, Taiwan, and Hong Kong, the participants heard presentations and held discussions on environmental education methods, NGO partnerships and networking, and a comparison of environmental journalism in Greater China.

The second day of the conference consisted of two in-depth workshops. In the journalist workshop the participants listened to a presentation on the impact of air pollution on human health and discussed how they could improve their reporting on air pollution. In the NGO workshop, the participants broke into small groups to exchange information and techniques for promoting public participation in their environmental activities, expanding their use of the internet, and exploring how to better utilize their limited funds to undertake environmental activities. The two workshops joined together on the last afternoon for a lively "Journalist and NGO Dialogue."

The Woodrow Wilson Center received generous support from the United States Institute for Peace to support this forum.

Bilingual forum proceedings will be available August 2001. For more information on the forum or the proceedings see the Environmental Change and Security Project Web page (<http://ecsp.si.edu>) or contact Jennifer L. Turner at chinaenv@erols.com.