

Kitakyushu Initiative for a Clean Environment: Successful and Transferable Practices

Chongqing (China): SO₂ Pollution Control

Institute for Global Environmental Strategies (IGES)¹

Target area: Air pollution (SO₂ pollution control)

Time Period: 1991 to 2000

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1. Background

Chongqing is located between the central and western part of China, in upper Yantze, which links five provinces including Sichuan, Shanxi, Hubei, Hunan, and Guizhou. Established in 1997, Chongqing is the 4th Municipality directly under the jurisdiction of central government.

There are 40 districts or counties under the jurisdiction of Chongqing covering an area of 82,000 km², with a population of 309,109. The main city zone has a constructed land area of 190 km². The total GDP in 2000 was RMB 159 billion yuan or an average of RMB 5157 yuan per capita.

Chongqing has sub-tropical wet monsoon weather, with high humidity, low wind velocity and high countercurrent temperature frequency. The geographic and weather conditions are not advantageous for pollution diffusion.

2. Environmental challenge

SO₂ pollution is a major environmental concern in Chongqing. In the mid-1980s, SO₂ concentration was seven times higher than the national standard (type 2). Chongqing has been assigned as acid rain control zone by national government, because it is the most acid rain damaged city in China. The major reasons for the high levels of pollution are as follows:

- The use of coal as a major fuel (70% of energy consumption) which is mainly high sulfur ash content coal with an average sulfur content of 3.5 %, and an average ash content of 25%. Gas emissions from coal were the major air pollution source.
- The efficiency of energy combustion was low.
- Chongqing is a traditional industrial city with many heavy industries. Most major pollution sources are located in the main city zone.

A survey conducted by the Chongqing Environmental Protection Bureau in association with the Environment & Economic Policy Research Center of the State Environmental Protection Administration (SEPA) reveals a loss of RMB 1.765 billion yuan resulting from acid rain in 1993, which accounted for 4.42% of Chongqing's GDP in the same year.

3. Achievements

From the late 1970s to the early 1990s, SO₂ and acid rain pollution was critical due to various causes, which seriously restrained the sustainable social and economic development of Chongqing. With the support of the Chinese government and the international community, Chongqing enhanced its SO₂ measures from 1994 and has made a continuous effort to effectively prevent SO₂ pollution and acid rain problems (Fig.1, Fig.2).

- i. Air quality improved significantly
- ii. Technical upgrading and revolution of energy promoted
- iii. Significant social benefit achieved

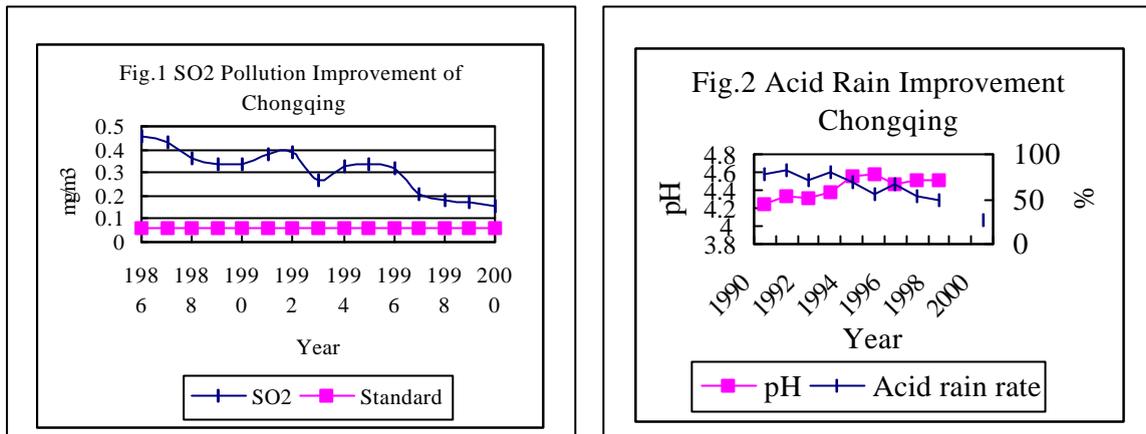


Table 1

ENVIRONMENTAL INDICATORS (Air :Decrease in air pollution emission density)		
Item	1995	2000
TSP	0.3	0.248 (Standard is 0.2m g/m ³)
SO ₂	0.34	0.156 (Standard is 0.06m g/m ³)
Natural dustfall	15.9	11.38 (ton/km ² per month)
PH	4.325(1991)	4.52(1998)
Acid rain rate	62.4%	27.7%

3.1 Actions

3.1.1 Energy consumption structure transfer

Chongqing has rich natural gas resources and sufficient gas reserves. Its rich resources created a good situation for improvements to the energy structure. The thermal efficiency of fuel gas is higher than that of fuel coal. The thermal efficiency of boilers, tea-burners and kitchen stoves is estimated to be 1.3, 2.4 and 4 times of that of fuel coal, respectively. Therefore improvements to the structure of energy was an effective method to save energy. Coal consumption will be reduced from 61% to 38%, and natural gas will be increased from 26% to 49% by 2010. Over 90% of household will use natural gas by 2010.

3.1.2 Construction of FGD Plant for the major pollutant source- coal-fired power station

Huanneng Luohuang Power Plant and Chongqing Power Plant are major pollutant sources, which was made in construction of corresponding flue gas desulphurization units, the first large-size limestone-gypsum in China. The flue gas desulphurization units have desulphurizing rates of over 95% and can reduce the discharge of 167,000 tons of SO₂ annually.

With regard to power plants and manufacturing plants that consume large amounts of coal, it is desirable from an environmental, as well as economical point of view, to use low priced coal with high

sulfur content and recover sulfur with desulfurization equipment. However, there are problems with the lack of domestic technologies and capital procurement for desulfurization equipment; presently, it is dependent on ODA. Chongqing is actively introducing overseas support and is using Yen- and Deutsche mark- loans in the “China-Japan Environmental Development Model City Project”.

Regulations to monitor the management of SO₂ pollution due to coal burning in Chongqing make obligatory the following: prevention of new establishment of coal burning power plants in cities and suburbs; establishment of newly constructed or remodeled desulfurization facilities in power plants using coal that exceeds sulfur content of 1%; SO₂ reduction measures in existing power plants using coal with sulfur content over 1%.

3.1.3 Local pollution sources: Countermeasures for iron and cement factories

With the exclusion of power plants, the following countermeasures are being carried out for boilers (20 t/h and 35 t/h): cleaner fuel (low sulfur content coal, sprayed coal, circulated sulfide technologies); cleaner production and end of pipe measures (desulfurization, dust collection; discontinuation/closure) and relocation of industries. By the end of 2000, over 2,300 industries had been discontinued or closed down out of 5,169 industries emitting SO₂ (air) and COD (water) pollutants. Adverse effects on the economy are low and improvements to industrial structure could be conducted through the discontinuation/closure of heavily polluting industries. Pollutants were remarkably reduced.

3.1.4 Regional level pollution sources: Countermeasures for households and small/medium sized companies

Looking at other SO₂ emission sources and amounts, the breakdown is as follows: small and medium sized boilers under 10 t/h = 20% (1,152 boilers); furnaces/stoves for tea = 4% (1,500 furnaces); boilers for food and drink = 7% (185,000). There are 2,652 small and medium sized boilers and furnaces/stoves for tea and until June 30, 2001, core businesses established contracts with the city government and carried out treatment of gas emissions and reformation of fuel equipment, as well as the promotion of cleaner fuel. The city government provided 100,000,000 yuan in assistance, which is equivalent to 20-30% of the environmental investment of core industries.

Since 1995, 20,000 food and drink boilers have undergone gas emission treatment and reformation of fuel equipment, as well as change to cleaner fuel. In addition, over 500 heavily polluting industries (15 types) have stopped production or undergone closure.

From the point of view of expenditure, the establishment of desulfurization facilities for households and small and medium sized businesses with little coal consumption has placed a great burden on facility investment. It is advisable to transform industry through the closure of industries, together with use of gas and clean energy such as sprayed coal and briquettes.

3.1.5 Coal mining countermeasures

Regulations to monitor the management of SO₂ pollution due to coal burning in Chongqing makes obligatory the following: prevention of construction of new coal mines exceeding a sulfur content of 3% in areas with acid rain regulations; systematic reduction or discontinuation of production in existing coal mines exceeding sulfur content of 3%; establishment of coal spraying facilities in newly constructed and remodeled coal mines exceeding sulfur content of 1.5%; strategic establishment of coal spraying facilities based on demand in existing coal mines.

3.2 Implementation

3.2.1 Policies and Regulations

A list of the policies and regulations to carry out these activities are as follows:

- 1989: Provisional Regulation on Control over SO₂ from Coal-Burning, requesting use of low sulfur coal, washed coal, power-assorted coal and sulfur-entrapped coal, or to build FGD plant. SO₂ Discharge fee was charged on a trial basis.
- 1996: Act for control over SO₂ from Coal-Burning, and overall charges on SO₂ discharge started, which was used to finance SO₂ treatment.
- 2000: Notice on Implementation of Clean Energy Program to Control Air Pollution, detailing the content and requirement of the Clean Energy Program. Four documents were issued regarding the construction of the Clean Energy Program, which details the responsibilities of municipal government, district government, department concerned, as well as preferential policies.
- 2000-2001: Liability clauses signed with each district government and municipal department concerned with regard to the schedule and target of the Clean Energy Program. Accomplishments in this area are regarded as an important part of appraising the leaders' annual job performance on environmental protection.

The Chongqing Municipal Commodity Price Bureau, Economic Commission and Gas Company have also formulated a series of preferential policies that clarify tariff on gas for boilers, tea-burners and large kitchens. Some charges were abolished and/or reduced.

3.2.2 Administration

The Mayor of Chongqing has raised the target for construction of the "Clean Energy Program" in his Government Work Statement, which has unified the understanding of all the city residents. Leaders have presided over several meetings especially for discussion of the construction of the Clean Energy Program, and have provided instruction to ensure the smooth implementation of the Clean Energy Program. Improvements to the energy structure and SO₂ prevention involve a number of governmental departments, and each government or department must conduct joint efforts and work

closely with each other to enable an achievement of the target.

3.2.3 Finance

The Chongqing government has spent RMB 120 million Yuan on pollution prevention inclusive of the Clean Energy Program, and has actively implemented the Sino-Japanese Co-operative Program in Construction of Environmental Demonstrative Cities. At the same time Chongqing Government has requested each local government to spend the corresponding money on pollution prevention.

The government plans to borrow 4.4 billion Japanese Yen from Japanese ODA to construct a natural gas pipeline.

3.2.4 Technology

Technologies used in the above activities are as follows:

- Scientific planning
- Technical upgrading and revolution of energy promoted: Changes from utilization of steam hammer to the more advanced electric hammer or hydraulic hammer and from steam heated electroplated chamber or other production facilities to dispersed electric heating. In this way, energy consumption is reduced by 70%.
- Switch to cleaner energy will have added flue gas waste recovery facilities to raise thermal efficiency through re-positioning boiler houses and shortening steam pipes. The operation becomes more economical as a result of lower employment of fewer boiler workers and/or maintenance personnel, as well as less land. After changes to cleaner energy, expenses on coal transport, sludge and waste discharge can be saved. Through energy saving and management strengthening, running costs becomes significantly lower.
- Public participation and supervision of press media

It is not sufficient to have only government departments supervise improvements to energy structures, as SO₂ pollution involves a large variety of communities. Only by monitoring and supervision by the public and mass media will owners adhere to regulations on SO₂ prevention.

4 Transferability

- Scientific Planning: SO₂ and acid rain prevention is a complicated systematic program therefore scientific research must be conducted continuously to develop a scientific, rational and practical program, enabling SO₂ prevention to be carried out effectively according to priorities.
- Strict law enforcement: During the course of the implementation of Chongqing's Clean Energy Program, the Municipal Government and the Municipal Environmental Protection Bureau have held 21 mobilization meetings, 22 co-ordination meetings at municipal level and 110 site meetings, and have published 32 issues of the schedule. The Municipal and district environmental protection department have taken the forms issuing Notice to Make Correction

within the Time-Limit, Notice on Action, Early-Warning Notice, and Notice to Stop within the Time-Limit and Administrative Penalty Notice to urge the owners to fulfill the job. At one time, Chongqing Municipal Environmental Protection Bureau imposed a compulsory shutdown of coal-fired boilers of 5 large-scale enterprises, which not only caused these enterprises to fulfill their obligations but also moved other owners to actively respond.

- Out source utilization: Chongqing fully utilized environmental international assistance from ODA and multilateral financial agencies such as World Bank and ADB. With regard to SO₂ countermeasures, Chongqing gained effective technical and financial support from pollutant source investigation, plan making, desulfurization equipment install, monitoring system, and gas infrastructure construction, as well as strong support from the national government.