Prescribing the Cure: Environmental Policy 101

In effect, to follow, not to force the public inclination; to give a direction, a form, a technical dress, and a specific sanction, to the general sense of the community, is the true end of legislation.

Edmund Burke, "Letter to the Sheriffs of Bristol"

Assume that you have just been installed as the head of a newly established International Environmental Organization (IEO), with broad authority to address the world's environmental problems. How should you proceed?

In essence, the policy problem boils down to two issues:

- First, what are the ends of environmental policy? Which problems deserve our attention, and what should be our goals in addressing them?
- Second, what means should we use to achieve those ends? What are the best policy instruments—government-mandated controls, market-based instruments such as taxes or tradable allowances, technology programs, voluntary partnerships with industry, or some other approach?

The analytic tools described in this chapter could be applied to any environmental problem, whether international or domestic. International environmental problems are a subset of environmental problems more generally. In examining the policy process, I will begin by taking the perspective of a rational decision maker—the head of the IEO—seeking to develop the optimal environmental policy.[1] If one were in charge, what should one do? In later chapters, I will consider how multiple actors, each with his or her own interests and perspectives, complicate the situation. That is to say, I will introduce politics into the equation. Before resigning ourselves to the art of the possible, however, it will be useful to consider the ideal, if only to provide a benchmark against which to evaluate our options. We begin, then, by examining environmental problems in *policy* rather than *political* terms.

What Are the Goals of Environmental Policy?

What is the goal of international environmental law? This apparently simple question is harder than it looks. Should environmental policy seek to protect the environment for its own sake or for the benefit of humans? Should it aim to prevent any damage from occurring (indeed, is this even possible?) or only significant damage—and if the latter, how should it define what damages are significant? Put another way, should it protect the environment at all costs or only to the extent that the environmental benefits exceed the economic costs? How should it value future harms and benefits as compared to present ones? And how should it value uncertain risks versus more definite ones?

Our answers to these questions have important implications for every facet of environmental policy. Consider the most basic issue: what environmental changes constitute *problems?* Would the disappearance, say, of the malaria mosquito be cause for celebration or sorrow? Opinions differ, depending on the value one places on biological diversity. Some see the extinction of any species as a loss, even those dangerous to humans. Others would welcome the elimination of the malaria mosquito, which is a leading cause of infant mortality worldwide and, according to one estimate, costs Africa more than $12 billion a year in lost growth.[2] Indeed, some have even suggested that if "specicide" were to become feasible (for example, through genetic engineering), the malaria mosquito would be the ideal candidate.[3] This perspective may perhaps show that we have not completely given up the view expressed by Reverend Hickeringill in the eighteenth century, that our goal should be to get rid of "noisome and offensive" animals "with as speedy a riddance and despatch" as possible.[4]

The relative priority we give to different issues also raises issues of environmental values. Global warming, for example, may cause long-term, irreversible damage for coastal communities, agriculture, human health, and biological diversity. But lack of access to safe drinking water kills more than a million people per year right now. How should we assess the relative importance of these problems? Given limited resources, which deserves our attention? That depends on our views about the larger objectives of international environmental law.

Finally, once an environmental problem has been identified and put on the policy agenda, what should be our goal in addressing it? What should be the objective, say, of international climate change policy? Should it seek to prevent global warming altogether, or only warming above some "dangerous" limit? If we could prevent climate change by injecting dust into the upper atmosphere to block incoming sunlight, or by putting mirrors into space to reflect it away, would these represent "solutions"? Or would it be unethical, in some way, to purposefully remake nature? What we consider a solution to an environmental problem depends on how we define the problem, which in turn depends on our values.

The role of values in environmental decision making is nicely illustrated by a cartoon I once saw showing a logger with a chainsaw looking at a tree labeled "the very last tree," while thinking "the very last chair." The contrasting characterizations reflect the difference between valuing nature as an end in itself and as useful for humankind. The person who sees trees as wilderness finds the destruction of old-growth forest problematic; the person who sees them only as proto-chairs does not, as long as sufficient trees remain.

Running through much of the debate about international environmental policy are two different conceptions of the aims that we should pursue—what Daniel Farber facetiously calls the "tree hugger" and the "bean counter" approaches.[5] Tree huggers define the goal of environmental policies in absolutist terms: preventing pollution, preserving species, and so forth. Bean counters see the world in terms of trade-offs and seek to balance costs and benefits to achieve the optimal outcome. Tree huggers tend to reflect "moral outrage," bean counters "cool analysis."[6]

Absolutist Approaches

From an absolutist perspective, the goal of environmental policy should be to prevent environmental harm. Consider, for example, the acid rain problem. Acid rain emerged as an international issue in the 1970s, first in Europe and then in North America. It is caused by emissions of sulfur dioxide (SO_2) and nitrous oxides (NO_x) from a wide variety of sources, including power plants, automobiles, and industrial facilities such as smelters. These emissions constitute "pollution" in the strict sense of the term—that is, substances introduced by humans into the environment with harmful effects, in particular for forests and lakes.[7]

From a tree hugger perspective, our goal in addressing acid rain should be to reduce emissions of SO_2 and NO_x to the level at which no harm is caused—if such a threshold exists—or, if not, to eliminate emissions altogether.[8] The 1994 Sulfur Protocol to the Long-Range Transboundary Air Pollution Convention (LRTAP) moved in this direction through its adoption of a "critical loads" approach, which seeks to determine the maximum levels of acid deposition that will not cause significant environmental damage and then to reduce emissions so as not to exceed these critical loads.[9]

Of course, trying to eliminate pollution altogether comes at a very high cost, potentially. The emissions of SO_2 and NO_x that result in acid rain are produced by a host of activities central to modern industrial society, such as electricity generation, transportation, and industrial production. Until viable substitutes are developed, eliminating emissions (or even reducing them drastically) could have dire economic effects. In recognition of this fact, the 1994 Sulfur Protocol did not try to close the gap entirely between current emissions and the lower levels necessary not to exceed critical loads; instead, it set a goal of achieving gap closure of only 80 percent.[10]

These same economic considerations apply to other environmental problems as well. Stopping anthropogenic climate change, conserving biological diversity, eliminating marine pollution, and phasing out the use of dangerous pesticides and chemicals would all involve significant costs, particularly since the marginal costs of abatement typically escalate as pollution is progressively reduced. To what extent are we willing to incur these costs in order to solve a particular environmental problem?

A dyed-in-the-wool tree hugger might respond by saying, in essence, "damn the expenses, full speed ahead." This was the approach initially taken by the U.S. Endangered Species Act (ESA). In *Tennessee Valley Authority v. Hill,* the Supreme Court ruled that the ESA required that the federal government take action to prevent the extinction of species regardless of the cost.[11] Similarly, the Clean Water Act attempted to eliminate all water pollution by 1985, and the Delaney Clause continues to require the prohibition of any food additive that has been shown to cause cancer, regardless of the cost of doing so and no matter how remote the cancer risk. Polling since the early 1980s indicates that a majority of Americans consistently claim to support the view that "protecting the environment is so important that requirements and standards cannot be too high, and continuing environmental improvements must be made regardless of cost."[12]

This absolutist attitude can be justified in various ways. One rationale is to frame the environmental debate in terms of rights.[13] If one sees environmental protection as a right and not simply as a policy preference—a right, for example, to a clean environment—then this implies that people (or nature itself, if the rights in question are ecological rather than human rights) should be able to vindicate these rights regardless of the costs. In 1968, Senator Gaylord Nelson even proposed a constitutional amendment guaranteeing the "inalienable right to a decent environment."[14] Although this provision was never adopted, several states and countries have adopted similar provisions,[15] and a number of human rights cases have found that environmental damage can violate an individual's human rights.[16]

The rights-based approach reflects an attempt to privilege environmental goals—to take them out of the normal hurly-burly of politics and give them a higher status. The more one venerates nature and casts environmental protection as an ethical imperative, the more appropriate this attitude may seem. If one takes the view expressed by Aldo Leopold, that a "thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community [and] . . . wrong when it tends otherwise,"[17] then this might seem to suggest that a consideration of economic costs—or anything else for that matter, other than what is good for the environment—is not just inappropriate but almost immoral.[18]

Uncertainty provides a second basic rationale for an absolutist approach. To the extent that environmental risks are uncertain, we cannot weigh their costs and benefits with any confidence, nor can we be certain that any particular level of activity is "safe." To ensure safety, we must ban risky activities altogether. In essence, this is the rationale for the moratorium on commercial whaling, described in Chapter 1: since we cannot be certain that any level is safe, we must stop commercial whaling completely.

The implications of this precautionary perspective go further than the rights-based approach because it does not simply aim to eliminate environmental harms, but environmental risks. Consider, for example, the critical loads approach in the 1994 Sulfur Protocol and its analogue in water pollution policy, assimilative capacity. These standards require a great deal of information about the thresholds below which emissions or discharges are safe. Given the uncertainties in our scientific understanding, however, information of this kind may not be reliable. On this basis, those who stress the problem of uncertainty argue that we should shift away from an assimilative capacity approach to a "best available technology" standard. International environmental law addresses this problem of uncertainty through the precautionary principle, which, in its strongest form, says, "if in doubt, don't."[19]

The problem with both the rights-based and the precautionary versions of absolutism is that public policy inevitably involves trade-offs.

Reducing environmental harm is important, but it is not the only factor in the equation; we must also consider the economic and social costs of doing so. Similarly, "[c]aution should be high on everyone's agenda," as Christopher Stone notes,[20] but this does not mean it should be the only objective. Nor, in any event, is it achievable, since reducing one risk often increases another. Setting environmental goals in absolutist terms prevents one from even considering these trade-offs, much less addressing them in a systematic way.

Trade-offs exist not only between environmental protection and economic well-being, but between the environment and other values such as human health. On the one hand, malaria infects an estimated 300 to 500 million people per year worldwide and kills an estimated 2 million people, mostly children. On the other hand, the most effective pesticide against the malaria mosquito, DDT (which helped Northern countries eliminate malaria in the 1950s) is now known to be a persistent organic pollutant that harms birds and fish. Since the publication of Rachel Carson's *Silent Spring* in 1962, DDT has become the symbol in the West of an insidious chemical killer. Should environmental policy ban DDT, even if this means more malaria? Or should it allow the limited use of DDT in order to save children's lives? However we come down on this question, we face a difficult trade-off.[21]

Balancing Approaches

Rather than viewing environmental policy in moral terms, economists—bean counters *par excellence*—take a consequentialist approach, arguing that the objective of environmental policy should be to maximize social welfare as a whole. This requires considering, in a systematic way, the costs as well as the benefits of environmental actions, including the compliance costs for the private sector, the administrative costs for government, and the indirect economic costs resulting from general equilibrium effects. In order to maximize social welfare in addressing acid rain, for example, we should reduce emissions of SO_2 and NO_x only insofar as the marginal benefits of a reduction (the environmental and health benefits resulting from less acid rain) exceed its marginal costs—that is, only insofar as the reductions are "efficient." This is how an economist would define the objective of environmental policy. Further reductions beyond this "optimal" level of pollution would not make sense, even if they provided environmental benefits, because their costs would exceed their benefits.[22]

Cost-benefit analysis requires us to be able to compare the costs and benefits of environmental policies systematically. We need a metric, for

Box 4.1. Costs and Benefits of Environmental Regulation

Costs

- *Direct compliance costs*—Environmental regulation typically imposes direct costs on the regulatory target. For example, a regulation might require companies to install new equipment or to hire additional personnel.
- *Opportunity costs*—By requiring resources to be used for one purpose, environmental policies preclude those resources from being used for other purposes. Establishing a protected area for elephants, for example, prevents land from being used for agricultural purposes.
- *Administrative costs*—Environmental policies may entail substantial monitoring and enforcement costs for government.
- *Indirect economic costs*—Changes in prices in one sector have effects on the rest of the economy, referred to by economists as "general equilibrium effects." If markets are operating efficiently, policy-induced price changes introduce inefficiencies that may cost more than the direct compliance costs of environmental regulation.

Benefits

- *Health benefits*—Better air or water quality may result in reduced medical expenses and fewer days of illness.
- *Direct economic benefits*—Protection of commercially exploited resources, such as trees or fisheries, provide economic benefits to those using the resources.
- *Ecosystem services*—Protection of resources such as wetlands provide indirect benefits in the form of ecosystem services—for example, water purification, flood control, protection against coastline erosion, and so forth. One study estimated the global value of seventeen ecosystem services at $16–54 trillion per year. (Robert Costanza et al., "The Value of the World's Ecosystem Services and the Natural Capital," *Nature* 387 (1997), pp. 253–260, at 259.)
- *Existence (non-use) value*—Regardless of whether a species or other resource provides any direct or indirect economic benefit, some people may value its continued existence.

example, to compare the economic costs of installing a scrubber or switching to cleaner coal with the environmental benefits of healthier forests or cleaner lakes. The standard economic tool for making such comparisons is prices. The prices people are willing to pay are assumed to reveal their preferences about how much they value different things. The problem, of course, is that many environmental resources, including clean air, clean water, and biological diversity, are not traded in the market and thus do not have a market price.[23]

A considerable amount of environmental economics is devoted to the problem of how to put a price on non-market goods. Economists have devised several tools to answer this question. "Contingent valuation" relies on surveys about what people say they would be willing to pay for environmental goods (or how much they would be willing to accept in return for agreeing to allow a resource to be degraded).[24] In contrast, "hedonic property pricing" attempts to examine empirically how changes in environmental factors (say, clean air or proximity to a hazardous waste site) affect property prices.[25]

Cost-benefit analysis has many weaknesses, which critics are fond of noting. To begin with, environmentalists argue that cost-benefit analysis is skewed against environmental regulation. On the one hand, it tends to downplay environmental benefits such as ecosystem services and aesthetic values, which may be omitted from cost-benefit analyses because they are difficult to value. On the other hand, it tends to overemphasize the costs of satisfying regulations, both because of its (over?) reliance on industry estimates and because many economists are professionally skeptical about the potential for efficiency gains that both improve the environment and reduce costs.[26]

A second objection to cost-benefit analysis relates to the problem of valuing the future. Cost-benefit analysis requires valuation not only of non-market goods, but also of future costs and benefits; it requires a methodology to compare costs and benefits across time. Most people would prefer to have a dollar now to a dollar ten years in the future, even leaving aside the effects of inflation. They would prefer to "get it while [they] can," as Janis Joplin cogently put it. The degree to which people value the present more than the future is measured by what economists refer to as the "discount rate."[27] If the discount rate is, say, 5 percent per year, then the "present value" of having a dollar a year from now is only 95 cents. As we look further into the future, the present value of future benefits declines steeply as the discount rate increases. With a 5 percent discount rate, the present value of a dollar ten years from now is only 61 cents; but if one discounts the future more steeply, say at 10 percent, then the present value of that same future dollar drops to only 39 cents.

Because most international environmental regulation involves incurring costs now to gain environmental benefits in the future, discounting plays a huge role in cost-benefit analyses. Depending on whether we apply a 5 or 10 percent discount rate, the amount we should be willing to spend today to gain a dollar's worth of environmental benefit in ten years' time varies from 61 to 39 cents. The further into the future we look, the bigger the effect of discount rates. At a 5 percent discount rate, a dollar's worth of environmental benefit received seventy-five years hence is worth only 3 cents now, but at a 10 percent discount rate, the present value of that same dollar of environmental benefit plummets to a tenth of a penny. Thus, for very long-term problems such as climate change, which have a century-plus time horizon, cost-benefit analysis is extremely sensitive to the choice of discount rate. Which discount rate we use—10 percent or 5 percent or 2 percent—is crucial in determining how much we should spend now to avert climate change damages far off in the future.[28]

The effective discount rate of private parties is revealed by examining the minimum rate of return they expect in their investment and spending decisions.[29] This "private discount rate" varies from place to place and from time to time, depending on the level of uncertainty about the future. In the United States and other Western industrialized countries, which enjoy considerable stability and where people, as a result, have a high degree of confidence about the future, the private discount rate is comparatively low—about 4 to 6 percent. In developing countries, which are less stable, much higher discount rates apply, in the range of 10 to 25 percent.[30]

Although private discount rates can be determined in a relatively objective manner, public discount rates are much more controversial. Should public policies discount the future, and, if so, to what degree? What is the appropriate "social" discount rate? Is the continued existence of whales 100 years from now really less valuable than their existence today, as discounting analysis would suggest? Is their continued existence 400 years from now significantly less valuable than 300 years from now? Are future generations not entitled to equal consideration as our own? If so, how is this consistent with discounting? Ultimately, the answers to these questions are ethical rather than economic in nature.

On a more fundamental level, some critics of cost-benefit analysis challenge the view that people's self-interested preferences as consumers are equivalent to their views as citizens about public policy.[31] An individual, as a consumer, might not be willing to pay 50 cents more per gallon of gasoline to improve air quality; but the same individual, in her capacity as a publicly minded citizen, might support government regulations with similar costs. Indeed, some argue that the entire exercise of cost-benefit analysis is misguided because it considers only human preferences, rather than the value of the environment as an end in itself, and attempts to put a price on resources that are, in some sense, priceless.[32]

Although these objections to cost-benefit analysis require careful consideration, none to my mind is decisive. Most relate to the way that cost-benefit analysis is practiced, rather than to the approach itself, which can be more flexible than its critics contend. Valuation techniques, for example, can factor in people's views as citizens rather than consumers, as well as their views about the existence value of a resource (that is, the value they place simply on its existence), not just its instrumental value (that is, its value because of the benefit it provides to humans).[33] Moreover, if private discount rates seem too high, we can apply a lower social discount rate for environmental protection.

The bigger problem with cost-benefit analysis is practical—namely, that, in many cases, estimates of how people value non-market goods are simply not reliable. This can cut both ways, of course; it can lead to over- as well as undervaluation of environmental resources. It is easy to say, in a survey, that one would be willing to pay $1,000 to protect a species, but whether one would do so in practice, with a limited budget, is a different question.

Moreover, with respect to long-term problems such as climate change, we face tremendous scientific and economic uncertainties. How much global warming will occur over the next 50 to 100 years, and what will be its impacts? How much will technology improve over the same time horizon? What will be the cost of solar power 100 years hence, or carbon sequestration, or some other technology that we have not yet even discovered? Given these uncertainties—not to mention the sensitivity of long-term cost estimates to the choice of a social discount rate—quantitative cost-benefit assessments seem of only limited use in deciding what we should do now to address a long-term problem such as climate change. In such cases, cost-benefit analysis is likely to give a false sense of precision and objectivity.[34] Niels Bohr once reputedly observed, "Never express yourself more clearly than you are able to think."[35] A similar thing might be said of cost-benefit analysis: never calculate more clearly than you know.

But even though, in practice, quantitative cost-benefit analysis may rarely be feasible, this does not relieve us of the need to think about both costs and benefits; it just means that we should do so in a more qualitative manner. As Benjamin Franklin wrote in a letter to Joseph Priestly, explaining his process of decision making:

> [T]ho' the Weight of Reasons [pro and con] cannot be taken with the Precision of Algebraic Quantities, yet when each is thus considered separately and comparatively, and the whole lies before me, I think I can judge better,

> and am less likely to make a rash Step; and in fact I have found great Advantage from this kind of Equation, in what might be called *Moral* or *Prudential Algebra*.[36]

Whether we like it or not, environmental policies almost always involve both pros and cons. The only question is whether we consider these trade-offs explicitly—as Franklin suggested—or keep them hidden, allowing very different approaches to be taken in different regulatory contexts.[37]

So the bottom line is this: attempts to balance costs and benefits may be imperfect and imprecise. Ultimately, the choice of regulatory goals is not fully determined by objective, "cool" analysis; it involves value choices. However, decisions about whether something is an environmental problem and, if so, what to do about it, should be informed by a systematic examination of the costs and benefits of inaction versus action. This "prudential algebra" introduces a useful discipline to policy analysis. Without it, we are more likely to have a regulatory mishmash, difficult to defend on any rational basis, involving large expenditures of time and effort on relatively minor problems and smaller expenditures on more significant ones.

Other Policy Desiderata

Assume that we have agreed on an environmental goal for a given issue area, whether on the basis of a careful cost-benefit analysis or, as is more common, of some political compromise. Say, for example, we have decided to reduce consumption of ozone-depleting substances by 50 percent in order to protect the stratospheric ozone layer or to reduce emissions of carbon dioxide by 20 percent to combat climate change. The next task is to choose the means that we will use to achieve this end. In evaluating the various options, at least three policy desiderata are relevant: environmental effectiveness, cost-effectiveness, and equity.

Environmental Effectiveness

The starting point of any assessment of policy options is to consider how well a particular approach achieves its environmental goal. This much goes without saying, but answering this question is complicated. An environmental measure—say, an oil discharge standard for tankers aimed at limiting coastal oil pollution—might, on its face, appear sufficient to achieve its goal. However, what is the likelihood that tankers will actually comply with this requirement? This may depend, in part, on how easy it is to monitor and enforce the discharge standard. And will the requirement merely displace pollution from one place to another? Will it have "leakage"?

In some cases an environmental measure might have other environmental benefits (or harms) that should be taken into account in considering its environmental effectiveness. A renewable portfolio standard (requiring utilities to produce a certain amount of electricity from renewable sources) might be chosen to address the problem of acid rain, for example. But unlike other possible regulatory approaches, such as a requirement to install scrubbers, the renewable standard would have the added benefit of helping to address the climate change problem.

Different approaches might also differ in the degree to which they help induce technological advances or change public attitudes and awareness. A policy instrument that tends to lock in a particular technology may be less environmentally effective, in the long run, than an instrument that provides incentives for ongoing technological innovation, such as an emissions trading system. In assessing the issue of environmental effectiveness, we must therefore consider not only the immediate requirements of a proposed policy measure, but also issues of implementation, leakage, co-benefits, technological change, and public awareness.

Cost-Effectiveness

However we go about establishing our environmental goals—whether on the basis of cost-benefit analysis or exclusively environmental considerations—most people would agree that we should seek to achieve those goals at the lowest cost possible. We want to get the most bang for our buck, so to speak. In general, a policy is cost-effective if it equalizes the marginal cost of compliance across time and place. Whenever pollution could be reduced more cheaply in the future than now, or by one country rather than another, then the same level of environmental result could be achieved at a lower cost by shifting some of the pollution reductions into the future or to the other country with the lower abatement costs.

Because the terms are similar, it is easy to confuse cost-benefit and cost-effectiveness analysis. The difference is that cost-benefit analysis encompasses the goals of environmental policy, whereas cost-effectiveness analysis considers only the means. In essence, cost-effectiveness is a subpart of cost-benefit analysis. Environmentalists generally find cost-effectiveness less objectionable than cost-benefit analysis because it does not require comparing economic costs and environmental benefits; it simply requires comparing the economic and administrative costs of one policy option versus another.

Equity

Another important consideration in evaluating environmental policies is whether they entail a fair distribution of costs and benefits. This issue is important for both normative and practical reasons. From a normative standpoint, equity is a policy desideratum in its own right. In addition, from a practical standpoint, if a policy is not perceived as equitable, then it is less likely to be accepted and followed.

Cost-benefit analysis itself does not address the equity issue; it seeks simply to maximize aggregate economic value. If one group of people (or countries) bears the costs of a policy and another receives the benefits, the policy is still efficient as long as, in the aggregate, the benefits exceed the costs. Some economists argue that, in designing environmental policies, we should focus only on cost-effectiveness, not equity. In their view, if a policy has unfair distributional effects, we should not shift to a less efficient but more equitable policy, which reduces a society's aggregate welfare. Rather, we should tackle the equity issue directly, through redistributive mechanisms such as taxes (or, in the international arena, through financial and technical assistance). But this reasoning, though logical, is unrealistic at best and disingenuous at worst. The political reality is that significant redistributive policies are unlikely to be adopted internationally. So if equity is not addressed in the design of environmental standards, it may not be addressed at all.

In addressing environmental or resource problems, what would constitute an equitable response? One possibility is that people have equal entitlements to commons resources. In international environmental law, this principle underlies arguments by developing countries such as India that states have an equal entitlement to the atmosphere and that climate change policy should therefore aim to equalize per capita levels of emissions among countries.

In contrast, unidirectional externalities suggest a different principle of equity, based on the idea of responsibility. Why does it seem unfair to require the victim to pay the polluter to stop? The answer is that we generally feel that the actor who causes damage should be held responsible[38] and that the polluter should pay. This equation of causation with responsibility is at the heart of tort law.

Ability to pay represents a third distributional principle. If the polluting state is rich and the victim state poor, then a "victim pays" solution seems even more inequitable.[39] In the context of climate change, for example, poor developing countries would be among the principal beneficiaries of an effective agreement because they are most vulnerable to the adverse effects of global warming. However, no one in the negotiations expects them to pay rich industrialized countries to reduce their greenhouse gas emissions. Quite the contrary. The widely shared assumption, by rich and poor countries alike, is that rich industrialized countries should pay not only for their own abatement costs, but also for some of the abatement and adaptation costs of poor developing countries that will be adversely affected by climate change.

Whom Should We Regulate?

Another preliminary consideration in environmental policy is to determine the appropriate target of a regulatory instrument. At the domestic level, environmental regulations typically set standards for private conduct—for example, emissions standards for electric utilities, or vehicle standards for car manufacturers or owners. Governmental conduct is the target of environmental regulation only infrequently; for example, the National Environmental Policy Act (NEPA) requires that the federal government perform environmental impact assessments before making major federal decisions.

At the international level, the situation is reversed: legal requirements almost always apply to states rather than to private actors, even though, as in domestic environmental law, private action is usually the real concern. The Kyoto Protocol, for example, is ultimately aimed at reducing greenhouse gas emissions by private actors such as electric utilities, manufacturers, and individuals, but its emissions targets apply to states.

One of the few exceptions to this general rule is found in the international agreement addressing oil pollution from ships (MARPOL), which sets forth detailed specifications for the construction and design of oil tankers, as well as rules limiting discharges of oil, garbage, and other dangerous materials by operators of private vessels.[40] Even MARPOL, however, does not attempt to make these rules applicable to private actors directly; instead, its requirements apply to flag states, which are required to make MARPOL's rules applicable, as a matter of national law, to ships flying their flag.[41]

Could international environmental law, in the future, apply directly to private actors? The development of international criminal law demonstrates that, in theory, the answer is yes. The statute of the International Criminal Court defines rules of conduct for individuals, which if violated constitute international criminal offenses. Although, at present, international law imposes obligations on private actors only with respect to war crimes and crimes against humanity, not the environment, there is nothing to prevent international environmental law from moving in that direction. Even if it were to do so, however, it would still need to rely on national governments for implementation and enforcement, given the absence of international institutions with strong administrative powers. Indeed, even the Statute of the International Criminal Court, which establishes an international prosecutor and court, still depends on national governments to arrest and turn over suspects.

Policy Toolkit

With these initial considerations in mind, let us consider the environmental policy toolkit. What is the range of policy instruments for addressing environmental problems such as acid rain, global warming, or habitat loss?[42]

Further Research

When uncertainty is high, one easy option is to pursue further study, either to understand the problem better (through basic scientific research) or to develop better responses (through technology R&D). This was the preferred approach of the Reagan Administration to the acid rain problem in the 1980s and of the second Bush Administration to climate change.

Does a research-oriented strategy make sense, or is it simply a cop-out, a way to avoid doing anything now? Like so much else, it depends. In some cases, a problem might turn out to be overblown, or much cheaper solutions might be developed, so a policy focusing on research might result in significant savings. That has been the argument of climate change skeptics, who point to other "crises" that never materialized. In other cases, however, delay causes the problem to become entrenched and necessitates more drastic response measures later, resulting in higher long-term costs.

Informational Measures

Measures aimed at providing information represent another, comparatively unintrusive type of policy response.[43] They do not regulate environmentally destructive behavior directly. Instead, they seek to affect behavior in other ways.

First, informational measures can help actors make choices that they themselves regard as better. As we discussed earlier, according to economic theory, people are rational actors, but they can behave rationally only if they have sufficient information. If Roberta Crusoe does not know that disposal of garbage on her island will poison her water supply, for example, then she will have no reason to stop doing so. Ignorance can thus be one source of market failure. By informing people (and governments) about the environmental consequences of their behavior, informational measures allow them to make a rational decision as to whether they wish to change how they act.[44]

Several specific types of measures seek to give actors the information they need to make better informed choices:

Product information and labeling. Product information and labeling programs aim to promote consumer choice. The theory is that, if people know how much pollution a car causes, or how much electricity a refrigerator or computer uses, or whether tuna was caught in a manner that harmed dolphins, this knowledge might influence their buying decisions. Even in the absence of government requirements, third-party assessors (or the sellers themselves) could provide such information in response to consumer demand, but governmental labeling programs help ensure that information is provided in a consistent, trustworthy manner. Examples of consumer labeling policies include the European Community's eco-labeling program, which awards eco-labels to products that have low environmental impacts over their entire life cycle, and the U.S. Energy Star program, which awards labels to energy-efficient products.

Environmental impact assessment (EIA). Just as labeling measures promote better-informed consumer choice, environmental impact assessments promote better informed government decision making by requiring governments to consider in advance the environmental impacts of their actions. EIA requirements originated at the national level (initially, in the United States in the National Environmental Policy Act of 1969) but have now migrated to the international level, where they have been incorporated into a number of environmental treaties, most notably, the 1991 Espoo Convention on Environmental Impact Assessment in a Transboundary Context, a regional treaty that applies principally in Europe.[45] The World Bank and other international financial institutions also now include EIAs as part of their project approval process.

Prior informed consent (PIC). In contrast to labeling and EIA requirements, PIC requirements allow governments to make informed choices, not about their own activities, but about whether to allow potentially hazardous activities by private actors. They safeguard the sovereign decision-making authority of national governments by requiring companies to provide information to the government in advance and to proceed only if they receive the government's prior informed consent. PIC requirements are a central element of international regimes regulating trade in hazardous substances, such as the Basel Convention on the Transboundary Movements of Hazardous Wastes and the Rotterdam Convention on trade in hazardous chemicals and pesticides.

Hazard warnings. Without knowledge of a potential or an actual danger, actors cannot respond appropriately. Warnings can be provided in advance—for example, labeling requirements for containers that need special handling because they contain hazardous substances.[46] Or warnings can be provided after the fact—for example, emergency notifications of oil spills or nuclear accidents, which are often critical in enabling other states to minimize their damages.[47]

Thus far we have been considering measures intended to enable actors to make better decisions by providing them with information. In some cases, however, simply providing actors with information may not be enough to change their behavior. Information is useful when environmental harms occur out of ignorance. But when actors are able to externalize the consequences of their behavior, then engaging in environmentally destructive behavior may be fully rational. In such cases, informational measures must play a different role if they are to be effective. They must promote accountability and deterrence by providing information, not to those causing the environmental damage, but to others who are able to exert pressure over the polluter—states, NGOs, international organizations, and the general public.

Sometimes, sunlight itself may be enough to induce a change in behavior; it may be, as Louis Brandeis once wrote, the "best of disinfectants."[48] People (and governments) tend to behave differently when they must do so openly rather than in secret. If a company is discovered to be dumping toxic chemicals or employing child labor, for example, then its reputation is likely to suffer, possibly affecting consumer behavior and ultimately the company's bottom line. Even when an actor is impervious to diffuse social pressure, information can play an important role in enabling others to exert more specific forms of pressure. This can be done either informally (for example, through non-governmental boycotts of fish sold by whaling countries) or formally (through intergovernmental procedures for dispute settlement).

Information measures that serve an accountability/deterrent function include:

Advance notification requirements. A number of international instruments require states to notify one another about activities likely to have a significant adverse transboundary impact.[49] These requirements afford potential victims the opportunity to weigh in before any damage has been done, in order to persuade the other state to mend its ways and to prevent disputes from arising.

Disclosure requirements. Informational requirements can also be designed to allow the public at large to influence environmental decision making more effectively.[50] Principle 10 of the Rio Declaration states that governments shall provide individuals with appropriate access to information concerning the environment. This requirement has been further spelled out in the 1998 Aarhus Convention, a regional agreement applying in Europe.[51] In parallel, information measures can require disclosure by industry of potentially dangerous activities such as toxic releases.[52] The underlying rationale of these disclosure requirements is that information is empowering and that citizens, if informed, will be able to exert influence more effectively.

Reporting requirements. Finally, information measures can require states to report to international bodies on their environmental performance—for example, their emissions of greenhouse gases, the number of prosecutions brought to enforce MARPOL's vessel-source pollution standards, or the permits issued pursuant to the Convention on International Trade in Endangered Species (CITES). As discussed further in Chapter 11, international bodies (and other countries) can use this information both to assess compliance by a country with its existing international obligations and to evaluate overall progress in addressing a problem, in order to determine whether additional measures are needed.

Although our discussion has distinguished between information measures aimed at helping actors make better informed choices about their own behavior and those intended to allow one actor to influence the behavior of another, often no clear line exists between the two. Reporting requirements, for example, can serve both functions. Not only do they allow others to evaluate a country's performance, but the process of preparing the report may force a country to take a hard look at itself, possibly catalyzing internal changes.

On the whole, informational requirements are the least intrusive form of environmental regulation. They empower rather than limit actors by helping them to decide what products to buy, what projects to undertake, and what activities by others to protest. Informational measures thus pose the least opportunity for "government failure," in which government imposes policies that promote special interests rather than the public interest. At the same time, reliance on voluntary changes in behavior and on informal pressure rather than legal compulsion may render informational measures less environmentally effective than other types of environmental regulation.

Command-and-Control Regulation

In contrast to informational measures, which leave decision-making authority in the hands of individual actors, command-and-control regulation centralizes decision making. Instead of allowing individuals to choose the fuel economy of their car, the government might mandate corporate average fuel economy (CAFE) standards. Or, at the international level, rather than allowing each individual country to decide on its level of carbon emissions, states might collectively negotiate emission limitations, as they did in the Kyoto Protocol.

Command-and-control regulation can intervene at various points along the causal chain from individual activities to environmental effects. The further along this causal chain that regulation impinges, the more flexibility individuals have in deciding how they will comply. Consider, for example, different regulatory approaches to limiting smog caused by auto emissions of carbon monoxide, volatile organic compounds (VOCs), and nitrogen oxides:

- A requirement that all cars have catalytic converters applies to the polluting activity itself and would leave auto manufacturers and consumers with little if any discretion about what they must do to comply.
- A requirement that cars not emit more than a certain amount of pollution per mile driven would give car manufacturers flexibility about what technologies to use.
- A requirement that automobiles not emit more than a certain amount over the course of a year would leave car owners with even more flexibility (for example, they might simply drive less in order to comply).
- A requirement that urban areas take measures to reduce smog below specified levels would give the regulatory target (in this case, local governments) tremendous flexibility about how to comply.

International environmental lawyers commonly refer to requirements to do particular things as *obligations of conduct,* and obligations to achieve particular results as *obligations of result.* An obligation to impose a national carbon tax would be an obligation of conduct, whereas a national emissions target (say to reduce emissions by 30 percent) would be an obligation of result.

SPECIFICATION STANDARDS

Specification standards anchor one end of the regulatory spectrum; they represent the most directive type of command-and-control regulation. A requirement that power plants use scrubbers to remove sulfur dioxide from their emissions is an example of a technology-based specification standard; packaging requirements for shipments of hazardous chemicals are another.

At the international level, specification standards are rare. One of the few agreements that sets specification standards is MARPOL, which establishes construction, design, and equipment standards to limit pollution from ships. These standards include requirements that oil tankers have double hulls, segregated ballast tanks, and oil discharge monitoring equipment. The limitations adopted by the International Whaling Commission on the types of harpoons that may be used to kill whales are further examples of what amount to technology standards.

Specification standards have several significant drawbacks.[53] Government does not have a good track record in picking particular technologies, so the standards chosen may not reflect the most effective or cheapest ways to reduce pollution. Moreover, once a particular technology is selected, companies have no incentive to engage in further innovation in order to discover better ways to reduce pollution. Specification standards are also typically uniform; they treat all pollution sources and regions the same, even though pollution sources and regions often differ in important respects.[54] The costs of installing a technology may vary significantly from one plant to another, and particular regions may not all be equally vulnerable to a particular type of pollution. Some ecosystems, for example, have a high buffering capacity, making them less sensitive to particular types of pollution, whereas others are highly vulnerable. So a one-size-fits-all solution (say, requiring all power plants to use scrubbers or all cars to have catalytic converters) means high costs for some companies and low costs for others, overregulation in less vulnerable areas, and underregulation in more vulnerable ones.

At the same time, specification standards can provide two benefits that are particularly important internationally. First, these standards are comparatively easy to implement, monitor, and enforce.[55] It is easy to inspect a car to see if it has a catalytic converter, or an oil tanker to see if it has a double hull and segregated ballast tanks. Moreover, since the design and equipment of a ship are enduring characteristics, they allow enforcement measures to be taken against the vessel at any point in time, wherever it may go. According to one study, MARPOL's effectiveness in reducing oil pollution is attributable largely to its use of such standards.[56]

Second, if a technology creates what economists refer to as network externalities, then once a sufficient number of actors have adopted the technology, others will have an incentive to do so as well. The technology standard becomes self-enforcing and thus avoids the enforcement issues that otherwise plague international environmental law.[57] California's automobile pollution standards provide an illustration. California is a sufficiently big market that, once it adopts an automobile standard (such as a requirement to use catalytic converters) automobile manufacturers may find it easier to manufacture a single car that meets the California standard rather than different cars for different markets. Similar "tipping effects" may, in part, account for the success of MARPOL's construction and design standards for oil tankers. Since any state may take action against a vessel while in port, shipbuilders are unwilling to build, and financial institutions unwilling to finance and insure, vessels that fail to comply. As Scott Barrett explains, "The value of a particular tanker increases with the number of ports to which it has access. So, as more coastal states participated in [MARPOL], barring other kinds of oil tankers from entering their ports, the greater became the incentive for yet other states to participate."[58]

PERFORMANCE STANDARDS

In contrast to specification standards, performance standards look further down the causal chain at indicators of performance rather than at the specific technologies used to achieve those results. Performance standards come in many varieties. Some apply to particular products, such as fuel efficiency for cars and energy efficiency standards for appliances. Others apply to the production process, such as the effluent discharge standards in the U.S. Clean Water Act and the emissions standards in the U.S. Clean Air Act. Some are based on best available technologies (BATs), and others on cost-benefit balancing or the achievement of environmental objectives. An important issue in establishing performance standards is the choice of regulatory target. Does a performance standard seek to regulate the performance of individual facilities, companies as a whole, or larger governmental units?

In international environmental law, an early example of a performance standard was the oil discharge requirement set forth in the 1954 agreement on oil pollution (OILPOL), which limited discharges from oil tankers to no more than 100 parts per million of oil.[59] This discharge standard has been progressively strengthened and is now included in the MARPOL Convention.

In contrast, international air pollution regimes use a quite different type of performance standard, applicable not to the performance of individuals products or producers, but to the performance of a country as a whole. The European acid rain regime, for example, imposes limits on overall national emissions of pollutants such as sulfur dioxide, NO_x, and volatile organic compounds. Similarly, the ozone regime limits national consumption and production of ozone-depleting substances, and the Kyoto Protocol limits national emissions of a basket of six greenhouse gases, including carbon dioxide.

As with specification standards, uniform performance standards, which set the same requirements for all actors everywhere in the world, may be inefficient because of differences in the marginal cost of abatement for different polluters, the vulnerability of different regions to environmental damage, or both. To avoid these problems, performance standards can be differentiated more easily than specification standards. For example, MARPOL imposes stricter discharge limits when a vessel is close to shore or in an area that has been designated as specially vulnerable than when the vessel is on the high seas. Similarly, Kyoto's emissions targets are differentiated for each participating country.

Otherwise, the pros and cons of performance standards tend to be the mirror image of specification standards. On the positive side, performance standards give the regulatory target flexibility as to how it will achieve its obligations. This makes them more cost-effective than technology standards by enabling the regulatory target to choose the cheapest way to improve its performance. Under OILPOL, for example, oil tankers were free to limit discharges by installing segregated ballast tanks or a clean oil-washing system or by instituting more careful operational procedures. Similarly, states can achieve their Kyoto emissions targets by adopting a domestic technology standard, a performance standard for private emitters, or one of the market-based mechanisms that we will explore below, such as a pollution tax or "cap-and-trade" system.

The more comprehensive the performance standard, the greater is its flexibility and cost-effectiveness. The Kyoto Protocol's emissions reduction targets apply to a basket of six greenhouse gases. As a result, when implementing their targets, states have flexibility in their choice of which gases to reduce. If one state can reduce its emissions of methane more cheaply than carbon dioxide, and another the reverse, then each is free to make whatever reductions are cheapest.[60]

On the negative side, discharge standards are more difficult to implement and enforce than technology-based specification standards. It is easy to determine under MARPOL whether an oil tanker has segregated ballast tanks, but much harder to determine its discharges of oil at sea. For this reason, regulation of vessel-source pollution has moved from a focus on performance standards in OILPOL to a focus on construction, design, and equipment standards in MARPOL.

ENVIRONMENTAL QUALITY STANDARDS

Environmental quality standards apply even further down the causal chain that runs from technologies to performance to environmental effects. They go directly to the bottom line of environmental policy—namely, ensuring a satisfactory level of environmental quality. Examples in U.S. law include the Clean Air Act's ambient air quality standards and the Clean Water Act's goal of making lakes and rivers "swimmable and drinkable."[61] Environmental quality standards form the basis of the 1978 Great Lakes Water Quality Agreement between the United States and Canada and are also used in some European Union directives.

Environmental quality standards give the regulated actor maximum flexibility in developing pollution control requirements tailored to the ultimate objective of environmental quality. Rather than having to meet a uniform emissions standard, the regulated actor can establish a less stringent emissions standard if it has lower vulnerability to pollution damage, for example, because of greater absorptive capacity.

This flexibility brings with it two downsides, however. First, environmental quality standards are information intensive. To set pollution control requirements, we need information about what level of pollution loadings are safe for each locale—information that may prove incorrect, owing to uncertainty. Second, environmental quality standards impose relatively little control over the actors that they aim to regulate. Given informational uncertainties, states have significant discretion in deciding what levels of emissions reductions are compatible with an environmental quality standard. For these twin reasons, the North Sea pollution regime, which began as one of the few international regimes to employ environmental quality standards, eventually moved in the direction of uniform emissions standards.[62]

Today, environmental quality objectives are often employed in international agreements to provide guidance in setting more specific international performance or specification standards, rather than in place of them.[63] For example, the 1994 Sulfur Protocol to LRTAP employs a "critical loads" approach, an environmental quality standard based on the maximum levels of acid deposition that will not cause significant harm to the most vulnerable ecosystem in a given geographic area. Similarly, the UN Climate Change Convention defines its objective in environmental quality terms, namely, to stabilize greenhouse gas concentrations at a level that will avoid dangerous climate change.[64] In both cases, the environmental quality objectives do not serve as obligations on states. Rather, they are intended to guide the development of more specific regulatory requirements.

Market-Based Approaches

Market-based instruments, which aim to ensure that environmental externalities are properly priced, represent a final type of regulatory approach. The principal advantage of market-based approaches is cost-effectiveness: by allowing the market to determine how pollution can be reduced most cheaply, potentially large cost savings are possible. Studies of actual and proposed emissions trading programs in the United States estimate cost savings of between 20 and 90 percent.[65] The emissions trading program under the 1990 Clean Air Act, for example, allowed utilities and consumers to reduce sulfur dioxide emissions for about one-quarter of the original cost estimates. In addition, market-based instruments give polluters a continuing incentive to reduce pollution to the efficient level (where the marginal cost of abatement equals the marginal benefit) in the most cost-effective manner possible.

POLLUTION TAXES OR CHARGES

Pollution taxes (often referred to as "Pigovian taxes" after the British economist, Albert Pigou, who initially proposed them) put a price on pollution, thereby internalizing the pollution's externalities. This gives actors an incentive in the marketplace to reduce their pollution. If a pollution tax is set at a level that corresponds to the environmental externality, then actors will reduce their pollution to the economically efficient level. They will reduce their pollution as long as doing so is less costly than paying the tax. The United States implemented its obligations under the Montreal Protocol, in part, by imposing an excise tax on ozone-depleting substances. Similarly, Denmark has used a carbon tax to cut its greenhouse gas emissions. One problem with imposing taxes at the international level is determining how the revenues will be spent. This problem may help explain why, thus far, no international regime has imposed taxes on pollution.

SUBSIDIES

Subsidies for measures that reduce pollution are the mirror image of taxes. Rather than raising the cost of inaction, subsidies lower the cost of action. Because it is usually easier, politically, for governments to provide individuals with a benefit than to impose a burden (to lower taxes, for example, rather than to raise them), subsidies are a popular environmental policy instrument.

Subsidies can take many forms: investments in R & D, tax credits, lower interest rates on loans, and direct payments, to name a few. In the United States, the federal government provides tax breaks for hybrid and other low-emission cars. Similarly, Japan subsidizes homeowners' installation of solar panels on roofs; and Germany and Denmark subsidize wind power through support for research and development, cheaper loan rates, and electricity rate regulation. As these examples suggest, subsidies tend to be technology specific and therefore raise some of the same problems that we considered earlier in connection with specification standards. In contrast, a tax on emissions of carbon dioxide is technology neutral. A polluter could lower its tax burden through any pollution reduction strategy: wind, solar, energy conservation, and so forth.

A variety of international environmental regimes involve financial transfers to developing countries, which are a type of subsidy. For example, the Global Environment Facility provides assistance to developing countries for their "incremental costs" of producing global public goods, including by reducing their greenhouse gas emissions and their consumption of ozone-depleting substances. We will explore these financial transfers further in Chapter 11.

LIABILITY RULES

At first glance, imposition of liability for pollution damages (as was done in the *Trail Smelter* case, for example) might not seem to constitute a market instrument. Like other market instruments, however, liability rules have the effect of raising the cost of pollution and thereby providing a price incentive to polluters to clean up their act. One common criticism of liability rules is that environmental policy should aim to prevent pollution, rather than simply provide a remedy to victims. This argument is ill-founded inasmuch as liability rules have a deterrent as well as a compensatory effect. The only real difference between a liability regime and a pollution tax is that a pollution tax is calculated *ex ante,* based on an estimate of the expected pollution damage, and does not require proof of the causal relationship between the taxed activity and particular environmental damages. In contrast, a liability regime operates, *ex post,* after the pollution damage has occurred, and requires proof of damages and causation. Thus, where evidence of causation is limited, the likelihood that a liability system will result in payments of damages may be low and the price signal correspondingly weak.[66]

Internationally, states have shown little inclination to develop a general liability regime for environmental damage and only mixed support, at best, for issue-specific regimes imposing civil liability on private actors. To the extent liability rules are used at all, they typically serve not as the primary policy instrument, but rather as a backstop to provide compensation when damage occurs despite a regime's preventive rules—for example, when the construction and design standards in MARPOL fail to prevent an oil spill. The earliest liability regimes were developed in free-standing instruments, which addressed high-risk activities such as the transport of oil by sea and nuclear activities.[67] More recent liability regimes have been add-ons to existing multilateral environmental agreements, such as the Antarctic Environment Protocol and the Basel Convention on the Transboundary Movements of Hazardous Wastes.[68]

TRADABLE ALLOWANCES

A tradable allowance—or "cap-and-trade"—system combines a performance standard with a market-based approach. As with a performance standard, emissions are capped at a defined level and each polluter receives allowances for their permitted level of emissions. In contrast to a pure performance standard, however, each polluter need not achieve its emissions target by reducing its own emissions. Instead, if reducing its own emissions is expensive, a polluter can buy allowances from other actors who are able to reduce their emissions more cheaply. Through these trades of emissions allowances, the market directs emissions reductions to those actors who can reduce their emissions most cost-effectively. The allowance market gives them an incentive to reduce their emissions by more than the required amount and then sell their excess emissions allowances to other polluters with higher abatement costs. Tradable allowances were first used in a significant way at the national level in the 1990 U.S. Clean Air Act Amendments for sulfur emissions from power plants and are widely seen as having significantly reduced compliance costs. The Kyoto Protocol established the first tradable allowance system at the international level.

PRICE- VS. QUANTITY-BASED INSTRUMENTS

Pollution taxes, subsidies, and liability rules are all examples of what economists refer to as *price-based instruments*. They seek to influence behavior either by raising the costs of pollution or by lowering the costs of abatement. How much pollution will actually decrease as a result of this price signal is uncertain and will depend on the responsiveness of behavior to changes in price (which economists measure using the concept of price elasticity). In contrast, a cap-and-trade system is a *quantity-based instrument*. It starts by setting an overall level of pollution reduction (determined through the number of emissions allowances that are created) and then uses the market to achieve that permissible level of emissions in the most cost-effective manner.

If there were perfect information about the responsiveness of behavior to prices, then price- and quantity-based instruments would produce exactly the same result. To the extent there is uncertainty, then they differ. Price-based instruments provide certainty about prices—that is, the costs of abatement—and place the risk of uncertainty on the amount of pollution abatement that will result. A given tax rate may reduce pollution by more than the intended amount or less. In contrast, quantity-based instruments provide certainty about the level of pollution reduction (to the extent, of course, that there is perfect compliance) but uncertainty about the cost. Achieving the required level of emissions reduction might be cheaper than expected or more expensive. In some cases, this uncertainty about costs can prove to be a major political problem, as the Kyoto Protocol illustrates. Critics argued that the costs of complying with Kyoto would be economically ruinous, an argument that contributed to the Bush Administration's decision to reject Kyoto.

To address concerns about the potentially high costs of complying with quantity-based instruments, some economists have proposed combining features of a quantity- and a price-based approach, through what has become known as a safety valve device.[69] Under this approach, emissions are capped, and tradable emissions allowances are issued. However, if the market price for allowances rises above a predetermined, safety-valve level—in other words, if the costs of compliance go too high—then the target is relaxed through the issuance of additional emissions allowances at the safety-valve price.

By ensuring that compliance costs cannot rise above a predetermined level, a safety valve removes one of the principal obstacles to the negotiation and acceptance of emissions reduction targets. As with a pollution tax, however, this economic predictability comes at the expense of environmental predictability: if mitigation costs prove high and the safety valve kicks in, then the level of actual emissions reductions achieved will be less than that under a fixed target.

So there are risks either way. Just as we have no assurance as to the levels of reductions a given price will achieve, we have no assurance about how much a particular emissions reduction will cost. The difference is that the economic risks of excessive costs are near-term, while the environmental risks of insufficient reductions in emissions are longer-term and may be correctable through stronger measures later. Moreover, with a guaranteed ceiling on costs, countries might be willing to accept more ambitious commitments, leading to greater environmental benefits if costs prove low and the safety valve does not kick in.

Conclusions

From a policy perspective, there is no shortage of regulatory instruments to address environmental problems. Informational approaches are the least intrusive and hence pose the least danger of "government failure," but they may result in less environmental change. Command-and-control regulations are blunt instruments that often create inefficiencies but can be effective in providing environmental benefits (at least in states with strong administrative capacities). Market-based mechanisms are the most cost-effective but are appropriate primarily for global problems such as climate change, where the location of the emissions reductions does not matter. Each has its strengths and weaknesses, but together they represent a sophisticated toolkit for international environmental lawyers.

The problem in international environmental law lies less in formulating desirable policy options than in getting these policies adopted and implemented. In other words, the challenge is less one of policy than of politics. Even in domestic political systems, with established institutions and procedures to make and enforce the law, environmental policy faces daunting political challenges. This is even truer in a decentralized international system, with more than 190 states, which depends, in large part, on mutual agreement to make the law and on self-compliance to implement it.

Recommended Reading

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