The magnitude of the economic potentials unleashed in Shengze is truly magnificent. Formerly, Shengze was similar to many other Chinese localities, plagued with seemingly insurmountable rural unemployment. But within just a few years, the spectacular advances in silk production have converted the township, which is small by Chinese standards, into a labour-shortage economy, now needing to employ a migrant workforce as large as the local labour supply. This phenomenon alone renders the Shengze model worthy of further study.

Notes

1 Compared to 'small collectives' which refer to truly cooperative undertakings under the control of the Street Neighbourhood Committee in urban centres, 'large collectives' are 'virtual' state-owned enterprises. They are normally run directly by the Industrial Bureau of the municipality or its equivalent. See Y. Y. Kueh, *Economic Planning and Local Mobilization in Post-Mao China*. London: School of Oriental and African Studies, University of London, *Research Notes and Studies No. 7*, 1985, pp. 4 and 11.

2 See Yao Haixin and Wang Yue, *Jinri huaxia diyi zhen – wujiangshi shengze zhen* ('The No. 1 Town in China: Shengze Township in Wujiang Municipality'), in *Jiangnan Cunzhen Fazhan Zhilu (The Road to Development of Villages and Townships in South China)*. Nanjing: Jiangsu Renmin Chubanche, 1993.

3 See G. A. Carlino, 'Increasing Returns to Scale in Metropolitan Manufacturing', *Journal of Regional Science*, 1979, Vol. 19, pp. 363–73.

4 It should, however, also be noted that the value of fixed assets of the firms and industry, as shown in Tables 6.1 and 6.2 are all measured at original purchase prices, rather than any constant prices. Domestic inflation and renminbi devaluation (which would result in higher rmb prices for imported machine and equipment) might have therefore helped to boost the average value of the accumulated capital stock. However, a careful scrutiny of the data given for the various years from 1988 to 1994 does not reveal any consistent bias. As a matter of fact, most of the years concerned are marked with a relatively stable price level and rmb exchange rate, except for 1994, which, however, is the terminal year of our time series. The unification of the 'dual' rmb exchange rates and hence the substantial devaluation of the currency on 1 January 1994 had clearly come in too late to affect the import bill for the massive capital equipment imported by Shengze from overseas. (For greater detail, see the discussion in section 6.3.)

7

Approaches to Controlling Industrial Pollution

Since the 1980s there has been a dramatic growth in the numbers of rural enterprises in China. But because of poor management and generally low levels of technology the growth of these enterprises has resulted in serious concerns about the inefficient use of resources and environmental degradation. These problems have serious implications for the continuing economic development of rural areas and for the health of rural residents. It is, therefore, imperative that effective measures be adopted to deal with these problems.

The first two sections of this chapter describe the growth of rural industrial enterprises in Chongqing, Sichuan and the resulting degradation of its rural environment. The chapter then describes the current system of pollution control and discusses some of its shortcomings. Drawing on the experience of Chongqing, the chapter concludes by suggesting ways to improve pollution control in rural China. Among the suggestions is the adoption of a 'market' system for 'transacting' emission rights and reforming property rights.

7.1 The growth of rural enterprises and industrial pollution in Chongqing

7.1.1 Rapid development of rural enterprises

The administrative jurisdiction of Chongqing is comprised of 21 units, including urban districts (*shiqu*), county-level cities (*xianji shi*), and counties (*xian*). Except for the urban districts of Dadukou and Yuzhong, all other units contain rural areas which support non-agricultural activities such as township and village industries, construction, transportation, commerce, and food services. This chapter focuses primarily upon rural industrial enterprises, but because disaggregated

statistics are not always available the data presented will sometimes refer to all rural enterprises rather than rural industrial enterprises alone.

Rural enterprises in Chongqing have exhibited steady growth during the reform period. Between 1979 and 1993 the gross output value produced by rural enterprises, the taxes they remitted to the state, their total profits, and their contributions to agriculture grew at an average annual rate of 37.4 per cent, 41.8 per cent, 30.0 per cent, and 28.2 per cent respectively. Rural enterprises have also contributed significantly to the development of agriculture by absorbing surplus rural labour and increasing peasant incomes.

By the end of 1994, there were 323 600 rural enterprises in Chongqing (including 92 900 industrial enterprises), employing 2.09 million people, or 33.0 per cent of the total rural labour force. In 1994 the total output of rural enterprises reached 71.02 billion yuan, of which 36.16 billion yuan came from rural industrial enterprises. In the same year rural enterprises generated profits of 3.42 billion yuan from gross earnings of 67.64 billion yuan. Furthermore, rural enterprises remitted 2.46 billion yuan in taxes to the state, paid 4.98 billion yuan in wages and salaries, and subsidized agriculture by 0.26 billion yuan. Clearly, rural enterprises have become an important part of Chongqing's rural and municipal economies.

7.1.2 Rural industrial pollution in Chongqing

While the growth of rural enterprises in Chongqing has resulted in a rapid transformation of the rural economy, the average scale of production is small and the level of technology in these rural enterprises relatively low. Combined with the disorderly growth and uneven distribution of such enterprises, these factors have led to a highly inefficient use of energy and other raw materials. Moreover, emissions of liquid, gaseous, and solid pollutants from rural enterprises have been random and difficult to control, presenting challenges to pollution prevention and treatment. Furthermore, because many rural enterprises are located in villages, adjacent to waterways, or amidst cultivated fields, they often present a direct threat to the health of rural residents, to the quality of agricultural products, and to the entire agricultural ecosystem.

A series of investigations into 11 of the most seriously polluting industries was undertaken in 1992 when a total of 26 059 rural enterprises in the coking, paper, chemical, electroplating, tanning, printing and dying, distilling, cement, brick and tile, porcelain, smelting, and

asbestos industries were surveyed. The surveyed enterprises comprised 29.2 per cent of all rural enterprises in Chongqing, and accounted for 48.1 per cent of the total rural-industrial-output value produced in 1992. In addition to the general survey, a more detailed investigation was conducted among a sub-group of 9634 of the surveyed enterprises. Some of the major findings of the two surveys are presented below.

In 1992, the enterprises surveyed consumed a total of 24.60 million tons of water and produced 11.90 million tons of liquid effluent. The volume of liquid effluent discharged by the sub-group (9634 enterprises) of surveyed enterprises was 7.04 million tons. Of this volume the main pollutants (identified in Table 7.1) accounted for 15 438 tons. The volumes and average densities of the main pollutants discharged by the sub-group of enterprises surveyed are presented in Table 7.1. As for gaseous emissions, in 1992 the rural enterprises surveyed consumed 1.70 million tons of coal and 680 000 tons of coking coal, while the sub-group of enterprises surveyed burned 988 000 tons of coal and generated 11.40 million cubic meters of gaseous emissions. The type and distribution of the main air pollutants discharged by the sub-group of enterprises surveyed are presented in Table 7.2. Finally, in 1992, the 26 059 surveyed enterprises discarded 139 000 tons of solid industrial waste, and the sub-group of 9634 rural enterprises surveyed discarded 42 000 tons of solid waste, most of which originated with enterprises involved in the construction, chemical, and smelting industries. The solid waste materials included fragments of brick, tile, and porcelain, as well as chemical and smelting residues. Much of this waste was simply piled on land near the production sites.

The volume of pollutants emitted by individual rural enterprises in Chongqing was not in itself particularly problematic. The cumulative output and the composition and spatial proliferation of polluting rural industries, however, exacerbated the pollution problem. Moreover, compared to industries at or above the county level, rural industrial enterprises in Chongqing were significantly less efficient in their utilization of raw materials. This is clearly illustrated in Table 7.3, which presents data on the volume of recoverable pollutants per unit output value by enterprises at different levels of ownership. Measured in these terms, rural industrial enterprises in Chongqing were anywhere from 1.3 to 62.8 times less efficient than industries at the county level or higher.

In the 1980s and the early 1990s, rural industries in Chongqing generally utilized minimal and/or ineffective environmental protection

Table 7.1 Volumes and average densities of main liquid pollutants discharged by the sub-group of 9634 rural enterprises, 1992

Part A

Pollutant	*Volume (tons)*	*Pollutant caused by (%)*			*Average density (mg/kl)*		*Maximum allowable standard (mg/kl)*	*Ratio by which standard is exceeded*	
		Paper	*Distilling*	*Coking*	*Enterprises above village level*	*Enterprises at village level and below*		*Above village level*	*Below village level*
COD	7671	70.3	17.3	–	999.7	4434.2	150	6	30
Suspended	7452	60.2	9.8	18.6	869.7	5505.5	100	9	55
Phenols	239	–	–	100	867.4	506.4	1	867	506
Sulphides	59.3	–	–	100	174.4	119.2	1	174	119
Hyrides	10.3	–	–	99.9	7.1	17.7	1	7	18

Part B

Pollutant	*Volume* (tons)	*Electroplating industry (%)*	*Average density (mg/kl)*		*Maximum allowable standard (mg/kl)*	*Ratio by which standard is exceeded*	
			Enterprises above village level	*Enterprises at village level and below*		*Above village level*	*Below village level*
Chromide	2.34	94.9	1.69	–	0.5	3	–
Nickel	1.32	100	4.26	–	1	4	–
Copper	0.16	100	0.53	–	0.5	–	–
Zinc	3.09	90.3	2.29	–	2	–	–

Source: Compiled from data provided by the Chongqing Rural Enterprise Bureau.

Table 7.2 Volume and distribution of main air pollutants discharged by the sub-group of 9634 rural enterprise, 1992

Pollutant	*Volume (tons)*	*Pollutant accounted by (%)*			
		Brick, tile, ceramics	*Coking*	*Cement*	*Chemical*
SO_2	48 896	75.8	–	7.7	6.5
Particulate	14 112	5.7	–	91.1	–
Smoke	10 002	72.0	13.1	–	–
Fluorine	493.5	98.6	–	–	–
Benzene Series	23.4	–	100	–	–

Sources: Compiled from data provided by the Chongqing Rural Enterprise Bureau.

equipment. The initial investment in such equipment by all the enterprises surveyed in 1992 was only 11.61 million yuan, or 1.2 per cent of the total initial value of fixed capital investment. Waste water was usually only treated in settling basins before being discharged, while gaseous waste was treated simply through the use of dusters to extract heavier particulates. More than three-quarters of the liquid effluents discharged by the sub-group of enterprises surveyed were untreated. Only 39.2 per cent of the volume of treated effluents met or exceeded the acceptable standards. Table 7.4 compares the levels of effluent treatment by the sub-group of enterprises surveyed according to their level of ownership. Table 7.5 also shows the number of enterprises in the sub-group surveyed that utilized environmental protection equipment in six of the worst water-polluting industries. As for the treatment of gaseous emissions, 64.7 per cent of the surveyed enterprises that used boilers had installed equipment to reduce the discharge of particulates. However, only 51.0 per cent of these boilers actually reduced the emission of particulates to the acceptable standard. Meanwhile, of the total of 13 906 kilns in the surveyed enterprises, only 11.2 per cent had installed any sort of emission control equipment whatsoever. The survey findings clearly indicate that the control and treatment of polluting emissions is woefully inadequate and the majority of rural enterprises in Chongqing discharged untreated liquid, gaseous, and solid wastes directly into the environment.

Table 7.3 Volumes of recoverable water, air, and solid pollutants per unit output value by enterprises at different levels of ownership, 1992 (kg/RMB 10 000)

Part A: Water pollutants

	COD	*Phenols*	*Hydrides*	**Chromides*	**Cadmium*	*Composites*	*Other*
Township	117	4.47	0.16	35.8	3.88	121.7	1.69
County and above	50.6	0.07	0.016	10.5	0.15	50.7	0.47
Ratio of township to county and above	1.3	62.8	9	2.4	24.9	1.4	2.6

* (g/RMB 10 000)

Part B: Air and solid pollutants

	SO_2	*Smoke*	*Particulates*	*Composites*	*Solids*
Township	746	157	215	1119	641
County and above	294	69	44	407	169
Ratio of township to country and above	1.5	1.3	3.8	1.7	2.8

Source: Compiled from data provided by the Chongqing Rural Enterprise Bureau.

Table 7.4 Treatment of liquid effluents by the sub-group of 9634 rural enterprises, 1992

	Discharged volume (10 000 tons/year)	*Treated volume (10 000 tons/year)*	*Ratio (%)*	*Treated volume which reached standard (10 000 tons/year)*	*Ratio (%)*
Enterprises above village level	567	146	25.8	57.4	39.2
Enterprises at village level and below	25	0.3	1.2	0	0

Source: Compiled from data provided by the Chongqing Rural Enterprise Bureau.

Table 7.5 Number of the sub-group of 9634 rural enterprises utilizing environmental protection equipment, 1992

	Printing and dyeing	*Electroplating*	*Tanning*	*Chemical*	*Paper*	*Distilling*	*Total*
Total number of enterprises	12	32	17	397	1166	544	2168
Enterprises with environmental protection equipment	6	6	1	35	15	8	71
Ratio (%)	50	18.8	5.9	8.8	1.3	1.5	3.3

Source: Compiled from data provided by the Chongqing Rural Enterprise Bureau.

7.2 Analysis of the characteristics of industrial pollution in rural areas

7.2.1 The character of rural industrial pollutants

The causes of rural industrial pollution in China can be divided into two basic categories. The first is the inefficient storage and utilization of primary resources such as coal and ferrous and non-ferrous metals, and the discharge of large volumes of particulates and sulphur dioxide in related industrial processes. The second is the production of ordi-

nary organic wastes, particularly by distilleries, tanneries, and agricultural sidelines. Inefficient processing and the improper handling of various inputs not only result in economic losses and lost production opportunities, but also accounts for a large proportion of the total volume of industrial pollutants. Mining and smelting industries in the vicinity of Chongqing are particularly problematic in this regard. Analysis of the data collected for this study suggests, for example, that local mining operations processed only 15 to 20 per cent of recoverable coal and ores. Moreover, most of these mines were spatially dispersed, small-scale, open-pit operations, factors which help to explain their high levels of inefficiency.

The primary or 'crude' rural pollutants are generally considered less harmful than more sophisticated types of pollutants associated with more advanced levels of industrial production. Furthermore, the opportunities for reducing crude industrial pollution are also favourable, since relatively simple and inexpensive technologies can have a significant positive impact. In addition to technology, the control and treatment of industrial pollutants also requires appropriate regulatory and administrative structures. In fact, there is enormous potential to realize significant pollution control and treatment through the effective implementation of existing regulations and accounting procedures. Strengthening the Mineral Resource Law, for example, would put pressure on rural enterprises to manage their processing activities more carefully. At the enterprise level, better management of raw materials and outputs, production, labour, and the improvement of simple accounting procedures would significantly enhance the efficient use of resources, thereby reducing economic losses and environmental degradation.

7.2.2 The structure of industry and environmental degradation

Much of the environmental degradation in suburban Chongqing is related to the fact that suburban areas support many of the same polluting industries as urban areas. Polluting industries and pollutants are, therefore, spatially dispersed. This has three distinct implications for the environment.

Firstly, the failure to locate industries according to their regional comparative advantages restricts the efficient allocation of resources for environmental protection. Providing transportation and energy to many scattered enterprises has caused more stress on equipment and resulted in greater waste of materials and resources. It has also made the dissemination of environmental protection information and

technologies more difficult, and it is difficult to monitor and control pollution over such large areas. Moreover, the dispersed pattern of industries creates an equally dispersed profile of similar types of pollutants, thereby affecting the absorptive capacity of the environment. Finally, the inefficient use and abuse of farmland for non-agricultural activities has expanded the areas of environmental degradation.

Secondly, the growing numbers of small enterprises in suburban Chongqing has been accompanied by a disproportionately high increase in the output of pollutants. Since the capacity to use pollution control and treatment is related to the size of the enterprise, small enterprises are less able to afford the direct costs of environmental protection. Small enterprises also find it more difficult to utilize advanced technology that would both increase productivity and reduce pollution per unit of output. It is also technically more difficult for small-scale industries to develop appropriate control and treatment mechanisms for their typically non-specialized production.

Thirdly and finally, intense competition for investment capital among both rural and urban enterprises limits the funds available for environmental protection, not just at the enterprise level, but throughout the rural and urban industrial structure.

7.3 Environmental policy for rural industry: implementation and evaluation

7.3.1 Implementation of environmental policies for industry

Rural industrial pollution and environmental degradation have hampered the successful transformation of the economy not just in suburban Chongqing, but for all of China. Moreover, current trends suggest that the situation will worsen considerably, making effective pollution control and treatment in rural areas even more urgent. Whether or not rural industry will respond to the problem will ultimately depend on the government's environmental policy at the macro level and the specific microeconomic mechanisms used to implement the policy.

As a first step toward implementing a comprehensive rural environmental policy, the State Council promulgated 'The Decision on Strengthening Environmental Management of Township and Neighbourhood Enterprises' in 1984. But, because of local distortions and other related factors, this policy has remained largely ineffective. Instead, the environmental management of rural industry has essentially copied the three-prong system used to supervise urban state-owned industrial enterprises. First, there is an environmental impact

assessment to evaluate in advance the impact of emissions and to propose strategies for controlling and reducing pollution. The second prong is the requirement that pollution control be included in the design and construction of new or expanding enterprises and utilized in production. The third is a system of effluent fees for emissions, and fines when the discharge exceeds acceptable standards.

This system has been in effect in Chongqing since the mid-1980s, yet between 1986 and 1989 only 6.9 per cent of the rural enterprises to which these rules applied actually conducted an environmental impact assessment, and only 18 per cent implemented pollution control and treatment mechanisms (even at this rate, Chongqing's levels of compliance were slightly higher than the national average). Between 1986 and 1989, the number of Chongqing rural enterprises that paid fees or were levied fines rose from 459 to 1721, and over the same 4-year period, nearly 15 million yuan in effluent fees were collected from rural enterprises, of which 83 per cent were fines for exceeding acceptable emission levels. But of the surveyed enterprises, only 1.9 per cent actually paid effluent fees (including fines). This amounted to only 3.22 million yuan, or 0.03 per cent of the total output value produced, most of which was paid by a small number of larger rural enterprises. In fact, more than 95 per cent of the large rural enterprises, and virtually all of the small and medium-sized rural enterprises surveyed paid no effluent fees at all.

7.3.2 Evaluation of environmental policy for rural industry

There are a number of significant problems with the current environmental protection system. Although an increasing number of enterprises have undertaken measures to control and treat their emissions, the rate of rural industrial expansion has greatly exceeded the rate of compliance with environmental protection standards. In addition, the substantial investments required to comply with the present emission standards greatly exceed the economic capacity of rural enterprises. These problems can be attributed in part to the focus on achieving specific emission standards at the enterprise level, without regard to the differences in local and regional conditions that affect the capacity of the environment to absorb pollutants. Forcing urban and rural industries to comply to the same emission standard ignores some important factors. For example, the capacity of the environment to absorb pollutants produced by rural enterprises may be greater than in urban areas. It may also be necessary to vary the volume of liquid emissions permitted according to season in order to account for variations

in relevant environmental conditions. Thus, in general terms, the control, treatment, and reduction of pollution needs to be more carefully considered in terms of the spatial and temporal variations in emissions, the varying opportunities and abilities to undertake environmental protection measures, and differing environmental circumstances.

7.4 Measures to improve pollution control in rural areas

We conclude by examining ways to improve pollution control in rural China. Two general measures worth considering include establishing a market for emission rights, and reorganizing property rights. In addition several suggestions specific to Chongqing will be discussed.

7.4.1 Creating a market for environmental protection

The fundamental assumption which underlies this suggestion is that the natural environment has a capacity to absorb certain levels of pollution, defined here as the 'environmental resource'. Under the premise of guaranteeing environmental quality the state, as socio-economic manager and owner of this environmental resource, will determine the total acceptable volume of pollutants which may be discharged in a given administrative jurisdiction or similarly defined region. Individual enterprises or industrial units are given rights to discharge a specific volume and profile of pollutants into the environment. These rights (which may be viewed as a kind of emission quota) could then be exchanged by enterprises through various kinds of transactions in order to take advantage of spatial and temporal variations in emissions and environmental carrying capacity. The objective is to achieve a kind of market-driven balance between environmental resources, overall environmental protection goals, and optimization of the investments necessary for achieving these goals. In other words, in order better to address the serious environmental problems in rural areas, the right to discharge pollutants should be transformed into an exchangeable commodity.

One method for transacting environmental protection is the direct sale and immediate exchange of emission rights between two parties on completion of a negotiated agreement. An enterprise may sell emission rights either from its accumulated long-term allocations that have been 'banked', or from its current unused quotas (i.e., unused because of temporary shutdown for retooling or other similar reasons).

It is expected that such exchanges would comprise the bulk of the transactions in environmental protection. A potential problem associated with such transactions, however, is market volatility which may affect long-term pollution control plans, yet other methods of transacting environmental protection are possible. For example, an enterprise might purchase the future emission quotas of another enterprise if the cost is less than to invest in additional pollution control and treatment equipment. For individual enterprises, the potential benefits of a market for environmental protection may be substantial. Of course, all such arrangements must be closely monitored to ensure that total emissions in each period do not exceed the pre-determined level set by the government.

7.4.2 Reorganize property rights

The Chinese constitution stipulates that all property and environmental resources other than collectively owned agricultural land belong to the state. In practice, however, the rights to various resources are more complex and less clear. Because township and village governments control most rural enterprises, they effectively control the rights to exploit environmental resources even though they have no legal ownership rights. Under these circumstances, it is not surprising that in order to maximize short-term profits rural enterprises will select the least-cost method to exploit environmental resources. In other words, there is a strong link between enterprise ownership, the economic management priorities of enterprises, environmental degradation, and the inefficient use of resources.

The separation of the property rights of rural enterprises from the right to exploit environmental resources, and the overlap of local government ownership and economic management, pose several challenges to the implementation of the environmental protection policy. First, the ownership of rural enterprises by local governments tends to generate similar industrial structures and to replicate patterns of pollution throughout the countryside. Second, given the existing nature of rural ownership and property rights, township and village governments are likely to respond only to environmental policies that are sensitive to local economic and environmental conditions, and to accommodate variations according to the ability of local enterprises to comply with policies. Third, market distortions and imperfections (such as immobile factors and imperfect information) will restrict the benefits of a market for the exchange and redistribution of the rights to discharge pollutants.

In view of these problems, the reform of property rights may create opportunities for improving environmental protection. For example, separating local governments from rural enterprises by creating limited-liability joint-stock enterprises would benefit the environment in several ways. (A step in this direction was taken in November 1994 when the Standing Committee of the Chongqing People's Congress promulgated the 'Regulations for the Joint-Stock System for Rural Enterprises in Chongqing'.) First, such a system would encourage the concentration of capital, thereby allowing enterprises to take advantage of economies of scale, reducing emissions per unit of output, and enabling more enterprises to invest in pollution control and treatment equipment. Second, because limited-liability joint-stock companies would be under greater pressure to generate higher returns for their investors, they would use resources more efficiently. Third, because limited-liability joint-stock companies are likely to have a more flexible management style, they may be better able to cope with the changes in production needed to implement sound environmental protection policies.

7.4.3 Other suggestions for reducing industrial pollution in rural Chongqing

In addition to the above suggestions, it is believed that Chongqing's rural environment would be improved by changing the structure of its rural industry, by rationalizing the distribution of rural industrial enterprises, by experimenting with alternative ways to reduce the discharge of harmful emissions, and by improving the management and collection of effluent fees.

Severe environmental degradation in suburban Chongqing is due in part to idiosyncrasies in the organization and structure of its rural industry. Restructuring Chongqing's rural industry would require careful development planning, a high priority given to environmental protection, and the introduction of market mechanisms in the management of the economy. The construction of the Three Gorges Dam also provides opportunities to encourage the development of non-polluting industries. Specifically, the development of heavily polluting industries such as chemicals and construction materials in the area between Zhenwu and the Gele Mountains should no longer be permitted. In addition, there should be a moratorium on the further development of industries with highly toxic emissions (i.e. paper, printing and dying) in the vicinity of the two rivers that supply drinking water to the region. To give direction to the restructuring of rural industry a

priority list should be created to clarify which industries are to be encouraged, which are to be restricted, and which are prohibited.

Rural environmental degradation is also linked to the dispersed location of industries in suburban Chongqing. To facilitate environmental protection rural industrial enterprises should be encouraged to locate in rural industrial blocks or zones. The creation of such industrial zones should be coordinated with real estate development in small towns and cities, and funds generated by real estate development should be used to finance public facilities and a centralized industrial infrastructure to enhance coordinated and centralized control and treatment of pollution. The industrial zones should be administered by a management committee comprised of local government officials (including those from environmental protection agencies) and enterprise representatives. One of the management committee's responsibilities should be to determine the total volume of emissions permitted.

Because of their small size, rural industrial enterprises in Chongqing have an economically and technologically limited capacity to achieve established emission control standards by using pollution control and treatment technology. Therefore, alternative approaches to reduce the discharge of harmful emissions are needed. Among possible strategies are the following:

(i) Rural enterprises should be encouraged to produce products that generate fewer pollutants as by-products.
(ii) Rural enterprises should be encouraged to utilize raw materials, energy sources, and other inputs which produce fewer harmful emissions. These include the use of recycled paper or semi-processed commercial pulp in paper making, coal with lower sulphur and ash content, and natural gas.
(iii) Rural enterprises could adopt new technology and equipment to reduce harmful emissions per unit of output.
(iv) Rural enterprises should reorganize and redesign selected industrial processes so as to take advantage of opportunities to recover or to reuse waste emissions, e.g., the recovery of dust from the cement industry.
(v) Rural enterprises should be encouraged to improve accounting practices and production management to help to prevent waste.
(vi) The relocation of highly polluting urban industries into the countryside without a commensurate transfer of equipment and expertise to deal with environmental protection should be halted.

In addition, the system of levying environmental fees and fines on rural industries in Chongqing needs to be reorganized First, levies should fluctuate according to variations in regional environmental carrying capacity and the density of pollution sources. Accordingly, enterprises in urban and semi-urban areas would pay higher fees than enterprises in rural areas. In addition, environmental levies should take into account the enterprise's proximity to sensitive ecosystems such as lakes and rivers, and health issues such as the need to preserve sources of drinking water and clean air near areas of high population density. Second, levies should also fluctuate in response to the particular circumstances of enterprises and their efforts to control emissions. Thus, variations in environmental fees that are linked to spatial and temporal considerations must be coupled with incremental and graduated adjustments which respond to other factors. Such factors might include graduated fees that are based on well-defined criteria, thereby providing incentives for reducing environmental degradation.

The successful implementation of this system of environmental fees, and of environmental management in general, will depend upon sophisticated and highly sensitive methods of monitoring, data collection, and reporting procedures, and all rural industries should be included. The ultimate objective of the environmental policy proposed in this study is to establish economic and administrative incentives that will stimulate improvements in environmental protection among all rural enterprises in suburban Chongqing.