

# FINANCING ENVIRONMENTAL INVESTMENTS IN CHINA: A PRELIMINARY STUDY

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## **1. Introduction**

1. The financing of environmental investments is fundamental to achieving goals of pollution control and environmental improvement. In many developing countries, however, economic constraints mean that competition for scarce public funds is often intense, and more financial resources may flow to poverty eradication programmes than to environmental ones. Since China implemented its "open door" foreign economic policy in the late 1970s, the country has witnessed rapid economic development. A consequence of this has been increased pollution, which both politicians and policy-makers recognise must be addressed urgently if adverse short- and long-term environmental, economic and public health impacts are to be reduced. However, pollution control requires both a coherent policy framework and a sound investment strategy if it is to address problems effectively and efficiently. The various departments within government responsible for environmental policy and natural resource management need to co-operate in developing coherent strategies that utilise existing sources of environmental financing more effectively and examining potential new sources of funds.

2. An environmental financing strategy can help provide guidance about ways to bridge the gap between the demand and supply of environmental investments and thereby facilitate the achievement of environmental objectives. By reference to the environmental financing strategy methodology developed by the OECD, this paper analyses China's environmental financing strategy for the next five years (2001-2005). The authors suggest that in this period the demand for environmental investment in China cannot be met if sole reliance is placed on current financing sources. Accordingly, new financing sources need to be developed.

3. The paper is structured in four parts. In the first part, the demand for environmental investment in China in the next five years is examined briefly. Particular emphasis is given to controlling water pollution. The second part discusses the supply side of environmental investment, focusing on the financing gap under the present situation. In the third part, the environment financing strategy proposed for the next five years to overcome the gap is discussed. The final part presents conclusions.

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## 2. Analyzing the Demand for Environmental Investment in China, 2001-2005

### 2.1 Structure of the Demand for Environmental Investment

4. The demand for environmental investment refers to the funds needed for implementing environmental projects. This can be broken down into different categories such as the demand for investment in public environmental infrastructure projects, pollution control projects in industrial enterprises, institutional capacity building, and operation and maintenance costs associated with pollution control facilities. For convenience, the demand for environmental investment can be expressed as:

$$I_D = I_{inf} + I_{ent} + I_{cap} + I_{O\&M}$$

Where:  $I_D$  is the total demand for environmental investment;  $I_{inf}$  is the investment demand by environmental projects;  $I_{ent}$  is the investment demand by enterprises for pollution control;  $I_{cap}$  is the investment demand to support institutional capacity building;  $I_{O\&M}$  refers to the investment demand associated with operating and maintaining public and industrial pollution control facilities. Generally speaking, investment in pollution control in China includes  $I_{inf}$ ,  $I_{ent}$  and  $I_{cap}$ , but not  $I_{O\&M}$ .

5. A different way to classify the demand for environmental investment is by pollution media and natural resource protection. Investment demand is then broken down into that required to control air and water pollution, for solid waste treatment and disposal, and for environmental protection, etc.

### 2.2 Overall Demand for Environmental Investment in China, 2001-2005

6. China's 10<sup>th</sup> five-year plan spans the period 2001-2005. During this period, China intends to strengthen its environmental pollution control in order to address the effects of air, water and other types of pollution, to reduce damage to the country's terrestrial and aquatic ecology as well as to improve the environmental quality in major cities and regions. Investment in pollution control must increase to achieve these goals. The demand for environmental investment in pollution control during the next 5 years will exceed 1.3% of GDP, or 700-800 billion yuan<sup>1</sup>. Of this total, about 250 billion yuan will be used to address water pollution. In the next section of the paper we consider the case of investment in water pollution control in more detail.

### 2.3 Demand for Investment in Water Pollution Control, 2001-2005

#### 2.3.1 Water Pollution in China: An Overview

7. The pollution of water in rivers and lakes is a major environmental problem in China. Wastewater control measures have been inadequate in managing the adverse environmental effects associated with rapid economic development, resulting in major river basins suffering increasingly serious water pollution. For example, the country's seven main river systems are all polluted to varying degrees. The main water pollutants are organic substances, ammonia, nitrogen and volatile hydroxybenzene, all of which impact upon chemical oxygen demand (COD).

8. In many cases pollutant discharges into waterways exceeds the latter's assimilative capacity. Approximately 25 billion tons of wastewater from industrial sources was discharged in 1999, together with 6.9 million tons of COD and 5.3 million tons of suspended solids (Editorial Committee of China

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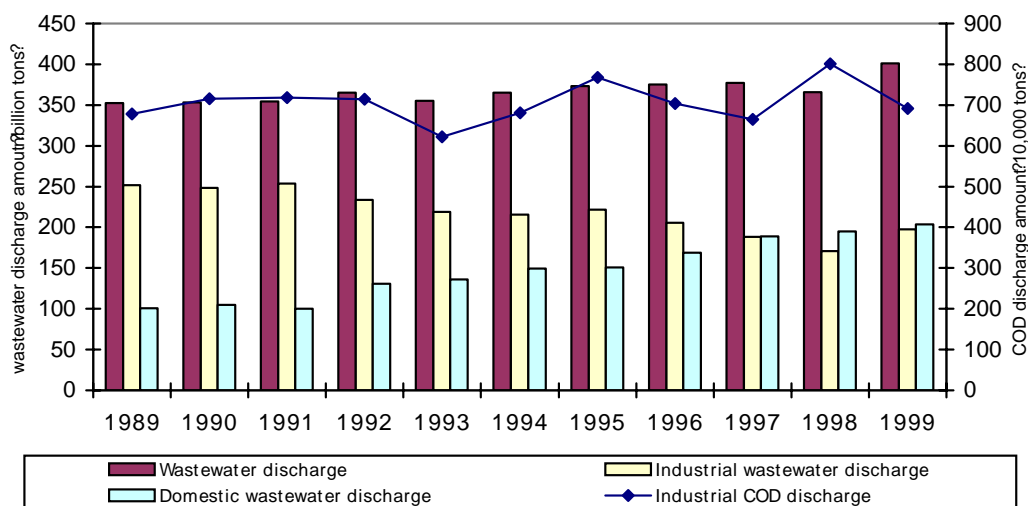
<sup>1</sup> US\$1 = 8.2770 yuan <<<http://www.bloomberg.com/markets/wcv1.html>>> accessed 2 November 2000.

Environmental Yearbook, 1999; see also Figure 1). Considerable quantities of untreated domestic sewage and wastewater were also discharged directly into rivers, lakes and marine waters. Approximately 20.4 billion tons of treated domestic wastewater was discharged in 1999.

9. Since 1997 water pollution from urban domestic sources has exceeded that from industry. In the next 5 years, China's total population is projected to increase by 85 million people and the urban population alone by 70 million. After 2005, the rate of growth in the urban population will surpass the national population growth rate. The urgency of establishing new, or upgrading existing, wastewater treatment plants arises from the range of anticipated pressures on the quantity and quality of water resources. These pressures include continued population growth, an increased rate of urbanization and further industrialisation<sup>2</sup> as part of the economic modernisation process. In 1995, the government implemented the so-called "one control and two compliance" policy targeted at industrial polluters and which aims to ensure their compliance with relevant discharge and emission standards by this year, with particular emphasis on their compliance with ambient standards in urban areas. Indirectly, it is hoped the policy will encourage some restructuring in the industry sector.

**Figure 1.: Quantity of Wastewater Discharged, 1989-1999**

Source: China Environmental Yearbook, 1989-1999.

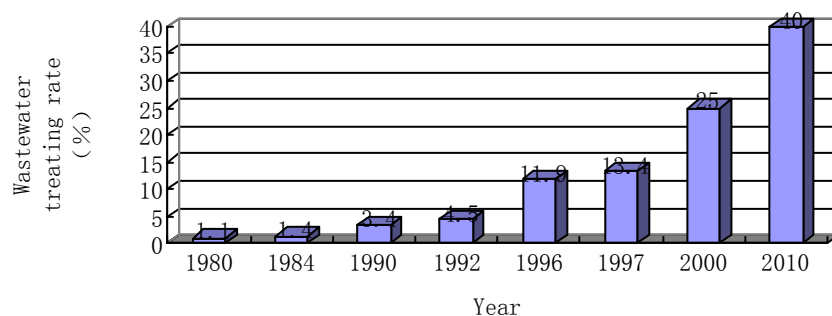


10. Figure 2 shows that currently the proportion of urban wastewater in China that is treated before discharge is about 25%, a rather low figure. The increase, albeit slight, in the total quantity of wastewater discharged over the decade 1989-1999 reflects the contribution from rural enterprises and agricultural non-point sources as well as from industry and urban areas. Pollution from these different sources represents the basis for considering the demand for investment in the water sector in China. Accordingly, urban wastewater treatment and river basin wastewater management will be the focus of water pollution control in next five years.

**Figure 2.: Centralised Urban Wastewater Treatment (%), 1980-2010**

<sup>2</sup> The installation of newer, more resource efficient technologies associated with cleaner production offers the potential to reduce demand for water, energy, raw materials and other inputs. Financial, organisational and other barriers to the uptake of such technologies should not be under-estimated, however.

Note: Figure for 2000 is estimated and that for 2010 a projection.



### 2.3.2 Water Pollution Control: Goals and Demand for Investment

11. If it is assumed that 50% of China's cities with a population over 500,000 will establish centralised urban wastewater treatment facilities in the next 5 years, the newly-created treatment capacity will be 40 million tons/day. In addition, if the compliance rate with industrial wastewater discharge standards reaches 95% the total amount of COD discharged in 2005 will be the same as that recorded in 2000.

12. Nationally, COD discharge in 1998 was 15.88 million tons and this is estimated to reduce to about 14 million tons in 2000. It is projected that during the period 2001-2005, COD of domestic wastewater sources will increase by 1.5 million tons. In order to meet the target level established by the government, however, 4.88 million tons of COD discharge must be reduced by 2005. The commissioning of newly-established wastewater treatment facilities in the next five years will reduce the COD loading by 3 million tons, leaving a gap of 1.88 million tons between the projected and target figures. Approximately 250 billion yuan of investment will be needed to upgrade the quality of water bodies graded below Class V. Of this sum, 100 billion yuan will be required for the construction of urban wastewater treatment plants and the remaining 150 billion yuan used to finance projects aimed at controlling existing water pollution sources, undertaking comprehensive river basin management and pollution control and the construction of pollution control facilities under the “three simultaneous steps”<sup>3</sup> requirement for new or expanded projects.

### 2.3.3 Wastewater Pollution Control Projects

13. Water pollution control is to be achieved through the implementation of a series of projects. Since the beginning of the 9<sup>th</sup> five-year plan in 1996, China has taken steps to implement the “China Transcentury Green Engineering Program”. This aims to encourage good planning for key environmental projects, to evaluate their design using a specific assessment system and to facilitate their implementation. Phase I of the program ended in 1999, by which time 1053 projects had been commenced or completed. This accounted for 66% of the total projects designed and 90.34 billion yuan had been expended (60.2% of the total project investment planned). Sixteen provinces and municipalities achieved a project inception and completion rate over 80%. Overall, the implementation of the 9<sup>th</sup> five-year plan has played an important role in improving China’s environment.

14. Phase II of the Transcentury Green Engineering Program will be implemented during the period 2000-2005. The emphasis will be on the integrated environmental management of river basins and marine

<sup>3</sup> This requires that pollution prevention and control measures are incorporated into the design, construction and operation of all new projects and the expansion or upgrading of existing ones.

areas, the development of regional and urban environmental infrastructure, control of key pollution sources and comprehensive waste reduction and re-use, nature conservation and protection of biodiversity. Approximately 1200 projects and 200 billion yuan in investment are planned in this phase. The government intends to contribute 100 billion yuan to the program, focusing on controlling river basin pollution, environmental infrastructure construction in major cities, establishing nature conservation areas and biodiversity protection programs and supporting the development of new policies and technical demonstration projects. In this context, the Transcentury Green Program is expected to contribute substantively to strengthening environmental management in China.

15. Pollution control projects in major river basins and marine areas are given priority in Phase II of the Transcentury Green Program. This is consistent with the environmental protection goals set out in the 10<sup>th</sup> five-year plan. Strategies and concrete projects for water pollution control will focus on improving water quality, strengthening administrative co-ordination and reducing the total volume of pollution.

16. Information provided by the relevant government agencies indicates that in the next five years approximately 450 water management projects will be implemented within the framework of the Transcentury Green Engineering Program, requiring about 90 billion yuan of investment. The construction of wastewater treatment plants will account for about 300 of these projects and investment needs will be in the order of 65 million yuan (or 70% of the total investment figure). This reflects the government's high priority in building new urban wastewater treatment plants in the next decade but it also highlights the important role that environmental financing will play in facilitating the achievement of the target set. Geographically, the main river basins targeted are those of the Yangtze and Yellow rivers and the major provinces where investment in water pollution control projects will be concentrated are Chongqing, Jiangsu, Shanghai and Zhejiang.

#### 2.3.4 *Principal Technologies and their Costs*

17. Wastewater treatment plants that provide treatment of primary and secondary standards are the main facility to be built in China in the next five years. Given that the cost of wastewater treatment is a function of the amount treated, construction of a central wastewater treatment plant can reduce the overall investment cost, improve treatment efficiency and contribute to pollution control over a broad area. For this reason, the construction of urban wastewater treatment plants is identified as a priority in the 10<sup>th</sup> five-year plan.

18. According to the 1996 Ministry of Construction document entitled *Estimated Cost Indexes for National Municipal Project Investment*, the investment in urban wastewater treatment plants is expected to be in the range 650-1000 yuan/m<sup>3</sup>/d for plants that provide treatment of a primary standard and between 1500-2700 yuan/m<sup>3</sup>/d for plants meeting secondary treatment standard (the average investment figure estimated by the Ministry of Construction is 825 and 2100 yuan/m<sup>3</sup>/d respectively). Urban wastewater is required to meet secondary treatment standards, for which the investment required is 2,925 yuan/m<sup>3</sup>/d. Investment in a sewage collection system is estimated at 42-118 yuan/m<sup>3</sup>/d/km, with an average figure of 80 yuan/m<sup>3</sup>/d/km. Based on a discharge distance of 10 km, the required investment in a sewage collection system will be 800 yuan/m<sup>3</sup>/d. The combined figure for investment in a wastewater treatment plant and sewage collection system is 3725 yuan/m<sup>3</sup>/d, assuming an annual water treatment quantity equal to 10yuan/m<sup>3</sup>. The presently inadequate number of urban wastewater treatment plants means is to be addressed as a high priority. The design and procurement of the necessary plant is expected to be undertaken domestically. It is estimated that the investment of 100 billion yuan could result in treatment capability approaching 40million tons/day at a cost of 2500 yuan/m<sup>3</sup>/d.

19. In the area of industrial wastewater control, different sectors have adopted different treatment standards. Water discharged from industrial point sources can be treated in urban wastewater treatment plants only if it has been pre-treated and only if it meets the inflow standard of the wastewater treatment plant. The structure of industrial wastewater pollution has clear characteristics. In 1998, three sectors -- chemicals, paper manufacturing and metal smelting -- accounted for half of the total wastewater discharged nationally, while the paper manufacturing industry alone discharged half of the total COD from the industry sector. Of the various sectors in China's economy, those in industry contributing the largest pollution intensity per unit output are paper manufacturing, electric power generation, chemicals, mining and metal smelting. Industrial activities account for the largest environmental cost per unit output. In this context, controlling industrial water pollution will be a focus of future policy and enforcement efforts in China. During the 9<sup>th</sup> five-year plan (1996-2000) discharges from industrial point sources decreased in terms of their share of total pollutant discharge and it is hoped that this trend will continue. Based on the "one control and two compliance" policy, industrial pollution sources will be controlled through measures that include industrial sector restructuring, modernisation of equipment and the introduction of cleaner production technologies and practices to promote pollution prevention.

### 3. Environmental Investment: Supply Side Analysis

20. The total demand for environmental investment during the next five years will be 250 billion yuan. Of this sum, 100 billion yuan will be required from central and lower levels of government to fund the construction of new urban wastewater treatment plants. A further 50 billion yuan will be needed to finance investment to control existing pollution sources and the remaining 100 billion yuan will be used for pollution control projects subject to the "three simultaneous steps" regulation. Enterprises will be required to finance the two latter items themselves.

21. In addition, the operating costs of wastewater treatment plants are not insignificant. At present, a wastewater treatment plant of 100,000 tons capacity requires 100 billion yuan to cover annual operation and maintenance costs, exclusive of depreciation and interest payments on loans. By the end of 2005 when new urban wastewater treatment plants capable of treating 40 million tons/day are in place, their operation and maintenance costs will be 4 billion yuan per year. The annual operating cost of existing urban wastewater treatment plants and plants during the next five years will be up to 5 billion yuan.

#### 3.1 Comparing Planned and Actual Investment Between 1981-2000

22. The planned and actual environmental investments spanning the period from the 6<sup>th</sup> (1981-1985) to the 9<sup>th</sup> (1996-2000) five-year plan is shown in Table 1. The figures indicate that in both the 7<sup>th</sup> and 8<sup>th</sup> five-year plan period actual investment exceeded planned investment. However, a comparison on the basis of proportion of GDP shows that the figure for actual investment was less than that for planned investment during the 8<sup>th</sup> five-year plan period: 0.73% and 0.8% respectively. In the 9<sup>th</sup> five-year period (1996-2000) planned environmental investment is expected to be 450 billion yuan (or 1.3% of GDP). Data from the last four years indicates that the actual investment totals about 338.61 billion yuan (or 0.95% of GDP). The difference between planned and actual investment is thus a shortfall of 111.39 billion yuan. Without extra funds to cover this gap, national environmental objectives cannot be achieved.

**Table 1. Comparison of Planned and Actual Environmental Investments, 1981-2000**

Five-year Plan	Start & end date of five-year	Planned investment (billion yuan)	Share of GDP (%)	Actual investment (billion yuan)	Share of GDP (%)	Difference between planned &
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	plan					actual investment (billion yuan)
6 <sup>th</sup>	1981-1985	-	-	17.0	0.49	
7 <sup>th</sup>	1986-1990	33.0		47.6	0.69	
8 <sup>th</sup>	1991-1995	83.0	0.8	130.60	0.73	
9 <sup>th</sup>	1996-2000	450.0	1.3	338.61	0.95	111.39
Break out of figures for each year in the 9 <sup>th</sup> five-year plan	1996			40.80	0.61	
	1997			50.20	0.69	
	1998			65.29	0.84	
	1999			82.32	1.00	
	2000*			100.0	1.20	

\* Figures for 2000 are estimates, and assume that the economy grows by 7.5%.

23. Investment in industrial water pollution control and urban infrastructure development exhibited a gradual upward trend. In 1998, investment in industrial wastewater control was 7.16 billion yuan. The figure for investment in urban infrastructure in the same year was 15.4 billion yuan, principally to fund new domestic wastewater treatment facilities (see Table 2). In the first three years of the 9<sup>th</sup> five-year plan period, total investment in industrial wastewater pollution control and domestic wastewater treatment projects was 156.29 billion yuan. The average annual investment was thus 52 billion yuan over this period (i.e. 156.29 billion yuan/3 years), which was less than the amount of annual planned investment of 90 billion yuan identified in the five year plan period (i.e. 450 billion yuan/5 years, equating to 90 billion yuan annually). This indicates that the supply of investment funds did not match demand, limiting prospects for achieving water pollution control goals.

**Table 2. Investment in Water Pollution Control, 1991-1999**

Year	Investment in industrial pollution control projects (billion yuan)	Investment in urban wastewater treatment projects (billion yuan)	Total investment (billion yuan)	Proportion of GDP (%)
1991	2.921	1.606	4.527	0.21
1992	2.981	2.085	5.066	0.19
1993	2.942	3.700	6.642	0.19
1994	3.470	3.826	7.296	0.16
1995	4.559	4.801	9.360	0.16
1996	4.741	6.682	11.423	0.17
1997	7.279	9.013	16.281	0.22
1998	7.168	15.452	22.620	0.28
1999	6.867	..	..	..

### 3.2 Traditional Sources of Financing Pollution Control

#### 3.2.1 Overall Situation

24. Under China's planned economy all responsibility for environmental protection was vested in the government. From 1973 to the early-1980s, all funding for environmental investments (targeted mainly at industrial pollution control) was sourced from the state budget. However, as China makes the transition to

a market economy environmental financing sources have diversified. A major reason is that since the late-1980s it has been recognised that the demand for financing pollution control projects cannot be met through reliance on funds provided by the state budget. In this context, eight sources of environmental financing have been identified. Funds are sourced from:

- levies imposed on new construction projects;
- levies imposed on the renovation of existing plants and charges on users of recreational facilities;
- fees, taxes and charges related to the construction of urban infrastructure;
- the pollution levy imposed on non-compliance discharge (this is used to subsidise pollution control projects in enterprises that pay the levy);
- money raised by selling products capable of re-use under the “three kinds of waste” policy;
- loans from banks and other financial institutions;
- specific environmental funds for pollution control established by various levels of government; and
- money allocated for capacity building from the budget of environmental protection departments (State Environmental Protection Administration, 1993, 1999).

25. The first three listed sources are the main ones in terms of revenue. The breakdown for the different environmental financing sources during 7<sup>th</sup>, 8<sup>th</sup> and the majority of the 9<sup>th</sup> five- year plan periods is shown in Table 3. The table indicates that funds derived from the “three simultaneous steps” regulation and the renovation of existing facilities showed a downward trend. On the other hand, fund contributions from urban infrastructure construction developments rose.

26. All new construction projects and the expansion of existing plants are subject to the “three simultaneous steps” regulation. Accordingly, they are required to make provision for industrial pollution prevention and control measures in their fixed capital investment plans. In 1999, 4% of total project investment was used to fund such measures.

27. Under the plant renovation and recreation category, seven percent of the funds raised are set aside for investment in pollution control. This proportion can be increased to address serious pollution problems. Management responsibility falls to the provincial economic commission and relevant local public utility department. Enterprises receiving funds from this source are required to use it for pollution control investments and may supplement it by using money from their own sources. With the gradual shift towards a market economy, the government is progressively reducing its contribution from the state budget and enterprises are expected to meet the cost themselves, reflecting the polluter-pays principle.

28. The construction of urban infrastructure projects provides a further source of funds for environmental financing. They include the urban maintenance fee levied by large and medium sized city administrations, the urban construction and maintenance tax and local charges. The revenue is used to support investment in pollution control measures and comprehensive urban environmental planning. The total amount of urban environmental investments is trending up while the share used to fund infrastructure projects shows a variable pattern (see Table 4).



**Table 3. Sources of Environmental Investment, 1986-1999**

Year	Total annual investment (billion yuan)	Of which funds contributed by (in billion yuan):					
		Levy on construction projects (1)	Levy on renovation and redevpt. projects	Levy on urban infrastructure construction	Pollution levy	Revenue from the "3 kinds of waste" policy	Other sources
7 <sup>th</sup> five-yr plan period (1986-1990)	476.42	35.72	12.11	32.25	6.83	1.16	11.93
1991	17.01	34.39	34.78	32.79	11.93	1.25	16.21
1992	20.56	33.81	8.73	34.78	12.06	1.05	9.57
1993	26.88	32.73	7.77	39.54	10.81	1.19	7.96
1994	30.72	34.94	8.07	36.83	10.58	1.09	8.49
1995	35.49	35.54	8.07	36.85	9.69	1.29	8.56
8 <sup>th</sup> five-yr plan period (1991-1995)	1306.57	34.4	8.4	36.6	10.8	1.18	8.7
1996	40.82	31.52	3.93	41.85	9.07	1.64	11.35
1997	50.25	28.51	2.49	51.20	9.12	1.84	6.85
1998	65.29	23.38	1.94	59.44	7.59	1.43	6.09
1999	82.32	24.17	2.05	58.18		1.06	

(1) Includes levy on construction work undertaken in older enterprises.

Sources: China Environmental Yearbook 1996-1999; State Environmental Protection Administration.

**Table 4. Total Urban Environmental Investment and Share Used to Fund Infrastructure Development, 1991-1999**

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total urban environmental investment (million yuan)	55.8	71.5	106.3	113.2	130.8	170.8	257.3	388.9	478.9
% used to fund urban infrastructure projects	32.79	39.54	39.54	36.83	36.85	41.85	51.20	59.56	

29. A portion of the revenue raised by the pollution levy is used for funding pollution prevention and control measures. In accordance with the "Temporary Measures for Collection of the Pollution Levy" issued by the State Council in 1982, local governments collect levies from enterprises that are not in

compliance with the relevant emission standards. The revenue is channeled to a specific fund for pollution control and capacity building in local environmental institutions. At present there is no environmental fund established at the national level but virtually every province, municipality, city or county has such a fund in place. The pollution levy is the main source of revenue for these funds. One implication of the government's requirement that all emissions conform to the specified standards by the end of 2000 is that revenue collected under the pollution levy will fall.

30. In considering the establishment of a national environmental protection fund, the focus should be on funding investments to reduce pollution at the regional and river basin levels rather than at the enterprise level. Existing funds for environmental protection include the environmental subsidy fund, which is jointly managed by the local environmental protection bureau and finance department and subsidises investment by enterprises in pollution control measures; and environmental loans, which are established using a share of the revenue raised by the pollution levy. Sub-national environmental protection departments manage the disbursement of loans in accordance with the Temporary Procedures for Repayment Specific Funds for Pollution Control issued by the State Council in 1988.

31. China's State Environmental Protection Administration (SEPA) has carried out a pilot project on the proposed reform of the pollution levy, in which the charge base is changed from pollutant concentration to total load of pollutants discharged. Under this approach, any discharge will be subject to the pollution levy and revenue can be generated on the basis of appropriately designed charge rates.

32. Products which are re-usable as raw material can be sold under the "three kinds of waste" policy, with the revenue being retained by the enterprise. The purpose is to provide them with both an economic incentive to reduce the total volume of waste and flexibility in how the money so raised will be used.

33. Other sources of funds for pollution control include grants, commercial loans (excluding environmental loans), foreign aid and those contributed by the enterprises themselves.

### 3.2.2 *Industrial Pollution Control*

34. The control of industrial pollution has traditionally been the main focus of environmental protection efforts in China. Financing sources include levies associated with the "three simultaneous steps" regulation and plant renovation projects, charges for recreational facilities usage, revenue from selling re-usable products under the "three kinds of waste" policy, the environmental subsidy fund, environmental loans and others (see Table 5). A comparison of tables 3 and 5 shows that investment in industrial pollution control accounts for a relatively small proportion of total environmental investment. For example, total environmental investment in 1996 and 1997 was 91.09 billion yuan while for the same period investments in industrial pollution control was just 20.97 billion yuan (or 23% of total environmental investment).

35. Projects to control air and water pollution receive most funding. There were 2647 water pollution control projects in 1996, with total investment reaching 4.74 billion yuan or an average of 1.79million yuan/project. In 1998 there were 7376 projects targeting water pollution control and the total investment was 7.17 billion yuan, representing an average investment of 0.97million yuan/project (see Table 6).

**Table 5. Financing Sources for Industrial Pollution Control, 1992-1998**

Year			Total annual investment (mill. yuan)			Of which funds contributed by (in million yuan):		
		Levy on construction projects	Levy on renovation and redevpt. projects	Revenue from the "3 kinds of waste" policy	Env. subsidies	Env. loans	Other sources (except foreign funds)	Foreign funds
1992	623.89	21.9	28.1	3.4	17.1	9.6	29.5	
1993	680.75	19.0	30.2	4.6	15.5	5.9	30.6	
1994	814.41	22.3	30.1	4.0	12.3	7.3	31.2	
1995	954.36	24.2	29.6	4.7	10.5	6.1	30.8	
1996	932.97	19.4	17.2	7.2	3.6	5.7	46.9	5.6
1997	1164.39	12.4	10.7	7.9	3.2	8.1	57.5	2.6
1998	1220.46	8.7	10.4	7.7	3.7	7.4	62.2	3.6

Source: China Environmental Yearbook, 1993-1999.

**Table 6. Number of Projects and Investment Amount by Media, 1996-1999**

Year	Wastewater		Air emissions		Solid waste		Noise		Other	
	No.^	Invest.*	No.	Invest.*	No.	Invest.*	No.	Invest.*	No.	Invest.*
1996	2649	474.1	3012	280.8	450	90.98	504	9.59	375	100.79
1997	4243	727.91	3431	287.23	425	63.09	493	8.28	393	77.88
1998	7376	716.79	5153	323.81	628	87.24	551	7.66	666	84.95
1999		688		510		83		9		237

^ No. refers to number of projects

\* Investment amount unit is million yuan.

Source: China Environmental Yearbook, 1997-1999.

36. In the past the budgetary allocation to enterprises from the central government enabled the former to pay the requisite levies on new and renovated construction projects. Today, enterprises are responsible for their payment from their own financial resources. The funding of investment in urban environmental infrastructure is still borne by the government at present. And it also provides environmental protection subsidies and environmental loans. Over time and parallel with the shift to a market economy, the government has changed its policies so that environmental financing is a responsibility increasingly shared with industry.

37. It is expected that in the next 5 years revenue from construction projects subject to the "three simultaneous steps" regulation, the levy imposed on renovation and redevelopment projects and environmental subsidies will be all increased by 10%. The total for each would then be 53.03 billion, 5.56

billion, 83.34 billion and 17.23 billion yuan (see Table 8). Approximately 36% of the total funds available for environmental investment may be directed to water pollution control projects<sup>4</sup>.

### 3.3 *Financing Environmental Investment in China: New Approaches*

38. In recent years, China has experimented with several new approaches in financing environmental investments. They include the use of foreign funds, government bonds, funds generated from the listing of enterprises on the stock market and corporate bonds.

#### 3.3.1 *Use of Foreign Funds*

39. This includes foreign funds made available to, or guaranteed by, the government and those raised overseas by enterprises themselves. In this paper we focus on foreign funds made available to the government. During the 8<sup>th</sup> five-year plan period China utilised US\$1.177 billion of such foreign funds while in the 9<sup>th</sup> five-year plan period this figure is expected to rise to US\$4 billion. Between 1996 and 1997, loans made available to China for environmental projects by the World Bank, Asian Development Bank, Japan and other countries totaled US\$4 billion. In 1998, US\$3.02 billion of foreign funds were used in environmental protection projects. Of this sum, US\$0.42 billion was provided as grants and US\$2.6 billion in loans (see Table 7). The grants were used principally to meet China's commitments under various international agreements while only a small amount was used for local institutional capacity building and investment in pollution control. In the case of the loans, the majority was used to fund pollution control projects with a small amount used for capacity building purposes.

**Table 7. Funds Provided to China for Environmental Projects By International Sources in 1998 (US\$ billion)**

Type	Total	Amount spent on pollution control*	Amount spent on meeting international commitments	Amount spent on capacity building	Source of funds
Grant	0.42	0.01	0.37	0.04	International financial institutions, developed countries, foundations
Loan	2.6	2.47	0.13	0	International financial institutions
<b>Total</b>	<b>3.02</b>	<b>2.48</b>	<b>0.50</b>	<b>0.04</b>	

\* Includes projects under the China Transcentury Green Engineering Program.

Source: China Environmental Yearbook, 1999.

40. The availability and use of foreign funds is an important mechanism to support the Chinese government's goal of modernising the economy and strengthening environmental management. One estimate is that about US\$8 billion would be needed from foreign sources to ensure protection of China's environment.

<sup>4</sup> This is calculated from the proportion of total environmental investment expected to be directed to water pollution projects, as indicated in Table 8.

### 3.3.2 Wastewater Treatment Charges

41. A joint document issued by the State Development and Planning Commission, the Ministry of Construction and the State Environmental Protection Administration invokes the user-pays principle as the basis for strengthening both the collection of wastewater treatment charges and centralized treatment of wastewater in order to improve urban wastewater management. Prior to the issuance of the document some provinces and municipalities had already initiated charging for urban wastewater treatment. However, because of the low charge rate the revenue collected did not cover the operating cost of treatment plants. In light of factors such as the domestic economic situation, polluters' ability to pay and degree of water pollution, wastewater treatment charge rates will be locally regulated and no unified national charge rate is expected in the short term.

42. In 1998, there were 266 wastewater treatment plants with a capacity of 11.36 million tons/day. Annual operating costs totaled 1.07 billion yuan (China Environmental Yearbook 1999:538). From this, the average operating cost of urban wastewater treatment plants is calculated as 0.4 yuan/ton. In the opinion of the relevant government agencies, the charge rate for wastewater treatment will be not less than 0.2 yuan/cubic meter for the time being (calculated on the basis of water consumption). Since there is a coefficient of about 0.7 between water consumption and water discharge, a charge rate of 0.4 yuan/ton will be difficult to attain in the near future. In the next five years treatment capacity is expected to reach 400 million tons/day, and assuming that the increment of wastewater treatment capacity for each year keeps pace with demand, then at the end of that time 70% of the available capacity will be utilised and the charge rate would be 0.7 yuan/ton. By that time, approximately 24.63 billion yuan will have been generated by applying the user-pays principle while at the same time the operating cost of the treatment plants will be 23.6 billion yuan. A small surplus of just over 1 billion yuan would remain.

43. Some local governments have begun to collect wastewater treatment charges even though the wastewater treatment plant has yet to be built. The rationale is to collect revenue now to finance the plant's eventual construction. Paying in advance is quite different to the user-pays principle.

44. If the construction of wastewater treatment plants is to be financed by charges then the existing charge rate will need to be increased. This will create problems in terms of users' ability to pay, however. In 1998, an urban family's average annual income was 5458.34 yuan and expenses totaled 4331.6 yuan (State Statistics Bureau 1999). Assuming that:

- 5 tons of water is consumed per person per month;
- the water treatment charge is 0.5yuan/ton; and
- the wastewater quantity is calculated as 80% of the total amount of water consumed

then the wastewater treatment charge accounts for 0.4% of the family's total income. Maintaining this percentage is likely to be acceptable to urban residents so long as other expenses either stay the same or change only slightly.

### 3.3.3 Government Bonds

45. The Asian financial crisis impacted heavily on Malaysia, Philippines, Thailand and Korea but it also had implications for China's economic development goals. China did not devalue its currency and this affected its trade competitiveness. The government adopted measures to stimulate domestic demand and to promote investment in infrastructure development as well as raising funds by issuing bonds. In 1998 the central government issued bonds totaling 100 billion yuan, followed in 1999 by a further issue to the value of 60 billion yuan (later increased to 110 billion yuan). To promote fixed capital investment and economic

development, it is expected that in the year 2000 government bonds issue will approach 100-150 billion yuan in value. The funds generated will be used for the development of infrastructure in the agriculture sector, and water conservancy and transportation projects.

46. Bonds are also used as an instrument to help finance the development of urban environmental infrastructure. In 1999, the government issued bonds worth 60 billion yuan for this purpose. Of this total, 13.8 billion yuan, or 23.1%, was used for urban infrastructure construction and pollution control projects in the “three lakes and three rivers” water basins as well as in the Beijing metropolitan area.

47. The amount of special government bonds to be issued during 10<sup>th</sup> five-year plan period remains unclear for several reasons. First, the rate of economic growth is fluid, although figures for the first half of the year were better than for the same period in the previous year. Second, the number of good projects in which to invest is decreasing. Bond issues in 1998 and 1999 were used to finance the best projects and potential candidates are now fewer or less attractive. In addition, local governments are reluctant at this time to purchase more bonds and to take on the associated financial commitment. Notwithstanding these comments, it is estimated that bonds to the value of 50 billion yuan will be used to finance environmental investments in the next five years.

#### 3.3.4 *Stock Market Financing*

48. The involvement of listed environment-related companies as both passive and active investors in environmental projects is new in China. For example, an article in the Economic Daily News of June 2, 2000 reported that there were over 30 listed companies in China involved in businesses connected with the environment. According to the 1999 annual report prepared by each company, they were profitable, exhibited excellent overall performance and had high growth potential. At present their business interests include: producing environmental equipment for emissions monitoring, industrial wastewater treatment, power generation, domestic solid waste management, vehicle emissions and noise pollution control; developing new types of environmentally-friendly building materials; producing energy saving devices for vehicles; ‘greening’ the production process in the chemicals and paper-making industries; offering environmental consulting services in areas such as environmental assessment, eco-agriculture and afforestation; and advising on cleaner production technologies and practices. Some of these listed company's offer financing in return for shares in start-up environmental operations and also invest in both established environmental businesses and new projects.

49. As at 16 December, 1999, there were 919 companies listed on the A market board of the Shanghai and Shenzhen stock exchanges. Their shares were then worth 275.9 billion yuan and the total market value of the companies was 2759.8 billion yuan (Ma Hong, 2000). It is projected that in the next 5 years there will be 30 environmental companies listed on the stock market.

#### 3.3.5 *Corporate Bonds*

50. In western capital markets, the corporate bond market is as well developed as the stock market. The corporate bond market in China has developed relatively quickly in recent years and is likely to accelerate during the period of the 10<sup>th</sup> five-year plan. Factors such as the lower cost of issuing this type of bond and the simple issuing procedure mean that enterprises often prefer to use this financial instrument. It represents a new way for enterprises to raise revenue to finance their pollution control investments.

### 3.3.6 Equity Transfer

51. This includes corporatisation of public utilities and services, leasing and the build-operate-transfer (BOT) approach. Environmental infrastructure is regarded as public property in China, which means that both their construction and operation has traditionally been financed from the central budget. Currently SEPA is pushing for corporatisation, leasing of facilities and the use of the BOT model in the construction and operation of environmental infrastructure.

52. Under corporatisation ownership of public infrastructure and services remains with the government but their operation is more commercial in nature so that concepts such as cost recovery and profit are accorded high priority. Globally, there is a trend towards increased corporatisation as governments seek to gain greater efficiencies and returns from their investment in public goods. International financial institutions such as the World Bank and the Asian Development Bank have provided technical assistance to China on the establishment of limited liability companies or listed companies to manage the operations of corporatised utilities. A key concern for these entities is the establishment of realistic charges so that operational and maintenance costs are recovered. Charges for wastewater treatment plants have generally been raised but their level is constrained by local economic conditions within communities.

53. Revenue generated by the leasing of environmental facilities is often re-invested in the construction of new plant. It is a useful way of mobilising finance from existing capital works.

54. The BOT model is a well-established method for infrastructure development. The developer not only builds the facility but also operates it under contract to the government (national or sub-national) as the owner for an agreed period, at the end of which the facility reverts to the owner. Effective implementation of the BOT approach can be complicated. A number of pilot BOT projects have been undertaken in China. The Lainbin electric power plant project in Guanxi province and the water reservoir project in Chengdu city are two examples. For both investors and the government as owner the terms and conditions of the contract are crucial, especially the rights of each party and the calculation of charge levels.

55. There are currently no BOT projects for wastewater treatment plants in China. This is mainly because of the high cost of treating wastewater, generally around 0.5yuan/ton on average, while the unit investment cost for a wastewater treatment plant is about 2100 yuan/ton/day. For a wastewater treatment plant capable of treating 100,000 tons and with a working life of 20 years, the treatment charge rate would need to be about 1.05 yuan per cubic meter of wastewater in order to recover investment and operating costs. Consumers would have to pay more in water treatment charges in addition to a higher price for the supply of water. However, in the present economic conditions it is difficult to raise the treatment charge to this level. This currently makes the BOT approach unattractive to investors for financing wastewater treatment projects.

56. If 1% of new construction projects for wastewater treatment plants is established using the BOT approach, we estimate the total investment required is 0.84 billion yuan. Based on this, the supply of environment investment in such plants is considered below.

57. The total supply of environment investment can be described by:

$$I_S = I_{\text{cap}} + I_{\text{ent}} + I_{\text{ubn}} + I_{\text{use}} + I_{\text{forn}} + I_{\text{bond}} + I_{\text{BOT}} + I_{\text{evnf}} + I_{\text{share}}$$

Where:

- $I_S$  refers to total investment supply for water pollution control;
- $I_{\text{cap}}$  represents the funds sourced from new construction projects subject to the “three simultaneous steps” regulation;

- $I_{ent}$  is the funds from the levy on renovation/redevelopment projects;
- $I_{ubn}$  refers to funds from the levy on urban infrastructure construction projects;
- $I_{use}$  refers to revenue from user charges;
- $I_{form}$  refers to funds from foreign sources;
- $I_{bond}$  refers to government bonds;
- $I_{BOT}$  refers to BOT financing;
- $I_{evnf}$  refers to funds raised by the pollution levy; and
- $I_{share}$  refers to funds raised by companies listed on the share market.

58. In the period 2001-2005 the total supply of investment in water pollution control is estimated at about 220.03 billion yuan, whereas the expected demand is 250 billion yuan. Thus, a shortfall of 29.97 billion yuan exists (see Table 8).



**Table 8. : Estimated Demand and Supply for Investment in Water Pollution Control**

Experts' estimate of investment demand, 2001-2005		Estimated investment supply for water pollution control		Notes
Total environmental investment	700-800 billion yuan	Funds from new projects under the "3 simultaneous steps" regulation	53.03 billion yuan	
Of which, investment in water pollution control	250 billion yuan	Funds from levy on renovations/redevpts	5.56 billion yuan	
		Levy on urban infrastructure construction projects	83.34 billion yuan	
		Revenue from user charges	1.03 billion yuan	Must consider ability of users to pay
		Funds from foreign sources	21.33 billion yuan	
		Government bonds	16.67 billion yuan	Depends on govt. policy about recipient sectors of funds raised
		BOT financing	0.84 billion yuan	Supporting policies and viable projects needed
		Revenue from pollution levy	17.23 billion yuan	National environmental fund should be established
		Funds from listed companies	1.0 billion yuan	Further listing of companies should be encouraged
		Contribution by Enterprises	20.0 billion yuan	Robust enforcement of environmental legislation & further economic incentives to stimulate investment in pollution control needed
Estimated total investment in water pollution control	250 billion yuan	Estimated total investment supply for water pollution control	220.03 billion yuan	Financing gap: 29.97 billion yuan

#### **4. Environmental Financing Strategy: Closing the Gap between Demand and Supply**

59. The financing gap indicated in Table 8 needs to be closed. The development of an environmental financing strategy can provide a framework for this. In this section we discuss the development of an integrated environmental financing strategy that draws upon contributions from the national government,

enterprises, consumers of environmental goods and services and foreign sources. More broadly, adjustments to some government policies could have a positive effect in lowering the financing demand and at the same time reduce the call on the central budget. On the supply side increased efforts need to be made to use existing financing sources more efficiently and effectively as well as identifying new sources.

### ***Increasing the Supply of Funds***

#### ***4.1.1 Central Budget Allocation***

60. In China the allocation from the central budget still represents the primary source of environmental investment. Indeed, the share of funding from this source for environmental investments is trending up as the serious condition of the environment is increasingly recognised by policy-makers. Data on the amount of funds allocated from the central budget for environmental investments are not available. Instead, we take the case of environmental investment in Beijing as an example.

61. Beijing faces serious environmental problems relating to air, water and noise pollution. Beginning in 1998 the municipal government increased its funding of environmental investments to address these problems. The municipal government's contribution in 1998 was 240.14 million yuan, accounting for 29.5% of the total environmental investment that year. In 1999 the municipal government contributed 445.85 million yuan, representing 38.4% of total environmental investment (see Table 9). In the next 5 years, it is expected that the municipal government's contribution will remain the principal source of funding for environmental investments.

**Table 9. Investment in Pollution Control in Beijing Municipality, 1998-1999**

Source	1998		1999	
	Value (million yuan)	% of total environmental investment	Value (million yuan)	% of total environmental investment
Total expenditure	240.14	29.5	445.85	38.4
(i) Allocation from central govt	45.0	5.5	103	8.9
(ii) Allocation from local budget <sup>^</sup>	195.14	23.9	342.85	29.5
Loans	143.85	17.6	20.33	1.7
(i) Domestic	120.0	14.7	0	0
(ii) International	43.85	5.4	20.33	1.7
Self-funded*	396.27	48.6	695.85	59.9
Other	15.0	1.8	0	0
Total	815.26	100	1162.03	100

<sup>^</sup> Includes local government loans.

\* Funds contributed by enterprises themselves.

Source: Interview with officials from the Beijing Municipal Environmental Protection Bureau and the State Statistics Bureau.

#### 4.1.2 Reform of Pollution Levy System

62. Reform of the existing pollution levy system is imperative. First implemented in 1982, the system's guiding principle is that charges are applied only to emissions and discharges that are in non-compliance with the relevant standard. Since the implementation of the system, enterprises have strengthened their pollution control efforts but more needs to be done. In this context, the government has announced that enterprises must meet the relevant discharge/emission standards for a number of key pollutants by the end of 2000. Because only those pollutants considered a priority have been targeted by the announcement, it is likely that the emission of others will remain above the relevant standard and for which non-compliance charges will continue to be collected. The concept of charging on the basis of total load discharge was adopted by the government during the 9<sup>th</sup> five-year plan period and reflected in the Water Pollution Prevention and Control Law and the Air Pollution Prevention and Control Law.

63. During the period 1 July 1998 to 31 June 1999, the cities of Hangzhou, Zhengzhou and Jilin undertook a trial of the proposed reforms to the pollution levy system. Higher charges for emissions and a system designed on the basis of total load discharge are the core of the reforms. The trial showed that higher charge rates both increased revenue and acted as a stimulus for enterprises to intensify their pollution control efforts. SEPA and other relevant government agencies are considering extending the trial to 30 other cities.

64. Further analysis is needed on the relationship between higher charge rates for discharge and the impact on revenue collection. Higher charge rates will act as an incentive for enterprises to reduce their discharges, which will reduce the amount of revenue collected in the long term. In addition, the weak financial situation of many enterprises acts as a constraint on setting charges too high. The key lies in designing a practical system that balances these considerations.

#### *4.1.3 Establishment of a National Environmental Fund*

65. As noted earlier China does not currently have a national environmental fund. SEPA considers it a priority task to link the establishment of such a fund with the reform of the pollution levy system. A national environmental fund would provide a source of financing for the construction of environmental infrastructure, including pollution control projects in different regions and river basins.

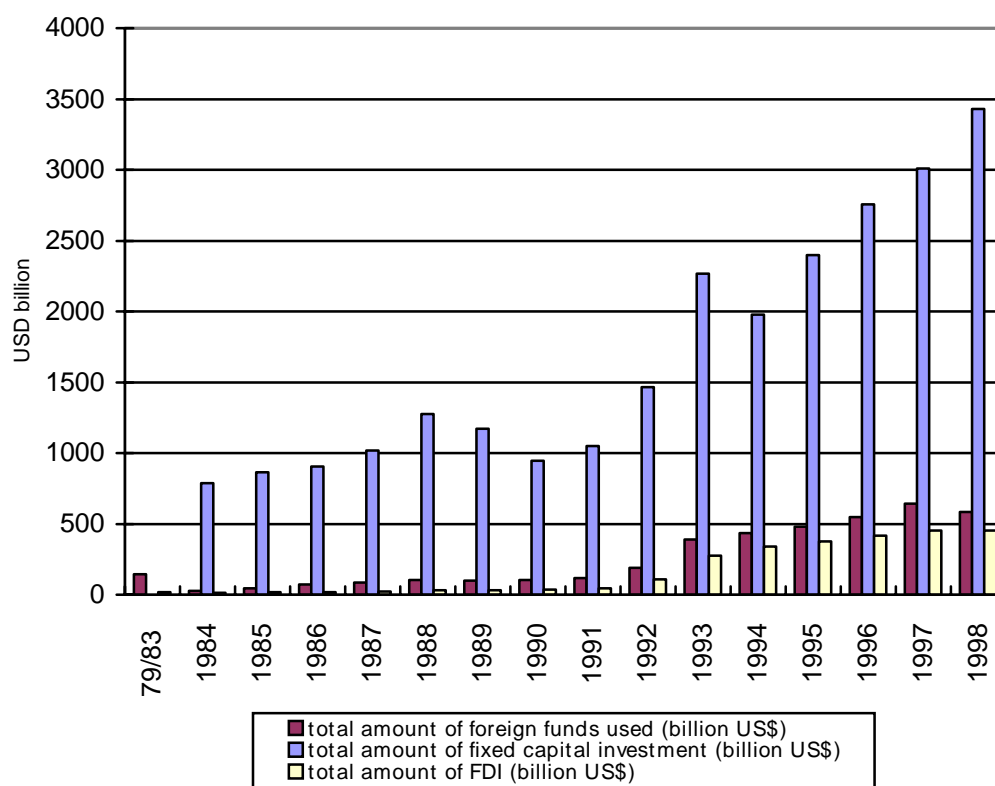
66. Proposals for the establishment of a national environmental fund have been aired in the past but did not progress very far. There were several reasons for this. First, the need to rationalise the various charge, tax and other revenue raising instruments established by the central government was a fundamental requirement. Second, the relevant government agencies could not reach agreement on the design of the fund, especially its purpose and management structure. For example, a proposal to design the fund as a government-controlled entity was considered inconsistent with the shift towards a market economy. Third, the performance of existing local environmental funds was not as strong as expected and this experience moderated expectations about the potential of a national environmental fund. Many of these issues have been resolved and prospects for establishing a national environmental fund now appear good.

#### *4.1.4 Use of Foreign-sourced Funds*

67. With the acceleration of the process of economic globalisation, China has increased opportunities to access international capital. Foreign direct investment (FDI) in China has been, and will continue to be, an important source of funds for the country's economic modernisation (see Figure 3). In 1998 FDI represented 15% of total fixed capital investment in China. Due to the lack of data, it is impossible to analyse the share of FDI going into environment investments.

68. In addition, loans and grants have been provided to China by international financing institutions, other international organisations, bilateral aid donors and NGOs to help her meet commitments under multilateral environmental agreements.

**Figure 3: Foreign Funds Used, Fixed Capital Investment and FDI, 1979-1998**



Source: State Statistics Bureau 1999.

#### 4.1.4 Development of a Municipal Bond Scheme for Funding Environmental Infrastructure Development

69. At present only the central level of government can issue bonds. This is in contrast to the situation in many developed countries where local governments can issue bonds to finance the development of public infrastructure. It is possible that during the 10<sup>th</sup> five-year plan period the central government will authorise pilot testing of a local government bond scheme in a number of provinces, municipalities and cities. Indeed, in the last two years local governments have on-sold bonds issued by the central government in a way that operates almost indirectly as a local government bond scheme.

#### 4.1.5 Corporatisation of Environmental Utilities and Services

70. Corporatisation would allow the government to retain ownership of environmental utilities and services, such as wastewater treatment plants and waste management, and promote the use of commercial principles in their operation and management, e.g. cost recovery and returning a profit on operations by applying the user-pays principle. The government would still maintain its regulatory role to ensure that the “rules of the game” were being adhered to, e.g. fair pricing structure.

71. An alternative would be to convert utilities such as wastewater treatment plants into limited liability companies and seek to attract investment by enterprises or individuals. Funds so received would be used to improve the operations of the facility.

#### 4.1.6 *Use of Lottery Revenue*

72. At present only two lotteries operate in China, with the purpose of raising money for social welfare and sports programmes. During 10<sup>th</sup> five-year plan period, the central government is expected to issue a policy statement concerning the trial implementation of new lotteries. One possibility would be for money raised through any new lottery to be used to fund environmental infrastructure projects. The benefits to local communities from such a use of the revenue could be considerable.

## 4.2 *Moderating the Demand for Environmental Financing*

### 4.2.1 *Improving the Implementation and Enforcement of Environmental Legislation*

73. China's environmental legislation has been undergoing continuous revision since the implementation of its open-door policy in the late 1970s. At present, six laws focus on pollution control and 13 laws on resource management and ecological protection. By the end of 1999, the State Council had issued 123 administrative regulations concerning the environment and resource protection while 427 environmental standards had been drafted. These instruments provide a legal framework to support pollution control and environmental protection efforts. Despite this, the implementation and enforcement of their provisions needs to be strengthened urgently in order to stimulate meaningful change in behaviour by polluters. That change is possible is demonstrated by the example of Beijing. In 1998 the municipal government began to strengthen the enforcement of pollution control and this resulted in an increase in the amount of funding by enterprises in pollution control measures. The figures were 396.27 million yuan (or 48.6% of the total environmental investment) in 1998, rising to 695.85 million yuan (or 59.9% of the total environmental investment) in 1999 (see Table 9).

### 4.2.2 *Corporatisation*

74. Corporatising environmental utilities and services would introduce commercial principles of return on investment and cost recovery through applying user charges. Profits could be used to help fund upgrades and new projects. Overall, the result could be a reduction of the demand on the central budget for funding the construction, operation and maintenance of environmental infrastructure.

### 4.2.3 *Setting Realistic Environmental Goals*

75. If environmental goals are set unrealistically high the amount of investment required to meet them may be too great in financial terms. A better strategy would be to ensure that the goals are challenging but achievable so that polluters have an incentive to invest in technologies or operational and management practices that would help them meet the set goals in a cost-effective and environmentally efficient manner.

## 5. **Conclusion**

76. In the past investment in environmental infrastructure in China was solely financed and implemented by the state. With the transition to a market economy this pattern has changed. The government has introduced measures that have acted to diversify the sources of environmental financing and created incentives for enterprises to take more responsibility for adopting pollution control technologies and practices. The example of increased environmental investment by enterprises operating in

the Beijing municipality was cited in the paper. Nonetheless, the government still contributes funds for environmental investment through an allocation from the central budget.

77. In the next 5 years, it is projected that the demand for investment in water pollution control will be around 250 billion yuan while the supply of funds is expected to be about 220.03 billion yuan. This would leave a financing gap of 29.97 billion yuan. In order to close the gap, a coherent environmental financing strategy is needed.

78. Such a strategy should encourage investment from a variety of sources, public and private and domestic and international. In addition, further consideration needs to be given to the establishment of a national environmental fund, implementing a reformed pollution levy system and corporatisation of environmental utilities and services.

79. Finally, the projections of the demand for, and supply of, finance for environmental investments presented in this paper are tentative. Information on some governmental expenditure is not publicly available and the accuracy of certain statistics is open to question. These factors have hindered the analysis and point to the need for further work.

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