Controlling Environmental Risks Through Economic Incentives

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I. Solving the Dilemma of Environmental Regulation

Our current environmental regulatory programs rely almost entirely on legal rules and orders to control pollution, toxic wastes, chemical hazards, and other harmful byproducts of industrialization. A detailed, elaborate and ever-growing set of federal regulations govern the air and water pollution released from hundreds of thousands of industrial sources and millions of automobiles, the hazardous wastes resulting from over a million generators, and the risks posed by thousands of pesticides and other chemical products.

The inevitable drawbacks of this command and control regulatory strategy are increasingly apparent: excessive bureaucratic centralization, rigidity, cost, litigation and delay. The only apparent cure for these drawbacks is to make standards less rigorous or to ease enforcement, weakening environmental protection. There appears to be an indissoluble conflict between environmental goals on the one hand and liberty, diversity, and economic growth on the other. The seeming dilemma of our environmental regulatory policy is that its defects can be cured only by sacrificing the environment and human health.

This dilemma has dominated the politics of environmental protection for the past dozen years. In the early 1970s Congress enacted an ambitious array of new environmental regulatory statutes that sought to control conduct throughout the nation in order to clean the air and water and eliminate safety risks from chemicals and wastes. As these programs were implemented, their costs and other drawbacks became apparent, triggering industry and public backlash against excessive bureaucratic regulation by Washington. This backlash helped propel Ronald Reagan to the White House. The Reagan administration adopted the log-

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ical cure for excessive regulation: a cut-back in enforcement coupled with efforts to reduce the stringency of regulatory standards. These initiatives, however, provoked sharply adverse public reaction. The American public remained strongly committed to environmental goals, and correctly perceived that the Reagan administration's policies would sacrifice those goals. Recent Congressional legislation has revived the environmental regulatory strategies of the early 70s, enacting ambitious and detailed command and control programs for hazardous waste control and cleanup. These statutes include highly specific, court-enforced mandates and deadlines for administrative enforcement. Such measures will inevitably produce renewed backlash against overregulation.

This policy seesaw is inevitable so long as we continue to rely on centralized command and control regulation to achieve environmental goals. The solution to the dilemma is expanded use of economic incentives to achieve environmental goals. New market-based tools for reducing pollution and hazardous waste can effectively protect the environment and human health while avoiding many of the drawbacks of regulatory rules and orders. Economic incentives are not a cure-all. They are not presently suitable for some types of environmental problems. But they have important advantages over existing programs in many applications and deserve to be adopted on a broad scale.

Our current environmental regulatory system was an understandable response to a perceived need for immediate controls to prevent a pollution crisis. But the system has grown to the point where it amounts to nothing less than a massive effort at Soviet-style central planning of the economy to achieve environmental goals. It strangles investment and innovation. It encourages costly and divisive litigation and delay. It unduly limits private initiative and choice. The centralized command system is simply unacceptable as a long-term environmental protection strategy for a large and diverse nation committed to the market and decentralized ordering.

II. REGULATION BY RULES AND ORDERS: THE SOURCES OF THE DILEMMA

Over the past two decades we have gained a great deal of practical and theoretical knowledge about the consequences of using

regulatory commands to achieve environmental goals. This knowledge explains the sources of the dilemma described above.

Regulatory standards specify the conduct required of a class or category of actors. They are widely used to deal with air and water pollution and toxic waste. Some standards are based on environmental quality goals. A goal, such as a specific level of air quality, is first adopted. Standards are then adopted that limit the contribution by each source in an air basin to pollution in that basin. For example, coal-fired power plants in the basin may be prohibited from emitting more than x tons of sulfur dioxide daily. The standards are designed so that the total of emissions from all sources in the basin are limited sufficiently to ensure that the air quality goal is met. Other standards are technology-based. Each source regardless of its location is required to install and operate the best pollution control technology that is available and economically affordable. Our air, water and toxic waste regulatory programs all use a combination of environmental quality and technology-based approaches, but technology-based standards dominate.

Screening is another form of regulation. It involves the administrative use of general criteria, such as "unreasonable risk," on a case-by-case basis to determine whether particular products, such as pesticides or other chemicals, or facilities, such as new industrial plants or waste sites, are environmentally acceptable.

In the United States, in contrast to many other industrial democracies, regulation is centrally dictated by the federal government and litigation of regulatory issues is pervasive. Congress has given federal agencies the principal authority to adopt regulations and oversee their implementation and enforcement. It has judged state and local regulation inadequate because states and localities are under pressure to relax environmental controls in order to attract industry and often lack adequate administrative and enforcement resources. Adversary litigation infects almost every aspect of the regulatory process, including standard-setting, implementation, and enforcement. Industry has traditionally enjoyed the right to participate in a formal administrative proceeding before an agency adopts regulations, and to judicial review of the regulations adopted. In the last twenty years the right to participate in agency proceedings and obtain judicial review has been extended to environmental advocacy groups and other organizations seeking stronger regulatory standards and enforcement.

Centralization and litigation seriously aggravate the inevitable dysfunctions of command and control regulation. The regulators must define required or prohibited conduct with considerable precision in order to withstand legal challenge. This requires administrators to acquire and analyze an enormous amount of information about the conduct of those being regulated and the consequences of different regulatory decisions. When regulation is carried on by federal agencies in Washington far removed from the great variety of activities being regulated, serious problems of decision making overload due to the difficulties in acquiring and processing the necessary information become inevitable. In order to cope with the demands involved in regulating several hundred thousand industrial sources of air and water pollution and over a million hazardous waste generators, federal regulators have relied heavily on "wholesale" standards that impose the same requirements on all sources in a given industry or other category. In order to simplify the decision process further, federal regulators have ignored local environmental variables and relied heavily on nationally uniform technology-based standards. This wholesale approach produces standards that require more control than necessary to achieve environmental quality objectives in some areas, and less control than is necessary in others. Also, plants with low costs of pollution control and those with high control costs are often required to clean up the same amount. As explained in the Ackerman-Stewart paper, this misallocation of control burdens makes pollution control far more costly than it need be. If controls were tailored to individual plant costs, our current expenditures for air and water pollution control could be reduced from over $50 billion annually to $25 billion or less with no sacrifice of overall environmental quality. Such tailoring, however, is an administrative impossibility in a centralized system of regulation. Federal administrators in Washington could not possibly devise individually-tailored standards for each of hundreds of thousands of plants and facilities, particularly when each standard would require a formal hearing and a possible lawsuit.

In addition to being unduly costly and environmentally inappropriate, centralized uniform standards are likely to be unworkable or arbitrary in many applications, resulting in industry noncompliance and resentment. Industry has turned to litigation for relief, challenging the factual and analytical justifications for agency regulations through protracted and costly administrative

hearings and judicial review proceedings that serve to delay the implementation of regulatory programs and encourage firms to spend money on lawyers rather than cleanup.

Environmental advocacy groups are also disgruntled with the system of regulatory standards. They fear, often with good reason, that beleaguered federal administrators with limited resources will often fail to deal with important environmental problems or fail to ensure adequate implementation and enforcement of the standards which they do adopt. The problem of enforcement is a serious one. Even when the administration in Washington is committed to strong enforcement, federal agencies cannot themselves enforce standards against hundreds of thousands of plants. The zeal and ability of state and local enforcement agencies is often eroded by competition for industry and by limited resources. Non-compliance is widespread. Environmental groups have resorted to the courts to challenge regulatory laxity and mandate administrative implementation and enforcement.

Repeated litigation by industry and environmental groups, challenging the scientific, economic and engineering details of regulatory decisions, burdens the courts and strains their competence. It also introduces considerable additional cost, delay, and uncertainty into the already cumbersome process of centralized regulation. The recent proliferation of litigation to impose liability for cleaning up toxic waste problems caused by past regulatory failures has added to the litigation overload.

Some of the dysfunctions of centralized standards can be reduced by a shift to case-by-case screening, but only at the cost of introducing other problems equally severe. "Retail" case-by-case screening of particular chemicals, for example, avoids the rigidities of "wholesale" standards. But if the number of chemicals to be reviewed is large, the decisionmaking capacities of the center will be overwhelmed. This type of centralized overload has crippled implementation of the Toxic Substances Control Act. Centralized screening is also heavily burdened by litigation. Each decision on each chemical is potentially subject to formal adversary proceedings and court review. Many new chemicals are not reviewed at all or are examined only perfunctorily, and even less is done about existing chemicals. Overload also makes it difficult to determine priorities and ensure that limited administrative re-

sources are dedicated to the most serious or readily-solved problems.

Centralized regulation tends to discourage technological innovation and investment in new products and plants, harming the international competitiveness of United States industry. Regulatory standards, particularly those that are technology-based, are driven by a reluctance to shut down any existing plants and as a result end up imposing disproportionate burdens on new pollutants. Regulatory screening is biased against new plants and products, which must undergo a costly, time-consuming, and uncertain process of regulatory clearance before they can be built or placed on the market.

Centralized regulation is, for all of these reasons, inherently incapable of achieving environmental protection goals in an efficient and economical manner. As explained further in the Ackerman-Stewart paper, this system also undermines the democratic accountability of environmental policy decisions. The use of centralized standards or screening inevitably requires Congress to delegate enormous discretion to federal bureaucracies to formulate the hundreds of standards required to regulate different environmental problems caused by different technologies or to review case by case the thousands of products and new plants subject to central review. The exercise of discretion by administrators inevitably invites legal challenge by those dissatisfied with the decision. Choices about environmental protection priorities and goals are buried in thousands of highly technical standard-setting decisions made by agencies and reviewed by courts. The decisionmaking process is dominated by lawyers representing organized industry and environmental groups.

III. ECONOMIC INCENTIVES: A SOLUTION TO THE DILEMMA

Economic incentive systems, including pollution charges, transferable pollution permits, and waste deposit and refund programs, use market principles to achieve environmental goals while avoiding many of the dysfunctions of centralized regulation.

Regulatory commands dictate specific behavior by each plant, facility, or product manufacturer in an effort to control the quantity of pollution or chemical risk that it produces. Economic incentive systems do not seek to dictate the conduct of each of hundreds of thousands of enterprises. Instead, they impose a price or economic cost on conduct that creates pollution or chem-

ical risk, leaving to each enterprise the decision on the exact level of control.

Charges impose a fee or tax on each ton or other unit of pollution discharged. Transferable pollution permits achieve the same result by limiting the total units of pollution permitted, issuing freely-marketable permits equal in number to the units permitted, and requiring polluters to have permits equal to their discharges. Because pollution control is costly and the number of discharge permits is limited, the permits will command a positive price, set by market supply and demand. Because firms will have to buy a permit for each unit of pollution they emit, they will effectively pay a tax proportionate to their pollution. Deposit and refund systems impose a tax on waste-creating activities and then give a refund for each unit of waste that is recycled or properly disposed of. In effect, they impose a net tax on each unit of waste that an enterprise fails to recycle or dispose of properly.

Under a pollution fee or tax system the level of the charge is set to induce control responses by firms that, in the aggregate, will reduce pollution sufficiently to achieve the environmental goal. There is, however, uncertainty in the amount of total reduction that will be achieved by any given level of charge because the precise control responses of firms to the charge may be difficult to predict. This uncertainty is eliminated in marketable permit systems; the total number of permits is simply set at the level needed to achieve the environmental quality goal. Deposit and refund systems are similar to fees. They provide incentives for firms to engage in recycling or disposing of waste properly. The higher the deposit and refund, the greater the incentive. The incentive level can be calibrated so as roughly to achieve particular environmental quality goals.

Under economic incentive systems, the decision as to how much and how to control is made on an individual basis by each plant or enterprise. This decentralized flexibility gives economic incentive systems several important advantages over command and control regulation.

First, such systems achieve large cost savings by giving firms with relatively low control costs an incentive to control above the level mandated by uniform regulation, while allowing firms with high costs to control less. As further explained in the Ackerman-Stewart paper, this cost-effective reallocation of control burdens can produce tens of billions of dollars of cost savings annually.

Second, government administrators do not need to acquire the detailed information needed to determine the feasible and appropriate level of control for each plant or product. Once an economic system is in place, control decisions are made by plant executives and engineers, not the government. The delays, distortions, and costs of centralized regulations and associated litigation are greatly reduced.

Third, flexibility in control technologies is encouraged. Regulation tends to mandate, either explicitly or in practice, specific control technologies. Economic incentives leave each business with the freedom to devise the control methods that are most appropriate, effective, and cheapest for its particular circumstances.

Fourth, there is no penalty imposed on new products and plants. All sources of pollution or chemical risk are subject to the same incentive levels and new products or plants do not have to go through a cumbersome and time-consuming review process.

Fifth, economic incentives provide enterprises with an ongoing incentive to devise new products or production technologies to reduce still further the amount of pollution and chemical risk which they produce. Under a system of regulatory standards, enterprises have incentives to find cheaper ways of complying with the control levels required by existing regulations, but not to find ways of controlling still further. Under economic incentive systems they can make money by doing so. These systems harness the market in order to maintain and improve the quality of the environment.

Sixth, economic incentive systems can enhance the democratic accountability of environmental policy decisions. As explained in the Ackerman-Stewart paper, such systems avoid the arcane technical details and complex recipes for standard-setting and implementation that dominate regulatory policy. Such systems focus the debate on the basics—which risks should be controlled and how much they should be controlled.

Seventh, as the Ackerman-Stewart paper also explains, economic incentive systems can be used to provide government with an appropriate and important new source of revenue. Polluting businesses are using the public's air and water resources. Under regulation, they are given licenses to pollute for free. Under economic incentive systems, they can and should be required to pay for the privilege.

The experience to date with economic incentives in pollution control has been relatively limited, but what there is tends to confirm the advantages explained above. The various systems of emissions trading adopted by EPA under the Clean Air Act, which effectively create limited pollution permit markets, have resulted in substantial savings in control costs and encouraged innovation and new investment without sacrifice of environmental goals. Experience with effluent treatment charges for water pollution has shown that charges promote cost-effective allocation of control burdens among plants, lower total cleanup costs substantially, encourage cost-saving flexibility in control methods, and induce the development and adoption of new cleanup technologies. The Russell paper summarizes the successful experience with refund and deposit systems for dealing with a variety of environmental problems.

Economic incentive systems are not necessarily appropriate for all pollution and chemical risk problems. They require some quantifiable index of pollution or contribution to risk that can be measured and serve as the basis for charges, refunds, or permit units. It is feasible to devise such measures for many forms of pollution and chemical risk. But some risks elude workable quantification, at least for the present. For example, current methods for assessing the various risks associated with pesticides may not be adequate for developing a workable risk tax on pesticides.

Charges and marketable permit systems are designed to induce an aggregate reduction in pollution or risk without ensuring a particular level of control at any given facility or location. It may therefore not be appropriate in dealing with pollutants or chemical risks that have localized "threshold" effects, causing serious damage only if they exceed a given concentration at a particular location. But many, perhaps most, environmental risks do not involve such thresholds.

Economic incentives are most appropriate for inducing continuing reductions in overall risks or pollution levels. They could readily be used to deal effectively with many "conventional" air and water pollutants now subject to regulatory controls; to deal with regional pollution problems such as ozone and acid deposition; and to minimize the production of toxic wastes and promote their safe treatment and disposal. With improvements in risk measurement and assessment, economic incentive systems could

be used to control the hazards posed by pesticides and other chemical products.

IV. OBJECTIONS AND OBSTACLES TO EXPANDED USE OF ECONOMIC INCENTIVES

Economic incentives have great advantages as tools for protecting the environment and human health. Why have they been so little used? Why has the command and control tradition been so dominant in U.S. regulatory policy?

Economists have attributed the prevalence of command and control regulation to the important role of lawyers in the United States. The legislators that create regulatory programs and the officials that administer them are mainly lawyers, who are said to have a professional bias in favor of legal directives as a policy instrument. This argument may bear some weight, but not very much. Command and control regulation is also the dominant instrument of environmental health and safety programs in other industrial democracies, although in those nations the aggravating effects of centralization and litigation are generally far less.

The widespread use of legal commands in the areas of environmental, health and safety protection may in part be attributable to a moral predilection for prohibition. Serious harm to human health or the environment is viewed by the public as unacceptable, and conduct causing such harm is seen as morally reprehensible. A legal ban on such conduct is understood as the appropriate remedy.

Scientific and economic knowledge have, however, undermined this satisfyingly simplistic approach. Science makes it increasingly clear that no sharp line can be drawn between "safe" and "unsafe" levels of pollution or chemical exposure. Nearly all exposure levels, no matter how small, pose some risk. Reality is not neatly divided into the pure and the impure. It confronts us with infinitely fine gradations of risk. The choice is between more risk and less risk.

If we choose to reduce existing levels of risk, the means of doing so must be adopted to our economic and social institutions. In the United States, we rely heavily on the market and decentralized private ordering. In this institutional setting, economic incentives are likely to do far better in managing risk than legalistic prohibitions. Such incentives can obtain more risk reduction at far less cost than a clumsy array of centralized commands. By

working with the market rather than against it, economic incentives avoid penalizing new investment and harming the competitiveness of U.S. industry. They also give industry continuing incentives to develop environmentally superior products and processes in order to maintain reduced levels of risk in the face of continued economic growth.

Some critics, however, oppose economic incentives on the grounds that they depreciate basic values by allowing human health and environmental integrity to be traded off for dollars. This criticism confuses ends and means and also ignores the inescapable need to choose among competing values in defining our goals.

Economic incentives are simply one among several possible means for achieving the environmental goals that we choose. In many situations they are functionally far superior to legal commands. While attacked as a "license to pollute," economic incentives in fact require industry to pay for the use of common resources rather than giving away this valuable privilege for nothing, as regulatory permit programs do.

The use of economic incentives to achieve environmental goals by no means requires that we set goals themselves through economic criteria such as cost/benefit analysis. Given that risk is pervasive and generally graduated, environmental goals can rarely if ever be absolute. They require that choices or compromises be made among competing values. But those choices need not be made on the basis of narrow economic considerations. We might wish, for example, to set ambitious, self-sacrificing goals for reducing acid rain or carbon dioxide generation in order to preserve the world's ecosystems for the sake of future generations. Economic incentives would nonetheless be the best means of achieving these non-economic goals.

Other critics maintain that economic incentives would allow the wealthy to "buy up" the environment. This criticism is also based on misconception. In a market economy, resources should presumptively be allocated through supply and demand to ensure their efficient use. If we decide to use the air and water to dispose of a limited amount of industrial residuals, there is no reason why we should not allocate the use of the air and water for this purpose throughout the market, just as we allocate other resources. As explained previously, use of the price system to ration our use of the environment will reduce control costs and stimulate the de-

velopment of less polluting technologies. It may be that, for equity or other reasons, we may want to subsidize certain polluters, such as municipalities or economically marginal firms; this should be done openly and explicitly by charging them lower fees or issuing them permits for a reduced fee.

Still other critics oppose economic incentive systems because of their supposed political consequences. Legal commands often invoke and claim to vindicate rights to a clean and healthy environment. Such appeals generate political support for strong control measures. Economic incentives may make the economic aspects of environmental cleanup more explicit. The critics fear that doing so may erode political support for ambitious goals. This justification for regulation is both disingenuous and antidemocratic. The regulatory appeal to environmental rights is disingenuous in concealing the fact that command strategies inevitably involve major compromises in setting and implementing environmental goals. These compromises, however, are generally hidden from public view, buried in the technical details of myriad regulatory rules and orders. Economic incentives may indeed make the compromises more apparent. As the Ackerman-Stewart paper explains, however, such visibility should be applauded for promoting the democratic accountability in environmental policymaking. Other major social problems, such as social assistance and education, carry explicit economic price tags. There is no good reason why environmental programs should not as well.

Even though there is little merit to these criticisms, the use of economic incentives in the United States remains limited because of institutional inertia and the vested interest of politically important actors in maintaining the status quo. The symptoms of regulatory dysfunction have only recently become severe following the enactment of ambitious federal environmental, health and safety programs in the early 1970s. In the meantime, however, environmental groups, regulatory bureaucracies, and even the regulated industries have invested considerable energies in fine-tuning the existing system and learning to live with it. From their perspective, the regulatory status quo has faults but it "works," and they are understandably wary of the uncertainties involved in abandoning it for new market-based systems. Such systems could well reduce the need for a large regulatory bureaucracy, threaten existing plants by lowering regulatory barriers to new competition, and deprive litigation-oriented environmental groups of much of

their appeal. As a practical matter, these self-interested concerns must be addressed in any realistic proposals for change.

In addition, there are many practical concerns that can be legitimately raised about the feasibility of designing and implementing economic incentive systems in particular settings. As previously noted, such systems may be inappropriate in dealing with situations where localized concentrations of pollution must be strictly controlled in order to prevent dangerous thresholds from being exceeded. Questions have also been raised about the administrative feasibility of the steps needed to set up and carry out economic incentive systems. The lack of operational experience with economic incentives in many settings makes wholesale change undesirable. The problems of transition from the existing regulatory system to new incentive systems must also be carefully considered.

These issues are briefly surveyed in the concluding section of this essay, and examined in greater detail in the Ackerman-Stewart and Russell papers. The case for economic incentives at the level of principle is extremely powerful. The challenge is to devise practical implementing measures.

V. Designing and Implementing Economic Incentives for Environmental Protection

Economic incentive systems require some quantitative measure of the risk or activity to be controlled. Existing regulatory standards for most air and water pollutants are already expressed in terms of quantities of permitted emissions. Accordingly, as the Ackerman-Stewart paper explains, there would not be great operational difficulty in converting from regulatory standards to charges, transferable permits, or other economic incentives to control such pollutants.

In the case of hazardous waste, as the Russell paper develops, the situation is more complicated. In theory, charges or other incentives could be targeted at the end of the waste stream. For example, a tax could be imposed on waste that was discharged without proper treatment. But because such wastes can readily be moved about, detecting such discharges is far more difficult than it is in the case of "point source" air and water pollution discharges from industrial plants. Deposit and refund systems represent a promising solution to this problem. A charge is imposed on the amount of waste initially generated in the production pro-

cess. The assessment of the charge provides an initial accounting of waste generated and provides revenues to finance refunds. Such refunds are provided for wastes that are properly treated and stored, giving firms an incentive to undertake and report such treatment and storage. The assessment and refund system provides data that enables administrators to identify missing wastes.

Risks, including those posed by pesticides and other chemical products, that are currently handled through regulatory screening rather than standards are less susceptible to control through economic incentives because workable quantitative measures of such risks are unavailable. There is, however, no reason in principle why such measures could not be developed. Such measures would be of great help in setting risk control goals and priorities as well as providing a foundation for economic incentives to achieve such control.

Economic incentive systems do not specify the conduct required of individual facilities, and allow them the freedom to determine their own control levels so long as they pay a charge on or hold permits equal to each unit of pollution or risk which they produced. Such systems accordingly depend on accurate government monitoring of the amount of pollution or risk produced. Critics of economic incentives have claimed that monitoring technologies and capacities are inadequate to prevent widespread cheating. They conclude that we should use technology-based regulation because compliance is much easier to monitor when plants install particular control technologies than when actual discharges must be measured.

Existing monitoring capacities are indeed deficient in a number of areas. But they need to be upgraded regardless of whether we use technology-based regulatory standards or economic incentives to achieve environmental goals. In order for technology-based standards to be effective, monitoring is needed to ensure that control equipment is properly operating. Non-compliance with existing regulatory standards because of substandard operation and maintenance is widespread. As the Ackerman-Stewart paper explains, a switch to economic incentives would provide a strong impetus for government upgrading of monitoring capabilities. Because the government will make money from permit auctions or charges, it will have a powerful interest in detecting cheating.

A third operational consideration in designing and implementing economic incentive systems is that they control aggregate pollution or risk levels, but not the levels produced by any one facility or at any one location. They are therefore best adapted to deal with environmental problems that are not local in character. Good examples include acid rain, ozone and the discharge of pollutants by many facilities into the same water body or air basin. Local effects can, however, often be dealt with by a combination of regulation and economic incentives. Such combinations may do better than policy instruments alone. An example is provided by the deposit and refund systems examined in the Russell paper. The economic incentives provided by the deposit and refund will lead enterprises to do two things: reduce overall amount of waste generated and properly dispose of such wastes as they continue to be generated. What constitutes proper disposal will, however, be defined by regulations designed to prevent local effects.

Other forms of mixed regulatory/incentive schemes could be adopted as a compromise or transition between a pure regulatory program and a pure economic incentive system. Photochemical oxidant (smog) provides a case in point. The Clean Air Act imposes technology-based controls on plants and motor vehicles in order to achieve certain air quality goals. After 15 years of regulation, we are still far from achieving those goals in some heavily polluted cities, in part because regulatory standards fail to provide sufficient incentives for innovation and investment in new, environmentally superior facilities and products. The appropriate solution is to substitute a system of marketable, depreciating pollution permits for the existing regulatory system. But such a step would be opposed politically on the ground that it is too drastic and could cause adjustment problems. A compromise which deserves serious attention is to retain the existing regulatory system but impose a fee on or institute a marketable permit system for the remaining emissions that are allowed by regulation; this addition would give enterprises a continuing incentive to develop and adopt less polluting technologies.

The emissions trading programs pioneered by the federal Environmental Protection Agency under the Clean Air Act illustrate how it is possible to insert economic incentive elements within existing regulatory programs and gain some, if not all, of the advantages of those incentives. The use of deposit and refund systems in conjunction with hazardous waste regulation is another

example of a hybrid system. In order to lessen opposition, such hybrids should be designed to ensure that part of the reduction in control costs achieved through use of economic incentives is passed onto industry, and part used to secure additional reduction in pollution or risk.

The political and ideological commitment to the regulatory tradition in the United States is so strong that hybrid schemes may be required even in the case of environmental problems that have not yet been regulated at all. Acid deposition is a case in point. Acid rain and dry depositions have not been regulated under the Clean Air Act. The Act's command and control regulatory strategy, which is directed at preventing local air quality violations in the vicinity of polluting sources, is virtually useless in dealing with upper atmosphere pollution transport across state boundaries. The ideal solution to the problem would be a region-wide system of depreciating transferable permits. For example, acid rain in the northeast United States could be attacked by issuing all sources in the region permits equal to their existing emissions; depreciating those permits at a fixed rate annually (say 5%) until the desired level of reductions was obtained and making permits freely marketable in order to obtain the desired reductions at the lowest cost and encourage innovation in pollution-reducing technologies. A hybrid compromise would be to impose specific reduction obligations on each state or industry and allow market reallocations of those control requirements.

In the longer view, it is clear that we cannot continue to rely predominantly on centralized commands to achieve environmental protection goals. The U.S. economy and its constituent technologies will continue to develop and become more diverse and complex. The effort to centrally plan and direct these diverse activities through federal regulation and litigation is doomed to failure in the long run. Either such controls will become less and less effective as the activities to be regulated multiply and change, or massive interventions will be required to maintain central control, at serious and probably unacceptable cost to economic productivity and growth and to liberty and diversity.

Regulatory politics are usually based on the assumption that economic and environmental goals are antagonistic, that one goal must be sacrificed for the other. Such sacrifices are often inevitable when regulatory commands are used to secure environmental goals. But the two goals are not necessarily in conflict, and in the

longer view they are complementary. A cleaner environment depends, as countries such as Japan have learned, on encouraging innovation and new investment so that the highly polluting technologies of yesterday can be replaced by new technologies that are superior from an environmental as well as an economic perspective. Economic incentive systems nurture these complementary goals by using market forces to promote environmental protection.

From the long run perspective, the question is not whether we will move to economic incentives but how soon. The Ackerman-Stewart and Russell papers which follow discuss in greater detail some of the steps that should be taken in the near term to expand the use of economic incentives for environmental protection.