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AIR PROTECTION AND ENERGY USAGE

Wang, Han Chen*

Energy is one of the requirements of human existence and of material production. By the time human beings obtain and use energy, the original natural environment has been changed. Wastes are produced that damage and pollute the environment in which human beings live. It is important, therefore, to research how to develop and use energy in a rational and efficient manner so as to protect the atmosphere.

ENERGY STRUCTURE AND AIR POLLUTION IN CHINA

In China, coal is the main energy source. According to 1984 statistics, the basic sources of energy in China include 75.1 percent coal, 17.7 percent petroleum, 2.3 percent natural gas, and 4.9 percent hydroelectric power. In many other countries, coal only provides 30 percent of the original energy. At present, 75 percent of industrial fuel and power, as well as 85 percent of the residential fuel are supplied by coal. Combustion of coal causes a much greater burden to the environment than petroleum or natural gas. The heating capacity of coal is lower than petroleum or natural gas, so in order to get the same quantity of heat, the consumption of coal must be 1.5 to 2 times that of heavy oil. Heavy metal pollution from coal may be from one to ten times that of heavy oil. In addition, because coal has more sulfur and nitrogen, it emits more sulfur dioxide and nitrogen oxides than petroleum and natural gas. Transportation and storage of coal may also cause certain problems in the atmosphere.

Every year, 28 million tons of dust and 14 million tons of sulfur dioxide are emitted into the air in China, among which, about 80 percent of this dust and 90 percent of the sulfur dioxide are from coal. Thus, air pollution in China is mostly pollution from coal smoke.

According to a recent atmospheric quality monitoring report, the total amount of suspended particulates and sulfur dioxide pollution is very serious, especially the suspended particulates. Conditions in most of the places monitored exceed

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the national emission standards. Some places are experiencing acid rain because the coal burned contains a high sulfur content while geographical and meteorological conditions are not favorable for diffusion of pollutants.

Apart from the coal problem and unfavorable geographical and meteorological conditions there are other important reasons for energy waste and environmental pollution. These include poor management, unreasonable distribution of energy, backward coal product processing technology, and low heating rate of coal burning facilities.

PLANS TO ENHANCE LEGISLATION AND STRENGTHEN MANAGEMENT

China is a developing country with limited financial and material resources. It is impossible for the country to allocate more money for environmental protection and elimination of air pollution. Therefore, strengthening environmental management, raising efficiency in the use of energy, and eliminating the discharge of the "three wastes" have great significance. In recent years, we have given the highest priority to legislation and management and regarded them as the most important work in environmental protection.

In 1979, with "The Environmental Protection Law of the P. R. C. (trial implementation)", the basic law of environmental protection was established. According to the requirements of this law, some special laws and regulations were promulgated to protect the atmosphere, such as "The Air Environment Quality Standards", "Boiler Smoke Dust Emission Standards", "The Regulations on Technical Policy of Prevention and Control of Coal Smoke and Similar Pollution", and "Temporary Regulations on Energy Saving". Others about to be promulgated include "The Air Pollution Prevention and Control Law", "The Industrial Furnace and Kiln Smoke Dust Emission Standards" and "Temporary Methods for Smoke Dust Control Area Management". These laws and regulations establish legal requirements for the prevention and control of air pollution. The government at different levels and its EPA also have published some air pollution rules and regulations that address more local or specific situations.

The above mentioned documents are all designed to treat energy conservation as the central issue. Prevention and control of air pollution have been made a part of energy conservation methods, municipal construction guidelines, smoke prevention and dust control in furnaces and kilns, coal burning power station reformation, etc., so as to unify economic, environmental, and social benefits. This basic guiding idea is concretely illustrated in the following example.

The Environmental Protection Law clearly stipulates that central heating systems and gas supplies in cities should be actively developed to replace individual boilers and family stoves; measures must be taken with coal burning boilers to prevent smoke and control dust; and smoke dust emissions must comply with national or local standards. "The Regulations on Technical Policy of Prevention and Control of Coal Smoke and Similar Pollution", established a number of new requirements. Included in these regulations are the following: that newly built residential or industrial areas should take the heat resulting from electricity production or central heating systems; flammable gas and waste heat outputs produced by enterprises must be collected and made available for residential usage if economically reasonable; central heating systems and city gas supplies should be developed; low sulfur anthracite should be supplied for urban use; and processed coal products should be actively promoted to replace raw coal.

The enforcement of these legal requirements plays an important role in air pollution prevention and control. Some benefits are as follows:

(1) It has promoted the installation of central heating systems as a part of new construction. For example, in Liaoning Province, 11 of 13 big cities, as well as 44 county level cities and 15 counties built central heating systems. Based on available statistics, central heating systems that combine heat and electricity production, industrial waste heat usage and district boiler houses could supply heat to families in 17.36 million square meters by the end of 1985. In 1980, only 2.5 percent of the people in this province could be supplied with central heat; by 1985, the number increased to 10 percent. During these five years, 2.46 million tons of coal were saved; 3,726 hot water boilers were replaced by central heating systems; and 248,000 square meters of boiler house buildings and 5000 boiler operators were saved for other jobs. At the same time, emission of smoke was reduced by 123,000 tons and sulfur dioxide was reduced by 73,000 tons.

Shengyang, a city in Liaoning Province, invested 14 million Yan of RMB to rebuild the Shengyang power station, in order to produce electricity and thermal energy at the same time. The heat produced was supplied to the Tiexi District residential area, which covers about 2.3 million square meters. Central heating replaced 203 boilers; saved 100,000 tons of coal and 800,000 kwh of electricity per season; and eliminated 1,670 boiler operators. The economic benefit was 3.1 million yan of RMB. The total investment could be returned in 4 years. By using central heating systems, smoke-dust was reduced by 8,000 tons, sulfur dioxide was reduced by more than 1,000 tons, sus-

pended particulates were reduced from 1,413 micrograms to 490 micrograms, and sulfur dioxide per cubic meter of air was reduced from 154 micrograms to 45 micrograms.

Central heating systems in China have been developed to a new stage. In 1980, central heating systems covered only 18 million square meters, while in 1985, the total supply area increased to 55 million square meters. The average saving on coal per year has been 1.3 million tons. Smoke-dust emission has been reduced by 58,000 tons and sulfur dioxide has been reduced by 25,000 tons.

(2) The composition of urban fuel use has undergone certain changes. Active measures have been taken to collect coke-oven gas and coal-mine gas. Factories are using coal instead of natural gas or gas derived from coal. City coal-gas supplies are developing. For example, the city of Fushueng in Liaoning Province actively collects coal-mine gas to supply 80,000 families. In this way, 100,000 tons of coal can be saved every year, and the investment is only 30 percent of a new coal-gas production facility. In addition, there will be 30,000 tons less waste and 20,000 tons less sulfur dioxide yearly.

Another example is the city of Chengdu in Sichuan Province. The city required factories to use coal instead of natural gas in order to supply gas to 120,000 families. Every year it can save 80,000 tons of coal, reduce 5,700 tons of sulfur dioxide emissions and 24,000 tons of waste. The concentration of sulfur dioxide in the city's 57 square kilometer area had exceeded the national ambient air quality standards. After using natural gas, sulfur dioxide in the air declined to below the standards.

During the period of the "sixth five-year plan", gas supplies were developed very quickly in cities. About 11 million people could use gas in 1980, while in 1985, the figure increased to 25 million people. Seventy percent of the residentially-used gas comes from collected flammable gas. By using such gas, 3.2 million tons per year of coal can be saved; 60,000 tons of sulfur dioxide emissions into the air can be reduced; and the city can discharge one million tons less waste.

(3) Processed coal products are now more widely used. In China, residential consumption of coal is about 83 million tons per year. In 1985, honeycomb briquet production reached 21.17 million tons—double the output of 1980. Honeycomb briquets are 20 to 30 percent more efficient than unprocessed coal. Combustion of briquets produces 90 percent less smoke-dust emissions and 40 percent less sulfur dioxide emissions because they contain lime or calcium carbide. The total coal saving in five years amounts to more than 11 million tons.

(4) Striking progress has been achieved in smoke prevention and dust control. In order to meet national standards, there has been widespread replacement of the low efficiency, but serious pollution-causing boilers. By 1985, 70 percent of the 100,000 heavy polluting big boilers in the country had been replaced or retrofitted with pollution control equipment. In major cities, certain boilers have been equipped with automatic coal feeding machines and dust-control facilities. Many cities, in regulating single boilers to prevent smoke and control dust, have designated smoke-dust control areas. In doing so, the elimination of individual sources of pollution has been changed to comprehensive control. As a result, smoke prevention and dust control has been enhanced and strengthened.

(5) Major progress also has been made for industrial air pollution prevention and control. The electric power and metallurgy industries control pollution by strengthening management, practicing an economic responsibility system, adjusting industry layout, transforming technology and making comprehensive usage of resources and materials. These measures have very obvious results. For instance, most electric power producers have adopted the electrostatic precipitation technique for major new and enlarged coal-burning generating facilities. Older coal burning power stations generally use a Venturi scrubber instead of the inefficient dust-collecting cyclone.

The use of high technology increased from 5 percent in 1980 to 30 percent in 1985. Although 43 percent more coal was used in 1985 than in 1980, dust emission only increased by 5.7 percent. During the period of "the sixth five-year plan", the nation's raw steel output increased by more than 9.5 million tons, while dust emissions were reduced by 200,000 tons. Dust emissions in major steel mills were reduced by about 20 percent.

The "sixth five-year plan" is a period of rapid development in our social economy. Although industrial output and population both are increasing greatly, and coal consumption also has substantially increased, degradation of urban air quality has been mitigated and, in some cities, has even improved. The results show that strengthening management through legislation is very necessary.

POLLUTION IS STILL SERIOUS, AND WE HAVE AN ARDUOUS TASK

Although we have made some progress in air protection, the situation is still very serious. Air pollution in China equals that occurring in some developed countries during the

most seriously polluted period of the 1950s and 1960s. In some large cities, the concentration of suspended particulates in the air in 1983 was from several to tens of times that of foreign cities during the same period of time.

Along with economic growth and rising living standards, coal consumption will continue to increase. Current estimates indicate that by the year 2000, coal consumption in China will increase to about 1.3 billion tons, and in 2020 the amount will be 3 billion tons—equal to the present total consumption of the world. Preventing and controlling coal smoke-related pollution, therefore, will be a long-term and arduous task in China.

In China, air pollution primarily results from industrial and urban coal combustion facilities. At present, there are 300,000 hot water boilers, tens of millions of coal burning stoves, and large numbers of industrial furnaces and kilns. The total coal consumption by these facilities is about 500 million tons, which is 60 percent of the total national consumption. Coal burned by these boilers and stoves is mostly unprocessed coal. This usage is the main source of air pollution.

Based on the experience of other countries in air pollution prevention and control, the best strategy is to shift fuel usage to clean fuels such as petroleum, natural gas and nuclear power; to develop electricity and gas supplies for cooking and other uses in cities; and to promote the construction of central heating systems instead of building separate boilers. Nevertheless, we can hardly realize all these things in a short time. Considering the actual conditions in China, the best strategy is to complete laws and regulations, strengthen supervision and management, and increase the efficient use of energy. In this way we can do a better job of preventing and eliminating air pollution in China.