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## **China: Selected Environmental Issues and Policies**

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# China: Selected Environmental Issues and Policies

## Summary

China's robust economic growth in the past two decades has resulted in serious and widespread environmental degradation and pollution. Over this period, China has changed from a predominantly rural economy to a much more industrialized and urbanized economy. The country's large population, coupled with rapid growth, has greatly increased China's demand for, and consumption of, energy, water, and other natural resources. Air and water pollution have become severe in many regions, and the resulting impacts on resources, public health, and quality of life are increasingly seen by many Chinese officials as a threat to gains made in economic development.

Since the 1980s, the government has adopted dozens of pollution control and resource management laws and regulations, although implementation and enforcement have been problematic. As environmental degradation worsened in the 1990s, China accelerated efforts to address pollution problems for human health, environmental, and economic reasons. The government's pollution control initiatives have targeted water pollution from industrial and municipal sources and air pollution from various sources including industry, power plants, coal mines, and households. In the 1990s, the government closed thousands of inefficient, polluting factories and small coal mines and power plants, strengthened some laws and their enforcement, and increased spending on pollution control projects. As motor vehicles have become an increasing source of air pollution, they too are becoming subject to regulation.

Globally, China currently ranks second only to the United States in both energy consumption and greenhouse gas emissions. The government has not focused on greenhouse gas reductions in their own right, but on "no regrets" strategies to reduce energy consumption and control pollution. China's greenhouse gas emissions declined significantly in 1998 and 1999, for various reasons, including this strategy. Moreover, a major success of China's recent development is that its energy demand recently has grown less rapidly than GDP. Like the United States, China has ratified the United Nations Framework Convention on Climate Change, and has signed, but not ratified, the Kyoto Protocol.

The United States and China have numerous cooperative environmental agreements in place, and both the U.S. Government and the private sector continue to follow environmental conditions in China with interest and concern, as China's environmental problems are linked with global concerns, and as the Chinese pollution control efforts create a large potential market for U.S. exports.

Although China's environmental problems remain challenging, some significant progress has been made. The World Bank recently reported that China's effort to reduce pollution "has staved off an abrupt worsening of environmental conditions in general" and that its "achievements are arguably unprecedented in any country at China's state of economic development." However, the Bank and others also anticipate that the environmental challenge facing China is likely to become far greater and more complex over the next decade as growth continues. While economic growth will remain the top priority for the government, it now appears that environmental issues will be an increasingly prominent concern, as well.

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# China: Selected Environmental Issues and Policies

## Introduction

China's rapid economic growth in the past two decades has not come without costs, particularly in the area of environmental quality and public health. Over this period, China has changed from a predominantly rural economy to a much more industrialized and urbanized economy. The country's rapid economic growth has markedly increased China's demand for, and consumption of, energy, water, and other natural resources. Air and water pollution have become severe in many regions, and the resulting impacts on resources, public health, and overall quality of life are increasingly seen by Chinese officials as a threat to gains made in economic development. State environment officials and researchers recently estimated that the cost of pollution to China's economy may range from 4 to 8% of gross domestic product (GDP); other cost estimates have been higher.<sup>1</sup>

In light of these circumstances, Chinese officials have stressed the need to reduce pollution and improve resource management, with a goal of making China's development sustainable. Since the 1980s, the central government has adopted numerous pollution control and resource management laws and regulations. In the 1990s, the government closed thousands of inefficient, polluting factories and small coal mines and power plants, strengthened laws and their enforcement, and increased spending on pollution control projects. Additionally, environmental protection was raised to the status of "national fundamental policy" and, in 1998, the State Environmental Protection Administration (SEPA) was elevated to ministerial status.<sup>2</sup> Other efforts being pursued to reduce environmental degradation include the adoption of policies to achieve more efficient energy production, encourage cleaner production methods, and improve the conservation and management of water and other natural resources. Expenditures on environmental protection have increased significantly since the mid-1990s, and China's Environment Minister, Xie Zhenhua, recently reported that total investment in environmental protection increased 28.8% last year to 1.1% of GDP<sup>3</sup>. Government projections indicate that environmental expenditures are likely to continue to grow significantly over the next 5 years.

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<sup>1</sup>U.S. Embassy, Beijing, China. *The Cost of Environmental Degradation in China*. December 2000. Available at Internet website: [<http://www.usembassy-china.org.ch/english/sandt/CostofPollution-web.html>].

<sup>2</sup>Eduard B. Vermeer. *Industrial Pollution in China and Remedial Policies*. The China Quarterly. London. December 1998. No. 156, p. 953.

<sup>3</sup>U.S. Embassy, Beijing. Unclassified cable on China's Year 2000 State of the Environment Report. June 15, 2001.

Notwithstanding government officials' growing commitment to environmental protection, China faces environmental and economic development challenges on an immense scale. With a population exceeding 1.25 billion and with the annual per-capita income of rural Chinese at roughly \$250, economic development remains the key priority for Chinese leaders. The environmental challenge China faces is how to continue its economic growth without endangering the sustainability of that growth and the health of its citizens. This report finds that Chinese officials are increasingly recognizing the need to deal with this challenge, and although successes can be found there are many remaining challenges.

The scale of China's environmental problems and the country's efforts to address them are of interest to the United States and other nations for various reasons, perhaps primarily because of China's potential impact on the global environment through its increasing air pollution and projected growth in carbon dioxide emissions, and because of its continuing loss of arable land and growing demand for natural resources. Moreover, as China more aggressively addresses its air and water pollution problems, it presents a potentially large market for pollution control and energy efficient technologies and services.

This report provides an overview of China's air and water pollution problems and associated environmental and public health impacts, with attention also to the implications of China's growing energy needs and the issue of global climate change. It also reviews China's policies and laws to address pollution problems, and discusses opportunities for, and examples of, U.S.-China cooperation on these matters. Multilateral cooperation and assistance on environmental pollution matters are also discussed. Finally, the report briefly looks at environmental technology issues and China's initiatives to reduce pollution in the power generation, automobile, industrial, and municipal sectors and mentions opportunities for (and obstacles to) U.S. companies to participate in China's growing environmental technology market. This report focuses primarily on selected major pollution issues that have played key roles in increasing the priority of environment on the national agenda; it does not attempt the much larger task of comprehensively addressing the full array of environmental issues, many equally challenging, such as toxic waste, pesticide concerns, waste disposal and others. Further, it does not attempt to cover natural resource issues such as deforestation, agriculture, and desertification.

It should be noted that the emissions data and other environmental information reported here are based often on rough estimates or limited monitoring (a common situation worldwide). Obtaining rigorous, reliable, and consistent environmental data remains difficult. Moreover, environmental conditions and government monitoring and regulatory actions in China have been in considerable flux in recent years. Consequently, sources used for this paper have reported sometimes seemingly divergent observations and information. However, the available information does provide a broad picture of environmental conditions and of the government's policies and initiatives to address them.

## **Air Pollution: Overview**

Perhaps more than any other pollution problem, air quality concerns may have elevated environmental regulation on the national agenda in China. Many of China's cities and rural areas are often cloaked in a haze of polluted air, and several of the world's worst

air quality cities are located in China.<sup>4</sup> A number of factors contribute to the country's severe air pollution problems. Key among these are China's rapid growth and industrialization, its large population and rising incomes, its heavy reliance on coal burning as an energy source, and its relatively inefficient (although improving) energy use. Additionally, vehicle emissions, which were not significant until recently, have become a major source of air pollution in large cities and are increasing rapidly. Because of the adverse impacts on public health, quality of life, and economic development, air pollution problems have prompted a broad range of government actions that have led to some notable improvements in recent years. Nonetheless, substantial challenges remain.

According to China's State Environmental Protection Administration (SEPA), coal burning is the primary cause of air pollution in China,<sup>5</sup> with major pollutants of governmental concern and attention being total suspended particulates (TSP) (e.g., soot, dust, and fine particles) and sulfur dioxide (SO<sub>2</sub>), both of which are important causes of respiratory illnesses. Coal burning is estimated to account for 70% of the smoke and dust in the air and 90% of the sulfur dioxide emissions. In major cities, TSP and sulfur dioxide levels were 2 to 5 times the World Health Organization's (WHO's) guidelines in 1995.<sup>6</sup> In 1998, nearly one-third of 322 cities monitored in China exceeded the WHO guideline for sulfur dioxide, and only 1 in 20 cities met the WHO guideline for total suspended particulates.<sup>7</sup>

Coal burning in industrial boilers and small household stoves is responsible for a large portion of particulates, especially those most damaging to health. These inefficient boilers and stoves also are responsible for most SO<sub>2</sub> and nitrogen dioxide (NO<sub>2</sub>) emissions.<sup>8</sup> In northern China, where coal has been used for residential space heating, particulate pollution has been especially severe. According to a 1997 World Bank report, household stoves accounted for just 15% of coal use in the mid-1990s, but were the source of 30% of air pollution in Chinese cities. Similarly, industrial boilers consumed 33% of the nation's coal but accounted for an even larger percentage of pollution.<sup>9</sup>

As a result of its coal consumption, China has become the world's top emitter of sulfur dioxide which is a key cause of acid precipitation. In addition to local adverse public health and welfare effects of SO<sub>2</sub> emissions, acid precipitation is transported long distances and has caused significant damage to crops and natural resources in China. In 1999, SEPA reported that acid precipitation was widespread and a significant problem in nearly one-

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<sup>4</sup>Corliss Karasov. *On a Different Scale: Putting China's Environmental Crisis in Perspective*. Environmental Health Perspectives. v. 108, n. 10. October 2000. p. A454.

<sup>5</sup>China State Environmental Protection Administration. *State of the Environment 1999*. "Atmospheric Environment." Available at: [<http://www.sepaec.gov.cn/SOE/99gb/air.htm>].

<sup>6</sup>World Bank. *Clear Water, Blue Skies: China's Environment in the New Century*. p. 6.

<sup>7</sup>Wang Yanjia and He Kebin. *The Air Pollution Picture in China*. IEEE Spectrum. December 1999. p. 55.

<sup>8</sup>World Bank. *Clear Water, Blue Skies*. p. 8.

<sup>9</sup>*Ibid.*

third of China's territory.<sup>10</sup> China's SO<sub>2</sub> emissions also reportedly contribute significantly to acid precipitation in Japan.

Coal combustion is also the dominant source of the greenhouse gas, carbon dioxide. China's carbon dioxide emissions are second only to the United States. Primarily because of the country's heavy reliance on coal as an energy source, analysts have projected that China would likely surpass the United States as the number one emitter of carbon dioxide within two decades. However, China's energy consumption declined markedly between 1997 and 1999, thus altering projections. China's energy use and carbon dioxide emissions are again increasing; consequently, China will remain a very significant contributor to greenhouse gas emissions. (See climate change section below.)

Although air pollution reports usually focus on the densely populated, industrialized eastern cities, China's western region also experiences severe air quality problems. According to the U.S. Embassy in Beijing, weekly air quality data reported in the Chinese press consistently show pollution levels to be highest in western cities. Officials attribute this situation largely to airborne soil from the surrounding arid countryside. This is a major problem also in Beijing, which suffers from severe episodes of such dust pollution—and the number of dust storms has increased markedly in recent years. The cause of this air pollution is attributed partly to government efforts to move people into western regions, introducing agriculture and deforestation into the area. In an attempt to address the extensive land degradation that has resulted and to mitigate severe flooding problems, the government has imposed restrictions on logging in key watersheds and is attempting to return some cropland to forest and grassland; however, excessive logging continues, although the overall rate of logging has declined.<sup>11</sup>

**Health and Environmental Impacts and Costs.** The costs of pollution in general, and air pollution in particular, are substantial, having a serious impact on human health as well as a significant effect on China's citizens and economy. The following preliminary calculations of such costs by the World Bank serve to illustrate why Chinese officials have begun to take strong actions to address environmental degradation:

- ! In major cities, an estimated 178,000 premature deaths occur each year because of pollution;
- ! Indoor air pollution, primarily from burning coal and biomass for cooking and heating, causes 111,000 premature deaths each year, mainly in rural areas; and
- ! Roughly 7.4 million work-years have been lost to health damages related to air pollution each year.<sup>12</sup>

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<sup>10</sup>China State Environmental Protection Administration. *State of the Environment 1999*. Atmospheric Environment. See: [<http://www.sepa.gov.cn/soechina99/air/airdown.htm>].

<sup>11</sup>U.S. Embassy, China. The Environment at the 2000 National Peoples Congress Plenary. Report from U.S. Embassy Beijing. March 2000. See Internet website: [<http://www.usembassy-china.org.ch/english/sandt/NPCenviro.htm>].

<sup>12</sup>World Bank. *Clear Water, Blue Skies*. p. 2.



In December 2000, the U.S. Embassy, Beijing, reported a variety of direct and indirect air pollution costs, including the following estimated impacts:

- ! The Chongqing Environmental Protection Bureau found that nearly a quarter of the municipality's vegetable crop was damaged by acid rain in 1993, and estimated damages to all crops and forests there totaled \$65 million;
- ! A 1999 Georgia Tech study calculated that reduced sunlight due to sooty air may be depressing yields on 70% of China's farms by 5 to 30% (Chinese factories and households emitted more than 23 million tons of soot and industrial dust in 1999, according to SEPA);
- ! More than 80% of children aged 5 to 7 tested in Guangzhou in early 2000 had unhealthful levels of lead in their blood; studies in other cities have shown elevated blood lead-levels (exceeding the WHO guideline) in more than 50% of children (exposure to lead can reduce intelligence and cause other neurological problems, especially in children); and
- ! Chronic obstructive pulmonary disease (COPD)—such as emphysema or bronchitis—is the leading cause of death in China; the rate of death from COPD is twice the average for developing countries. Moreover, the American Chemical Society estimated that, nationwide, more than a million deaths annually (one-eighth of total deaths) were attributable to air pollution between 1990 and 1995.<sup>13</sup>

**Government Measures to Reduce Air Pollution.** Because of such adverse impacts as those noted above, the national government has taken numerous steps to reduce air pollution, particularly in the most seriously polluted areas. Government initiatives have targeted a range of pollution sources including industry, motor vehicles, power plants, coal mines, and households.

One such effort has been to reduce exposures to lead, which have occurred primarily in urban areas, largely from the combustion of leaded gasoline. In 1997, the State Council required all sales of leaded gasoline to cease by July 1, 2000.<sup>14</sup> Several major urban areas, including Beijing, required leaded gasoline to be phased out by the end of 1997.<sup>15</sup> By the end of 1999, 70% of the vehicle gasoline consumed in China reportedly was lead-free, primarily because of the early controls imposed in urban areas. Other motor vehicle emissions are becoming increasingly serious, and government officials at the national and local levels have begun to address these emissions through regulations and other policy initiatives. (See the transportation section below.)

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<sup>13</sup>U.S. Embassy, Beijing, China. *The Cost of Environmental Degradation in China*.

<sup>14</sup>He Kebin and Cheng Chang. "Present and Future Pollution from Urban Transport in China." *China Environment Series*. Woodrow Wilson Center, Environmental Change and Security Project. Issue 3, 1999/2000. p. 44

<sup>15</sup>Jim Stover. *China's Environmental Framework 2000 and Beyond*. China Business Review. April-March 2000. p. 51

The national government also has targeted air pollution from industrial sources. In 1996, as part of the 9th Five-Year Plan, the State Council mandated that all of the more than 238,000 industrial enterprises in China meet emissions standards for key air and water pollutants by the end of 2000 or face closure. Key air pollutants identified in the Plan were primarily SO<sub>2</sub> and particulates (i.e., soot and industrial dust). Special attention was given to 18,000 large enterprises that accounted for more than two-thirds of all industrial emissions. Also by the end of 2000, 47 key cities were to meet national standards for air and water quality.

In November 2000, a U.S. Embassy report on environmental conditions in Hubei Province noted that,

It is conceivable that all or nearly all factories will meet (or at least be said to have met) emissions standards without any noticeable improvement in the city's air or water quality. Province-wide, more than 90 percent of factories had met emissions standards by the end of 1999, according to the EPB [local Environmental Protection Bureau] report, but as stated above, air and water quality were still far from satisfactory.<sup>16</sup>

The situation in Hubei might be typical for many areas. Beginning in January 2001, most provinces and key cities reported that 90% or more of the industries in their jurisdictions had met the standards. According to a U.S. Embassy review of government reports, nine areas claimed 99% compliance, while Shanghai, Hainan and Yunnan reported 100% compliance.<sup>17</sup> The Embassy noted that despite the high compliance rates and the closure of thousands of polluting industries, most of the 47 targeted cities still fail to meet applicable standards for air and water quality.

The Embassy offered several explanations for this outcome. First, the 1996 State Council Decision that mandated pollution controls did not address mobile sources, and automobiles are a growing source of air pollution. Similarly, wind-blown dust and the residential sector are other significant but unregulated pollution sources. Second, the Embassy suggested that emissions standards may be too lax, particularly for older factories. (As in the United States, older enterprises were given less stringent standards to meet than new ones. Consequently, areas with high concentrations of older industries would still experience significant pollution, even with compliance with emission standards.) Third, the process of certifying factory emissions "is complex and open to abuse ...". Fourth, the Embassy suggested that while authorities have closed hundreds of small, obsolete, polluting enterprises in recent years, they are hesitant to shut down large industries that have thousands of employees. (Some 500 large state-owned enterprises have been given a two-year extension to meet standards.) Moreover, the Embassy noted that, in the past, some bureaucrats have distorted statistics to show that targets were achieved.<sup>18</sup> The Embassy concluded that, as the easy actions to reduce pollution are exhausted (e.g., most of the industries closed were small, backward, and losing money),

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<sup>16</sup>U.S. Embassy Beijing, China. *Hebei: China's Environment in a Nutshell*. November 2000. Available at [<http://www.usembassy-china.org.cn/english/sandt/Hebeiweb.htm>].

<sup>17</sup>U.S. Embassy Beijing, China. Ninth Five-Year Plan Environmental Report Card. March 2001. Available at: [<http://www.usembassy-china.org.cn/english/sandt/9th5yearplan.htm>].

<sup>18</sup>U.S. Embassy Beijing. *Hebei: China's Environment in a Nutshell*. November 2000.

China will need to turn to more expensive technological solutions in order to maintain momentum in environmental improvement. China's under-funded environmental enforcement authorities will also need help from society in general in preventing back-sliding in the aftermath of last year's campaign.<sup>19</sup>

**Beijing Clean Air Campaign.** Many of the government's pollution control initiatives have focused on major cities in China, and particularly extensive efforts have been made in Beijing, the nation's capital. In 1998, municipal officials in Beijing undertook a major environmental pollution prevention campaign with a primary focus on air pollution control and prevention. This campaign reportedly was initiated in response to growing public and official concern regarding the capital city's poor air quality and also due to interest in hosting the 2008 Olympics.

Since 1998, Beijing has earmarked nearly \$3.6 billion for implementing 68 air pollution control measures. According to SEPA, these measures resulted in significant improvements in air quality by the end of 1999. Compared with 1998, SO<sub>2</sub> emissions had declined 31%, and NO<sub>2</sub> had declined 7.2%, and total suspended particulates (TSP) had declined 20%.<sup>20</sup> Levels of these pollutants reportedly all declined further during 2000. In addition to aggressive pollution control measures, favorable wind patterns also contributed to reductions in pollution levels. City officials recently announced new measures for the latest stage of this pollution prevention campaign, which include imposing stricter controls on automobile emissions and requiring Capital Iron and Steel, the city's largest polluter, to curtail operations.<sup>21</sup> Beijing is also taking actions to increase the use of cleaner fuels, such as natural gas and low-sulfur coal.

**Achievements and Challenges.** Although concerns remain regarding the government's efforts to control industrial pollution, air quality has improved recently, particularly from 1998 to 1999. Among the air pollution control initiatives within the 9th Five-Year Plan, the national government required the closure of small, dirty coal mines. SEPA reported that by the end of 1999, 31,200 illegal and "unreasonably located" coal mines had been closed, and the production of high sulfur content coal was reduced by more than 22 million tons. Similarly, numerous small power plants, cement plants, refineries, and blast furnaces were closed because of their inefficiency and relatively high pollution levels.<sup>22</sup> Table 1 shows the reductions in estimated sulfur dioxide and particulate emission levels from 1998 to 1999. Table 2 illustrates changes in reported emission levels over the period of the 9th Five-Year Plan.

<p><b>Table 1. Comparison of the Discharge of Major Pollutants in Waste Gas in 1999 and 1998</b> Unit (10 thousand tons)</p>
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<sup>19</sup>U.S. Embassy Beijing. Ninth Five-Year Plan Environmental Report Card. March 2001.

<sup>20</sup>China State Environmental Protection Administration. Report on the State of the Environment in China for 1999. Atmospheric Environment. Available at Internet website [<http://www.sepalbov.ch/soechina99/air/airdown.htm>].

<sup>21</sup>U.S. Embassy, Beijing. *Beijing Clean Air Campaign Enters Third Year*. Available at Internet website: [<http://www.usembassy-china.org.ch/english/sandt/Beijingairstep5.htm>].

<sup>22</sup>China State Environmental Protection Administration. Report on the State of the Environment in China for 1999.

Item	SO <sub>2</sub>			Smoke and Dust (Particulates)		
	Industrial	Domestic	Total	Industrial	Domestic	Total
1999	1460.1	397.4	1857.5	953.4	205.6	1159.0
1998	1594.0	497.0	2091.0	1179.0	276.0	1455.0
% decrease	-8.4	-20.0	-11.2	-19.1	-25.7	-20.3

Source: SEPA. Report on the State of the Environment in China 1999.

According to a World Bank analysis, China was able to continue its economic growth in the late 1990s while achieving significant reductions in industrial and urban air and water pollution. The main reason identified for this achievement was a reduction in pollution among Township and Village Industrial Enterprises (TVIEs), which, from 1989 until 1995, had increased the amount of pollution they generated by 123%. In that same period, County-and-Above-Owned Enterprises (CAOEs, which are primarily State-Owned Enterprises (SOEs)) had reduced their pollution load by 9.2%. From 1995 to 1998, the average decrease in pollution rates were 39.6% for TVIEs and 22.5% for CAOEs. World Bank analysts suggested several factors that may have had an effect on pollution reduction: economic stagnation, regulation (notably, the closure of thousands of highly polluting TVIEs), and restructuring in the industrial sector (e.g., a gradual shift from highly polluting industries (such as cement making) to less polluting industries (such as electronic and telecommunications industries)).<sup>23</sup>

Pollutant	1995 actual	1999 actual	2000 target	2000 actual	% change 1995-2000
SO <sub>2</sub>	23.7	18.6	24.6	20.0	-15.8
Soot	17.3	11.6	17.5	11.7	-33.2
Industrial dust	17.3	11.8	17.0	10.9	-36.9

Source: SEPA. Reports on the State of the Environment in China, 1999 and 2000.

For urban-based pollution, reductions in SO<sub>2</sub> and particulate emissions in the late 1990s were attributed mainly to stronger command and control interventions, particularly towards TVIEs, and fuel shifting, from coal to gas. Contributing factors not related to environmental protection efforts include the economic slowdown, reduced coal consumption, and the application of more efficient technologies (particularly in China's power industry).<sup>24</sup>

Despite these substantial air quality improvements, pollution levels in Chinese cities are still relatively high by international standards, as reflected by China's air quality standards. China's standard for average daily concentration of particulates (TSP) for

<sup>23</sup>Jostein Nygard, *China's Brown Agenda: Changed Environmental Pollution Trends*, paper presented at PACE 2000 Seminar, World Bank. August 31, 2000.

<sup>24</sup>*Ibid.*

residential areas, for example, is 200 micrograms/cubic meter ( $\text{ug}/\text{m}^3$ ), compared to the WHO guideline of  $90 \text{ ug}/\text{m}^3$  for TSP.<sup>25</sup>

While noting China's significant achievements in reducing pollution loads, the World Bank has identified major challenges that China faces in making further progress. Increased industrial growth and continuing rapid urbanization are key among them. Moreover, financial issues overlay these challenges. A 1997 World Bank report estimated that China would have to spend 2.1% of GDP (\$21 billion) annually to reach U.S. air quality standards of the early 1980s by 2020. According to the Chairman of the Environment and Natural Resources Committee of the National People's Congress, Qu Geping, China would need to spend \$40 billion to meet Chinese standards (for just three pollutants –  $\text{NO}_2$ ,  $\text{SO}_2$ , and particulates) in 46 key cities.<sup>26</sup>

Chairman Qu Geping further noted that the greatest obstacle to overcome in improving China's air quality is the country's dependence on coal,<sup>27</sup> which is likely to remain China's primary energy source for the foreseeable future. The government has recognized that its technology for coal energy production and use has been "comparatively backward"<sup>28</sup> and is looking both domestically and abroad for technical and financial assistance and foreign investment to address this problem. Multilateral institutions and bilateral technical assistance are playing significant roles. (See discussion on multilateral and bilateral cooperation below.)

For the 10<sup>th</sup> Five Year Plan, covering 2001 through 2005, Chinese officials identified specific targets for reducing air pollution. Objectives include the following:

- ! The concentration of  $\text{SO}_2$  in areas targeted for acid rain control will meet the national Grade II standard (i.e., daily average concentration less than 150 micrograms per cubic meter ( $\text{ug}/\text{m}^3$ ), and annual average less than  $60 \text{ ug}/\text{m}^3$ ). (The WHO standard for annual average  $\text{SO}_2$  concentrations is  $40 \text{ ug}/\text{m}^3$ .)<sup>29</sup>
- ! Total nationwide  $\text{SO}_2$  emissions will be capped at 19 million tons (SEPA estimated 1999 emissions totaled 18.6 million tons, down from 23.7 million tons in 1995; emissions within the acid rain control zones will be capped at 10.3 million tons (1999 emissions were 11.1 million tons).
- ! 90% of urban households will use gas for heating and cooking (84% now do).

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<sup>25</sup>U.S. Embassy, Beijing. *Ninth Five-Year Plan Environmental Report Card*. March 2001.

<sup>26</sup>U.S. Embassy, Beijing. *China's Clean Air Price Tag: US\$40 Billion*. May 2000. At Internet website: [<http://www.usembassy-china.org.ch/english/sandt/airqualitycost.htm>].

<sup>27</sup>*Ibid.*

<sup>28</sup>China Environment Yearbook: 1997. p. 123.

<sup>29</sup>Regulation of  $\text{SO}_2$  in the United States has evolved to extend well beyond the focus on annual and 24-hour National Ambient Air Quality Standards (NAAQS) to include New Source Performance Standards (NSPS, Sec. 111 of 1970 Clean Air Act Amendments (CAAA)), Prevention of Significant Deterioration (PSD, Part C of 1977 CAAA), and acid rain controls (Title IV of 1990 CAAA). Additional activities underway to further regulate  $\text{SO}_2$  emissions include a fine particulate NAAQS (1997), and regional haze rules (2001).

- ! The number of “key” cities targeted for pollution control will be increased from 47 to 100; all 100 cities are to meet applicable national standards by 2005 for air and water quality and noise.
- ! All 100 key cities are to install air quality monitoring equipment; data will be transmitted by satellite to a national monitoring center.

A report by the SEPA-affiliated China Research Academy of Environmental Sciences (CRAES) on the proposed 10<sup>th</sup> Five-Year Plan estimated that the investment requirement to meet the plan’s air quality goals would be \$36 billion, with one-third of that being used to install desulphurization equipment on coal-fired power plants in acid rain control areas. Mr. Xie Zhenhua, director of SEPA, has stated that the overall goal of the 10<sup>th</sup> Five-Year Plan is to reduce total emissions of major pollutants another 10%, and that the air and water pollution reduction targets might be achieved if environmental protection expenditures over that period equal 1.4% of GDP.<sup>30</sup>

**Air Pollution Prevention and Control Law Amendments.** In an effort to do more to improve air quality, China strengthened its national air pollution law in 2000. The objectives of the amendments are to improve enforcement, address critical air quality problems in key urban areas, and make greater use of market-based methods for cutting emissions. The new provisions increase penalties for violations, broaden the scope of the law, clarify authorities, and call for incentives for clean and renewable energy.<sup>31</sup> Among the major changes, the law prohibits pollutant emissions that exceed national standards and imposes compliance deadlines and higher fines for excess emissions; previously, such emissions were legal, provided that polluters paid fees on them.<sup>32</sup> Also, the law addresses mobile sources for the first time, and emission control systems will be required on new and existing vehicles. As an overarching change, the amendments broaden the focus of the law from controlling the concentration of pollutants emitted from individual sources to include controlling the total volume of pollutants entering an airshed.

When fully implemented, the amendments are intended to stabilize total air pollution emissions at 1995 levels by 2010. If emissions reductions reported in recent years are sustained, many areas could meet this goal without much additional reduction in pollution. However, air pollution remains severe relative to international standards.

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<sup>30</sup>U.S. Embassy, Beijing. *China’s Year 2000 “State of the Environment” Report*. Unclassified cable. June 15, 2001.

<sup>31</sup>Professional Association for China’s Environment (PACE). *China Environment Briefing*. Sinosphere. v. 3 n. 3. Summer 2000. p. 3. (See [<http://www.chinaenvironment.net/sino>].)

<sup>32</sup>Ferris, Richard J. Jr. and Hongjun Zhang, PhD. *Key Aspects of the 2000 Amendments to the Air Pollution Prevention and Control Law of the People’s Republic of China*. Briefing for Corporate Counsel and Environment, Health and Safety Managers. Beveridge and Diamond, P.C. February 2, 2001. Available at: [<http://www.bdlaw.com/archive.asp?id=3>].

## Climate Change

**Energy Consumption and Greenhouse Gas Emissions.** China currently ranks second in the world in both energy consumption and greenhouse gas emissions.<sup>33</sup> In 1999, China consumed approximately 32 quadrillion Btu (quads) of energy, and emitted approximately 669 million metric tons carbon equivalent (MMtCE). This corresponds to approximately 8% of world energy consumption and 10% of world greenhouse gas emissions. In contrast, the United States consumed approximately 97 quads, or 25% of world energy consumption; U.S. greenhouse gas emissions were approximately 1,520 MMtCE, or 25% of world emissions.<sup>34</sup> On a per capita basis, U.S. energy use and carbon emissions are some 10 to 12 times those of China.

One of the key factors in China's greenhouse gas emissions is that coal supplies over 70% of the energy in China.<sup>35</sup> By comparison, coal supplies approximately 33% of energy in the United States.<sup>36</sup> Per unit energy, coal has the highest carbon content of any fuel, and thus leads to the highest CO<sub>2</sub> emissions. In China, the use of coal leads to 80% of the country's greenhouse gas emissions.<sup>37</sup> However, despite high emissions from the fuel, coal is an abundant resource in the country, and any development strategy will likely involve further use.

It has been projected that China's carbon dioxide (CO<sub>2</sub>) emissions will exceed those of the United States by 2020.<sup>38</sup> Further, with China's rapidly growing economy, and resulting demand for power, projections estimate that China's greenhouse gas emissions could increase seven-fold in the next 25 years.<sup>39</sup> However, new data suggest that between 1997 and 1999, China's energy consumption dropped approximately 13%, while greenhouse gas emissions dropped by approximately 17%.<sup>40</sup> The decrease in energy consumption, mostly in the form of coal, was caused by many factors, including improvements in efficiency, household fuel switching (primarily from coal to natural gas), and economic reforms.<sup>41</sup> Greenhouse gas emissions dropped more quickly than energy

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<sup>33</sup>Pew Center on Global Climate Change, *Developing Countries and Climate Change: Electric Power Options in China*. May 2000.

<sup>34</sup>U. S. Department of Energy, Energy Information Administration (EIA), *International Energy Annual 1999*. February 2001. Tables E1 and H1.

<sup>35</sup>Pew Center on Global Climate Change, *Developing Countries and Climate Change*.

<sup>36</sup>U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 1999*. July 2000.

<sup>37</sup>Marlowe Hood and William Sweet, "Energy Policy and Politics in China," *IEEE Spectrum*. November 1999. p. 34.

<sup>38</sup>Jeffrey Logan, Aaron Frank, Jianwu Feng, and Indu John. *Climate Action in the United States and China*. Pacific Northwest National Laboratory and Woodrow Wilson Center. May 1999.

<sup>39</sup>Marlowe Hood and William Sweet, "Energy Policy and Politics in China."

<sup>40</sup>EIA, *International Energy Annual 1999*. Tables E1 and H1.

<sup>41</sup>Jonathan E. Sinton and David G. Fridley, "Growth in China's Carbon Dioxide Emissions is Slower than Expected," *Sinosphere*. Winter 2001. p. 3.

consumption because most of the energy savings were in coal, which leads to the most significant carbon dioxide emissions.

While China's energy use and greenhouse gas emissions have started growing again, it seems unlikely that Chinese greenhouse gas emissions will actually exceed U.S. emissions by 2020. Either way, China's share of world greenhouse gas emissions will likely continue to grow. A recent analysis by the Pacific Northwest National Laboratory projected that, under a moderate growth scenario,

China's overall energy use is expected to increase by just over 80 percent by 2020. Coal use will likely increase by two-thirds while growth in petroleum, natural gas, hydroelectric, and renewable energy sources will be considerably higher. How and where coal is used will affect emissions. Wide-spread use of desulfurization equipment, for example, could reduce the risk of acid rain even as coal use rises, but it will do nothing to check growth in carbon dioxide emissions.<sup>42</sup>

**China's Domestic Policy.** In general, China has not focused on greenhouse gas reductions in their own right, but on "no regrets" strategies (those that have benefits in other areas, in addition to emissions reductions) to reduce consumption and control pollution.<sup>43</sup> Pollution mitigation strategies include closing older, less efficient coal-fired plants and replacing them with significantly more efficient plants, as well as research into clean coal technologies such as integrated coal-gasification combined-cycle (IGCC) and fluidized bed plants.

Chinese leaders have also committed to expanding natural gas, nuclear energy, and hydropower production in the country. In 1998, power output from fossil fuel power plants grew by 1.3%, while nuclear and hydroelectric output grew by 5.5% and 6%, respectively. While more expensive, these fuels would allow China to limit its consumption of coal, and cut pollutant and greenhouse gas emissions. However, especially for hydroelectric and nuclear power plants, capital costs are extremely high. In addition, of concern are the drawbacks to these technologies, such as waste disposal for nuclear energy and population relocation for hydroelectric power.

To reduce domestic coal consumption and improve air quality, Beijing has banned the use of coal by industrial and household consumers within the city.<sup>44</sup> Further, in 1995, the Chinese government had encouraged the use of shaped coal (briquettes) in domestic furnaces, as opposed to raw coal.<sup>45</sup> To replace household coal use, China is expanding the natural gas network. Other initiatives to improve air quality and efficiency include higher efficiency consumer goods and improved emission controls for factories and power plants.

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<sup>42</sup>Jeffrey Logan. "China's Air Pollution Down Dramatically, But Can it Last?" Pacific Northwest National Laboratory. April 2001. Website: [<http://www.pnl.gov/china>]

<sup>43</sup>Logan, et. al., *Climate Action in the United States and China*.

<sup>44</sup>"Coal Burning in Beijing to be Banned By Turn of Century, Officials Say," *Daily Environment Report*. June 10, 1998.

<sup>45</sup>"The People's Republic of China National Report on Sustainable Development," *China Environment Yearbook 1997*. p. 124.



In addition to energy and emission control strategies, China has expanded forest coverage and protected some forest areas (primarily because of downstream flooding related to deforestation). Forested areas could potentially serve as carbon sinks, mitigating carbon dioxide emissions. However, the success of forest expansion has been questioned, as some argue that while forested landmass has increased, forest density has decreased, leading to a decrease in the actual number of trees. One problem is that while many new trees have been planted, husbandry has not been as successful, leading to a die-off of a large number of planted trees.

As noted above, while China's greenhouse gas emissions are relatively high, and expected to grow significantly, China has had some progress in reducing its greenhouse gas emissions, largely through improvements in energy efficiency. In the early 1980s, the Chinese government committed itself to energy conservation, mainly to deal with energy shortages.<sup>46</sup> Since that time, although energy consumption has increased, energy intensity<sup>47</sup> has dropped significantly. Energy consumption has nearly tripled since 1980,<sup>48</sup> while energy intensity is approximately 50% lower today than it was in 1980.<sup>49</sup> A major success of China's development is that unlike most developing countries, the country's energy demand has grown less rapidly than GDP.<sup>50</sup>

As part of its official long-term plans, the Chinese government has set the goal of 5% to 6% annual economic growth.<sup>51</sup> There are concerns that greenhouse gas emissions resulting from improved efficiency will be erased with a significant increase in energy use expected with continued development. Increased energy consumption in the natural gas, electricity, and transportation sectors will be a major part of this increase as consumer goods, such as automobiles, become more common and as household energy demand increases.<sup>52</sup>

**China's International Policy.** On the international side, China has been active in efforts to control global climate change. Both China and the United States have ratified the United Nations Framework Convention on Climate Change (UNFCCC), which contains voluntary, legally non-binding commitments that parties to the treaty will try to reduce greenhouse gas emissions to 1990 levels by 2000. Further, both China and the United States have signed, but not ratified, the Kyoto Protocol to the UNFCCC. If the Kyoto Protocol were to enter into force, industrialized/developed nations that had ratified

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<sup>46</sup>Logan, et. al., *Climate Action in the United States and China*.

<sup>47</sup>Energy intensity is a measure of the amount of energy consumed per unit of GDP.

<sup>48</sup>Yingzhong Lu, "The Role of Nuclear Energy in The CO<sub>2</sub> Mitigation Strategy of the People's Republic of China," *The Woodrow Wilson Center China Environment Series*.

<sup>49</sup>Vaclav Smil, "China's Energy and Resource Issues: Continuity and Change," *The China Quarterly*. 1998. p. 935.

<sup>50</sup>Fred Pearce, "Mythical Monster," *New Scientist*. January 9, 1999. p. 44.

<sup>51</sup>Jonathan E. Sinton and David G. Fridley, "Growth in China's Carbon Dioxide Emissions is Slower than Expected."

<sup>52</sup>Robert Collier, "WTO Bid Stirs Fears About Environment: Auto Boom May Add to China's Pollution," *San Francisco Chronicle*. May 18, 2000. p. A1.

it (developed countries are those listed in Annex I of the UNFCCC) would have legally binding obligations to reduce their greenhouse gas emissions collectively by 5% below 1990 levels, averaged over the period 2008 to 2012.<sup>53</sup>

Unlike developed countries (Annex I), developing countries such as China are not required to meet set levels of greenhouse gas reductions, but are committed in the UNFCCC to make and report efforts to reduce their emissions. This disparity between the obligations of developed and developing countries has been one of the major factors in the opposition of the U.S. Senate and the Bush Administration to the Kyoto Protocol. China's position remains firm that the first internationally mandated steps to reduce greenhouse gas emissions must be made by developed countries, and China does not intend to make international commitments at this time. However, it has strongly criticized the U.S. decision to pull out of the Kyoto Protocol negotiations.

China participates in bilateral and multilateral efforts to study the effects of global climate change, to transfer and use more efficient technology, and to develop a coordinated national climate change plan. Chinese activities include policy studies conducted with the World Bank and Asian Development Bank. Currently, China is working with Japan on methane emissions reductions from coke-gas utilization, and is negotiating projects with other countries.<sup>54</sup>

The United States also participates in bilateral and multilateral projects with China. Through the U.S. Country Studies Program, the United States works with developing countries, including China, on assessing emissions, climate change risk, and potential mitigation strategies. In addition, the U.S. Export-Import Bank (Ex-Im Bank) has partnered with the Chinese government on a Clean Energy Initiative to improve efficiency and reduce emissions. However, the U.S. Agency for International Development (USAID), which has made climate change an environmental priority, is forbidden by the U.S. Foreign Assistance Act (22 U.S.C. 2151) and other restrictions from providing assistance to China.<sup>55</sup>

**Opportunities for U.S. Business.** With China's economy developing so rapidly, there are many opportunities for U.S. businesses, even without U.S. participation in the Kyoto Protocol, which would allow developed nations to claim reductions in CO<sub>2</sub> emissions if they assist developing countries to install clean technologies.<sup>56</sup> A key area for U.S. businesses is in nuclear, hydroelectric, and renewable energy development. The United States is the largest producer of nuclear and hydroelectric power, thus U.S. businesses have experience with these technologies, though not necessarily focused on exports per se. Further, because of the high capital costs for these technologies, there could be opportunities for U.S. investment in Chinese power plants.

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<sup>53</sup>For more information, see CRS report RL30692, *Global Climate Change: The Kyoto Protocol*.

<sup>54</sup>Logan, et. al., *Climate Action in the United States and China*.

<sup>55</sup>*Ibid.*

<sup>56</sup>Paul Brown, "National Roundup: BNFL Seeks Carbon Deal with China," *The Guardian*. May 23, 2000. p. 12.

In addition to power plants, another opportunity for U.S. businesses is in the area of energy efficiency. Reductions in fuel use will lead directly to reductions in greenhouse gas emissions, as well as the other pollutants that are of key concern. U.S. businesses could export efficient domestic appliances, industrial boilers, lighting, and other goods. In addition, U.S. businesses could participate in transit and distributed generation projects within China.

## Transportation Sector

Transportation will continue to play a key role in both China's development and environment. Currently, mobile sources contribute approximately 45 to 60% of nitrogen oxide (NO<sub>x</sub>) emissions and approximately 85% of carbon monoxide (CO) emissions in the country's cities.<sup>57</sup> This is largely due to poor emissions control on mobile sources. Without new emissions controls, these emissions would increase dramatically as China's economy expands. China plans to further expand its growing highway system, especially in the poorer areas of western China. In fact, this expansion is a key component of China's development strategy for the its western provinces.<sup>58</sup> An increase in highways will lead to an increase in the number of vehicles on the road, especially as passenger vehicles become more accessible. However, new strategies already in place for emission controls, alternative fuels, and transit will help alleviate some of the potential problems of transportation growth in China. Further, bicycles, a national symbol, will continue to play a key role, especially in urban areas.

**Motor Vehicles.** The number of motor vehicles in China is small compared to the United States. There are approximately 16 million cars, trucks, and buses in China, compared to approximately 210 million in the United States.<sup>59</sup> In terms of vehicle ownership density, this disparity is even higher. About 785 vehicles per 1000 people are operated in the United States, compared to about 10 per 1000 people in China. Further, relatively few of these are passenger vehicles – approximately 20% in China, compared to approximately 97% in the United States.

However, this relatively small number of vehicles, especially passenger cars, understates their current and projected growth, as well as their environmental impact. Between 1994 and 2000, the number of motor vehicles grew from 2.4 million to more than 16 million.<sup>60</sup> Between 1985 and 1995, passenger vehicle growth rates averaged 18% per year, and China's minibus and taxi fleets grew from insignificant numbers to 100,000 and 585,000 vehicles, respectively over this period.<sup>61</sup>

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<sup>57</sup>Michael P. Walsh, "Transportation and the Environment in China," *China Environment Series*. Woodrow Wilson Center. Issue 3, 1999/2000.

<sup>58</sup>"China Looks West," *World Highways*. October 2000. p. 41.

<sup>59</sup>*Ibid.*

<sup>60</sup>Changhua Wu. "The Price of Growth," *The Bulletin of Atomic Scientists*. September/October 1999. p. 58.

<sup>61</sup>D. Tilly Chang. "A New Era for Public Transport Development in China," *China Environment Series*. Woodrow Wilson Center. Issue 3, 1999/2000.

Several factors will contribute to the continued growth of the vehicle numbers in the future. First, in the mid-1990s the State Planning Commission began to promote the “household car.”<sup>62</sup> If realized, a car in every household could put hundreds of millions of passenger vehicles on the road, in addition to trucks and buses. A second factor is that China’s accession into the World Trade Organization (WTO) could greatly increase the availability of cars in the Chinese market. Current tariffs on cars range from 80 to 100%, and, given WTO membership, these would be reduced to 25% by 2006, greatly reducing the cost of imported vehicles.<sup>63</sup> In addition, tariffs on auto parts would drop from 40-50% currently to 10% by 2006. Moreover, import quotas would be phased out by 2005.<sup>64</sup>

In order to make cars more affordable, the Chinese government is removing 238 separate fees on vehicle purchase and ownership that add as much as 40% to the cost of a car.<sup>65</sup> Further, installment buying is taking hold in the Chinese car market. The expansion of installment buying should make cars more affordable for consumers.<sup>66</sup> Because of these changes, approximately 70% of households in Guangzhou and Shanghai wish to purchase passenger cars in the next ten years, according to China Auto News.<sup>67</sup> Across the country, 70 million households report that they believe they could afford a private car.<sup>68</sup>

With a growing vehicle population, the environmental effects of motor vehicles could grow significantly. In fact, the potential environmental effects of passenger cars has become a major concern in China, and has spurred interest in transit system development. The environmental performance of most vehicles in China today is comparable to vehicles in the United States in the 1960s and 1970s.<sup>69</sup> Further, pollution control standards have not been strongly enforced in many places. However, China has taken major steps to improve motor vehicle emissions. As of 2000, leaded gasoline was phased out, and in 1998 China introduced catalyst-based emissions standards for all new passenger vehicles.<sup>70</sup> These initiatives will significantly reduce emissions of toxic and ozone-forming compounds. In addition, Beijing is requiring emission control retrofits for all vehicles operated there and manufactured between 1995 and 1998, and under the 2000 amendments to the national air pollution control law, emission control systems will be required on new and existing vehicles nationwide. Further, to promote the sales of cleaner

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<sup>62</sup>Chang - from Economic Daily, October 24, 1994.

<sup>63</sup>Michael P. Walsh. “China Auto Group Questions Price Cuts After WTO,” *Car Lines*. May 2000.

<sup>64</sup>Thomas Lum. CRS Report RS20624: *China’s Automobile Industry and WTO Accession*.

<sup>65</sup>“China: Tax Incentives Offered for Cleaner Cars Meeting ‘Euro-II’ Emission Standards,” *International Environment Reporter*. August 2, 2000. p. 612.

<sup>66</sup>Chang Weimin. “Car Credit May Accelerate Sales,” *China Daily*. May 9, 1997.

<sup>67</sup>“China: Cars’ Entering into Household Being Hot Spot,” *China Auto News*. May 10, 1999. p. 3.

<sup>68</sup>“70m Chinese Families Say Cars Are Affordable,” *China Market News*. November 30, 2000. p. 3.

<sup>69</sup>Walsh, “Transportation and Environment in China.”

<sup>70</sup>*Ibid.*

vehicles, the sales tax will be reduced by 30% on new cars that meet the “Euro-II” emissions standards, which took effect in the European Union in 1996.<sup>71</sup> These standards are significantly more stringent than the current national standards. Current U.S. standards meet or exceed the Euro II standards, so American car manufacturers should have little trouble building cars to meet the standards.<sup>72</sup> However, European manufacturers, who are familiar with the Euro II test procedures, will likely have at least a small advantage in producing these vehicles.

In addition to emission controls on motor vehicles, major municipalities such as Beijing, Chongqing, and Shanghai are implementing requirements for liquified petroleum gas (LPG) and natural gas vehicles and fueling stations.<sup>73</sup> Beijing has the largest natural gas bus fleet in the world, and several other cities are planning to convert thousands of taxis and buses to natural gas over the next few years. For example, the city of Haikou in Hainan Province plans to spend \$3.6 million to install natural gas systems in 5,400 buses and cars.<sup>74</sup> In addition, China is participating in a United Nations Development Programme (UNDP) project to test and demonstrate fuel cell buses. These plans are aimed at reducing vehicle pollution, as well as curbing petroleum use and greenhouse gas emissions.

**Opportunities for U.S. Businesses.** With the opening of markets, and the tightening of emission standards, there are likely to be many opportunities for U.S. companies in China. In fact, the U.S. and Foreign Commercial Service in Beijing estimates that by 2001, the market for emission control and emissions monitoring equipment will grow to \$270 million per year.<sup>75</sup> The retrofit of pre-1998 vehicles will lead to growth in the catalytic converter market in China. U.S. emissions control manufacturers have had experience over the past 30 years in equipping American cars with such devices, and could likely take advantage of growing demand in China, especially with the cuts in auto part tariffs as part of WTO accession. The increasing market for cars could also allow U.S. auto manufacturers to play a larger role in the Chinese auto market. While one possible disadvantage for U.S. manufacturers is that China has chosen to adopt European emissions standards, Chinese standards lag behind both European and American standards, so it is unlikely that U.S. manufacturers will have significant problems making vehicles compliant.

As stated above, according to the Chinese government, alternative fuels will play a role in China’s pollution control strategy. This is another potential area of opportunity for U.S. companies. Although they are not widely used in the United States, alternative fuel vehicles are growing in their use, thanks to supportive government programs and their superior emissions performance. Therefore, U.S. companies have had some experience

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<sup>71</sup>“China: Tax Incentives Offered,” *International Environment Reporter*.

<sup>72</sup>European Commission, Directorate-General for Energy and Transport. *EU Transport in Figures*. 2000. Table 7.1; CRS Report RS20247, *EPA’s Tier 2 Emission Standards for new Motor Vehicles: A Fact Sheet*.

<sup>73</sup>Pamela Baldinger. US-China Business Council, *Environmental Trends and Policies in China: Implications for Foreign Business*. March 2000.

<sup>74</sup>Jeffrey Logan and William Chandler. “Natural Gas Gains Momentum,” *The China Business Review*. July/August 1998. p. 40-50.

<sup>75</sup>Baldinger, US-China Business Council, *Environmental Trends and Policies in China*.

in manufacturing new alternative fuel vehicles, as well as retrofitting existing vehicles to operate on alternative fuels. Furthermore, U.S. companies have had experience in developing the infrastructure necessary to fuel these vehicles. It should be noted that due to the much smaller role that petroleum plays in Chinese transportation, it may prove easier to expand infrastructure for natural gas and other alternative fuels in China than it has been in the United States. Although not environmentally related, other opportunities for U.S. companies related to transportation include auto insurance and vehicle financing.

**Mass Transit.** The growth in motor vehicles has led to greater congestion and longer commute times in Chinese cities. Because of congestion and poor bus performance between the mid-1980s and mid-1990s, Chinese commuters began switching to other forms of transportation. In the case of more affluent citizens, these included personal vehicles, taxis, and minibuses. Poorer commuters switched to bicycles or walking. In Shanghai, the percentage of commuters using bus transit dropped from 24% to 15% between 1986 and 1995.<sup>76</sup> The movement away from bus transit has led to a “vicious cycle” in which vehicle congestion leads to slow bus service, causing commuters to seek out other means of transportation, thereby further increasing congestion.

While bus ridership is declining, rail transit is expanding. The Chinese government sees urban rail systems as key to maintaining economic growth and limiting urban pollution. In the mid-1980s, the government stated that rail should be the primary mode of transportation in urban areas. However, in 1995, to combat inflation, the Chinese government placed a moratorium on most light rail projects. This was lifted in 1999, and several projects were started or revived.<sup>77</sup> The China Communications and Transportation Association estimates that more than \$15.7 billion will be invested in rail transit over the next five years. Currently, subway systems operate in four cities: Beijing, Tianjin, Shanghai, and Guangzhou. Rail transit systems are planned in cities such as Chongqing, Shenzhen, and Nanjing.

**Opportunities for U.S. Businesses.** While transit projects currently are required to use at least 70% domestically manufactured locomotives and other equipment, municipal governments such as Beijing allow foreign companies to invest in and manage rail projects.<sup>78</sup> In addition to investment, opportunities for U.S. companies include construction, locomotives and cars, and control systems, although the opportunities for trade in equipment are constrained.

**Bicycles.** In Chinese cities, the bicycle plays a key role in transportation. In fact, the bicycle is seen as a national symbol, and until recently, it was the primary mode of urban transportation. There are between 400 and 600 million bicycles in the country. Many planners see bicycles as a way of reducing pollution. However, for many in China they are seen as an urban nuisance adding to congestion.

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<sup>76</sup>D. Tilly Chang, “A New Era for Public Transport Development in China.”

<sup>77</sup>*Ibid.*

<sup>78</sup>“China to Develop Rail Transit System in Big Cities,” *Xinhua News Agency*. August 14, 2000.

Widespread bicycle ownership began after the 1949 Communist Revolution, and ownership rapidly increased after 1979 when China opened its economy.<sup>79</sup> Because of unreliable public bus service in cities such as Shanghai, bicycle use surged again between the mid-1980s and mid-1990s.<sup>80</sup> But both bicycle production and use have dropped since the mid-1990s. In the early 1990s, bicycles accounted for approximately 60% of trips in Beijing. That number is now down to 40%.<sup>81</sup> Increasing automobile ownership, along with growth in taxis and subways has led to this decline. In 1998, annual bus, car, and truck production in China were up 31.8%, 4.7%, and 2.3%, respectively; annual bicycle production declined 15.5%.<sup>82</sup> Adding to the decline in bicycle use is the fact that in some cities they are off limits on major streets during rush hour. This ban has made daily commuting by bicycle impractical for many workers.

Despite the decline in the bicycle, because of such high ownership levels and continued use, it will likely continue to play a major role in Chinese transportation for years to come. As urban pollution continues to be a problem for the country, some Chinese leaders are looking for ways to increase bicycle use, while avoiding some of the associated traffic problems.

## Montreal Protocol on Stratospheric Ozone Depletion

China is a signatory to the 1985 Vienna Convention for the Protection of the Ozone Layer, the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, and the 1990 London Amendment to the Montreal Protocol.<sup>83</sup> As a developing country, China is an Article 5 country under the Protocol and, as of July 1, 1999, required to meet a chlorofluorocarbon (CFC) consumption and production freeze based on its average 1995-1997 consumption and production levels of ozone depleting substances (ODP) of 57,819 and 47,004 metric tons respectively.<sup>84</sup> After this date, China is required to reduce these substances 50% by 2005, 85% by 2007, and 100% by 2010.<sup>85</sup> Beginning in 2002, China is required to meet a production and consumption freeze for halons based on its average 1995-97 levels of 34,187 and 40,993 ODP metric tons respectively.<sup>86</sup> After this date, China is required to reduce these substances 50% by 2005, and 100% by 2010 (with

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<sup>79</sup>Philip P. Pan. "Bicycle No Longer King of the Road in China," *The Washington Post*. March 12, 2001. p. A01.

<sup>80</sup>D. Tilly Chang, "A New Era for Public Transport Development in China."

<sup>81</sup>Philip P. Pan, "Bicycle No Longer King."

<sup>82</sup>"China: Output of Automobiles Grows, Bicycles Falls," *China Business Information Network*. February 3, 1999. p. 1.

<sup>83</sup> China acceded to the Vienna Convention on September 9, 1989; the Montreal Protocol on June 14, 1991; and, the London Amendment on June 14, 1991. For a summary of the Protocol and its Amendments, see: Larry B. Parker, *Stratospheric Ozone Depletion: A Chronology of Assessment and Decision*, CRS Report 96-702 ENR, July 10, 1996

<sup>84</sup> CFCs covered by the London Amendments include CFC-11, -12, -113, -114, and -115.

<sup>85</sup> Article 5 countries are permitted to produce an additional 10% of their base production level to meet basic domestic needs (15% beginning in 2010).

<sup>86</sup> Under the Protocol, halons covered include halon 1121, 1301, and 2402.

possible exemptions for essential uses).<sup>87</sup> Other ozone depleting substances are also on reduction schedules based on China's average 1998-2000 levels; however, data are not yet available for calculating base levels.<sup>88</sup>

Data on China's CFC and halon production and consumption is shown in Table 3. As indicated CFC production rose sharply in the early 1990s, leveling off in the mid-1990s at 45,000 to 50,000 ODP metric tons. Consumption of CFCs peaked in 1994 at over 70,000 ODP metric tons, declining to 51,000 ODP metric tons in 1997. The Executive Committee of The Multilateral Fund for the Implementation of the Montreal Protocol reported in its December 2000 meeting that China reports its 1999 CFC consumption is below its base levels.<sup>89</sup> The Executive Committee also noted that preliminary indications were that China met its halon production targets in 1999, but may not have met its consumption targets.<sup>90</sup>

<b>Table 3: China's CFC and Halon Production and Consumption as Reported to UNEP (in metric tons of Ozone Depletion Potential [ODP])</b>				
Year	CFC Production	CFC Consumption	Halon Production	Halon Consumption
1986	11,540	29,237	11,200	17,316
1989	20,700	34,783	10,600	18,880
1990	20,688	41,829	10,800	17,790
1991	26,018	50,263	10,800	19,569
1992	24,941	57,045	11,000	14,404
1993	31,658	66,283	12,400	12,847
1994	50,809	70,779	21,550	20,150
1995	46,672	75,291	37,514	33,714
1996	44,016	47,089	40,269	33,115
1997	50,324	51,076	45,196	35,731
1998	n/a	n/a	n/a	n/a
<b>1995-97 base level</b>	<b>47,004</b>	<b>57,819</b>	<b>40,993</b>	<b>34,187</b>

<sup>87</sup> Article 5 countries are permitted to produce an additional 10% of their base production level to meet basic domestic needs (15% beginning in 2010).

<sup>88</sup> The phase-out schedule for methyl bromide is based on average 1995-98 levels; however, China's 1998 levels have not been published yet by UNEP.

<sup>89</sup> Executive Committee of The Multilateral Fund for the Implementation of the Montreal Protocol. *Report of the Twenty-First Meeting of the Sub-committee on Project Review, Thirty-second Meeting of the Executive Committee, Ouagadougou, December 6-8, 2000.* United Nations Environment Programme, UNEP/OzL.Pro/ExCom/32/21, December 7, 2000. p. 9.

<sup>90</sup>*Ibid.* p. 28.



Source: UNEP. *Production and Consumption of Ozone Depleting Substances: 1986-1998*. Ozone Secretariat, October 1999.

In summarizing China's progress in meeting the targets of the Montreal Protocol, The Executive Committee states:

In its submission [to the Executive Committee], China reported on a number of important initiatives it has undertaken during its third phase of institutional strengthening projects including: undertaking activities, to achieve 1999 freeze in production and consumption, developing and implementing over 300 individual and three large umbrella foam projects. In addition, China had received Executive Committee approval for five ODS sectoral phase-out programmes in the production sections, halons, solvents, tobacco and extended polystyrene/polyethylene foams. For example, China has closed and dismantled five halon production lines.... These and other activities reported are very encouraging, and the Executive Committee greatly appreciates the efforts of China.... The Executive Committee expresses the expectation that in the next two years, China will continue with the progress achieved and sustain and build upon its current levels of CFC reductions to achieve its goal of complying with the Protocol's ODS phase-out schedules.<sup>91</sup>

The optimism expressed by the Executive Committee is not shared by all observers. In 1998, The World Resources Institute (WRI) expressed concern about illegal trade in CFCs. Citing EPA sources, WRI states: "Apparently, much of the contraband CFCs both in the United States and Europe emanate from production facilities in China and Russia....The situation appears to be more problematic in China, which can still legally produce CFCs for consumption in the developing world. As it now stands, China is apparently the biggest source of material for the CFC black market in developed countries."<sup>92</sup> China is also primarily responsible for the increase in worldwide halon production over the past five years, after ten years of decline. Thus, China may represent significant challenges on these issues to the international community for many years to come.

## Water Pollution: Overview

China's robust industrialization and urbanization have vastly outpaced investments in wastewater treatment infrastructure, and this has led to widespread pollution of the nation's lakes, rivers, groundwater, and coastal marine waters. As with air pollution, the scale of China's water pollution problems is vast, and seven of the world's most polluted watersheds are located there.<sup>93</sup> In 1997, the National Environmental Protection Agency (NEPA, now SEPA) reported that the rivers, lakes and reservoirs in China were universally polluted to varying degrees: 78% of rivers flowing through cities were not usable

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<sup>91</sup>*Ibid.*, p. 9

<sup>92</sup>World Resources Institute. *1998-99 World Resources: A Guide to the Global Environment*, New York: Oxford University Press, 1998, p. 178.

<sup>93</sup>Corliss Karasov. On a Different Scale: Putting China's Environment Crisis in Perspective. *Environmental Health Perspectives*. v. 108, n. 10. October 2000. p. A455.

for most purposes, and 50% of urban ground water was polluted.<sup>94</sup> Moreover, pollution in major rivers and reservoirs was worse and more widespread than in the previous year.

In 1995, 100 centralized sewage treatment plants were in operation nationwide, and the capacity of these plants was adequate to treat only 5% of the sewage discharged annually.<sup>95</sup> Such low sewage treatment levels have caused widespread contamination of drinking water supplies, and government health statistics for the period 1990-1995, indicated that 700 million Chinese (more than one-half the population) were consuming drinking water that failed to meet China's minimum contamination standards for human and animal wastes.<sup>96</sup>

The total annual volume of wastewater produced in China has grown markedly, increasing from 29 billion tons in 1981 to 37 billion tons in 1995, with industrial wastewater accounting for roughly 60% of the total in 1995.<sup>97</sup> According to SEPA, the volume of industrial wastewater and urban sewage discharged reached 40.1 billion tons in 1999, with sewage discharges (of 20.4 billion tons) exceeding industrial wastewater discharges for the first time.<sup>98</sup> SEPA also reported that agriculture-related water pollution is worsening rapidly as animal operations become more concentrated and more fertilizer is used on farmland.

In addition to severe water pollution problems, China is at a disadvantage regarding water resource availability, having just one-fourth of the world's per-capita average. The cumulative wastewater discharges from municipal, industrial, and agricultural sources have exacerbated water scarcity problems in many areas of the country. More than half of China's 668 cities experience chronic water shortages, and these shortages are severe in some 100 cities.<sup>99</sup> While much of this scarcity is due to uneven distribution of water resources in the country, pollution also is a factor, particularly in southern cities, where between 60% and 70% of shortages are attributed to pollution.<sup>100</sup> The Chinese Academy

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<sup>94</sup>China National Environmental Protection Agency. *China Environment Yearbook, Report on the State of the Environment in China for 1996*. 1997. p. 56

<sup>95</sup>Crescencia Mauer and Changhua Wu, *et al.* "Water Pollution and Human Health in China." *China Environment Series*. Woodrow Wilson Center. Issue 2, Summer 1998. p. 31.

<sup>96</sup>World Resources Institute. *Regional Profile: China's Health and Environment. World Resources 1998-99*. 1999. p. 121.

<sup>97</sup>*Ibid.* p. 28-30.

<sup>98</sup>China State Environmental Protection Administration. *Report on the State of the Environment in China for 1999*. Water Environment. Available at Internet website [<http://www.sepa.gov.cn/soechina99.htm>].

<sup>99</sup>Maria Burke. *Managing China's Water Resources. Environmental Science and Technology*. May 1, 2000. p. 219A.

<sup>100</sup>China State Environmental Protection Administration. *Report on the State of the Environment in China for 1999*. Water Environment. p. 22.

of Sciences has estimated that economic losses from water shortages and pollution in urban areas just in northern China equaled about \$24 billion, or 3% of China's GDP, in 1997.<sup>101</sup>

Chinese and U.S. researchers have identified 3 key causes of water quality degradation in China: rapid and unregulated expansion of industrial activities; growth of urban and suburban areas without adequate investment in water supply infrastructure; and increased use of pesticides and fertilizers combined with a continued reliance on sewage irrigation.<sup>102</sup>

Industrialization has been especially rapid among China's township and village industrial enterprises (TVIEs) which are more than 50% locally owned and now account for more than 55% of rural GDP. A key issue researchers have identified here is that industrial growth among TVIEs "has occurred outside of the central government environmental management systems, and is only regulated to the degree that local bureaus and authorities choose to exercise such authority."<sup>103</sup> Although TVIEs became subject to state laws in 1996 and 1997, enforcement was quite lax. Consequently, most of the TVIEs have lacked wastewater treatment facilities and have discharged more wastewater and more highly polluted wastewater than the formerly dominant state-owned enterprises. Recently, industrial wastewater treatment rules have been enforced more aggressively, especially in urban areas. According to SEPA, in 1999, 87.2% of industrial wastewater received some treatment, and 66.7% of wastewater discharged attained standards.<sup>104</sup>

Untreated municipal sewage is a worsening problem for Chinese cities, and, in 1999, for the first time, domestic sewage discharges exceeded industrial discharges. By the end of 2000, industrial discharges had declined, but domestic sewage discharges had increased by more than 2 billion tons. Nonetheless, progress has been made in recent years. The number of municipal wastewater treatment plants in China increased from 37 in 1978 to 135 in 1996, while the percent of municipal wastewater treated increased from 1.4% in 1978 to 13.1% in 1996.<sup>105</sup> Nearly 83% of wastewater remained untreated in 1996. By late 2000, 30% of urban sewage was being treated, according to recent government statistics.<sup>106</sup>

**Health and Environmental Impacts and Costs.** Any discussion of health impacts and costs of water pollution in China may best be done in the context of the very significant progress China has made in controlling infectious diseases (including waterborne

<sup>101</sup>Working Group on Environment in U.S.-China Relations. Meeting Summaries. *China Environment Series*. Woodrow Wilson Center. Issue 3. June 3, 1998. p. 58.

<sup>102</sup>Mauer and Wu, *et al.*, Water Pollution and Human Health in China, p. 29.

<sup>103</sup>*Ibid.*, p. 36.

<sup>104</sup>China State Environmental Protection Administration. *Report on the State of the Environment in China for 1999*. Water Environment.

<sup>105</sup>Working Group on Environment in U.S.- China Relations. Meeting Summaries. *China Environment Series*. Environmental Change and Security Project of the Woodrow Wilson Center. Issue 3 June 3, 1998. p. 58.

<sup>106</sup>U.S. Embassy Beijing. *Environmental Objectives and Investment Requirements for China's 10<sup>th</sup> Five-Year Plan*. November 2000. Available at Internet website: [http://www.usembassy-china.cn/english/sandt/10FYP.htm].

diseases) compared to conditions existing in 1949. At that time, more than one-half of the population died from infectious and other nondegenerative diseases before reaching middle age (a statistic not uncommon for developing countries); in contrast, statistics from the Chinese Ministry of Health show that, by the mid 1990s, infectious diseases had declined markedly and were the cause of death for just 0.0004% of the population annually.<sup>107</sup> This progress is particularly notable given that China has the world's largest population and continues to be one of the world's poorer nations.

Nonetheless, China's deteriorating water quality that has resulted from its rapid urbanization, industrialization, and intensive agricultural practices is threatening to undermine some public health gains. Recent studies suggest that China's severe water pollution is increasing the traditional health risks of infectious diseases as well as the "modern" risks of illnesses associated with exposures to industrial chemicals in drinking water.<sup>108</sup>

In addition to public health concerns, the economic and ecological effects of water pollution also are being felt in China. The U.S. Embassy in Beijing recently identified several direct and indirect costs of water pollution:

- ! Red tides (abnormal algal growth caused by marine pollution) caused more than \$120 million in losses to the fishing industry in the Bohai, Yellow and South China seas in 1999, according to the Ministry of Agriculture.
- ! Fishermen in Hebei Province filed suit in November 2000 claiming wastewater from upstream paper mills in Henan Province killed \$3 million worth of fish.
- ! Toxic spills killed 2 million kilograms of fish in two rivers in Anhui Province in July 2000, costing local fishermen \$1.5 million in lost catch. Reports indicate that perhaps 1,000 incidents occur nationally each year.<sup>109</sup>

The U.S. Embassy noted the general concerns that water pollution spreads diseases, reduces agricultural output and imposes costs on industries that use water in their production processes. While such concerns are shared by all countries, China faces these water pollution problems on a very large scale.

**Government Measures to Reduce Water Pollution.** In response to the widespread deterioration of water resources, the national government adopted several strategies in the 1990s. These include increasing the number and capacity of municipal wastewater treatment facilities, more aggressively controlling industrial wastewater pollution (especially among TVIEs), and using sewage irrigation projects.

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<sup>107</sup>World Resources Institute. *Regional Profile: China's Health and Environment*. World resources 1998-99. p. 116.

<sup>108</sup>Mauer and Wu, *et al.*, Water Pollution and Human Health in China, p. 36.

<sup>109</sup>U.S. Embassy, Beijing, China. *The Cost of Environmental Degradation in China*.

In 1996, Chinese officials launched a nationwide campaign to close down inefficient and highly polluting enterprises that were affecting sensitive waterways.<sup>110</sup> According to the World Bank, during 1996 and 1997, the government closed nearly 17,000 small and medium enterprises in Henan Province alone, and most of these were TVI enterprises.<sup>111</sup> These closures correlated closely with a nearly 30% reduction in the total chemical oxygen demand (COD) load from industries.<sup>112</sup> Along the Huai River, 1,111 small paper mills were shut down which reduced the amount of wastewater discharged into the river by 15%.<sup>113</sup> The government also issued rules advancing industrial wastewater treatment in specific sectors, and, in the late 1990s, approximately 40,000 industrial wastewater treatment facilities were built.<sup>114</sup>

By closing polluting industries, improving the enforcement of water pollution laws, and increasing investments in wastewater treatment infrastructure, China has made progress in reducing the volume of polluted discharges, particularly in the industrial sector. (Table 4 compares total wastewater discharges and COD discharges from domestic and industrial wastewater sources during the 9th Five-Year Plan.)

Year	Total Wastewater Discharge		COD Discharge	
	Domestic	Industrial	Domestic	Industrial
1995	13,370	28,160	6.1	16.2
1998	19,480	20,050	6.9	8.0
1999	20,380	19,730	6.9	6.9
2000	22,090	19,420	7.4	7.1
Increase & decrease (%) 1995-2000	65.2	-31.0	21.3	-56.6

Source: SEPA. Report on the State of the Environment in China, 1999 and 2000.

**Goals and Challenges.** Chinese officials have long acted to address the serious nature of the country's water resource problems, and increasingly, the pollution aspect of

<sup>110</sup>Jim Stover. *China's Environmental Framework 2000 and Beyond*. China Business Review. April-March 2000. p. 51

<sup>111</sup>Jostein Nygard, *China's Brown Agenda: Changed Environmental Pollution Trends*.

<sup>112</sup>*Ibid*. Chemical oxygen demand (COD) is a measure of the capacity of water to consume oxygen during the breakdown of pollutants (i.e., decomposition of organic matter, such as sewage, and oxidation of inorganic chemicals, such as ammonia or nitrite). COD measurements are commonly made on samples of waste waters or of natural waters contaminated by domestic or industrial wastes and are used to indicate pollution loads.

<sup>113</sup>China Environment Yearbook: 1997. November 1997. p. 130.

<sup>114</sup>Working Group on Environment in U.S- China Relations "Conservation and Pollution of Water Resources in China." Working Group Summaries. *China Environment Series*. Woodrow Wilson Center. Issue 3, 1999/2000. p. 59.

those problems. However, challenges remain. As one expert on China's water resource issues noted, China's water problems are so serious that,

failure in the coming decades to conserve and improve the quality of water resources will seriously undermine China's growth prospects and threaten its political stability. Water shortages, increasing flood damage, and rampant pollution threaten to undermine both short-and long-term modernization goals. It is uncertain, moreover, if sufficient fresh water will be available in the coming decades to accommodate China's growing water demands for agriculture, industry, energy development, and domestic supply.<sup>115</sup>

In November 2000, China's State Council issued a circular setting goals for urban water conservation and pollution control. The circular set a goal for cities with populations of 500,000 or more to be treating at least 60% of sewage by 2005, and for all cities to be treating at least 60% of sewage by 2010.<sup>116</sup> The 10th Five-Year Plan increases the number of "key" cities targeted for pollution control from 47 (in the 9th Five-Year Plan) to 100. All of the targeted cities are expected to meet national water (and air) quality standards by the end of 2005.

Researchers have noted that, for China to meet its wastewater treatment goals, the country will have to overcome several financial and institutional hurdles. A key challenge is that municipal governments have had little or no experience with sewage treatment projects. Moreover, operation and maintenance costs and training typically have not been factored into project costs. China has relied, and continues to rely, heavily on foreign aid to fund wastewater treatment projects.<sup>117</sup>

While noting accomplishments over the past five years, a study by the Chinese central government, the World Bank and others project that water pollution control will become much more complex over the next 10 years, and that it is likely that water quality in rivers, lakes and ground water will deteriorate in many areas. The authors noted that, in many of China's stressed river basins, a huge gap exists between the ambient standards for designated water uses and the actual standards that are likely to be achievable within any reasonable planning time-frame. Pollution sources that require increased attention include municipal wastewater discharges and agricultural nonpoint source pollution (especially from intensive livestock production units), as well as continuing efforts to reduce industrial water pollution.<sup>118</sup>

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<sup>115</sup>Baruch Boxer. China's Water Problems in the Context of U.S.-China Relations. *China Environment Series*. Woodrow Wilson Center. Issue 2, Summer 1998. p. 20.

<sup>116</sup>British Broadcasting Corporation. *Circular Issued on Water Saving, Pollution, Sewage*. BBC Summary of World Broadcasts. November 29, 2000.

<sup>117</sup>Working Group on Environment in U.S.- China Relations. An Overview of Chinese Water Issues. Working Group Summaries. *China Environment Series*. Woodrow Wilson Center. Issue 2, Summer 1998. p. 47

<sup>118</sup>World Bank. *Sector Study on China's Environmental Issues*. Draft Executive Summary. 2001.

## Environmental Policies in China

In response to worsening pollution problems, environmental concerns have been expressed as a national priority in government policies and documents much more often over the past several years. As environmental pollution grew to uncomfortable and unhealthy levels, and as severe flooding was tied more directly to deforestation in the upland areas, recent Chinese policies and official pronouncements began to reflect this increase in priority for environmental protection. In many cases, laws are on the books—and have been for some time—to control pollution, but enforcement has been problematic. The government has identified a number of areas where environmental protection laws need to be strengthened or revised, and this process is underway. For example, amendments to the air pollution control law last year added numerous requirements and strengthened enforcement authority at the provincial and local levels. One conspicuous impediment to more effective environmental management has been the decentralization of enforcement activities, as well as lack of resources at the national, provincial, and local levels, and the relatively weak system of legal recourse or other methods to achieve implementation of environmental protection laws.

In general, however, while a review of major Chinese policy documents shows increased mention of environmental priorities, and the earlier reluctance to acknowledge environmental problems has faded, these policies also clearly demonstrate that economic development goals remain pre-eminent, and would be likely to prevail in any perceived conflict with environmental goals. Working in favor of stronger environmental protection is the slowly growing perception that environmental deterioration has become a problem in economic terms.

**10<sup>th</sup> Five Year Plan.** The document that most comprehensively outlines economic and social priorities for China is the five year plan. The 10<sup>th</sup> Five Year Plan, adopted on October 11, 2000, retains a primary emphasis on economic development, but also includes significant references to the importance of environmental (more often translated as “ecological”) protection, sometimes acknowledging the need to improve the current situation.

The Plan identifies “main objectives” as “relatively fast economic growth”, doubling gross domestic product between 2000 and 2010, establishing a social security system, and improving the participation of state owned enterprises (SOEs) in the international economy. Achieving these goals would enable, according to the plan, improvements in jobs, incomes, and material conditions; and “ecological construction and environment preservation will intensify.” The Plan clearly states, “Development is the overriding principle ... key to addressing all the problems in China,” and generally includes environmental concerns as the final item in lists such as “main assignments for the strategic adjustment of the economic structure” that include improving performance and returns of agriculture, industry and services, coordinated development between regional economies, expediting urbanization, and “special efforts to improve the infrastructure and the ecological environment essential for achieving a sustainable development.” Under speeding up industrial transformation, controlling pollution is a goal, along with increasing labor productivity. The Plan specifically targets closing factories and mines that “waste resources...and cause serious pollution.”

Other references to environment in the 10<sup>th</sup> Five Year Plan include water conservancy and “great efforts to address such problems as flooding, insufficient water resources, and water pollution.” The Plan states, “With respect to energy development, we should...optimize the mix of energy resources, make their use more efficient, and intensify our efforts in preserving the environment.” Improving the “ecological environment” is a key feature in the section on development of Western China “in a Big Way.” Another section promotes a greater degree of urbanization, stressing the role of markets and investment and an emphasis on medium and small cities; there is no mention of environmental concerns in the urbanization section.

Section 10 of the Plan is “Strengthen Management of the Population and Resources; Emphasize Ecological Projects and Protection of the Environment.” It begins, “Implementing a strategy of sustainable development has a bearing on the vital matter of the survival and development of the Chinese nation.” Population issues are emphasized first, followed by rational use of resources and urging protection and development of water, land, mineral, forestry, grassland, marine, and other such national resources, in keeping with the law. Prospecting for resources is encouraged. Strengthening “ecological construction” and curbing “deterioration of the ecology” is identified as a goal, along with environmental protection. The Plan states, “We should strengthen the overall control of air, water, garbage, and noise pollution in the cities and achieve obvious improvements in the quality of the environment in the larger cities.” It goes on to say, “The environmental protection industry should be developed vigorously, strengthening research and development on key industrial protection technology and processing equipment.” Improving environmental and climate monitoring systems is mentioned, as are perfecting and strengthening environmental protection laws and regulations, and strengthening law enforcement and oversight.

In commenting on the Plan, Premier Zhu Rongji stated the importance of the period for achieving the goals of the plan—economic and social development, economic restructuring, improving the socialist market economy, and opening to the outside world; environmental improvement was not among these top goals. However, among the remaining problems “not to be ignored” was “worsening ecological environment in some localities.” His comments on improving people’s livelihoods included a major emphasis on increasing the level and scope of consumption, with a mention of improving the quality of the environment.

**China’s Agenda 21 on Sustainable Development.** At the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, popularly known as the Earth Summit, a 40-chapter “action plan” for environmentally sustainable development was agreed upon by the world’s leaders.<sup>119</sup> Each nation made voluntary commitments (not legally binding) to engage in carrying out the goals of Agenda 21 (named for actions needed into the 21<sup>st</sup> century), as the action plan was called. China was one of the first countries to take up the challenge of formulating an Agenda 21 for its own development.

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<sup>119</sup>For more information on the Earth Summit, see CRS report 92-374 ENR, *Earth Summit Summary*.



In 1994, China completed its *Priority Programme for China's Agenda 21, First Tranche*, prepared by the State Planning Commission and the State Science and Technology Commission. This document outlined the “executable projects” that would serve as the “fundamental means for implementing China’s Agenda 21,” and that would be integrated into successive five-year plans, beginning with the 9<sup>th</sup>. Possibly reflecting expectations of developing countries that financial assistance might later be provided by developed countries for Agenda 21 – which has not happened to any appreciable degree – China prepared extensive lists of possible projects related to the very broad term, “sustainable development.” More than 500 proposals were suggested by various line ministries of the State Council, local governments, industrial sectors, academic institutions and other organizations.

The Priority Programme spells out 9 priority areas that encompass 62 projects. The priority areas are as follows:

- ! Capacity building for sustainable development, which includes revamping legislation and enforcement, policies, education and training, and public participation in sustainable development, with an emphasis on environmental issues;
- ! Sustainable agriculture, which includes management of water resources, development of “biological pesticides and green foods,” and demonstration projects related to the strategy for sustainable agriculture;
- ! Cleaner production and environmental protection industry, including introduction of clean technologies in principal industrial sectors and enterprises, development of environmental protection industry, and construction of industrial parks for environmental science and technology.
- ! Clean energy and transportation, including clean coal technologies, increases in energy efficiency, utilization of renewable energy, modern transport planning, light rail, etc.
- ! Conservation and sustainable utilization of natural resources, including establishing a monitoring network for ecology and the environment, reclamation of wastes and mine tailings, and a variety of land soil resources goals.
- ! Environmental pollution control, including waste water treatment and recycling, safe management of hazardous waste and toxic chemicals, acid rain control, treatment and disposal of radioactive wastes.
- ! Combating poverty and regional development.
- ! Population, health and human settlements, including demonstration projects in communities on sustainable development, family planning, health care, disaster mitigation, etc.
- ! Global change and biodiversity conservation, including climate change, conservation of biodiversity, prevention and control of desertification, etc.

The priority program for China's Agenda 21 makes it clear that these are projects and areas in which investment will be sought from a wide variety of sources, including multilateral agencies, bilateral programs, and private foreign investment. In its report in 2000, the U.S.-China Business Council reported that the Center for China's Agenda 21 indicated that international support had been secured for 36% of the original projects identified in the priority program, and that support for another 33% was under negotiation.<sup>120</sup>

Representative projects associated with some of the priority areas are:

- ! In the cleaner production and environment industry area: demonstration projects for cleaner production in the chemical industry; coal flue gas desulfurization technology development and commercialization; and cleaner production demonstration projects in the iron and steel, pharmaceutical, and alcohol industries.
- ! In the clean energy and transportation area: efficiency improvement and pollution control of medium to small size boilers; exploitation, development and utilization of coalbed methane resources; and a "green lights" program (installing energy efficient electric bulbs lighting technologies).
- ! In the environmental pollution control area: minimum discharge community demonstration; technical support and disposal demonstration project for hazardous wastes; and a variety of water pollution control, acid rain control and other pollution control projects for specific cities or corporations.

China's Agenda 21 spelled out under its Capacity Building priority a project involving the enactment and amendment of laws to strengthen areas and fill gaps where the legal system is weak. The project identifies the lack of appropriate legislation on solid wastes, pollution prevention, management of hazardous wastes and toxic chemicals, radioactive pollution, and natural resources management. The Agenda 21 program noted, "Although China has signed more than 20 international treaties on the environment and resources, the domestic legislation to implement these treaties has not yet been enacted." (See below for discussion of China's environmental laws and regulations.

**Trans-Century Green Project.** Another extensive list of environment-related projects compiled by China's government and proposed for potential foreign investment was unveiled at the 1997 U.S.-China Environment Forum established to facilitate U.S.-China cooperation. This list of nearly 1600 projects is called the Trans-Century Green Project. These projects are heavily focused on pollution control and treatment infrastructure projects, including urban sewage treatment in 17 different cities or communities; industrial wastewater treatment for 15 cities or enterprises; urban solid waste treatment and industrial waste treatment for 14 cities or industries; air pollution control in 18 different plants or areas. According to the U.S.-China Business Council, China's State Environmental Protection Agency (SEPA) has reported that by the end of 1997, some 11.3% of these projects had been completed, with total investment at \$1.3 billion, with international investment of \$99.5 million. In addition, one-third of the total, 523 projects, were reportedly underway, with investment in them of \$2.14 billion, of which \$290 million

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<sup>120</sup>Baldinger. *Environmental Trends and Policies in China*, p. 57.

were foreign funding.<sup>121</sup> By the end of 1999, 1,053 projects were completed or initiated, accounting for 72% of all Trans-Century projects and 60.2% of total investment for these projects.<sup>122</sup>

**China's Laws and Regulations on Environment.** As discussed elsewhere in this report, China has enacted a wide array of laws addressing most of the environmental issues that have been of concern over the years. Additionally, beginning in 1998, the newly reorganized State Environmental Protection Agency (SEPA) promulgated an extensive array of decisions and regulations to strengthen or create controls of a wide variety of pollutants and concerning numerous activities such as environmental standards measurement, environmental impact assessments, hazardous waste incineration, and many others. In 2000, the air pollution control law was greatly expanded and strengthened, as noted in the discussion of air quality.

A number of additional laws are reportedly in the drafting stage or being discussed, including a clean production law, a new marine environmental protection law, a radioactive pollution prevention law, and others.<sup>123</sup>

It remains problematic to determine the level of implementation and enforcement for laws and regulations in China. The decentralization of many governmental functions, and continuing reports of corruption—along with reports of crackdowns on corruption—make compliance very hard to determine. The U.S.-China Business Council report notes the disconnect that often occurs between the laws on the books and compliance with them:

As China's rapidly expanding body of environmental legislation grows more sophisticated, the gulf widens between what is mandated by law and how laws are actually implemented. As in many other areas of China's legal system, environmental laws often reflect a vision far removed from reality. A 1998 SEPA investigation of local compliance levels, for example, revealed that about one-third of the firms inspected were operating in accordance with the law; one-third were not using any environmental protection equipment at all; and about one-third operated their environmental technology "inefficiently" (i.e., only during inspections).<sup>124</sup>

The report noted several reasons for these discrepancies, first among them, the decentralized bureaucratic structure, in which enforcement of environmental laws and regulations is carried out primarily by provincial and local level environmental protection bureaus (EPBs), which report to provincial or local government authorities, not to SEPA. Therefore, development priorities of the local governments may often take priority over environmental protection laws. Other obstacles to enforcement include conflicts of interest arising from funding for the EPBs which comes from fines collected and the fact that the EPBs often have commercial subsidiaries that provide technology—sometimes encouraging inappropriate use of them; irrational pricing mechanisms that often make paying fines more

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<sup>121</sup>*Ibid.*, p. 58-59.

<sup>122</sup>China State Environmental Protection Administration. *State of the Environment 1999*. Website: [<http://www.sepa.gov.cn/soechina99/manage/managedown.htm>]

<sup>123</sup>*Ibid.*, p. 14-15.

<sup>124</sup>*Ibid.*, p. 17.

attractive than investing in pollution control technology; and unrealistically high legal standards or compliance timeframes. Other major obstacles cited are the lack of environmental experience and traditions among the public and among operators of industrial and other facilities, as well as the relatively weak system of tapping into public concerns and the relative lack of legal recourse for public concerns.

In general, it seems clear that the Chinese government has significantly increased efforts to mitigate environmental deterioration, and both laws and regulations are being upgraded. While compliance remains problematic, efforts are also underway in the government to increase understanding and support for environmental improvement and laws among the public and among industry and economic officials. Improvements in environmental quality, especially air quality, have been noted as plants have been closed, often in line with environmental mandates, and as the government takes some strong environmental steps.

**Governmental Organization for Environmental Protection.** As environmental problems worsened during the first half of the 1990's, the government also responded by reorganizing some of its environmental functions. Many experts on China place the turning point in the mid-1990's, in particular from 1996 onward. The U.S. China Business Council observed in its report, "The real turning point in official attitudes toward the environment, however, came in 1996, when both President Jiang Zemin and then-Premier Li Peng delivered speeches at China's Fourth National Environmental Protection Conference. For the first time the government included environmental protection projects and targets in the state plan and unveiled ambitious schemes to attract foreign investment."<sup>125</sup> As discussed below, the environmental functions of the government are organized across a number of agencies and organizations; lines of authority among these, however, can be difficult to ascertain, partly because of the complex, and somewhat impenetrable interrelationship between official government structures and the communist party hierarchy, as well as the complexity of the lines of authority between the national and lower level governmental entities.

*State Environmental Protection Agency (SEPA).* The agency with most direct responsibility for environmental protection and pollution control is China's State Environmental Protection Administration, the highest level administrative environmental authority at the national level. It superseded the previous National Environmental Protection Agency (NEPA) and was elevated to ministerial status in 1998 as part of government restructuring, but at the same time was cut back to 200 to 250 employees, a 30% reduction in staff. It operates with very limited funding and human resources. SEPA issues standards and regulations, and is responsible for enforcement. Although its elevation to ministerial status may have been intended as a signal to both Chinese and foreign constituencies that the environment has been elevated as a political priority, the reduction in staff and resources may create additional problems in its operations.

*The Environment and Natural Resources Protection Committee of the National People's Congress (NPC) and the State Council.* This Committee is the primary legislative entity for environmental issues, drafting legislation that is later considered by the Standing Committee of the NPC (essentially the working body of the NPC). The State

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<sup>125</sup>Baldinger, *Environmental Trends and Policies in China*, p. 9.

Council is the primary administrative secretariat for decisions of the NPC, and as such is the body to which ministerial bodies such as SEPA report. Thus the Council has key responsibilities for approving a wide range of environmental targets, priorities and plans, as well as SEPA's budget.

*State Development Planning Commission (SDPC).* The SDPC has a key role in comprehensive social and economic planning and development, including coordination of the five-year plans that outline the priorities and the framework for China's economic strategies. It has responsibility for developing the lists of priority projects for investment, including infrastructure. The SDPC develops major policies on such environmental issues as climate change and for renewable energy and gas utilization. It also plays a key role in project approval at local, provincial and national offices, and thus would be centrally involved environmental projects per se, as well as decisions on the extent to which environmental factors are taken into account in other major projects.

The *State Economic and Trade Commission (SETC)* is a key player in formulating national economic policies and objectives for communications, commerce, trade, and industrial technology, including domestic environmental protection technology. In the government reorganization of 1998, this ministry also absorbed former ministries of key relevance to environmental issues, including the former Ministry of Coal Industry, Ministry of Chemical Industry, and it oversees the offshore oil corporation, former Ministry of Electric Power and the State Bureau of Technological Supervision.<sup>126</sup> The SETC also has responsibility for approving technological expansion and renovation, especially for state owned enterprises (SOEs), which would have import for related environmental impacts and concerns.

*Other National Agencies.* According to the U.S. China Business Council, a number of other ministries would have key roles in environmental issues connected with their jurisdiction. Among these are the *Ministry of Construction*, which oversees urban engineering projects, including wastewater treatment, waste-recycling, desulfurization, and energy efficient heating equipment. The *Ministry of Foreign Trade and Economic Cooperation (MOFTEC)* is responsible for approval of all foreign investment. A subsidiary of this ministry, the China International Center for Economic and Technical Exchanges, manages United Nations Development Program projects and coordinates cooperation with international non-governmental organizations assisting in the sustainable development area. The *Ministry of Science and Technology* oversees China's Agenda 21 program for sustainable development, conducts research on new technologies, and funds scientific initiatives. Other relevant ministries would include the Ministry of Agriculture, the Ministry of Water Resources, and the Ministry of Land and Natural Resources.

*Provincial, Municipal and Local governments.* As noted above, the interplay among the national level ministries and between the national officials and the implementing authorities at the lower levels of government is complex, and often presents difficulties in the enforcement of environmental protection laws and policies. There is a paucity of human and financial resources available for environmental protection activities at all levels, making stringent enforcement efforts problematic. As in most nations, there are competing

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<sup>126</sup>*Ibid.*, p. 11.

priorities between the national-level ministries responsible for economic development and those with environmental responsibilities. Often, the economic development interests are seen to be in conflict with, and prevail over, environmental protection goals.

According to conversations with Chinese officials at both levels, it is not unusual for there to be differences in environmental priorities and competing perspectives at provincial and local levels. When the national environmental officials attempt to assure implementation of environmental goals, they may encounter resistance or apathy at the lower levels to the extent that such implementation is either greatly slowed or obviated.

Corruption is reportedly a major problem connected with the government's environmental protection efforts. According to a February 12, 2001, communication from the U.S. Embassy in China,

The State Accounting Bureau recently found serious problems in the collection, management and use of waste emission fees in 46 key cities. The Bureau found false accounts and mismanagement of funds totaling RMB 986 million (\$120 million), or some 27% of the total budget. ... Some Chinese environmentalists believe that corruption at all levels of government is China's biggest environmental problem.<sup>127</sup>

It remains difficult for China, as for most nations, to resolve conflicting environmental, economic and social needs in order to enforce environmental requirements. In a February 2, 2001 communication, the U.S. Embassy in China reported an article in *China Daily*, Jan. 22, 2001, that indicated 520 "strategic" state-owned enterprises that were facing a December 2000 deadline to meet pollution standards or be closed have been granted a possible 2-year extension by the SEPA. Because widespread non-compliance among these very large companies would have resulted in closings involving large-scale potential layoffs, SEPA made the decision to allow appeals for a 2-year extension. Such extensions would have to be approved by both local and SEPA authorities; SEPA reportedly indicated that those SOE's that have not made any efforts to reduce pollution would be closed. However, many smaller companies that failed to meet the end-of-2000 deadline have been closed.

## **United States-China Cooperation on Environment**

U.S. foreign assistance to China is limited or prohibited by a variety of laws pertaining to Tiananmen Square sanctions, human rights and other concerns; nevertheless, the United States and China have entered into a large number of cooperation agreements, addressing a wide variety of scientific and environmental issues. Numerous agreements on environmental cooperation have been concluded and are in place between Chinese agencies and U.S. agencies such as EPA, Department of the Interior, Department of Energy (DOE), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Export-Import Bank (Ex-Im Bank), and other agencies. The majority of these are for various forms of technical assistance, training, information exchange, workshops, and

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<sup>127</sup>This report is available at  
[<http://www.usembassy-china.org.cn/english/sandt/estnews0112.htm>]

research. Few, if any, involve more than \$100,000 to several hundred thousand dollars. Most are much smaller.

Some 123 cooperative efforts involving the United States Government and China were listed in a 1998 inventory prepared by the Woodrow Wilson Center's Working Group on Environment in U.S.-China Relations.<sup>128</sup> This list included 45 agreements between EPA and Chinese agencies, covering a wide variety of areas such as clean air and energy technology (development of investment and market strategies for clean energy projects); assessment of Chinese air quality management processes; phase-out of ozone depleting substances; automotive technology/leaded gas phase out; climate change research; coal mine methane market development; pollution prevention and control for China's river basins; and many others. An August 2000, EPA list showed 10 active cooperative projects between EPA and Chinese agencies, mainly SEPA, and listed another 9 "other" activities, including a number of workshops and meetings. During the period July 1999 through 2000, some 37 meetings were listed on an EPA calendar of United States-China events.

Clean energy and energy efficiency are a major focus of many of the environment-related U.S.-China cooperative efforts across several agencies. Cooperation with NOAA focuses on climate, weather, fisheries and coastal management.

U.S.- China cooperation on environment has a history of several decades, but has not been highly coordinated within the U.S. government; rather, agencies pursued accords in their areas of interest without necessarily relating to a unified government-wide strategy. Cooperative agreements on environment continue to be conducted by a large number of agencies, with varying degrees of interagency coordination in specific subject areas, but on a somewhat ad hoc basis.

**The U.S.-China Forum on Environment and Development.** In 1997, following Vice President Gore's visit to Beijing, the two governments established the inter-agency U.S.-China Forum on Environment and Development with a mission to address issues involving climate change, SO<sub>2</sub> emissions, energy efficiency, and water resources and treatment. The Forum created four working groups:

- ! Environmental Policy Working Group, focusing on multilateral environmental issues and negotiations, and addressing pollution prevention and control, health impacts of pollution, waste management, and hazardous waste;
- ! Energy Policy Working Group, focusing on energy generation, including conventional, alternative, renewable, and nuclear sources, and major energy consumption in industrial, transportation, building, and utility sectors;
- ! Science for Sustainable Development Working Group, focusing on application of science and technology to better understand and encourage sustainable development in China;

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<sup>128</sup>*Inventory of Environmental Work in China*, China Environment Series, Issue 3, 1999, 1999/2000. Environmental Change and Security Project, Woodrow Wilson Center, Washington, D.C. p. 78-104.

- ! Commercial Cooperation Working Group, focusing on trade, energy, environment, agriculture and other aspects of U.S.-China environmental relations, and working to identify areas in which environmental technology opportunities for U.S. firms in terms of China's environmental needs.<sup>129</sup>

These working groups were intended to create dialog at high levels of government, and to increase the priority and visibility for these issues in both governments. They did not command financial resources or result in specific project undertakings.

The second meeting of the U.S.-China Forum on Environment and Development took place in April, 1999, on the occasion of Chinese Premier Zhu Rongji's visit to the United States. At the conclusion of that meeting, a Memorandum of Understanding was signed between China's Ministry of Science and Technology and the State of Oregon, establishing a China-U.S. Center for Sustainable Development, based in Portland, Oregon. The Center's focus was described as land use planning, sustainable agriculture, sustainable forestry, environmental technology and cleaner production practices, sustainable cities, sustainable energy, marine environment, water resources, and capacity building for sustainable development.

Two secretariats were established: one in China under the Administrative Center for China's Agenda 21, and in the United States, under the International Sustainable Development Foundation, a non-profit non-governmental organization (NGO). As of February, 2001, the Center was still in its organizational phase, but its website indicates its plans to be "a new type of organization, combining the entrepreneurship and agility of the private sector with the authority of government to make policy decisions and mobilize resources across all levels of decision-making—national, regional and local."<sup>130</sup> Some of its activities in 2000 included hosting a number of consultations, delegations of officials on various sustainable development issues, and information exchange activities.

**Export-Import Bank.** The U.S. Export-Import Bank (Ex-Im Bank) supports short-, medium-, and long-term programs in China. Short- and medium-term programs include the trade of commodities, raw materials, and spare parts, while long-term programs generally focus on capital goods.<sup>131</sup>

The Ex-Im Bank charter requires the bank to take environmental effects into account in granting support for proposed programs, although these requirements only apply to long-term programs. As part of its environmental procedures, the bank has committed to increasing support for environmentally beneficial projects and products, especially those that lead to greenhouse gas reductions, such as renewable energy projects.<sup>132</sup>

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<sup>129</sup>*Ibid.* p. 85.

<sup>130</sup>[<http://www.chinauscenter.org>]

<sup>131</sup>Export-Import Bank of the United States. *U.S. Exports to the People's Republic of China*. November 1999. [website: <http://www.exim.gov/country/ebd-y-05.html>]

<sup>132</sup>Export-Import Bank. *Environmental Procedures*. June 27, 2000. Website: [<http://www.exim.gov/envproc.html>]



In April 1999, Ex-Im Bank and the State Development Bank of China (SDB) announced a \$100 million Clean Energy Program. This amount is small relative to all Ex-Im Bank programs in China, which totaled approximately \$5.9 billion in 1998.<sup>133</sup> A single program to sell commercial aircraft to Air China, for example, totals \$345 million.<sup>134</sup> The Clean Energy Program will promote the sale of U.S. technologies for renewable energy generation, efficient thermal power generation, building energy efficiency, and emissions reductions. Further, Ex-Im Bank maintains an environmental exports program, but no projects have yet been initiated in China.<sup>135</sup> Ex-Im Bank refused funding for the construction of the controversial Three Gorges Dam, primarily on environmental grounds in 1996.<sup>136</sup>

**Trade and Development Agency.** The U.S. Trade and Development Agency (TDA) provides grant funding to middle-income and developing countries for studies, training, and technical assistance. The Agency's mission is to aid development and to help the U.S. private sector compete for infrastructure and industrial projects in these countries. Foreign governments use TDA grants to hire U.S. companies to perform feasibility studies, thus involving businesses early on in projects that offer significant opportunities for export of U.S. goods and services.

In January 2001, President Clinton authorized TDA to operate in China, pursuant to a national interest waiver that lifted the 1989 sanction suspending the Agency's program there. The TDA is focusing its initial efforts on energy, environment, and aviation projects. A preliminary list of possible projects in China included projects involving power generation, gas development, clean coal technology, air pollution monitoring, motor vehicle inspection, and water and wastewater treatment.<sup>137</sup>

TDA efforts often are focused on projects that may receive funding through multilateral development organizations, such as the World Bank or the Asian Development Bank. The scope of the effort is small, however, as the TDA has a budget of roughly \$15 million for all of Asia.

## Multilateral Cooperation on Environment

China is involved in a wide range of multilateral international efforts on environmental issues. It is a recipient of funding from the Global Environment Facility (GEF)—a fund for meeting incremental environmental elements of projects in developing countries, the World Bank, and the Asian Development Bank. It is also a participant in a number of global

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<sup>133</sup>Export-Import Bank of the United States. *1998 Annual Report: Rising to Meet Today's Export Challenges*. 1999.

<sup>134</sup>"Ex-Im Bank Backs Sale of Boeing Jets to Air China," *Seattle Times*. March 10, 2000. p. F2.

<sup>135</sup>Baldinger, *Environmental Trends and Policies in China*, p. 37.

<sup>136</sup>Joanna Gail Salazar. "Damming the Child of the Ocean," *Journal of Environment and Development*. June 2000. p. 160-174.

<sup>137</sup>U.S. Trade and Development Agency. TDA Reopens U.S. Export Promotion Program in China Aviation, Energy and Environmental Sectors Named First Priorities. v.8, n. 1, 2001. Website: [[http://www.tda.gov/trade/update\\_index.html](http://www.tda.gov/trade/update_index.html)]

treaties, but has binding commitments under only a few. All of these efforts involve the scoping of environmental needs in various areas, and the engagement of private sector entities to implement all or part of the activities being funded.

**Global Environment Facility.** The Global Environment Facility (GEF) was established in 1991 to provide “incremental” funding through grants for projects that would enable the accomplishment of goals related to the GEF’s four priority areas: biological diversity, global climate change, international waters, and stratospheric ozone depletion. The GEF is administered by the World Bank, with joint responsibilities by the United Nations Development Programme (UNDP) and the U.N. Environment Programme (UNEP). Since GEF funding is not meant to meet the costs of an entire project, but to add to planned projects in order to fund the extra cost that enables the accomplishment of the GEF’s goals, the amount of money for each project is much smaller than those from other institutions.

The GEF is funding 12 projects on climate change in China, ranging from \$10 million to \$25,000. They focus on such projects as methane recovery and utilization, commercialization of renewable energy, participation in the climate change treaty process, energy conservation, and policy development. There are 5 GEF projects in China on biological diversity, including a variety of conservation efforts. There are also 5 projects in the international waters category, focused mainly on pollution prevention and control in coastal and marine areas, ranging in cost from \$18.5 million to \$5.2 million.<sup>138</sup>

**World Bank.** The World Bank lends extensively in China, but only a relatively small number of lending projects are identified under “environment” by the Bank. Its current list of environmental projects in China include 16 projects (not including the GEF projects it administers), many for specific regions or cities. The lending levels range from \$349 million for the Beijing Environment Project to \$50 million for an Environmental Technical Assistance Project.<sup>139</sup> In the “energy” category, the Bank listed 29 lending projects, of which 3 were renewable energy, one was for energy conservation, 8 were for hydroelectric, and 8 were for thermal power. Others included power marketing projects and more general power development.<sup>140</sup> Overall, the Bank reported a cumulative total of lending in China since it resumed membership in 1980 at \$35 billion as of June 30, 2000. Of this, some 19% was for energy projects, primarily thermal and hydroelectric power, and 12 % was for urban water supply, urban development and environmental improvements.<sup>141</sup>

In its current review of World Bank lending, the Bank’s section, “The World Bank and China” characterized its lending on environment as follows:

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<sup>138</sup>GEF project information is available at: [<http://www.gefweb.org>].

<sup>139</sup>For a list of projects, see [<http://www.worldbank.org>], and search by country and type of project.

<sup>140</sup>For additional discussion of World Bank environmental projects in China, see China Environment Series, *Inventory of Environmental Work in China*, Woodrow Wilson Center Environmental Change and Security Project, Issue 3, 1999/2000. Spring, p. 178 - 188.

<sup>141</sup>Report available on World Bank website, [<http://www.worldbank.org/eap>]

In the past few years, lending for environmental protection has become the fastest growing area of the World Bank's program in China. In FY2000, three projects with aggregate lending of \$700 million were approved, benefitting environmental infrastructure development and policy reforms in Beijing, Chongqing and Hebei Province. The Beijing project, which is associated with Global Environment Fund (GEF) grant, supports the Municipality's clean air program, among other initiatives. The Bank also acts as implementing agency for an array of other GEF projects as well as phase out of ozone-depleting substances funded by the Montreal Protocol. On the policy side, the Bank, SEPA and Norwegian partners are preparing an Environmental Sector Update to support preparation of the next five-year plan—particularly in environmental activities proposed for the western and central areas, in strengthening the environmental dimensions of investment programs in China, and promoting increased cooperation on environmental issues both within China and with the donor community.<sup>142</sup>

The World Bank has been active in conducting studies and compiling statistics on environmental problems in China, and continues to be a significant source of related information (see numerous citations in this report). For example, in February, the World Bank sponsored a workshop in Bangkok, "Fighting Air Pollution: From Plan to Action," which brought together city leaders from large cities across Asia, including Beijing and Shanghai. A World Bank Regional clean Air Initiative for Cities in East Asia was launched to continue information and idea sharing among these cities and donors. The World Bank is cooperating with other multilateral donors on this project including the governments of the Netherlands and Japan, and the Ford Motor Company.

**Asian Development Bank (ADB).** The ADB has provided loans to China since 1986, when China joined the Bank. In its "country highlights" section of its most recent annual report<sup>143</sup> the ADB reports that as of 1999, China had received 79 loans, with a cumulative total of \$5.3 billion in contracts. For 1999, eight loans for six projects were approved, totaling \$1.3 billion, of which the ADB categorized \$102 million as "environmental improvement." The nature of its environmental work in China was characterized by the ADB as follows:

For environmental protection and natural resource management, ADB loans and/or technical assistance addressed priority areas targeted by the Government, such as water pollution control of some major river basins and air and water pollution control in major cities. Of six loan projects approved in 1999, two projects (Suzhou Creek Rehabilitation and Shanxi Environment Improvement) had environmental improvement as a primary objective. Institutional strengthening of agencies involved in environment and natural resource policy planning, management, and enforcement is a key feature of ADB's capacity-building and policy support programs.<sup>144</sup>

The ADB also has a number of projects classified under Energy, which includes several wind power, acid rain control and improved coal methane projects. The Bank

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<sup>142</sup>World Bank. "The World Bank and China," [http://www.worldbank.org/eap], p. 5-6.

<sup>143</sup>See [http://www.adb.org/Countries/Hightlights/PRC.asp]

<sup>144</sup>*Ibid.*

also states its policy of identifying and mitigating the environmental impacts of all types of projects.<sup>145</sup>

## China's Environmental Technology Market

For China to achieve national goals for industrial wastewater treatment, sewage treatment, air pollution control, and energy efficiency, investments in environmental infrastructure must expand significantly. The government's intent to address widespread environmental degradation is reflected, as noted above, in the environmental objectives outlined for the 10th Five-Year Plan. A report supporting the plan identifies projects for which the government intends to seek funding during this period (2001-2005). Project goals include constructing more than 200 wastewater and sewage treatment facilities and installing desulfurization equipment on 51 coal-fired power plants.<sup>146</sup> The investment required for these and other environmental projects in the five-year plan is estimated to be \$85 billion, or roughly 1.3% of China's gross domestic product over the five-year period.<sup>147</sup> Moreover, China's growing pollution control requirements would be expected to create demand for additional environmental technologies and services. For 2001, in fact, the U.S. Department of State has included pollution control equipment on its list of "best prospects" for sales of U.S. goods and services in China.<sup>148</sup>

The following table provides the State Department's unofficial estimates of the value of China's environmental market. The authors note that it is difficult to quantify the market "because accurate data are scarce and environmental goods and services do not fit cleanly into standard customs classifications."<sup>149</sup>

	1998	1999	2000
Total Market Size	4,030	4,700	5,500
Total Local Production	1,800	2,090	2,420
Total Exports	50	65	70
Total Imports	2,280	2,675	3,150
Total Imports from U.S.	360	450	510

Source: U.S. Department of State. FY2001 Country Commercial Guide: China

<sup>145</sup>For further discussion of the ADB projects in China, see China Environment Series, *Inventory of Environmental Work in China*, Woodrow Wilson Center Environmental Change and Security Project, Issue 3, 1999/2000, p.169-173.

<sup>146</sup>U.S. Embassy Beijing. *Environmental Objectives and Investment Requirements for China's 10<sup>th</sup> Five-Year Plan*. November 2000. Available at Internet website: [<http://www.usembassy-china.org.ch/english/sandt10FYP.htm>].

<sup>147</sup>*Ibid.* This estimate assumes an annual growth rate in China of 7.5%.

<sup>148</sup>U.S. Department of State. *FY2001 Country Commercial Guide: China*. p. 2.

<sup>149</sup>U.S. Department of State. *FY2001 Country Commercial Guide: China*. p. 33.

The ability to gain meaningful access to that market is perhaps the key question for interested U.S. companies, and the answer appears to be complex and evolving. The U.S.-China Business Council recently reported that the market for pollution control and abatement technologies will be large, but the competition to participate in that market will be severe:

While most environmental infrastructure projects will continue to utilize domestic equipment and be funded locally, the PRC government is counting on receiving at least 20 percent of total funding from foreign sources - multilateral development institutions, bilateral government programs, non-governmental organizations, and the private sector. Competition to provide environmental services and equipment (an extremely broad category that ... includes water supply and treatment; solid and liquid waste treatment and disposal; pollution monitoring and reduction equipment; clean energy and energy efficiency investments; and engineering/consulting services) will be fierce. Many US companies will be at a disadvantage compared to European and Japanese firms backed by soft loans and more consistent, supportive government policies.<sup>150</sup>

Similarly, the State Department notes that while the overall environmental market in China is growing rapidly, only part of it is truly accessible to foreign firms. The reasons cited for this situation include: low-cost local competition, financing and hard currency constraints, closed bidding practices and other market barriers. However, several products viewed as having the best sales prospects are in the air and water pollution control areas. These include low-cost flue gas desulfurization systems, air and water monitoring instruments, drinking water purification systems, vehicle emissions control and testing devices, industrial wastewater treatment equipment, and resource recovery technologies.<sup>151</sup>

Research by the U.S.-China Business Council resulted in a similar view of “best prospects” for the Chinese market. In March 2000, the Council reported that the market for environmental protection equipment and technology was concentrated in several areas: sewage and wastewater treatment (including treatment of high-density organic wastewater, heavy metals, recycling and resource retrieval); dust removal equipment; desulfurization equipment for coal-burning power plants; noise pollution control and vehicle emissions controls; municipal solid waste incineration equipment and landfills; and monitoring equipment.<sup>152</sup>

Because of the difficulties in gaining access to the Chinese environmental market, most large U.S. environmental firms to date have participated primarily in World Bank and Asian Development Bank projects. The State Department anticipates that, for several reasons, this situation will change. First, environmental spending is expected to increase in China, particularly in the more affluent coastal cities. Also, China’s pending accession to the World Trade Organization (WTO) is expected to help U.S. exporters by reducing tariffs and discouraging import substitution policies. As required of WTO members, China has committed to provide national treatment to foreign investors whereby foreign firms will

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<sup>150</sup>Baldinger, *Environmental Trends and Policies in China*, p.6.

<sup>151</sup>U.S. Department of State. *FY2001 Country Commercial Guide: China*. p. 33.

<sup>152</sup>Baldinger, *Environmental Trends and Policies in China*, p.31.

be afforded the same competitive opportunities, including market access, as are available to domestic firms. The State Department cautions, however, that changes brought about by WTO accession are not expected to be immediate or dramatic in the environmental sector.<sup>153</sup> Finally, the recent reopening of the Trade and Development Agency program in China could also help U.S. businesses to compete for participation in major infrastructure projects.

## Conclusions

It is often noted that China's efforts to address air and water pollution and other environmental problems occur within a context of widespread poverty, population pressures, a shortage of natural resources, and outdated industrial infrastructure.<sup>154</sup> The types of environmental issues that China faces are typical for much of the world, but what makes China different from most countries is the vast scale of these challenges. During the past 20 years, the government has enacted numerous laws that address environmental protection and natural resource conservation. As overall environmental degradation has worsened in recent years, China has accelerated efforts to address pollution problems for human health, environmental, and economic reasons. It has done this while continuing rapid economic growth and in an evolving legal and institutional environment.

China's environmental protection efforts have already shown significant results. According to the World Bank,

the three most important [environmental results] have been a broad-based and absolute reduction in industrial air and water pollutant emissions during the second half of the 1990s, achieved thanks to a combination of regulation and industrial reform; the reversal of deforestation through massive investments in reforestation and afforestation; and reversal of secondary salinization in irrigation areas through major programs of both control and prevention during the 1980s and extending into the 1990s. These achievements are arguably unprecedented in any country at China's state of economic development and provide a strong indication that, given a high level of political commitment, real progress can be made.<sup>155</sup>

Although progress is noted, the Bank anticipates that the environmental challenge facing China is likely to become far greater and more complex over the next decade, and the emphasis will have to shift from "fighting fires" to pollution prevention ... a challenge familiar to all countries.

China's continuing industrialization and quickly growing demand for automobiles, appliances and other consumer goods will add to the challenges the country faces in controlling pollution. The opening of China's markets, largely through accession to the WTO, is expected to increase foreign access to the Chinese market and potentially hasten

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<sup>153</sup>U.S. Department of State. *FY2001 Country Commercial Guide: China*. p. 34.

<sup>154</sup>See for example, Michael Palmer, *Environmental Regulation in the People's Republic of China: The Face of Domestic Law*. The China Quarterly. 1998. p.788-808.

<sup>155</sup>World Bank. *China's Environmental Issues: The Bigger Picture*. News release regarding World Bank team's completion (final draft) of sector study on China's environmental protection efforts. March 7, 2001.

the availability of cleaner, more efficient technologies and products. Such foreign involvement could be an important factor in mitigating some of the pollution associated with such growth and might assist in making China's future development to be less polluting than its past.

The U.S. Embassy in China recently observed that environment has become a national priority in China, and pollution control is being taken seriously. The reasons for this heightened interest are multiple and include recognition by more officials at various government levels that economic progress is being hampered by heavy pollution, and by citizens increasingly concerned about the quality of the air they breathe and the water they drink. The Embassy also projected that additional progress will be made during the next 5 years, "as new projects come on line, as new enforcement and monitoring techniques are adopted, and as citizens become ever more interested and active" on environmental issues.<sup>156</sup> Economic growth will remain the priority for the government; however, by most accounts, it appears likely that environmental problems will increasingly be pursued along with economic progress.

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<sup>156</sup>U.S. Embassy, China. Fighting Pollution in Sichuan: Mixed Results. A December 2000 report from U.S. Consulate General Chengdu. See: [<http://www.usembassy-china.org.ch/english/english/sandt/SHICUAN-ENVIRONMENT.html>].