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The Impact of Policy Conflicts on Emissions Trading in China

Strengthening local capacity in the economic analysis of environmental issues

The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 10 member countries (i.e., Cambodia, China, Indonesia, Lao PDR, Malaysia, Myanmar, Papua New Guinea, the Philippines, Thailand, and Vietnam.) It aims to strengthen local capacity for the economic analysis of environmental issues so that researchers can provide sound advice to policy makers.

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In China, emissions trading is seen as a potentially cost-effective option for pollution control. As such, pilot emissions trading programs have been put in place. However they have not been successful at tackling the country's extremely pressing pollution problems. An EEPSEA research study looked at whether the environmental policies currently in place conflict with and reduce the effectiveness of the emissions trading approach. To do this, the study used an agent-based model to assess the SO_2 emissions trading market in the province of Jiangsu.

The study is the work of Bing Zhang and Yongliang Zhang from Nanjing University. It found that four main policies are in conflict with the emissions trading approach. Of these, China's Regional Total Pollution Control Policy has the most significant impact. In all, the study's modeling shows that policy conflicts reduce both the quantity of emissions traded and the potential cost savings that the emissions trading approach can bring. The study therefore makes a number of policy recommendations to enhance the effectiveness of the emissions trading approach. It recommends a hybrid policy approach that combines an emissions trading policy with a low emissions discharge levy.

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A summary of EEPSEA Research Report No. 2014-RR9: 'Policy Conflicts and the Performance of Emissions Trading Markets: An Adaptive Agent-based Analysis' by Bing Zhang and Yongliang Zhang. Comments should be sent to Bing Zhang, Department of Environmental Planning and Management, School of Environment, Nanjing University, Xianlin Campus, 163 Xianlin Avenue, Nanjing, China 210046. Email: zhangb@nju.edu.cn

China's pollution challenge

Pollution is a major problem in China and growing criticism, from both inside and outside the country, is forcing the government to act. As part of this response, the State Environmental Protection Agency (SEPA), now the Ministry of Environmental Protection, set a target for its 11th Five-Year Plan (2006-2010) of reducing the country's SO_2 emissions by 10% to 22.95 million tonnes.

A variety of policy options are available for SO_2 reduction and the most effective and cost-effective policies will need to be chosen if China is to meet its air quality targets. As mentioned above, emissions trading is seen as a potentially cost-effective pollution control option. Emissions trading is a market-based mechanism that allows regulated facilities (such as power stations) to transfer emissions allowances between themselves. When the system works properly, this leads to the distribution of emission reductions amongst facilities. It can therefore minimize the aggregate costs of achieving any given reduction in emissions.

In 2002, SEPA began the 4+3+1 program, which set up pilot emissions trading areas in Shandong, Jiangsu, Shanxi and Henan provinces, Shanghai and Tianjin municipalities, Liuzhou city, and the China Huaneng Group. The program was put in place against the backdrop of China's regulatory system for pollution control, which had been in existence for quite some time.

The Jiangsu SO_2 emissions trading market

Given the state-of-play in China, this study set out to examine whether an emissions trading policy, like that being piloted, is compatible with China's existing industrial pollution control policies. To do this, it focused on the Jiangsu

Province SO_2 emissions trading market. Jiangsu (see map above) is the only province in China that has both an acid rain control zone and a SO_2 control zone.

Under Jiangsu's emissions trading program, every power plant in the province is issued a permit based on their SO_2 discharge efficiency. Under the scheme, power plants should not discharge more SO_2 than their permits allow. Permits can be traded between power plants.

Four of China's key existing environmental policies were examined to assess their impact on the performance of Jiangsu's emissions trading program. These were the Regional Total Pollution Control Policy, the Pollution Discharge Standard, the Electricity Generation Right, and the Pollution Discharge Levy. Under the Regional Total Pollution Control Policy, every region in China has a regional cap on SO_2 emissions. The Pollution Discharge Standard requires every power plant in China to abate more than 85% of its SO_2 emissions. Power plants in China also have to factor in the restriction of the Electricity Generation Right, which limits the amount of electricity they can generate. In addition, all power plants in China pay a Pollution Discharge Levy.

Collecting information

The study looked at the 45 Jiangsu power plants. These plants accounted for 75.7% of the SO_2 emissions discharge created by the electric power industry in 2010, and produced 48,704 MW of power capacity. On 2010, 24 of them exceeded their emission permits while the others had a surplus.

The study collected a wide range of information to make its assessment. This included the electricity generation allowance, electricity prices, coal consumption, electricity generation, and SO_2 emissions for the years 2006-2010. This information was collected from the power plants and from the Environmental Statistics System of Jiangsu. Details of the emission discharge fee and coal prices were also gathered.

Face-to-face interviews were carried out at the 45 Jiangsu power plants. Power plant personnel were asked about their implementation data and about how they intended to achieve pollution control targets. They were asked the following questions: *Which factors will affect your decisions regarding emissions trading? How do you make an order if you want to trade your permits? How do you adjust your pollution control strategies by learning from pervious emission trades? Which factors/policies restrict your trades?*

Agent-based modeling

To assess the performance of the emissions trading system and the impact of traditional environmental policy upon it, the study used agent-based modeling (ABM). This takes into account the dynamic behavior and complex interactions between firms in emissions trading systems. The four chosen policy variables were factored into the emissions trading model and their impact was compared with a 'baseline' scenario in which policy conflicts were not taken into consideration.

The agent-based model was implemented in NetLogo. This is a purpose-built ABM language and environment, which is intended for use in modeling a range of phenomena, especially complex systems with a large number of interacting parts.

The impact of the four key policies

The study found that, due to the restraints imposed by China's Regional Total Pollution Control Policy, power plants cannot trade across regions, which severely limits the extent to which the market for pollution permits can be optimized. What's more, the required SO_2 Discharge Standard stops power plants with high emissions abatement costs from buying permits, as it forces them to reduce pollution by themselves.

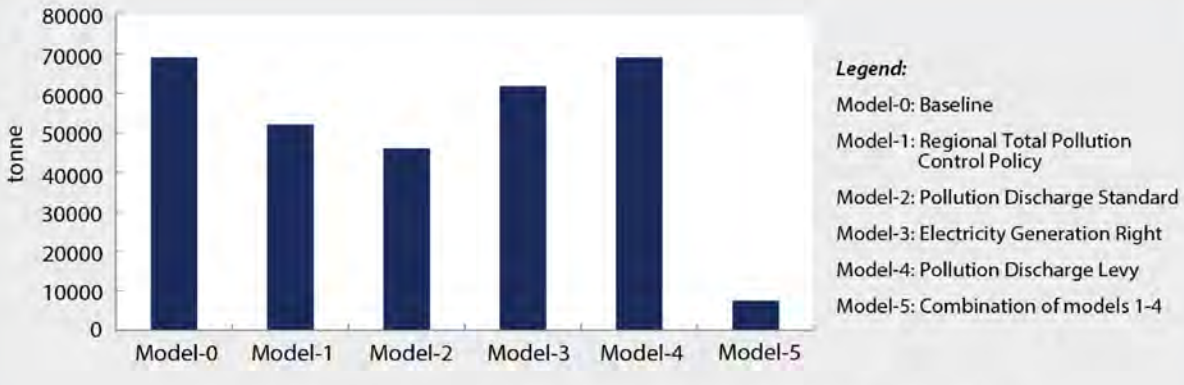
The Electricity Generation Right means that power plants cannot generate more electricity than they have a right to. This reduces the power plant managers' motivation to generate electricity and, in turn, decreases the demand for permits. This decrease in demand for permits then reduces the amount of emissions traded and depresses total pollution cost savings.

The Pollution Discharge Levy increases the costs of running a power plant and so reduces the motivation to generate electricity. Through its modeling assessment, the study found that when the Pollution Discharge Levy was set at a low level (e.g., zero), it did not affect the emissions trading amount and cost savings. However, when the Pollution Discharge Levy was set at a high level (e.g., CNY 5.67/kg), it would reduce both the market price of permits and the cost savings produced by the Jiangsu SO_2 emissions trading market.

Policy conflicts: the overall impact

When comparing the four different policy conflict scenarios, the study found that the Regional Total Pollution Control target had the most significant impact on the performance of the emissions trading market, reducing the quantity of emissions traded by 33.25% (see figure below). At the opposite end of this spectrum, the Pollution Discharge Levy had the smallest impact on the amount of emissions traded. In total, all four policy conflicts (model-5) reduced the quantity of emissions traded to 7,534 tonnes of SO_2. This is just 10.9% of the emissions traded in the baseline scenario in which these policy conflicts are absent.

It terms of costs, the study found that restrictions on emissions trading reduce the potential cost savings of the Jiangsu SO_2 emissions trading market. In particular, the study found that both the Pollution Discharge Standard and the Pollution Discharge Levy increased total pollution control costs (although the Electricity Generation Right decreased the total pollution control costs). The Regional Total Pollution Control Policy had the



Amount of emissions traded via the Jiangsu SO_2 emissions trading market

most significant impact on the cost savings of the Jiangsu SO_2 emissions trading market, reducing them by 42.3% (compared to the scenario in which policy conflicts are absent). When all four policy conflicts were taken into account, the emissions trading market only delivered a cost saving of CNY 1.55E+08, which was just 3.79% of the total emission control costs.

Policy implications

The results show that policy conflicts have a significant impact on the Jiangsu SO_2 emissions trading market, with the exception of the current low level of the Pollution Discharge Levy. Overall, the study found that policy conflicts or constraints reduce the amount of emissions traded and stand in the way of this market being optimized.

Since the size of the market has a significant impact on the performance of an emissions trading market, the study recommends that a large-scale emissions trading market be designed in China. This is because the results show that a province-level or a regional-level emissions trading market is more suitable for implementing a SO_2 emissions trading policy.

As the Electricity Generation Right inhibits power plants with a high marginal profit from buying SO_2 permits from plants with low marginal profits, the study recommends that a Generation Right trading system for power plants should also be developed.

Why a hybrid policy makes sense

The study simulation shows that an increase in the Pollution Discharge Levy depresses the emissions permit price. While the current low Pollution Discharge Levy does not affect either the amount of emissions trading or the total emission control costs, it is clear that superfluous environmental regulations will hinder the technology innovation of power plants and increase administrative costs.

Thus, the study recommends a low-level Pollution Discharge Levy for the SO_2 emissions trading policy in Jiangsu Province. It also recommends that the design of an emissions trading policy should be combined with a Pollution Discharge Levy policy. Indeed, the study considers that such a hybrid policy – in place of pure price or quantity controls – is more efficient as a "safety valve".

Overall, the study recommends that China should develop its emissions trading programs more carefully. The design of emissions trading policy should pay attention to existing environmental regulations, which have been designed without taking emissions trading into account.

However, the study notes that the behavior of the power plants in the emissions trading market is very complex and will be further affected by other environmental policies. The study therefore recommends that further research should be undertaken to take such future developments into consideration.

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