SUSTAINABLE DEVELOPMENT

Incentive-Based Policies for Environmental Management in Developing Countries

Robert C. Anderson

AUGUST 2002 · ISSUE BRIEF 02–07

Resources for the Future
1616 P Street, NW
Washington, D.C. 20036

Telephone: 202–328–5000
Fax: 202–939–3460
Internet: http://www.rff.org

Issue Briefs are short reports designed to provide topical, timely information and analysis to a broad nontechnical audience.

Incentive-based instruments use financial means, directly or indirectly, to motivate polluters to reduce the health and environmental risks posed by their facilities, processes, or products. These instruments typically provide monetary and near-monetary rewards for polluting less, and impose costs of various types for polluting more. According to economic theory and modeling exercises, incentive-based instruments such as pollution charges and tradable permits are more cost-effective than traditional forms of regulation. Incentive-based approaches also can address small sources of pollution such as households that are not easily controlled with traditional forms of regulation, as well as provide a reason for polluters to improve performance relative to existing regulatory requirements. Finally, incentive-based forms of regulation can provide a stimulus for technological change and innovation in pollution control.

Historically, environmental regulation has relied on the enforcement of regulations governing the discharge of pollutants to the environment. That so-called "command and control" approach worked reasonably well for the first rounds of control of large and highly visible sources of pollution. As control efforts tightened, however, high costs became a more visible drawback to the command and control approach. Regulators also noted problems in dealing with releases of pollution from small industrial sources and households.

As a group, incentive-based instruments differ from traditional command and control requirements in terms of their information and enforcement requirements, as well as institutional, political, and other demands. Among incentive-based instruments, there is tremendous variation in the prerequisites necessary for successful implementation.

Because of their limited resources and often-severe pollution problems, developing nations increasingly are being asked to consider and implement incentive-based regulations for managing the environment. These requests come from multilateral development organizations such as the World Bank and the Asian Development Bank, as well as individual donor agencies such as USAID. The primary drivers of these initiatives are desires to improve the environmental effectiveness of traditional regulatory strategies as well as to reduce compliance costs.

The range among costs per ton incurred to control pollution can vary by several orders of magnitude. Pollution charges and tradable permits offer a means of improving cost-effectiveness relative to purely command and control approaches by allowing control efforts to be effectively targeted where they are less costly. Air pollution in Cairo, Egypt, provides a graphic example of inefficiency. Cairo experiences some of the highest particulate matter readings in the world. Annual mean readings are 5 to 10 times U.S. and World Health Organization norms (depending upon the measure). Egyptian authorities have required electrostatic precipitators at some but not all of the local cement plants (average cost $9 per ton of PM reduction) and begun a vehicle inspection and maintenance and old taxi scrapping programs (average cost well over $5,000 per ton of PM and other pollutants). For political reasons, other cheaper control measures are not under consideration—such as emission controls at large state-owned steel and fertilizer plants and elimination of subsidies for high sulfur fuel oil.

Developing countries have implemented a variety of economic incentives for managing the environment. The variety of economic incentives in use today is one of the most remarkable developments in environmental management of the past decade. And with that variety, naturally, come different results.

TABLE 1

ECONOMIC INSTRUMENTS FOR MANAGING THE ENVIRONMENT

INSTRUMENT	EXAMPLES	SITUATION WHERE INSTRUMENT WORKS BEST
Pollution charges, taxes and fees	Emission charge: China, Central & Eastern Europe, FSU Effluent charge: all above plus Philippines Sewage charge: widespread Solid waste: widespread application	Damage caused by pollution is directly proportional to the amount of pollution. Monitoring data available
Input or output charges, taxes and fees	Carbon tax: no developing countries yet Leaded gas tax: Thailand, Philippines Fertilizer tax: no developing countries Water user fee: widespread Sewer fee: widespread CFC tax: no developing countries	Numerous sources No monitoring data Damage caused by pollution is directly proportional to the amount of pollution. Linkages between input or output and environment
Subsidies for environmentally friendly activities	Industrial pollution control: many examples Agricultural activity: many examples Municipal sewage plant: many examples	Monitoring data available Subsidy is not likely to stimulate new entrants
Removal of environmentally harmful subsidies	Fuel subsidies: China Agricultural subsidies: Egypt and others	Environmental harms from the subsidies can be documented Political will exists to remove subsidies
Deposit-refund	Beverage container: many voluntary examples, mandatory in Korea Lead-acid batteries: many voluntary examples Automobile bodies: Greece	No monitoring data Recyclable product
Performance bonds	Mining: Indonesia Timber harvesting: Philippines	Specific actions desired
Tradable permits	Emission: Santiago, Chile Effluent: no developing countries Water rights: Chile Fisheries access: several	Few, if any, pollution "hotspots" Precise control over amount of pollution important Marginal control costs vary across sources
Liability	Natural resource damage assessment: Russia, FSU, others on case-by-case basis	Large impacts
Information provision	Toxic releases: Mexico, India, others Product characteristics: Korea, Thailand, others	Recipients understand information
Voluntary mechanisms	Energy conservation: many under development Water conservation Pollution prevention: many cleaner production pilot projects	Firms willing to exceed applicable standards

Fees, Charges, and Taxes

From the perspective of sources, environmental fees, charges, and taxes are largely interchangeable in terms of their effects. Pollution may be targeted through environmental levies on inputs, outputs, or on pollution generated by sources. Developing countries have imposed a great variety of such levies. Levies on inputs and products generally are the simplest to collect but are more removed from the actual decision to pollute, weakening the incentive.

Emission and effluent fees impose requirements on regulators and the regulated community:

- Measurement of mass emissions or effluent
- Setting appropriate fee level
- Collecting amounts due, and
- Disposition of the amounts collected

Charges on air emissions are especially difficult because of difficulties in measuring mass emissions. Because emission standards in most nations are expressed in terms of concentrations, not mass, only fairly crude estimating techniques normally are used to calculate payments due.

The Chinese Pollution Levy System is the most comprehensive emission charge system in the developing world. Charges are too low to directly affect polluting behavior, however. Historically, about three-fourths of levy payments were returned to sources for pollution control investments and those investments are believed to have had an impact on emissions. The remainder pays for environmental management at the local and regional level. Thus, the Chinese levy can be thought of as a hybrid policy with a substantial subsidy component. Water effluent discharge is different in that sampling and flow measurement are relatively inexpensive. At Laguna Lake in the Philippines, a sophisticated effluent discharge fee system with high fee levels has proven effective in limiting BOD discharge.

Charges are sometimes levied on products—e.g., chlorofluorocarbons, low-efficiency automobiles, fertilizer, motor oil, and packaging—that are believed to have harmful effects on the environment. Other fees are charged for activities that are potentially damaging to the environment. Gasoline taxes in Thailand and the Philippines that differentiate between leaded and unleaded are an example.

Subsidies for Pollution Control

Two types of environmentally-related subsidies are noted: monetary payments to encourage environmentally friendly actions; and existing subsidies for energy, water, and other resources that have environmentally harmful consequences.

Subsidies to support reductions in pollution take many forms. Among the subsidies that are used at all levels of government to help manage environmental pollution are grants, low-interest loans, favorable tax treatment, and preferential procurement policies for products believed to pose relatively low environmental risks. Subsidies are used to support private-sector pollution prevention and control activities, the cleanup of contaminated industrial sites, farming and land preservation, consumer product waste management, alternative automobile fuels, clean-running cars, and municipal wastewater treatment.

Subsidies for environmental management are sometimes criticized because the government entity—and, ultimately, the taxpayer—providing the subsidy is helping to bear the costs that should be the responsibility of the polluter. However, sometimes the subsidy is paired with a tax, leaving the taxpayer burden unchanged. Other environmentally related subsidies, such as federal support for timber harvesting in the national forests, also are criticized because they have proven harmful to the environment. Nonetheless, subsidies have become a fairly common tool to manage the environment at every level of government.

Eliminating environmentally harmful subsidies can be even more effective when used to improve environmental quality. In the early 1990s, the World Bank made the phaseout of pesticide subsidies a condition for new lending to Egypt. The GOE agreed, and the use of pesticides dropped by nearly 70% over the next five years.

Deposit-Refund Systems

Deposit-refund systems require a monetary deposit at the time of sale of a product. The deposit is returned when the item is returned at the end of its useful life. In the United States, deposit-refund systems have been applied most widely to help control the disposal of lead-acid batteries, but they also are being applied in some states to products such as aluminum and glass cans, pesticide containers, and tires. When used products are valuable, as is currently the case for lead-acid batteries, the private sector often creates and manages a disposal system. Regardless of who manages the disposal of such products, the fees charged by this system help subsidize the return of recyclable products.

Deposit-refund systems appear to be most appropriate for discrete, solid commodities such as beverage containers, batteries, and car bodies that would cause environmental harm through their improper disposal. Government-mandated deposit systems for less discrete substances, like air and water pollutants, have not been attempted. One factor that limits the widespread use of deposit-refund systems is their high cost of implementation. Collecting and refunding deposits on the sale of individual products such as beverage containers tends to be expensive, and additional costs are involved in collecting and returning used products for disposal.

Among middle-income countries, South Korea has one of the most extensive deposit systems in terms of items covered. Under a 1991 amendment to its Solid Waste Management Act, South Korea introduced a comprehensive deposit program affecting packaged paper, metal cans, glass and PET bottles, batteries, tires, lubricating oils, televisions, and washing machines.

Performance bonds

Performance bonds are fees levied upon companies that extract certain natural resources, such as timber, coal, oil, and gas, and on construction activities. Amounts deposited as the performance bond can be refunded when the payer fulfills certain obligations. In that sense, a performance bond acts like a deposit-refund system.

While performance bonds give companies an economic incentive to reclaim mining sites, follow logging regulations, and perform construction activities in compliance with applicable rules, they are backed up by what might be a stronger incentive. A firm's ability to obtain future min-

eral leases, timber harvesting contracts, or construction permits is dependent in large part on satisfying today's regulatory requirements.

The People's Republic of China uses a performance bond to ensure compliance with its "three simultaneous" policy. The policy seeks to have projects designed, constructed, and operated in compliance with all environmental regulations. The use of performance bonds to ensure financial responsibility is overseen by the Ministry of Finance or by the relevant economic sector institution. The People's Republic of China has limited experience with performance bonding to ensure sufficient financial resources for environmental management. In the case of the "three simultaneous," the bond is intended to guarantee that an enterprise designs, builds, and operates its pollution control facilities in a manner that's consistent with applicable regulatory requirements. Provincial and local environmental protection bureaus administer the bond.

Beginning in 1997, Indonesia's Director General of Mining required mine operators to post a reclamation guarantee reflecting the value of the potential environmental damage the mining operation could cause. The amount of the guarantee is set at the estimated reclamation cost should the damage be caused. The Indonesian government refunds the guarantee upon satisfactory performance by the operator.

Beginning in 1991, the Philippines used a Forest Guarantee Bond (a returnable performance bond) to encourage responsible long-term management by leaseholders, offer a means for promptly penalizing lessees if there is a violation of the agreement, and provide a market-based measure of profitability of a forest lease with harvesting rights by having would-be leaseholders bid against one another for the right. The government set a floor price for leases that approximated 10% of the value of the standing timber. The government suspended the scheme in 1995 after it was clear that the bid amounts were not sufficient to discourage clear-cutting and did not produce the desired investments in planting and protecting forests. Instead, the bonds simply were forfeited.

Marketable Permits

The general principle of emissions trading systems is that sources may satisfy their obligations by one of two means: (1) limiting the releases of pollution to no more than the permitted amount, or (2) releasing more (or less) than the permitted amount and exchanging credits representing any deficiency (or surplus) in the quantity of emissions. Producers with average incremental costs of pollution control are likely to meet their obligations without trading. Producers with relatively high incremental control costs are likely to be buyers of pollution reduction credits; sources with relatively low incremental costs of control are likely to be sellers of excess credits. The broad objective of emissions trading is to lower the total costs of achieving a given environmental goal.

Emission trading has a number of technical and regulatory requirements that have limited its application in developing countries:

- the legal and regulatory framework, including the delineation of the roles and responsibilities of the different parties (regulators, emission sources, and others);
- the overall cap on emissions and the decision of which sources to include;
- the determination of emission quotas;

■ timing and spatial issues, such as how long the program will run, whether credits can be saved in one period and used in subsequent periods, and whether there will be adjustments to account for differences in the environmental impact of emissions from different locations;

■ the mechanism (or mechanisms) for measuring emissions (often a sophisticated and costly continuous emission monitoring device); and

■ tracking and enforcement requirements.

These requirements are considerably more challenging than the requirements for emission fees. Not only is greater precision of measurement desired (since sources will be buying and selling these quantities), but determining initial allocations, tracking needs, and whether to allow banking creates additional regulatory burdens.

While the United States has considerable experience with emission trading, there are relatively few other examples elsewhere in the world. Germany has an offset program that allows new sources to be located in areas with poor air quality without causing further deterioration in air quality. Santiago, Chile, established a program in tradable particulate credits in 1992. A 1993 revision of Taipei, Taiwan's Air Pollution Control Act included provisions under which individual sources may be exempted from emission standards if they can control sufficient amounts of the same types of emissions elsewhere in the same air pollution control region. Slovakia has established the foundation for trading in SO2 emissions, with actual trading not slated for another couple of years. Ontario Canada, has a pilot emission reduction trading program dating from 1997 that includes VOC, SO2, CO2, and NOx. At least two emission trading programs are under development in the People's Republic of China: nationwide trading of SO2 emissions from electric utilities, patterned after the U.S. Acid Rain program; and trading of SO2 emission reduction requirements in the city of Taiyuan (Shanxi Province). Many countries have started to design programs in tradable greenhouse gas emission credits.

Liability

Liability for damage to human health and the environment can be a powerful incentive to encourage corporations to engage in safe environmental practices, as well as to compensate those who are injured. If polluters are liable (and must pay) for the damage they cause, they will control pollution to the point where the marginal pollution damage equals the marginal costs of control. At this point, their total payments for controlling pollution and compensating victims are minimized. Liability can take two forms: civil law and common law. Civil liability is expressly written into law.

Many environmental statutes worldwide have civil liability provisions, though environmental liability actions in developing countries are relatively rare. Jurisdiction is one problem: Should a case be brought in the developing country where the spill occurred or in the home country of the concern that had the spill? As the example here illustrates, there is no universal rule regarding jurisdiction. Moreover, in some cases, individuals harmed by spills are not compensated due to unclear liability rules or inadequate financial guarantees prior to the start of operations.

On April 4, 1996 Cunard Lines' *Royal Viking Sun* strayed from course and ran into a coral reef off Tiran Island near Ras Mohammed in the Red Sea. Before the vessel was freed, it damaged ap-

proximately 2,000 square meters of reef. Egyptian authorities impounded the vessel and demanded $23.5 million in compensation for lost tourism revenues and damage to the environment. Cunard Lines settled for that amount (equivalent to more than $10,000 per square meter of reef).

A more comprehensive review would reveal that pursuing liability claims is very costly and the outcome is highly uncertain. This argues that liability is most appropriate only for large incidents and not routine polluting activities. Second, smaller and under-capitalized enterprises may find bankruptcy an attractive option in the event of a large pollution incident. Consequently, performance bonding or some other type of guarantee may be desirable for enterprises that have the potential to cause significant environmental harm.

Information Disclosure

The collection and public availability of information on environmental performance has proven to be a strong incentive for producers to reduce their emissions of pollution. The incentive derives from a number of factors. For example, when companies collect emissions information, they learn about the nature and magnitude of their emissions. When such information is made easily accessible to the public, workers and local communities have a much better idea of the environmental risks they face, so they are more prone to support or demand actions to reduce emissions. When a source's emissions are shown to decline over time, the source often reaps the benefits of better relationships with its employees and with the local community. Finally, in some cases, a proven, long-term record of environmental stewardship makes a company's products more desirable to consumers. Information disclosure takes several forms in developing countries: pollution release and transfer reporting, color-coding of firms, and product labeling. Color-coding will be discussed briefly.

In Indonesia, the Environmental Impact Management Agency created the Program for Pollution Control, Evaluation, and Rating (PROPER) to rate factories on their compliance with national wastewater discharge standards, then disclose the ratings to the public. PROPER uses five color categories to rate environmental performance: gold for firms that use best technology and reduce pollution to 5% of the national standard, green for firms that reduce pollution to 50% of national standards, blue for compliance with national standards, red for firms that fail to meet national standards, and black for those without pollution controls.

Formal as well as informal sanctions apply, depending upon the color class. For example, the Indonesian stock exchange will not list securities of firms that fall short of the blue classification. Cultural factors, such as shame avoidance and citizen lawsuits, also play a role in motivating polluters. Evidence suggests that this system is influencing behavior. In the first survey in June 1995, 35.3% of the 187 factories were in compliance with the government's water pollution regulations. Two years later, 49.2% of the factories were in compliance.

Similar programs are being developed in the Philippines, Mexico, Columbia, and the People's Republic of China.

Voluntary Actions

Voluntary pollution control programs are increasingly common in developed countries as regulators seek ways to motivate firms to go beyond compliance with existing environmental regulations. One example is cited here. Under Indonesia's PROKASIH (or Clean Rivers Program),

the largest polluters are encouraged to sign agreements to reduce pollution by specific amounts over a specific time period. In the first 2.5 years after the start of the program, about 1,000 polluters signed agreements, the majority of which took measures to reduce pollution. The government has released information on which signatories have complied and which have not and encouraged press coverage of signatories' performance under the program. Such a voluntary approach is distinct from the information-based approach described earlier since firms were not required to participate in the program initially. Those who do not participate receive no publicity. Those who join the program and follow through on commitments receive a reward in the form of a public commendation. Only those who fail to follow through on their commitments receive adverse publicity.

Conclusions

A wide variety of incentive-based programs are used in developing countries to help manage the environment. The institutional and administrative requirements of differing approaches vary greatly from one program to another. Pollutant trading imposes demands for pollutant dispersion modeling, monitoring, tracking, and enforcement that exceed capabilities in all but a handful of developing countries. Fees on pollution are much simpler to impose, though rarely are they seen at levels high enough to affect behavior. Liability also is unattractive as a means of controlling routine releases. However, many other incentive-based management tools have been implemented successfully in the developing world and this trend is continuing unabated.

Compromises often are necessary when policies are implemented. Emissions might not be measured directly, for example, implying that emission fees are based on estimates. Government agencies may own the most highly polluting factories, making enforcement of incentive-based as well as more traditional regulations problematic. Private sector enterprises may be regulated lightly or not at all if there is corruption, cronyism, or weak government institutions. Such situations would make it difficult to implement emission fees, for example. When direct control of pollution is difficult or impossible, removing subsidies and getting prices right can be an effective response, as market forces push the enterprises to modernize or close altogether. This approach requires political will—something that can be augmented through information campaigns and pollution reporting to garner popular support. External drivers also can be helpful—such as when lending by international institutions comes with conditional terms for price or subsidy adjustments.

Often the most effective incentive-based programs are tightly integrated with command and control measures. China's pollution levy system builds upon a system of emission and effluent limits. Initially, only releases in excess of specified concentrations were subject to the levy. To make the pollution levy more effective, China is moving away from concentration-based discharge limits and toward mass-based permitting. The process is taking many years, starting first with mass-based effluent charges and only recently adding mass-based charges for sulfur dioxide. Devising acceptable means to measure mass emissions and the attendant increase in regulatory burdens have slowed the process.

Further Readings

Asian Development Bank. 1997. *Potential Uses of Market-Based Instruments for Environmental Management in the Philippines*. Manila: Asian Development Bank.

Dietz, Thomas, and Paul Stern (eds.). 2002. *New Tools for Environmental Protection- Education, Information & Voluntary Measures*. Washington, D.C.: National Academy Press.

Panayotou, Theodore. 1998. *Instruments of Change: Motivating and Financing Sustainable Development.* London: Earthscan Publications.

USEPA. 2001. *The United States Experience with Economic Incentives for Environmental Management*. Washington, D.C., EPA-240-R-01-001

Vermeend, Dr. William, Jacob van der Vaart. 1998. *Greening Taxes: the Dutch Model*. Dordrecht: Kluwer.

Robert Anderson is a private consultant; his clients include the Asian Development Bank and the World Bank.