ECONOMY AND ENVIRONMENT PROGRAM FOR SOUTHEAST ASIA

POLICY BRIEF

COAL, COSTS AND CONSEQUENCES: IMPROVING CHINA'S ENERGY PRICING SYSTEM

An overhaul of China's complicated electricity pricing system and the introduction of 'polluter-pays' levies for generators could help to resolve the environmental and health problems caused by the country's power stations. This is the verdict of a recent study by two researchers from the Center for Environmental Sciences at Peking University.

The study, carried out by Zhang Shiqiu and Duan Yanxin with financial support from EEPSEA, looked at the Mawan Electricity Plant in Shenzhen, Guangdong Province. It found that the economic cost of the environmental damage caused by the plant was substantial and affected people for hundreds of kilometers around.

Zhang Shiqiu and Duan Yanxin also found that the cost of damages caused by the most destructive pollutant emitted by the power station greatly exceeded the cost of preventing the pollution in the first place. To encourage investment in pollution prevention, the researchers recommend that the external costs of power station pollution should be incorporated in the electricity pricing system - so bringing the power of market forces to bear on the problem.

The research was carried out against a background of rapidly accelerating energy demand in China. It has been projected that, unless things change dramatically, this will increase to somewhere between 2.7 to 4.4 billion tonnes (standard coal equivalent) by 2050 (from 1 billion tonnes in 1990). It will have potentially disastrous impact on the Chinese environment. Already in Southwest China, where high sulfur coal is commonly used, the electricity sector is one of the major contributors to air pollution.

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As well as being highly polluting, China's electricity supply system is also massively inefficient and plagued with problems in its pricing structure. Pricing policies vary from region, supplier and customer, while centralized planning and subsidies on electricity prices have led to the inefficient use of energy by companies and domestic consumers alike. All provinces experience regular blackouts, and electricity shortages cost the country billions of dollars in a year.

In light of these facts, the researchers were well aware of the need for information that would help policy makers reform the pricing system to encourage efficient electricity production & consumption and better pollution regulation. Zhang Shiqiu and Duan Yanxin undertook a detailed analysis of the situation at the Mawan plant, which uses high-quality imported and domestic coal and has a capacity of 2x300MW. Their aim: to put a price tag on what the plant was doing to the environment and people around it.

The first step in the project was to identify the main problems caused by the plant. Using data from the station's Environmental Impact Statement, the researchers highlighted eleven major pollutants which were having a substantial impact on the surrounding countryside.

The researchers then assembled - from primary and secondary sources - an arsenal of information about the plant itself; about how its pollution is dispersed; and about how the highlighted pollutants affect human health and the environment. They then divided the area surrounding the plant into four concentric circles - the outer one containing provinces neighboring Guangdong, hundreds of kilometers away from the plant - and set about calculating the damage caused by the power plant in each of these circles, pollutant by pollutant.

To make the calculation of the vast amount of data necessary feasible, the researchers used a computer program based on one developed for estimating environmental externalities associated with electricity resource options in New York State. This incorporated various sophisticated modeling devices which predict how pollutants disperse.

The researchers found that air pollutants were the most damaging of the emissions from the plant and that they were the cause of a whole range of environmental and health problems. For example, although the Mawan plant uses dust-reducing equipment, it is not very effective and particulates are responsible for such problems as chronic bronchitis, asthma and other acute respiratory problems. Crop damage, acid erosion of buildings and the contamination of water supplies were among the other problems detected.

The next step was to calculate the economic cost of the various illnesses and environmental problems caused by pollution from the plant. Health impacts were estimated using data transferred from other studies ("benefit transfer"). A number of established economic models were used to calculate the cost of pollutants on the environment. For example, the cost of waste water treatment was used as a proxy for the environmental cost of waste water pollution.

The results showed that, because of the plant's high smokestack, pollution had a particularly significant effect on areas far from the plant itself, with regions over 80km away suffering between 78.4% and 84.1% of the total environmental damages. Of the pollutants SO2, NOx and particulates alone accounted for 80.5 to 90% of all the damages. SO2 was the most significant - causing the deaths of between five and 13 persons per year and causing annual damage worth between $1.65 million and $2.95 million. The study also showed that SO2 emissions produce environmental costs of up to $173.50/ton. This compares favorably with SO2 mitigation costs which in China are about $100/ton.

In all the researchers found that the total cost of all the environmental and health impacts of the pollution coming from the Mawan plant was between $3.8 million and $6.7 million. Translated into cost per kWh of electricity, this worked out at between 0.015 yuan/kWh and 0.027 yuan/kWh, which is approximately 2.9 to 5.2% of the current price of electricity.

China's chaotic pricing system makes it difficult to incorporate the substantial environmental cost of power generation calculated by Zhang Shiqiu and Duan Yanxin. The researchers therefore call for a more manageable electricity tariff which would allow generators to pass on some of the costs of clean-up to consumers and so encourage energy efficiency and investment in appropriate technology.

In addition, the researchers recommend that a levy or charge on SO2 should be introduced that fully reflects the damage done by this key pollutant. They suggest that would encourage electricity producers to better mitigate pollution. The current trial SO2 charge, which was introduced in China in 1992, is well below this damage cost, covering only about 20% of the damages caused.

Zhang Shiqiu and Duan Yanxin hope that such a combination of carrots and sticks could provide a powerful new policy framework for electricity charging in China.

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The full text of this study is available as an EEPSEA Research Report:
Marginal Cost Pricing for Coal Fired Electricity in Coastal Cities of China: The Case of Mawan Electricity Plant in Shenzhen, Guangdong Province - Zhang Shiqiu and Duan Yanxin

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