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Instruments for Environmental Policy

Foreword

In its work of contributing to environmentally sustainable development, Sida has attached considerable importance to environmental economics for many years, partly for analytical purposes and partly as a tool for change. This paper discusses the design of policy instruments, and describes how we can use them to overcome various environmental problems. It describes, for example, how environmental economics can be applied in practice to give us cleaner air or a more sustainable use of natural resources. It provides an insight into how environmental issues can be related to social and economic issues.

The author, Thomas Sterner, is professor of environmental economics at Gothenburg University in Sweden and a University Fellow of Resources for the Future, Washington DC. For more than a decade he has collaborated intensively with Sida on issues concerning environment, resources, poverty and development. He has recently published a book, *Policy Instruments for Environmental and Natural Resource Management.* The book is a co-publication of Resources for the Future, the World Bank, and the Swedish International Development Cooperation Agency (Sida). This paper can be seen as an independent summary of the book.

The book, which is one of the most comprehensive books available on the subject, will be used as a textbook in various educational contexts. For persons who, for one reason or another, do not want to study the extensive material in the book, this paper can hopefully provide some quick insights into the character of some environmental problems and can stimulate ideas on how the problems can be solved. Policy instruments are necessary and need to be used much more extensively than they are today – we cannot allow unsustainable development to continue.

Mats Segnestam
Head of Sida's Environment Policy Division

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Author: Thomas Sterner, Gothenburg University
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Instruments for Environmental Policy

A frustration for many environmentalists is that seemingly simple solutions to serious environmental problems exist but nevertheless do not get implemented. This booklet is about designing policy instruments to ensure implementation.

We need first to understand why environmental policy is needed. Using the language of an economist, we would say that the reasons include market and policy failures that are linked to the evolution of property rights. Among the market failures we have external effects, public goods, common pool resources, non-competitive markets and imperfect information.

Externalities are non-market side effects of consumption or production such as soil erosion. The silting of dams or destruction of coral reefs are real costs but not carried by those who cause them. This can be seen as a consequence of incomplete property rights. If the rivers had owners with the right to clean water, they could sue the farmers thereby forcing them to consider the effects of erosion. The effects would be internalised.

Public goods are 'goods' or services that we enjoy in common such as defence, and clean air. The market tends to undersupply these goods since it is hard to exclude those who do not pay. Instead, political processes are needed such as the election of governments that collect taxes and finance public goods.

Common pool resources are resources we own in common but the goods produced with these resources are consumed individually (as private goods). Examples may include firewood, building materials, medicinal herbs, fruit or fodder when the resource they come from is managed as *common property*. The free-riding that can lead to the under-supply of public goods may also lead to the over-utilization of common pool resources unless institutions are strong enough to limit access and utilisation. This is often loosely (or in fact erroneously) referred to as the 'tragedy of the commons'.

Non-competitive markets, monopolies or oligopolies are often obstacles to the optimal supply of goods. For instance too little may be sold at too high a price.

Of all the market failures *unequally distributed information* (asymmetric information is the technical term) is perhaps the most pervasive. As economists we point out that there are no 'free lunches' yet we often

assume information is freely available to everyone. Information is costly and lack of information stops the market from operating perfectly. Understanding information asymmetries not only helps us design policy instruments to deal with monitoring difficulties, it goes to the heart of our most essential dilemma: how to promote social goals such as equity without destroying the incentives for work and efficiency. Because we do not have reliable data on, for instance, pollution damages and abatement costs we cannot design policies that are both efficient in resource allocation and fair when it comes to sharing the burdens of all the costs involved. To get the co-operation of those who have inside information we must accept that they get something in return.

The anatomy of the problem

Some archetypal examples illustrate the type of problems we are facing:

Fisheries

Many of the World's fisheries show decreasing yields. To maintain large catch volumes, earnings and employment, fishermen turn to larger boats, smaller mesh size and sophisticated technologies such as sonar and GPS navigation. Where there is over-fishing we have the paradoxical situation that if fishermen were to reduce effort they would, as a collective, be able to catch more. This is a situation where market failure calls for policy intervention to restrict fishing effort. There are good policies such as marine reserves, tradable quotas or common property resource arrangements. However many governments pursue the exact opposite of the policy they should: Instead of encouraging restraint they 'help' fishermen by subsidizing boats and technology thus lowering costs and increasing effort! Misguided design of instruments has added policy failure to market failure and worsened the problem of over-fishing.

Energy efficiency

There are good technologies for efficient energy use in transportation, lighting, heating and industrial processes[1] but they are seldom used because the consumer price of energy is too low and the new technologies are not commercially viable. Current energy prices do not include the external costs related to local and global environmental problems. The costs of children and adults getting asthma and bronchitis in the large urban areas are real costs (health and productivity loss) just like the costs associated with the risks of climate-induced sea-level rise. However these costs do not generally appear on our electricity bills or in the price of gasoline. Taxes, permits or other policies are needed to internalise these costs so that the consumer faces the real total cost of energy, which will automatically encourage the adoption of energy-efficient techniques.

Poverty and resource risks

The users of natural resources such as grazing lands typically know their biotypes well and have the knowledge to manage them rationally. How-

[1] We could mention fluorescent lighting, heat pumps, 'hyper-cars', tyristors. For energy production, wind power, solar power and bio-fuels come to mind.

ever, if they are poor and live close to the absolute margin of survival, they may not be able to bear the risk of a bad harvest. This can result in unsustainable behaviour: They may not dare to invest in new productive and sustainable methods but continue to use methods that are damaging to the ecosystem. These practices, although unsustainable, may be individually rational if markets or institutions for savings and insurance simply do not exist. This again shows the harmful effects of a market failure.

Conflicting aims

The income and equity aspects of environmental issues and policy instrument design are often crucial. Charging taxes to reduce herds, fishing or traffic may solve congestion and over-utilization problems but are still often resisted, since they leave the users with less welfare if the taxes collected are used for purposes seen as unproductive for the local users (such as central bureaucracies). In these cases we must build instruments that give the local users a price signal that internalises externalities without transferring the money out of the local community. There are numerous ways of doing this – one may be through permits allocated freely only to local users. Another may be through charges rather than taxes, using the fees collected for local environmental or resource funds that may be allocated in numerous ways decided on locally. Many environmental fees in developing countries operate in this way.

Information policy

In many cases the technology and ecology may be so complex that individual permits are bound to be part of the policy package. This may imply the risk of 'regulatory capture': when polluters dominate (and maybe corrupt) the regulators. The polluters have more information and typically greater resources at their disposal. In these circumstances, informational policy instruments may be an important first step. By collecting and spreading information, the agency can achieve several important goals:

- It creates a baseline for future action.
- It encourages transparency, making it difficult for individual inspectors to secretly agree to unreasonable emissions.
- Finally it opens the way for pressure from customers, workers, investors, neighbours and other groups concerned.

What is environmental economics?

Environmental or ecological economics[2] deals with the interface between economics and the surrounding life-support system of the Earth. Defined in this very general way, natural resource economics can be seen as an integral part of environmental economics although it is often treated separately. We deal with both, in order to take advantage of the lessons that these two areas can provide for each other. The subject is interdisciplinary and though economic theory can make a fundamental contribution to our understanding of policy instruments, it can do this only in collaboration with natural science, technology and other social sciences.

Some people doubt that the conventional economic paradigm is forceful enough to deal with the many serious environmental problems we are facing but I believe the main problem is that the available instruments are rarely used adequately. When it comes to empirical applications, only a handful of sectors and countries provide the results from the first systematic attempts at policy making. Before we worry about whether the available policy instruments are sufficient we should at least make more serious large-scale use of them.

Coping with disaster

While struggling to avoid ecological disasters we must remember that 'disaster' is already an apt description of everyday life for a large number of people in poor countries. Many of the problems people with low incomes face are deeply connected with the degradation of natural resources and in some cases, the spread of pollution. We need to focus more on the interaction between poverty and ecosystem resources and must take particular care to study the distributional characteristics of the environmental and resource issues we study. This applies particularly to the policy instruments we propose.

Instruments of many kinds

In this booklet 'instrument' is interpreted in a broad sense including common property resource management and the creation of property rights as well as legal, informational and political instruments including the build-up of appropriate institutions.

[2] Ecologists and natural scientists tend to call themselves "ecological" economists while economists appear to prefer the term "environmental". The terms do however overlap and we do not feel there is much point in making a great distinction between them.

Much of the discussion on policy instruments is conducted as if there were only two instruments — standards or taxes — but there are in fact many instruments with varying characteristics. The instruments are often classified as 'market-based' versus 'command and control' but this is a poor classification. Markets involve both prices and quantities; regulations are often backed by economic sanctions and economic theory does suggest that 'quantitative instruments' may be optimal in many cases. A striking classification is that of carrot, stick and sermon, symbolising economic incentives, legal instruments and information activities respectively.[3]

The World Bank (1997) provides one useful system (there are many others) for organizing the rich diversity of actual experiences in the field into four categories: 'Using markets', 'Creating markets', 'Environmental regulations', and 'Engaging the public' (Table 1)

Table 1 The Policy Matrix – Policy Instruments for Sustainable Development. Adapted from World Bank (1997)

Policy Instruments

Using markets	Creating markets	Environmental regulations	Engaging the public
– Subsidy reduction	– Property rights/ decentralization	– Standards	– Public participation
– Environmental charges	– Tradable permits/ rights	– Bans	– Information disclosure
– User charges	– International offset systems	– Permits/quotas	– Auditing
– Deposit-refund systems		– Zoning	– Labelling
– Targeted subsidies		– Voluntary Agreements	– Certification

Environmental problems can be met by one or several of these instruments. Taking an area such as fisheries, the reader can find from various countries, some example of almost every policy from subsidy reduction to input charges, tradable or non-tradable quotas, bans, active extension of property rights, labelling and standards.

The first category of instruments, 'Using markets' is subdivided into a number of policy instruments such as Subsidy reduction, Environmental charges on emissions, inputs or products, User taxes or fees, Performance bonds, Targeted subsidies or Deposit-refund systems. There are even more instruments in this category such as refunded emission payments and subsidized credits.

The next set of instruments is referred to as 'Creating markets' and consists of mechanisms for delineating rights. The most fundamental of these, with particular relevance for developing and transitional economies, is the actual creation of private property rights for land and other natural resources. A special form of right is the emission permit or catch permit

[3] Suggested by the political scientists Bemelmans-Videc, Rist and Vedung.

which is specially created for environmental or natural resource management. In an international context these are often referred to as international offset systems. An important addition, which is relevant at the very local level, is the operation of Common Property resource management schemes.

Under the heading of Regulation, we have Standards, Bans and (non-tradable) Permits or Quotas. We might add licenses as well as liability rules, which brings in a large area of law and the politics of enforcement. Instruments such as liability or performance bonds and penalties are part of the arsenal. Regulations may vary over time or between regions as in the case of zoning. So-called voluntary agreements, may also be seen as a form of regulation.

The last category, 'Engaging the public', includes such policies as information provision, labelling and community participation in management of water resources or waste disposal. In this category we can also include dialogue and collaboration between the EPA (environment protection agency), the public and the polluters.

Environmental auditing and certification, is a related policy instrument used mainly at company level (often used together with the labelling and information provision).

Stock of experiences

There is by now a large variety of policy instruments specifically designed for environmental and natural resource issues. In addition, most other policies are highly relevant for resource management, ranging from the definition and enforcement of property rights, through the efficiency of the court system, to macro-economic variables such as the rate of interest and the exchange rate. Market-based policy instruments can be designed in many ways — environment taxes and tradable permits are just two archetypes. There are many interesting cases involving the use of taxes, charges, deposit refund systems and other two-part instruments in Northern Europe, including the formerly planned economies such as Poland or the Baltic republic of Estonia, and in developing countries like China, Malaysia and Columbia.

Tradable permit schemes are used for pollution abatement not only in the US but also in many other countries, and with particular success for fishery management. Information access, labelling, liability and many other schemes broaden the menu of policies currently being used.

Sometimes policies such as energy taxes and subsidies are 'accidental' environmental instruments: They were not formulated with environmental goals primarily in mind. In spite of economists' recommendations to have one instrument for each goal, actual policies are shaped from complex bargaining processes and reflect many goals, some of them contradictory. They are seldom purely 'textbook' environmental policies but the same goes for policies aimed at furthering democracy, participation, equity and other goals. In spite of this, energy taxes provide a good illustration of the way environmental charges work. In other cases, physical licensing and control are predominant instruments. This should not upset economists since, according to economic theory, there are many cases when it is appropriate to use physical regulations. In some cases, even prohibition may be the most 'economic' instrument.

Selecting instruments

To select and design instruments, we need to consider these experiences systematically in the light of theoretical models. The choice will depend crucially on the *criteria* that are most important for policy selection and on the various *conditions* that characterize a particular problem.

Criteria

Economists generally assume that what is most important for society is welfare maximization and that welfare can be measured as a function of individual utilities. The utility and welfare functions may however be too complicated to be really operational and it is common to have a number of separate sub-goals. The most prominent sub-goals are cost-effectiveness, efficiency, sustainability, incentive compatibility and equity or fairness in the distribution of costs, and finally, administrative feasibility and flexibility. These terms are not perfectly clear nor are they completely separable and the political process is often a struggle in which different groups have different emphasis and interpretations of the various criteria.

- Cost-effectiveness means that if the instrument operates as planned, it would achieve the environmental goals at lowest cost.
- Efficiency is a more ambitious concept that includes the optimality of the goal (i.e. the level of abatement or of resource stock).
- Sustainability refers to long-term feasibility and fairness.
- Incentive compatibility means that the agents involved, (particularly the polluters, but also regulators, victims and others) have an incentive to provide information and undertake adequate abatement.
- Distributional and equity concerns mean that the distribution of costs should be seen as fair.
- Administrative feasibility includes the avoiding of excessive financial or informational costs for the operation of the instrument.

Naturally these criteria interact, since for example polluters who think a particular distribution of costs is strongly unfair will try to resist and stop implementation. They will not have an incentive to collaborate and particularly if information or power is not shared equally, this will ultimately lead to inefficiency. There are many political, cultural and psychological dimensions to policy formulation and implementation. So it is important to respect and follow the traditional rules for decision making, sometimes referred to as 'due process' — without, however, naïvely opening up opportunities for corruptive lobbying. Given the sometimes rapid changes in technology, ecology or of our understanding of the technical and ecological situation, there is also a need for flexibility in the chosen policy.

Conditions

The *criteria* also turn out to be of varying importance depending on the *conditions* that characterize each particular issue. In an economy with an even distribution of income, and when dealing with environmental problems with moderate abatement costs, equity issues are less important. On the other hand, when dealing with major issues that affect

health and ultimately life, in countries with large income gaps, distributional concerns may be seen as equally or more important than cost-effectiveness. When dealing with markets characterized by powerful monopolies or serious information inequality the issues of incentive compatibility may well be most important. In other words, we need an instrument that will make the powerful polluters co-operate.

The factors that will influence the choice of instruments the most will vary strongly from case to case. If abatement *costs* vary considerably then *efficiency* dictates that market mechanisms such as taxes or tradable permits be used. This is the classic argument for the superiority of the market and if total costs are high it will be a very important factor. If on the other hand the damage costs are sufficiently diverse then more physical, quantitative instruments may be called for such as zoning or differentiated regulations and licenses. If there are important information inequalities then policy instruments need to be *self-revealing* such as deposit refund schemes. Pure research and dissemination of information may also be crucial. In the face of some technical or ecological complexities, *flexibility* may be of paramount importance. This is a great advantage for policy instruments such as the tradable quotas used in fishing since decisions concerning the absolute level of catch are separated from distribution issues. The separation of these two aspects implies that the catch level can be delegated to expert bodies that can make rapid decisions based on scientific evidence without having to consider or renegotiate all the political complexities of the distribution of costs and rights. This may be a model worth considering in other areas such as climate change too.

Institutional resources

One of the most common factors that hamper policy making in many countries (particularly the poorer ones) is the weakness and lack of resources in the environmental protection agencies or ministries in charge of designing policies. This lack may include not only fiscal resources but also lack of staff, training, laboratory and other facilities. Experience has shown that it is important to prioritise and concentrate on a limited number of important issues and on the worst polluters. It is also important to build up institutions that are knowledgeable and obviously free from nepotism or corruption. To be successful, these institutions should build partnerships with the various stakeholders and to be seen not only as a policeman but also as a source of technology and know-how in modern sustainable technology.

Information and technology dissemination, research support and extension services are very important tasks in addition to the inevitable control function of the EPA. The setting of fees is a difficult and sensitive issue. In some cases, low fees that are earmarked for abatement, research and control may be a very useful instrument. Creating environmental funds in which the polluters have influence may help build political acceptance among regional or sectoral stakeholders who need to be involved rather than alienated. Effective environmental work often builds on functional partnerships in which it is important to clarify the respective roles and rights of each party.

In many cases the power of the polluters is considerable in relation to

the relative weakness of the environmental protection agencies. This means that such instruments as environmental taxes are impossible to enforce while tradable permits allow the planner to fine-tune the allocation of rights and distribution of costs to make a policy politically acceptable. Similarly charges that are differentiated and refunded or paid into environmental funds may be used to secure acceptance from important polluters and at the same time to strengthen the funding of the public agencies themselves.

Evidence shows that real policy making is seldom the neutral search for the optimal instrument to maximize global welfare. It is often a battle between different lobby groups striving either for survival, personal benefit, power or perhaps for environmental goals. It is crucial to respect transparent, democratic and bureaucratically feasible processes for decision making. The parties affected by legislation must be given the opportunity to influence it for the sake of legitimacy and because they are the best sources of information. The process must therefore be designed so they have an incentive to reveal at least part of this information. On the other hand, the parties can obviously not be given too much influence if this means that effective instruments are ruled out. To understand the politics of policy design, careful attention must be paid not only to the way the instruments work but also to the distribution of costs that they imply, between the polluters and others in society.

Seventeen specific considerations

Combining the many potentially applicable policy instruments with the many possible settings of criteria and conditions, we would get a huge wealth of combinations. Here, we consider a few of these, actually seventeen, combinations, picked for their relevance in general or for their specific relevance to environmental policymaking in developing countries.

Efficiency with different abatement costs

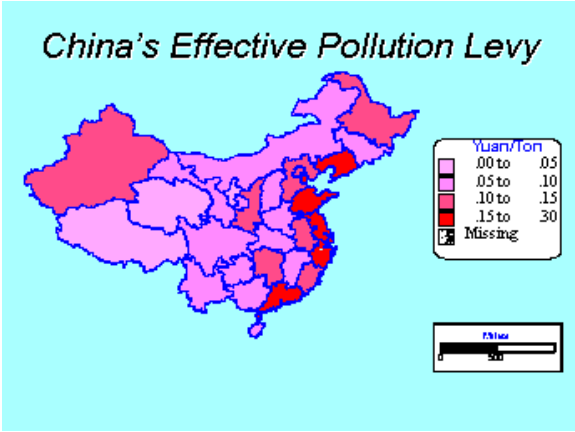
When abatement costs vary strongly between polluters, considerable cost savings can be realised by persuading polluters at the low-cost end do most of the required clean up. This provides a very strong case for *market-based instruments such as taxes and tradable permits*. These instruments save costs by encouraging specialization, which is one of the strongest advantages of the market mechanism. Good examples can be found in the area of energy economics or global climate change. The marginal cost of decreasing the atmospheric concentration of the NO_x or SO_x precursors to acid rain or of greenhouse gases will vary enormously between, say, the transport sector, industry forestry or agriculture. It also varies within each of these sectors or between countries. Several European countries have a good deal of experience with such taxes while the US has experiences from tradable permit programs.

Efficiency with varying damage costs

Sometimes the costs of environmental damage varies strongly – as in the case of health costs from vehicle emissions which vary between heavily populated and almost uninhabited areas, or between the nuisance of noise in the night compared to during the day. In these cases efficiency demands a corresponding *variation* in the strength of abatement efforts. This can be achieved by means of quantitative rules such as *zoning or time-dependent regulations*. Possible solutions include both the physical requirement for cleaner cars in some zones and the use of sophisticated, differentiated road pricing. The banning of very polluting vehicles with two-stroke engines from the streets of megacities such as Delhi is an example of a much-needed zoning policy in some of the world's most polluted cities. Another example is given by the pollution fees in China discussed in the box.

Pollution fees in China

In 1979 an environmental law was passed in China subjecting hundreds of thousands of Chinese companies to environmental taxes. In principle, fees are uniform but enforcement is variable so the effective fee varies by region as shown above. Since damage also varies (depending on population density etc) this appears quite appropriate. The fees collected are fed into environmental funds used largely to finance abatement. investments.



Common property approach

If co-operation and reciprocal monitoring can be organized then it could prove much more efficient than outside monitoring. This is in fact an essential comparative advantage of *common property resource (CPR)* systems. One policy instrument may therefore be to encourage the operation of such collaborative schemes.

CPR management of Irrigation Systems in Spain

On the Southern coast of Spain, towns like Valencia, Murcia or Alicante are served by rivers that are essential for agriculture in an otherwise very dry environment. Complex irrigation schemes involving the autonomous organisation of farmers has been documented for many hundreds of years (at least since 1435). Farmers elect their officials and hold weekly court procedures to decide on water allocation conflicts. The design of the institutions for monitoring, sanctions and democratic institutions have been researched in great detail, see for instance Ostrom (1990).

Handling uncertainty of damage costs

If a small added amount of some pollution risks to cause large damage then *quantitative permits* are to be preferred over taxes or fees. An example of this is when there are dramatic threshold values such as very poisonous pesticides like dieldrin. The policy maker cannot run the risk of searching for the optimal tax level but must simply make sure there is a safe *standard*. The costs of a small mistake in the quantity used can be terribly high and the precision of the quantitative instrument in this case is higher.

Handling uncertainty of abatement costs

Conversely, when the cost of abatement rises steeply and the marginal damage of pollution is relatively flat we should go for a market-based instrument such as a *tax*. In this case the tax more accurately avoids what could be excessive economic costs (maybe of bankruptcy and unemployment) if the standard set is too strict. Examples of this may be found in the formerly planned economies where abatement was urgently needed but where companies could sometimes not afford to switch technologies fast. On the other hand the social and political consequences of bankruptcies were potentially quite frightening.

Missing markets in insurance and banking

Cattle and Banking

A prominent example is the build-up of large cattle herds in areas where there are no other means of savings. This is unsustainable but may be an individually rational solution to the lack of markets for savings. In these cases the best policy is not to tax cattle but to help *provide the missing markets* by encouraging village banks. One of the few institutions that has managed to do banking sustainably among the poor is the Grameen Bank in Bangladesh. In 1999 the bank had provided loans to over 2 million people and financed more than half a million houses.

Insurance is generally not fully supplied by the market. Information asymmetry implies a market failure through incorrect selection of clients (it is the high-risk people who buy the insurance policies) and moral hazard (once people have a policy they may become reckless). These factors make it unprofitable to supply insurance based on statistically average risks and this in turn, leads to an under-supply of insurance. But users of natural resources typically operate at high levels of risk and cannot get the insurance they need. Nor, for similar reasons, do they have adequate access to regular banking/saving services. The result may be unsustainable behaviour: They may not dare to invest in new productive methods or they may use methods which are damaging to the ecosystem. One example of this is the lack of savings and banking services for the poor [see box]. Another similar example is the use of excessive doses of pesticide to reduce the risks posed by rats, birds or desert locusts and other insects. The average loss of harvest from pests may be very small, but the risk is still unacceptable to an uninsured farmer. In this case the ideal policy would be to facilitate insurance rather than simply banning pesticides.

Complex and potentially hazardous technology

When the technology to be monitored is sufficiently complex, as may be the case with many chemicals or in large industrial plants, it is hard to see how a tax can be designed in a sufficiently detailed way. This means that the criterion is no longer efficiency but rather feasibility and the avoidance of excessive damage risks. In this case *individual licensing* may be the best option. This is particularly so if the possible damage is serious as with the nuclear industry and some chemical industries.

Complex technology and unequal supply of information

In other similar cases where the damage and risks are less spectacular, the asymmetry of information as well as its complexity may imply that various forms of *voluntary agreement* or *information provision*, with or without *labelling* are the best available instruments. There are many examples of this, from the US Toxic Release Inventory to PROPER in Indonesia.

Table 2 Change in ratings due to PROPER disclosure

	June 1995	December 1995	December 1996	July 1997	Change In % units
Gold	**0**	**0**	**0**	**0**	**0**
Green	3	2	3	5	2
Blue	33	39	50	50	+17
Red	61	58	47	43	-18
Black	**3**	**2**	**1**	**2**	**-1**

Source BAPEDAL, Indonesia

When more traditional regulatory methods appeared fruitless, the Indonesian ministry for the environment used the culture of shame and reputation to lure firms into compliance. The mere act of publishing a rating for the firms provided a fairly strong incentive for them to try to improve their ratings as shown in the table.

Ecological complexity

In many cases it is the ecosystem itself that is complex, which implies that policies must be guided by the *precautionary principle*. When it comes to bio-diversity protection it would clearly be difficult to construct suitable indicators on which to base taxes. Not only are there many different features that may need to be monitored but the regulator might want to differentiate between different sites as well. One suitable set of policies is based on the *common property resource* management concept by which property rights are allocated and local knowledge of the ecosystem and of sustainable harvest methods is put to use. The Individually Tradable Fishing Quotas (*ITQs)* used by some fisheries are a good example of a new policy instrument where the issues related to the ecosystem complexity (the total allowable catch) are separated from the issues of allocation (of percentage shares) among resource users. This instrument has been strikingly successful in rebuilding threatened stocks and limiting fishing effort.

Global Public Goods

There are a number of resources or ecosystem attributes that can be described as global public goods. These include the temperature and climate of the atmosphere and the protection against ultraviolet radiation by the stratospheric ozone layer, just to mention two of the more obvious. The very fact that these are *global* public goods means that *international co-operation* is an essential condition for any successful program. The value of local programs may be to demonstrate that abate-

ment or reduced exploitation is possible. This may be important in some cases but is likely to be insufficient and will not replace international negotiation on concerted action.

Property rights

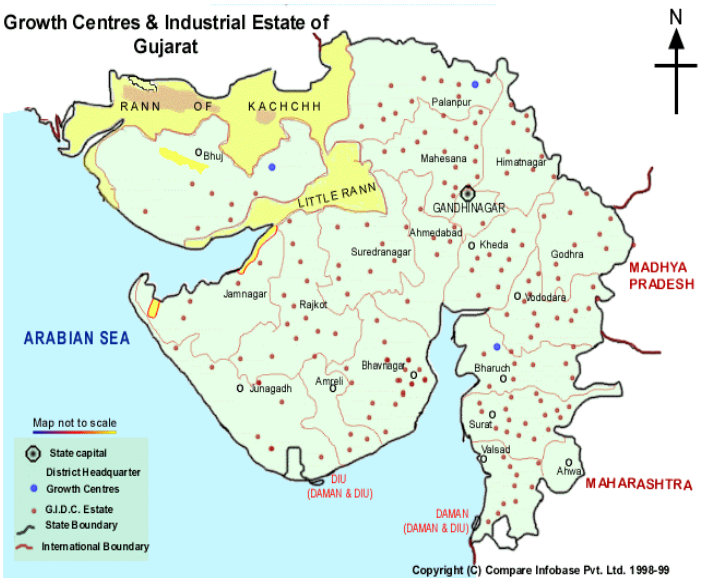
There are many cases when the provision of public goods is essential for the environment. Sometimes however, the public goods are not pure. They may be mixed or local public goods or have uses that make them closer to common pool resources. The appropriate policy instruments will vary with the circumstances. In many cases the reform or clarification of property rights is an important prerequisite for other policies. In the case of the common pool resources (marginal lands, mangroves, fishing sites, water sources) that are particularly important for many of the poorest, common property regimes are often the most appropriate. This is shown by numerous examples in water management, forestry, fisheries and wildlife management alluded to above. It is however not easy to create new common property resources. These social institutions work through reputation and social structure that create trust and reciprocity and such structures take time to build. In some cases it may still be useful to emulate or mimic some of the mechanisms of CPR management as in the example of industrial pollution management in Gujarat below.

Lack of resources

Frequently countries embarking on ambitious environmental programs find themselves limited by lack of knowledge, organization, technical, financial and human resources. Sophisticated instruments might appear to be completely out of their reach. There is however much common ground in all environmental control. They all require monitoring, reporting, verification and control. Physical 'command and control' instruments are not necessarily easy to administer. They too require control plus a system of penalties and enforcement that needs to be sufficiently severe to act as a deterrent but still not so severe that it becomes unenforceable in practice. For this reason informational, legal or market instruments may sometimes be preferable. The instrument may need to be designed specifically to deal with the EPA's lack of resources. The use of product charges rather than emission or effluent charges is one example that saves administrative resources (although it reduces allocative efficiency). Earmarking fees can also provide resources for the EPAs.

Industrial Pollution in India

Ankleshwar Industrial Estate in Gujarat is one of the largest in India, producing chemicals such as dyes and pharmaceuticals. It has 400 plants on 1600 Ha and has become a true hot spot of pollution. To control the situation and improve its image the Estate has installed some effluent treatment and attempted to monitor its own members and even fine them if they break local pollution rules. This has had some effect but there is still a long road to go.



Burden of cost and issues of political feasibility

As already mentioned congestion and overuse of commons can be technically corrected by a *tax* but while congestion may easily be lowered to an optimal level, the users may, as a collective, actually be worse off in welfare terms than they were before the tax. Sometimes the users claim an historic right to their level of activity, such as fishermen who have been born into their profession, taking over from generations of fishermen before them. They will clearly resist the idea of a state taking the entire surplus even if it does bring fishing down to sustainable levels. In other cases the polluter may just be too powerful to tax. In both these cases a tax is impossible but there are other policies available. Rights can be created. Either full property rights or at least pollution *permits* that are *allocated freely*. Also price instruments such as *charges* can be used as long as the proceeds are (at least partially) *refunded* or used in some way that is beneficial to (and decided by) the community concerned. In the US, road charges are *earmarked* for road funds and in many developing or transitional countries (notably Poland) environmental fees are earmarked for *environmental funds*.

Environmental Funds

Both China and Colombia have environmental fees. In the case of China, hundreds of thousands of firms are included in the program. In both cases the proceeds of the fees do not go to the treasury but are placed in environmental funds which are then used to finance a mix of costs including research, monitoring and administration costs for the EPA, as well as waste treatment plants and subsidies for abatement investments for the companies.

Policy-makers under pressure

Public policies are decided not just by abstract considerations of what is most effective but by lobbying and the influence of, sometimes powerful, groups on policy making. The policy maker should expect this and avoid certain instruments that are particularly prone to this type of problem. *Subsidies* are one obvious example: they are expensive not only in direct terms but even more so in terms of wasted energy spent on lobbying (and corruption). Even the *allocation of permits or mechanisms for refunding* may attract considerable lobbying, which needs to be taken into account. These issues are particularly important if the polluters to be targeted have any of a number of characteristics: If they are a small subgroup with regional or ethnic characteristics they may feel discriminated; if they are poor, welfare considerations become particularly relevant; if they are rich and powerful they may have the capacity of stopping or stalling implementation; if they are a small homogeneous group they can more easily organize. For each of these cases, we may have to consider allocation, refunding or compensation mechanisms separately.

Issues affecting the poor

The most urgent class of problems is that where poverty and environmental degradation occur together. Generally, the effects of the two problems will reinforce one another so that environmental degradation leads to decreased access to water, fodder, firewood and other important materials. Environmental degradation is particularly burdensome for the poor because they are more dependent on water, wood and other items collected from common lands since they do not have many private resources at their disposal. The desperation and short-sightedness caused by poverty may force the poor into unsustainable practices which actually increase resource degradation. All the categories of policy that have been discussed are applicable depending on the details of the individual case. Quite frequently in rural areas, common pool resources management may be a good way to deal with the problem. Difficulties sometimes arise because efficiency requires market solutions but many market solutions are socially unacceptable.

Cheap services or reliable services

It is desirable to supply poor people with important services like water, electricity or public transport at cheap rates (or free). However if prices are set below production costs, the companies that are supposed to supply the services will, in the long run, fail. Poor people need these vital services, and a reliable supply at a fair price may be much better than broken promises of almost free goods. Many countries such as India or Mexico have a history of promising to protect the poor by keeping electricity or water tariffs low – but one of the sad side-effects is that the poor frequently do not get connected to the relevant grids since they are not "profitable customers".

Policy making in a small open economy

In addition to the international dimensions of trans-boundary pollution and the restrictions imposed by international treaties, the reality of trade relations imposes even more restrictions that have to be considered when designing policy instruments. This is particularly noticeable in small open economies while larger (and more closed) economies have greater freedom in this respect. In the (small) open economy, the price of goods is set on the world market. Any local deviation, due for instance to a pollution tax on domestic production, will not change the world market price and therefore will have no effect on consumption. Its only effect will be on profits and thus market shares in the country concerned. If the pollutant in question is a global one, there is a risk of the ironic situation where an environmental tax merely moves production abroad and leaves pollution levels constant (or maybe even worsened). In this case, there are still many instruments available in addition to international *negotiation*: *refunded emission payments*, *taxes* on consumption (rather than production), free *permits*, *voluntary agreements* or *licensing*, *labelling* and *information provision*.

Local actions – global gains

An important category of projects may have benefits at various levels. For instance there may be local benefits such as protection of shorelines, moisture retention or the halting of soil erosion etc. At the same time there may be regional and international benefits such as carbon retention. Especially relevant are cases when the local benefits would be insufficient to achieve conservation but the total benefits might be enough. By using mechanisms that will compensate local economies for global benefits, it is hoped that this category of socially profitable projects may actually become feasible. The *Debt for Nature Swaps*, *Global Environment Facility* and *Carbon Fund* are all recent examples.

Summing up

Designing instruments for environmental policy we should remember that it has a serious purpose to make a difference in real economies. Sometimes reality does require a great deal of sophistication to match the complexities of technology, ecology and society. This does not mean that we should judge an instrument only by its complexity – just as little as we should judge it by how well it fulfils any other single criterion such as the 'polluters pay principle'.

The ultimate test is first, whether the policy gets implemented; second, at what level. These two factors will, together with other design characteristics, decide what effect the instrument has. A perfectly designed environmental tax set at too low a level may well be much less efficient than some other instrument that for some political reason was set at a higher level. Since the diversity and magnitude of problems ahead is so great, it will be a great challenge to adapt and develop the general principles discussed in this booklet and more extensively in the book "*Policy Instruments for Environmental and Natural Resource Management*", in order to strive for a more sustainable economy. This is an ongoing process and needs input from both theory and experience. The careful evaluation of new policies and the sharing and comparison of experiences must be an integral part of this process.

References

Bemelmans-Videc, M.L., R.C. Rist and E. Vedung (ed.) (1998), *Carrots, Sticks, and Sermons: Policy Instruments and their Evaluation*, New Brunswick, New Jersey and London: Transaction Publishers.

Dasgupta, P. (1993), *An inquiry into well-being and destitution*, Oxford; New York; Toronto and Melbourne: Oxford University Press, Clarendon Press

Ostrom, E. (1990) *Governing the Commons – The Evolution of Institutions for Collective Action*, Cambridge: Cambridge University Press.

Sterner, T. (2002), *Policy Instruments for Environmental and Natural Resource Management*, RFF Press, Resources for the Future, Washington DC, (in collaboration with the World Bank and Sida). For more information on the book, please contact RFF Press at www.rff.org.

World Bank (1997), *Five Years after Rio: Innovations in Environmental Policy*, Environmentally Sustainable Development Studies and Monograph Series No. 18.

There is a wealth of instruments at hand to be employed in environmental policy making, reaching from enforcement to encouragement and enlightenment. In this overview of policy instruments, Professor Thomas Sterner discusses pros and cons of different instruments and criteria and conditions for their use.

Professor Thomas Sterner, of Gothenburg University, is also the author of "Policy Instruments for Environmental and Natural Resource Management" in which he goes into depth with instrument design and employment in a wider context of economic theory and political practice.

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SWEDISH INTERNATIONAL
DEVELOPMENT COOPERATION AGENCY

SE-105 25 Stockholm Sweden
Phone: +46 (0)8 698 50 00
Fax: +46 (0)8 698 56 15
info@sida.se, www.sida.se