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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: Cambodia, China, Indonesia, Laos, Malaysia, Papua New Guinea, the Philippines, Sri Lanka, Thailand, and Viet Nam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to policymakers.

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Pollution Prevention Pays: Pollution Charges in Cambodia

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Across the developing world, governments are grappling with the problem of industrial pollution. A new report from Cambodia looks into a system of pollution levies that would encourage polluting firms to clean up their emissions. The report sets out a series of charges that are projected to produce pollution reductions of up to 85%. It recommends a number of regulatory →

A summary of EEPSEA Research Report 2006-RR1, *The Implementation of Effluent Taxes for Cambodian Industry: An Assessment of Pollutant Levies* by Sideth Muong, Ministry of Environment of Cambodia, No. 48, Blvd. Sihanouk, Phnom Penh, Cambodia. Tel: (855) 12 94 20 84. Email: smuong@yahoo.fr

"Companies would save ...

→ and administrative changes that would help bring about such an outcome.

The study was undertaken by Sideth Muong, from the Ministry of Environment of Cambodia. Muong focused on large-scale industry sectors that are known to be highly polluting. These include pulp & paper, food & beverages, metal treatment, chemicals and plastic production. The study was undertaken against a background of rapidly increasing industrial growth in the country. From 1990 to 2001, the average annual growth rates for the industrial and manufacturing sectors were 10.2% and 8.2% respectively (compared to 1.8% for the agricultural sector).

The Impact Of Industrial Pollution

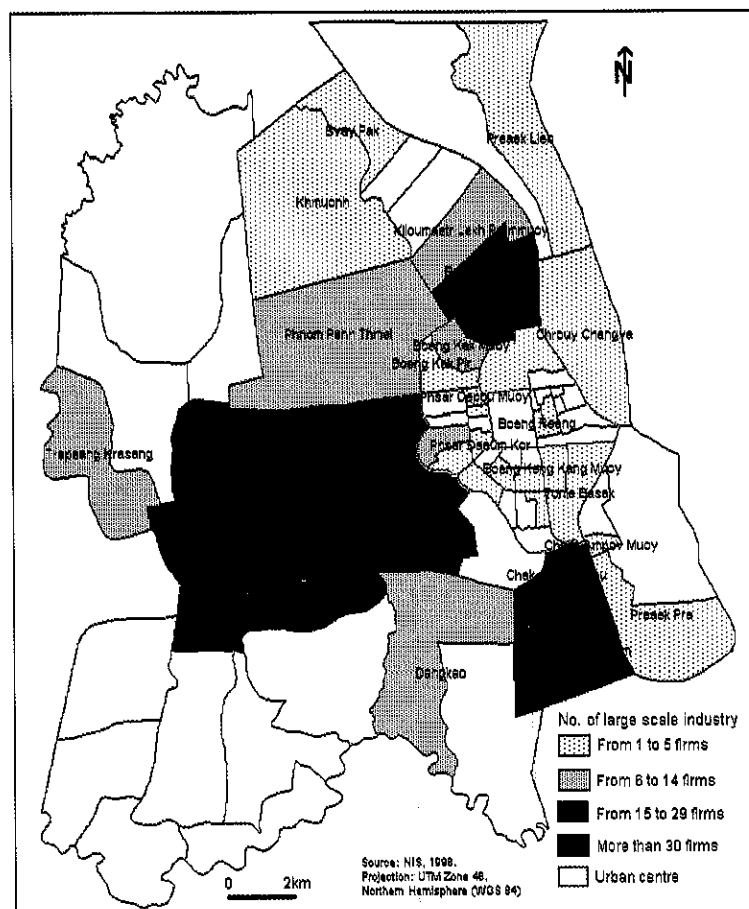
Cambodia's economic growth has had a number of negative environmental and social impacts. For example, increasing industrial effluent discharge is a major cause of the degradation in water quality that has been occurring in the Mekong River since 1994. Water treatment costs have risen, financed in part through increased water prices.

The government is responding to this challenge. In 1999, the Ministry of Environment issued discharge standards for companies that channeled their effluent into rivers. All pollution sources that do not meet these standards are subject to a penalty of up to KHR 50 million (USD 11,904). However,

enforcement of these standards has, so far, been limited, mainly due to a lack of trained inspection and enforcement staff at the Department of Pollution Control.

Who Are The Polluters?

Given the urgent need to address the water pollution problem and the potential cost of pollution abatement technology, Muong looked at the impact pollution levies would have on both the environment and on companies' bottom-lines. He also aimed to see whether a levy-based approach would bring more benefits to industry than a simple command-and-control penalty-based strategy.



Geographical distribution of firms located within Phnom Penh

First, he identified the firms and pollutants to be targeted by pollution levies. Information on industrial pollution was compiled from secondary sources and from a survey of 400 polluting firms. The effluent emissions from these plants were estimated at 7.6 million m³/year - equivalent to 1,584 tons per year of BOD emissions.

The survey produced reliable results on production, ownership, employment, effluent discharge and BOD emissions. This was helpful in identifying the most polluting industries, to which most attention should be devoted. However, most

through pollution abatement "

firms considered abatement costs to be confidential and only a few plants provided details on these.

Marginal abatement costs (MAC) from China and Vietnam were therefore used to estimate how much local firms would spend on pollution reduction. The use of Chinese MAC figures was justified by the fact that over 50% of the targeted plants were owned by citizens from China, Hong Kong, Taiwan and Macao. It was further justified by the fact that MAC estimates in China are based on the textile sector. MAC estimates from Vietnam were also used for comparison. The estimates from Vietnam represented average costs across all sectors.

Firms And Targets

The selection of firms for the study was based on the criteria of the 1999 water pollution legislation. This rules that emission permits must be obtained for plants that discharge at least 10 m³/day. 250 large firms that discharge at least this amount of

pollution were chosen for the main part of the study. Of these, 247 were textile plants. The other three were large beverage firms. The total BOD emissions from these 250 plants was 1,384 tons per year. The majority of these firms (83%) are located in Phnom Penh, with most of the others in the neighbouring province of Kandal. The large majority discharge their effluents into surrounding wetlands. About 20% of plants discharge into rivers.

The central aim of Muong's study was to find ways to bring pollution down and four pollution reduction targets were chosen. The least ambitious target was a 25% reduction in emissions – from the existing level of 1,384 tons/year to 1,038 ton/year. Three implications of meeting three other targets (40%, 65% and 85% reductions) were also investigated.

The Effluent Levy

The effluent levies that Muong assessed consisted of fixed and variable fees. The fixed

administration fee was designed to cover the costs of discharge permits, inspections, monitoring and enforcement programs. The variable fee was based on the volume of effluent produced and its BOD concentration.

Given a well-implemented levy system, polluting businesses will prevent or clean up their discharges if it costs them less than the pollution levy they would otherwise have had to pay. Conversely, they will tend not to clean up if this costs them more than the levy itself. An analysis of MAC figures and potential pollution levy charges therefore allowed Muong to calculate how much the levies would have to be to induce companies to achieve the desired levels of pollution abatement. It was then possible to calculate the overall pollution abatement costs for each company and the revenue generated by the levies.

Setting The Levy Charges

Muong found that using MAC figures from China and Vietnam produced very different results. For example, to achieve the 25% BOD reduction target, the fee levy would have to be USD 1 per ton of BOD (using MAC estimates from China) or USD 29 per ton of BOD (using the figures from Vietnam). Using MAC estimates from China, effluent levies as low as USD 13 per ton of BOD would be sufficient to meet the 85% BOD reduction target. To meet the same target the effluent levy would have to be USD 521 per ton of BOD if the MAC figures from Vietnam were used.

Timetable for fee application and estimate of revenue generation

	Fee rate	Targeted sector	BOD emission (ton/y)	Target BOD reduction if MAC*			Revenue generated (thousand USD/year)		
				CN	VN	PH	CN	VN	PH
Year 1	104	Textile, beverage (>10 m ³ /day)	1,384	96%	60%	25%	10.1	57.7	144.2
Year 2	260	Textile, beverage (>10 m ³ /day)	1,384	96%	81%	25%	14.4	68.5	252.3
Year 3	260	Textile, beverage (>10 m ³ /day)	1,384	96%	81%	25%	14.4	68.5	252.3
Year 4	469	All sectors (>10 m ³ /day)	1,384	96%	81%	45%	26.0	123.2	259.5
Year 5	495	All sectors (>10 m ³ /day)	1,452	96%	81%	45%	131.7	313.1	530.2
Year 6	521	All sectors	1,542	96%	90%	45%	131.9	315.6	531.9

Notes: *: MAC estimates: CN: China, VN: Vietnam, PH: Philippines. Fee rate is in USD/ton of BOD. The budget of the Ministry of Environment in 2003 is about USD 2.1 million. Thus, the effluent fee from USD 104 to 521 per ton of BOD would generate revenue of between 0.5% to 25% of the MOE' annual budget.

In all, with four target BOD reduction levels and two sets of MAC estimates, eight fee levies were calculated. These fees would generate from USD 1,009 to 130,080 per year in revenues. For efficiency purposes, only fees that would generate at least USD 10,000 per year in revenues were selected for further study. Given this criteria, the selected fee levies were therefore between USD 104 and 521 a ton of BOD.

Testing The Findings

As marginal abatement cost functions from two other countries were used, and as these varied quite significantly, an extensive sensitivity analysis was carried out to confirm suitable levels of effluent levies for Cambodia. In the first such analysis, the effect of a rise in BOD emissions of between 16% and 45% was modeled. It was found that the chosen fee levies of USD 104 and 521 a ton of BOD were still sufficient to meet the 40% BOD reduction target. The impact of the differences between both purchasing power parity and per capita income levels in Vietnam, China and Cambodia was also analysed. The results did not put the chosen levy values in question.

A Pollution Levy Strategy

In light of these findings Muong suggests a strategy to reduce pollution in Cambodia. He recommends the application of a levy of USD 104 a ton of BOD for an initial year. This levy should then be raised to USD 260. This would help reduce BOD emissions by between 40% and 65% and generate about USD 10,093 to USD 68,463 per year in revenue.

Muong predicts that if this effluent levy is applied to Cambodian industry, it will give companies a significant economic incentive to reduce their pollution output. Under his proposed scheme, companies would make an average saving of 31% if they abate, rather than forego any abatement and pay the levy. This is because the sum of their pollution charges and abatement costs would be significantly less than the fees they would have to pay if they did no clean up.

Implementing The Policy

Setting up a system of pollution levies will require regulatory changes. Muong recommends the establishment of an agency for the management of the effluent levies.

This would have three operational units: monitoring & enforcement; finance & fee collection; and revenue distribution. This new agency could be under the control of the Ministry of Environment or the Ministry of Finance or it could be an autonomous agency. Initially, eighty percent of revenue from the levies could be used to cover the agency's staff development. This amount could gradually be reduced so that, eventually, most revenue could be used to subsidize pollution reduction efforts by firms.

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